Supporting regional innovation through Clusters

A multiple-case study of five clusters in Innovation Leading + European Regions

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Abstract

Nowadays, emerging megatrends foster a fierce competition around the world. Authors are constantly studying the impacts of clustering on regional innovation and in turn economic growth and competitiveness of regions. The main focus of this thesis is firstly to identify why clusters are important for regional innovation performance and secondly to examine how clusters from top innovative regions in Europe, ranked by European Commission (RIS 2017) as Innovation Leaders +, support regional innovation performance in relation to three specific indicators. The indicators are: *1) SMEs introducing product or process innovations, 2) Innovative SMEs collaborating with others and 3) Sales of new to market and new to firm innovations* and they were chosen by using as a reference point the case of Västsverige (SE23).

The conducted research includes five strong clusters from five top innovative regions in Europe, ranked as Innovation Leaders + by RIS 2017. The regions are: [Stockholm (SE11), Etelä-Suomi (FI1C), Hovedstaden (Copenhagen) (DK01), Stuttgart (DE11) and Zürich (CH04)]. According to the findings of this study, clusters' importance is mainly derived by their ability to: i) *facilitate the efficient collaboration between Industry, Academia and Government (Triple Helix model), ii) provide access to a well-informed and extended network of partners and* iii) *organize, coordinate, support and provide information regarding interesting for the network projects or programmes*. Finally, the clusters' contribution to the chosen indicators is described by their focus on activities within the following themes.

SMEs introducing product or process innovations

- Providing access to an extended and well-informed network
- Facilitating an open dialog between Government and SME's
- Embracing testbeds

Innovative SMEs collaborating with others

- Organize and promote supportive programmes and projects
- Utilize regional strengths
- Collaborate within testbeds' context

Sales of new to market and new to firm innovations

- Connect SMEs with international network
- Coaching and training

By strengthening and utilizing their competence in the above-mentioned themes, clusters, represented by cluster organizations, can improve their regional innovation performance in relation to the chosen indicators and create value for their regions.

Keywords

Business clusters, Regional innovation performance, Innovation leading regions in Europe, Contribution of clusters, Cluster activities, Introducing innovation, Facilitate SMEs collaborations, Promote sales of new to market or new to firm innovations.

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Glossary

ACRONYM	DEFINITION
AI	Artificial intelligence
BRG	Business Region Göteborg AB
BW	Baden-Württemberg
EC	European Commission
EEN	Enterprise Europe Network
EIS	European Innovation Scoreboard
EU	European Union
GCB	German Convention Bureau
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IoT	Internet of Things
KSCAB	Kista Science City AB
KTH	Royal Institute of Technology (Stockholm)
OECD	Organisation for Economic Cooperation & Development
RIS	Regional Innovation Scoreboard
SIP	Strategic Innovation Program (VINNOVA)
STING	Stockholm Innovation & Growth AB

1 Introduction

Every day, entities such as entrepreneurs, SMEs, multinational companies, regions and countries turn their attention towards innovation. There are many authors arguing that clusters can have a significant impact over development and diffusion of innovation (Mazur, Barmuta, Demin, Tikhomirov, & Bykovskiy, 2016; Porter, 2000; Simmie, 2004; Yıldız & Aykanat, 2015). Innovation, in turn, has a positive impact in economic growth and competitiveness of a region (2005; Ciobanu, Petrariu, & Bumbac, 2013; Rondé & Hussler, 2005). As emerging megatrends foster a fiercer competition around the world, studying the activities and the methods that clusters use to stimulate, support and promote innovation tend to become indispensable for all entities in the business world.

In 1998, Porter pointed out in his book "*Clusters and the New Economics of Competition*", the beneficial relationship between clusters and regions, which constitutes a benchmark for many following researches. Through his work, Porter identified how clusters can represent a way of organizing the value chain that creates advantages such as increased flexibility, efficiency, effectiveness and consequently generation of innovation within a region (Porter, 1998). Since this study tries to connect the clusters with regional innovation performance, the researcher uses a qualitative study to identify how clusters in top innovative regions contribute to innovation performance. Nowadays, there are various platforms used by researchers to examine and compare regions and their clusters based on their innovation performance. A few examples are ClusterObservatory (ClusterObservatory.eu), Clustercollaboration (*clustercollaboration.eu*) and Regional Innovation Scoreboard (ec.europa.eu). However, this paper uses the *Regional Innovation Scoreboard* (RIS) tool from *European Commission* (EC) because both the assignor company and the researcher agreed on the facts that this tool is constantly updated, it provides a lot of information regarding the included indicators and includes detailed reports of the conducted research and analysis. Thus, the structure of the RIS allows the researcher to examine the selected cases based on their performance in three common (among the cases) indicators used by RIS to assess regional innovation performance. In general, RIS is used from EC to evaluate, analyse and rate the innovation performance of 220 regions across 22 European Union countries, Norway, Serbia and Switzerland and at a country level Cyprus, Estonia, Latvia, Lithuania, Luxemburg and Malta (EuropeanCommission, 2019d).

Over the years, *Business Region Göteborg AB* (BRG) from Gothenburg region has adopted the role of a cluster organization with strong competence and skills in *initiating* partnerships that result in business development and innovations, in *bringing* together companies, academia, and public sector and in *organizing* collaborating activities and projects based on the identified needs of each industry. It is generally accepted that clusters have a significant effect on innovation (Chapain, Cooke, De Propris, MacNeill, & Mateos-Garcia, 2010; Cooke, 2001; Cooke,

Delaurentis, Tödtling, & Trippl, 2007; Novelli, Schmitz, & Spencer, 2006) and through these activities BRG aims to strengthen innovation performance and innovation capacity of the region.

The case of Västsverige is used from this paper as a guideline help the researcher select the three indicators and give orientation to this study. According to the report from RIS 2017, from the 18 indicators used by EC to assess innovation performance, Västsverige had low ratings to: 1) *SMEs introducing product or process innovations as percentage of SMEs*, 2) *Innovative SMEs collaborating with others as percentage of SMEs* and 3) *Sales of new to market and new to firm innovations as percentage of total turnover* (EuropeanCommission, 2019d). Thus, the five selected regions [Stockholm, Etelä-Suomi, Hovedstaden (Copenhagen), Stuttgart and Zürich] were among the top performing regions in these specific indicators and ranked as Innovation Leaders + from EC (EuropeanCommission, 2019d). Therefore, it seems very interesting to apply a multiple-case study which will allow both academia and BRG to understand and utilize the generated knowledge over how clusters can support successfully regional innovation performance and by extension increase the innovation capacity of regions by addressing to the previously mentioned three areas.

Overall, this study is motivated to have a presumable contribution to the area of clusters and innovation management by going deeper into understanding why clusters in top innovative regions rated as Innovation Leaders + by European Commission are important for regional innovation performance and how they support regional innovation performance by addressing to above-mentioned three indicators from RIS 2017. Thus, this paper is motivated to reveal and analyse supportive methods and mechanisms based on the five clusters and regions (cases) ranked as Innovation Leaders + in Europe. Finally, this research seeks to build a theory which hopefully will add value to the region of Västsverige and BRG by revealing methods and mechanisms that clusters can apply in order to support regional innovation performance by addressing successfully to the three indicators presented above. Consequently, this paper will create value for other clusters and regions aiming to improve their regional innovation performance by addressing to the areas that the three indicators cover.

1.1 Background

Through years, many studies have been focusing mainly on the positive spill-over effects generated when the actors of a cluster in a specific area choose to co-exist or collaborate with other stakeholders (Mazur et al., 2016; Monteiro, Noronha Vaz, & Neto, 2011). Studying the contribution of clusters to regional innovation performance and how clusters contribute to increase innovativeness of a region seems to become increasingly important day after day.

Among the very first people to acknowledge innovation as a driving force behind economic growth, were the world famous Austrian political economist Joseph Aloïs Schumpeter and the British economist Redvers Opie (Schumpeter & Opie, 1934). In agreement with Schumpeter & Opie, Michael E. Porter supported that nation's competitiveness is affected by the capacity of its industry to innovate and upgrade (Porter, 1990). Therefore, we can argue today that innovation is one of the main drivers for a sustainable and international competitive environment (Edquist & Johnson, 1997). In modern economic history, innovation attracts a lot of the world's interest and a reason for that is because it is directly connected to knowledge and economic development (Cohen, 2011).

Holding a central position to this study, clusters are highly connected to innovation (Chapain et al., 2010; Cooke, 2001; Cooke et al., 2007; Novelli et al., 2006). The effects of clusters on regional innovation have been examined extensively through years from several researchers. Chapain et al. (2010) acknowledge that clustering allows businesses to have access to skilled labour and through shared activities get the opportunity to capture valuable spill-overs and increase innovation performance both for the businesses and for the region. Porter (1998) discusses the way that clusters affect competition, economic growth and success of regional industries. Additionally, clusters can represent an "*industrialized*" core which offers opportunities for economies of scale and (under certain circumstances) increased national income (Krugman, 1991b). More recent studies tend to focus on how clusters can affect innovation systems and the importance of clusters in the process of creating and shaping sustainable innovating mechanisms (Asheim & Coenen, 2005; Monteiro et al., 2011). Focusing mainly on innovation-driven growth triggered by regional motives, the above-mentioned studies revealed that policy makers and researchers tend to converge towards a single conclusion. Regions, and by extension clusters, undoubtedly hold a key role in cultivating, attracting and retaining innovative actors (OECD, 2013), which in turn affects regional innovation performance the central concept of this paper.

1.2 Purpose

Taking into consideration the trends in the previous studies (1.1 Background), this study is motivated to have an academic interest with a potential contribution to the areas of clustering and innovation. By addressing to the indicators for innovation performance from RIS 2017: 1) *SMEs introducing product or process innovations as percentage of SMEs, 2) Innovative SMEs collaborating with others as percentage of SMEs and 3) Sales of new to market and new to firm innovations as percentage of total turnover*, this paper aims to go deeper into understanding why clusters are important and how clusters in top innovative regions (rated as Innovation Leaders + by EC) can strengthen regional innovation performance. In addition, this paper is motivated to reveal and analyse the methods that clusters use to support

innovation, based on the five clusters (cases presented in Methodology) from five different regions [Stockholm, Etelä-Suomi, Hovedstaden (Copenhagen), Stuttgart and Zürich] ranked as Innovation Leaders + by EC and with high ratings in the specific indicators (EuropeanCommission, 2019d). According to literature, there are various activities that allow clusters to support regional innovation performance. A few examples are *Firm formation*, *Information and Communication* and *Cooperation* (Ketels, Lindqvist, & Sölvell, 2006; Konstantynova & Lehmann, 2016). Cluster organizations try to connect actors from regional networks by creating and supporting projects, though which they achieve diffusion of knowledge and information (R Baptista & Swann, 1996; Rui Baptista & Swann, 1998; Sanchez & Omar, 2012). Eventually, this thesis seeks to build a theory (research implications) which will add value to the region of Västsverige and BRG by revealing methods that clusters can apply in order to support regional innovation performance and address successfully to the three areas pointed by RIS 2017 as weak areas for the region of Västsverige. In addition, this paper has the potential to create value for other clusters and regions which will utilize the generated knowledge in order to improve their regional innovation performance by focusing on the areas that the selected indicators cover.

1.3 Research questions

To achieve the formulated purpose of this thesis, a research was conducted in the targeted regions providing answers to the following questions:

Research Question 1: *Why clusters are important for regional innovation performance?*

Research Question 2: *How clusters at the targeted top innovative regions contribute to the following indicators from RIS 2017?*

- **i)** *SMEs introducing product or process innovations*
- **ii)** *Innovative SMEs collaborating with others*
- **iii)** *Sales of new to market and new to firm innovations*

1.4 Delimitations

The report from RIS 2017 includes the *Top-25 Regional Innovation Leaders* across the 22 European Union countries, Norway, Serbia and Switzerland and at a country level Cyprus, Estonia, Latvia, Lithuania, Luxemburg and Malta (Appendix 1). According to the information from the European Commission 18 out of the 25 regions from that table, are named as Regional Innovation Leaders successively from 2011. That implies that it would be very interesting from a business and academic perspective to study all the 18 regions from the Top-25 Regional Innovation Leaders Table. However, due to the limited timeframe of the thesis, this study choses to focus only

on five regions due to their innovation capacity and their performance to the three selected indicators. Furthermore, taking again into consideration the timeframe of the project, the research of the project does not try to analyse in depth the examined cases but it focuses on the breadth of the research which adds validity and reliability to the results.

Defined in the Methodology part of this study, it is of secondary importance whether the examined clusters operate in the same industry or not. This study focuses more on non-industry-oriented methods and activities, which can reveal the general position and contribution of a cluster in a top innovative region in relation the formulated questions and the targeted indicators.

Even though the structure and the characteristics of a cluster organization or other cultural-related characteristics may have a significant impact on the ability of the clusters to contribute, stimulate and promote innovation on a regional level, the executed research was not intending to detect such information. On the contrary, this research focuses on the actual activities, methods and mechanisms that clusters and cluster organizations use to support innovation performance by addressing to the areas from the three selected indicators.

Finally, the case of Business Region Göteborg and Västsverige was used as a benchmark providing orientation to this thesis by facilitating the selection of the indicators in which, according to EC, Västsverige has low ratings. Therefore, there is no intention to compare the examined regions with the region of Västsverige.

1.5 Disposition

The study starts by introducing the reader to the content of the thesis. The first chapter provides the reader with information regarding the background, the purpose, the research questions and the delimitations of the study taking always into consideration the limitations of the project. Then, the theoretical framework acts as a guide to the executed research. By applying a qualitative research strategy based on semi-structured interviews, the empirical and secondary data are gathered and they are analysed in order to extract the most valuable information of the study answering the formulated questions. Finally, the last chapter includes the conclusion of the research, the research implications, the limitations of the project and suggestions for future research.

2 Literature review

Chapter 2 describes the Regional Innovation Scoreboard from European Commission and continues by explaining the phenomenon of clustering under the spectre of the formulated research questions.

2.1 Regional Innovation Scoreboard (RIS)

As mentioned in the introduction, researchers can derive information regarding innovation performance of regions through various sources including websites like Cluster Observatory (ClusterObservatory.eu), Cluster collaboration (clustercollaboration.eu) and Regional Innovation Scoreboard (ec.europa.eu). However, this paper uses RIS tool from EC because as the assignor company and the researcher agreed after a brief research, EC examines and analyses constantly information regarding innovation performance of the European regions and countries. EC generates new editions of the RIS tool every one or two years. Furthermore, EC provides supporting documents with information explaining the included indicators and the executed analysis (EuropeanCommission, 2019d). Thus, the structure of the RIS allows the researcher to examine the regions based on their performance in three common (between the regions) indicators that EC uses to assess innovation performance.

RIS 2017 uses 18 indicators to assess the innovation performance of the European regions. This paper targets to identify how clusters in five of the most innovative regions in European Union support innovation performance by using the indicators of RIS 2017 and examining clusters' contribution in the areas related to them. RIS provides the foundation for this study and therefore it is important to discuss more about what it is and why it is used in this paper.

2.1.1 Regional Innovation Scoreboard

As mentioned in the introduction, this study tries to connect the clusters with regional innovation performance. The researcher uses the RIS to identify which clusters are Innovation Leaders + and examine afterwards how clusters in these regions contribute to innovation performance. EC publishes annually the *European Innovation Scoreboard* (EIS), a tool used to assess and compare the national research and innovation systems of the EU countries, other European countries, and regional neighbours (EuropeanCommission, 2019b). On the other hand, *Region Innovation Scoreboard* (RIS) represents an extension of the EIS and it is used to assess and compare the regional innovation performance based on a limited number of indicators (compared to EIS) (EuropeanCommission, 2019d). This study will base its research upon three indicators of RIS 2017, in which Västsverige has low rating scores (Paragraph 2.1.3.).

Also emphasized by RIS 2017, regions and the clusters within regions are particularly important for regional economic development and innovation performance (EuropeanCommission, 2019d). Clusters, usually represented by cluster initiatives such as BRG, try to boost innovation performance of a region because, as European Commission confirms, innovation is crucial – especially for regions – for productivity, competitiveness and growth (EuropeanCommission, 2018). Based on that, this study uses RIS 2017 trying to reveal why clusters are important for innovation performance and what activities and mechanisms support and promote regional innovation performance in relation to the targeted indicators. The most recent edition of the Regional Innovation Scoreboard is RIS 2017 and examines 220 regions across 22 EU countries, Norway, Serbia and Switzerland. RIS includes also Cyprus, Estonia, Latvia, Lithuania, Luxembourg, and Malta at country level. The report uses 18 of the total 27 indicators used in EIS containing data regarding the economic structure of the regions, business and socio-demographic indicators which according to EC have significant impact on the performance scores of the regions.

2.1.1.1 Most innovative regions in Europe (RIS 2017)

The five innovation leading regions which are part of this study were selected from BRG and the researcher because they are ranked as Innovation Leaders + and they also perform exceptionally in the three areas covered by the examined indicators. Therefore, it is believed that the clusters in these regions will be able to provide valid and reliable answers to the formulated questions. RIS 2017 aims to reveal the most innovative regions among over 220 regions across Europe by categorizing the regions into 4 innovation performance groups according to their performance (Figure 1). Furthermore, each group includes three sub-categories: A high one-third (marked with "**+**"), representing the most innovative regions of the specific performance group, a middle one-third and a low one-third (marked with "**-**"), representing the least innovative regions of the specific performance group (Figure 1). The focus of this study relies upon the darkest bullet of the first category, which is Innovation Leaders +.

Figure 1, *Innovation performance groups*. (Source: RIS 2017)

According to RIS 2017 and the table Top -25 Regional Innovation Leaders (Appendix 1) the top three most innovative regions within Europe for the year 2017 were Stockholm from Sweden, Hovedstaden (Copenhagen) from Denmark and South

East from United Kingdom. Overall, the most innovative region among all the examined by the RIS 2017 regions, was Zürich from Switzerland.

2.1.1.2 Main findings of RIS 2017

Except revealing the most innovative regions, RIS 2017 points out a few additional findings extracted from analysing and comparing the gathered data used in RIS 2017. EC suggests that among the most important additional findings of RIS 2017 are the four points presented below (EuropeanCommission, 2019d):

- *The most innovative regions are typically in the most innovative countries.*
- *Rank results revealed: Stockholm most innovative region in the EU.*
- *For most regions innovation performance has improved over time.*
- *Strong link between innovation and regional competitiveness.*

2.1.2 Indicators for regional innovation performance

As mentioned before, RIS 2017 uses 18 indicators to measure regional innovation performance. The indicators were carefully selected from European Commission to capture innovation performance even if there are structural differences between the regions. For example, RIS 2017 uses business R&D expenditures, EPO patent applications and innovative enterprises to find out and point out that differences in economic structures, like in the share of industries in GDP, can be captured by differences in these three indicators. Likewise, differences in the characteristics of enterprises can explain differences in R&D spending and innovation activities. Demographic characteristics, such as the density of populated areas may explain differences in tertiary education or life-long learning as well. Even though, this paper does not aim to go deeper and analyse the contribution of clusters in relation to the differences in economic structures or characteristics of the companies, it is important to know that these indicators are designed to assess innovation performance and they can capture such differences.

The 18 indicators that RIS 2017 uses to measure regional innovation performance are grouped in four types: *Framework conditions*, *Investments*, *Innovation activities*, and *Impacts*. The table with the indicators is presented in the Appendixes section (Appendix 2).

2.1.3 Weak indicators of Västsverige

As explained before, this study focuses on 3 of the 18 indicators which according to the report of the RIS 2017, Västsverige's ratings are decreasing over the years or they are lower than the ratings from other regions ranked as Innovation Leaders +.

The first indicator is '*SMEs introducing product or process innovations as percentage of SMEs*'. RIS 2017 uses data, derived from Eurostat and the National Statistical Offices, to assess technological innovation by measuring the introduction of new products or processes. As EC points out, the increasing amount of technological innovators should be translated into higher innovation performance.

The second indicator is '*Innovative SMEs collaborating with others as percentage of SMEs*' and examines the level that SMEs are engaged in innovation cooperation. This indicator shows the ability of a company to reach information and knowledge or to cooperate with other actors and innovate. EC adds that this indicator is a measure of the shared knowledge between public research institutions and companies, and between companies. The indicator is targeting SMEs, because almost all large multinational enterprises are actively engaged to innovation collaborations.

The third indicator is '*Sales of new to market and new to firm innovations as percentage of total turnover*'. Although Västsverige's rating to this indicators was almost doubled from RIS 2016 to RIS 2017 (0,19 →0,36, in a scale from 0 to 1), the rating is still low. The indicator is calculated by dividing the numerator which is the turnover of the new products (new to market and new to firm) with the denominator which is the total turnover from SMEs.

2.2 Clusters

Michael Porter introduced the term Business Cluster, also known as Porterian Cluster in 1990 in his book "*The Competitive Advantage of Nations*" (Porter, 1990). According to a simplified definition that he presented to us later, "*A cluster (in business world) is a geographical proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and externalities.*", (Porter, 2008). This is the definition of the term cluster as it is used also in this study.

Through years, more and more researchers focus on the relationship between clustering and innovation (Asheim & Coenen, 2005; Cooke, 2001; Mytelka & Farinelli, 2000; Novelli et al., 2006; Pouder & St. John, 1996). Innovation is the epicentre of this paper and is it used as Maranville (1992) described it as a better idea, a new creative thought, a new more efficient method or in other words a better "*solution*" to the new requirements and needs of a market. OECD argues that innovation for regions represents a tool which is used to promote economic development. Therefore, regions design strategies and policies grounded in a regional analysis of the strengths and weaknesses, favouring entrepreneurship, business growth and innovation.

A core concept in the theory of clusters is *localized learning* (knowledge). The effects of this concept benefit directly the region and the existing firms but also in long run, they facilitate economic growth and prosperity (Malmberg & Maskell, 2006).

Clusters are very important for the regions as their activities trigger the creation of localized learnings. According to Markusen (2017) these localized learnings are mainly technological spill-overs originated from the innovating activities of the clusters' network, like entrepreneurs, firms and academia. Etzkowitz Henry and Leydesdorff Loet designed a framework which describes the interactions between the academia, industry and governments powered by an ultimate purpose of fostering economic and social development through innovation. This framework is fundamental for this paper and it was theorized in the 1990's known as "*The triple helix model of innovation*" (Leydesdorff 1995) (Figure 2).

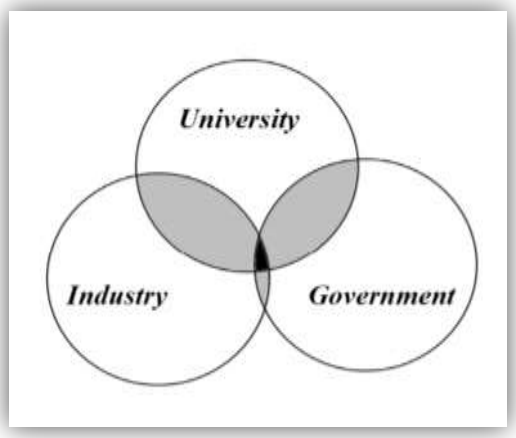

Figure 2, *Representation of the Triple Helix* (Source: Smith and Leydesdorff, 2014)

The foundations of clustering theory are seen in the *competitive advantage theory* that Porter described by using the *Diamond Model (Porter, 1990)*. The four forces composing the diamond model are: *Demand conditions, Related and supporting industries, Firm strategy, Structure and rivalry within the industry* and according to Porter these forces contribute to the competitive advantage of a company or a region. Clusters represent the manifestation of this model to an economy and the close proximity of the actors pushes them to innovate and develop regions further more (Monteiro et al., 2011; Porter, 1990).

After Baptista and Swann (1998) examined 248 manufacturing firms for a period of 8 years, they concluded that firms within strong clusters are more likely to innovate. Today, European Commission uses quantitative data, such as employment growth, to reinforce with numbers the findings of the studies underlining the importance of clusters and their impact over innovation (Rui Baptista & Swann, 1998), economic and social development, knowledge production and diffusion (Monteiro et al., 2011) and competitiveness (Fundeanu & Badele, 2014). According to EC from 2010 to 2013 33.3% of the total companies within clusters had an employment growth more than 10%. However, only 18.2% of the companies outside the clusters had the same percentage of employment growth (>10%) (EuropeanCommission, 2019a). The five cases from this study are strong clusters in five different countries and therefore,

according to the literature above, it is anticipated that they will be able to explain the valuable role of a cluster in supporting regional innovation.

2.2.1 Cluster initiatives & Cluster organizations

Clusters are dynamic and complex but also constantly evolving constellations of participants. They can be compared to a living organization, unceasingly self-adapting to the unique characteristics of each environment, industry and/or region (Cooke et al., 2007).

Although, it is very difficult to define or identify a common structure among clusters, and it is not targeted in this study, they usually constitute of suppliers, customers, governmental and nongovernmental institutions, universities, professionals and any other stakeholder who is able to add value to the value chain of the targeted industry (Monteiro et al., 2011). However, according to Sölvell, Lindqvist et al. (2003) cited also by European Commission, there are "*...organized efforts (aiming) to increase the growth and competitiveness of a cluster within a region, involving cluster firms, government and/or the research community".* These efforts are called *Cluster Initiatives* and they are often operationalized by a *Cluster Organization*. According to European Commission cluster organizations, are usually public or private entities aiming to trigger, support and promote activities, between the members of the cluster, in terms of innovation, networking, business environment and human resources. In addition, cluster organizations target to strengthen clusters and its' competitiveness. (EuropeanCommission, 2018). The five cases of this thesis are five cluster organizations acting in one main industry including a variety of members or partnerships in their networks.

2.2.2 Policies

Cluster policies is a concept that many countries tried to work with in order to support and grow clusters and reap the benefits of clustering effects (EuropeanCommission, 2018). The efforts are focusing mostly on changes to national or regional economic policies that can support clustering and the creation of cluster organisations or cluster initiatives (Andersson, Serger, Sörvik, & Hansson, 2004; Borrás & Tsagdis, 2008; Ketels, Lindqvist, & Sölvell, 2012; Sölvell, 2009). As a result, clusters are able to grow stronger and support regional networks which in turn has a positive impact on regional innovation performance. European Commission, World Bank and other institutions like UNCTAD, recognised the importance of the clusters in the process of development of a country and especially in relation to regional policies (Uyarra & Ramlogan, 2012). Ultimately, this research will reveal more information regarding how policies influence innovation performance of a region and how clusters are in a position to influence the policies in favour of innovation.

Uyarra and Ramlogan (2012), remind us that in many cases benefits of clustering occur without establishing policies. The policies and the results of the policies are not directly connected with clusters but with general concepts like infrastructures, research and education (Uyarra & Ramlogan, 2012). Enright (2000) revealed through a worldwide survey that policies are seen as "*unimportant*" to the development of a cluster. Nevertheless, policy makers hold an influential key role to the reality of innovation and economic development of an geographical area (Uyarra & Ramlogan, 2012). As Arthur, W Brian argues, they can just "*push the system gently toward favoured structures that can grow and emerge naturally*" (Arthur, 1999).

2.2.3 Activities

This study focuses a lot on the activities of the Cluster Initiatives and Cluster Organizations, regardless their industry. Cluster Organizations try to strengthen cooperation and bring actors closer, collaborating under the same vision (Lublinski, 2003; Porter, 1998). According to Konstantynova and Lehmann (2016) the activities of a cluster initiatives and organizations can be numerous. The most commonly found activities aiming to facilitate communication between the members of the cluster, sharing information and knowledge, co-operation, networking, education & training, policy action, innovation & technology and internalization (Konstantynova & Lehmann, 2016; Sölvell et al., 2003).

Hospers et al. (2008) argues that implemented policies usually "*target*" specific activities from certain regions. Undoubtedly, policy making is a "*brainteaser*" for the policy makers' minds, as they can either support established and leading activities in a region which, in turn, will boost innovation performance, or provide support to a region by risking draining all the available resources without having in the end any substantial impact (Uyarra & Ramlogan, 2012).

Ketels, Lindqvist et al. (2006), after a survey on 1,400 cluster initiatives and comprehensive data from 450 cluster initiatives, categorized the activities of the business clusters and cluster initiatives in seven groups. The groups are presented below at *Table 2*.

It was 10 years after Ketels, Lindqvist et al.(2006), when Konstantynova (2016) examined the data from four ICT clusters in four different European and Non-European countries (Germany, Austria, Ukraine and Serbia) and she concluded to seven dominant bundles of cluster activities (Table 1).

Bundles of activities *(Konstantynova 2016)*
Information and Communication
Training and Qualification
Cooperation
Marketing & PR
Access to financing
Protection of property rights
Political lobbying

Table 1, *Groups of activities of cluster initiatives and organizations*. (Source: Konstantynova 2016)

Groups of activities *(Ketels, Lindqvist et al. 2006)*
Joint production
Joint sales
Human resources upgrading
Intelligence
Business environment
Firm formation
Joint R&D

Table 2, *Groups of activities of cluster initiatives and organizations*. (Source: Ketels, Lindqvist et al. 2006)

As the reader goes through the seven groups from Ketels, Lindqvist et al.(2006), and the seven bundles of activities from Konstantynova (2016) it seems inevitable to compare the categories and detect a resemblance in the foundation of the seven groups and the seven bundles to the four types of measuring regional innovation performance from European Commission and RIS 2017 (Table 3).

Categories of indicators *(RIS 2017)*
Framework conditions
Investments
Innovation activities
Impacts

Table 3, *Categories for measuring innovation performance used by RIS 2017*. (Source: RIS 2017)

In all cases, taking into consideration the above-mentioned literature the main focus relies on concepts like promoting collaboration, business and regional development, triggering and supporting innovation, impacts (e.g. sales) and human resources (e.g. researchers). Ultimately, these concepts have as an objective to facilitate economic growth and increase competitiveness of the regions and by extension of the countries where they belong.

2.2.4 Contribution of clusters to the three targeted indicators

As mentioned in the introduction, this study is aiming to understand how clusters support regional innovation performance. Therefore, the researcher tries to identify

how clusters, and more specifically cluster organizations, contribute to the indicators that RIS 2017 uses to rate regional innovation performance. Taking into consideration the delimitations presented in the introduction and the limitations presented in the final chapter, this paper focuses on three of the indicators that RIS 2017 uses, in which Västsverige's ratings are lower than other innovative regions from RIS 2017. The three indicators are: *SMEs introducing product or process innovations as percentage of SMEs, innovative SMEs collaborating with others as percentage of SMEs and sales of new to market and new to firm innovations as percentage of total turnover*.

2.2.4.1 SMEs introducing product or process innovations as percentage of SMEs

European Commission uses the indicator "*SMEs introducing product or process innovations as percentage of SMEs*" to rate innovation performance of regions. According to the studies below, clusters can increase directly or indirectly regional innovation performance by supporting their regions and the actors in the region, e.g. SMEs, in their effort to introduce products and process innovations. Among the most obvious roles of a cluster initiatives and cluster organizations is to connect actors (Porter, 1998). As Porter argues, by connecting actors they are able to share infrastructure, which can result into more innovative products and processes. He also points out that effective communication among the actors grants access to input and output markets (Porter, 1998). This access allows them to grow and introduce more innovations. As a collateral benefit, boosting innovation performance clusters get the chance to facilitate economic growth and increase competitiveness of a region though this process which by default is their main mission.

Baptista and Swann (1998) connect the clusters' success and the creation of new technologies, with the concept of sharing knowledge and the appearance of spill-over effects sourcing from the activities of the clusters. They argue that "*One of the main reasons behind the existence and success of clusters is the pervasiveness of knowledge externalities or spill-overs. It seems likely that spill-overs, particularly those associated with new technological knowledge, tend to be geographically localised.*" Towards the same findings points out a study conducted by Hoen (2001), which reveals that clustering generally leads to innovations, diffusion of technologies and information, spill-overs and competitive advantages.

Clusters can also support SMEs on introducing product or process innovation and regional innovation performance by increasing high quality skilled labour and specialized machinery. According to Ozkanli and Akdeve (2006) clustering enables enterprises to have access to high-quality and skilled labour but also to specialized machinery. In turn, high-quality labour triggers face-to-face interaction and diffusion of knowledge and information. That allows actors and especially SMEs to utilize this knowledge and generate more product and process innovations.

2.2.4.2 Innovative SMEs collaborating with others as percentage of SMEs

Among the several benefits of clustering are low transportation costs, strong localized supply and demand but also economies of scope and scale. These benefits drive SMEs and other actors to collaborate efficiently and increase innovation capacity of the regions (Krugman, 1991a; Sanchez & Omar, 2012).

Another paper from Baptista and Swann (1996) revealed that there is a higher possibility that strong clusters will attract new entrants, e.g. entrepreneurs and SMEs. Through increased collaboration and other benefits of clustering, these entrants tend to grow faster compared to other actors of a region without cluster.

Reaping the benefits of their strong network, clusters promote collaborations, cooperative research and striving, sharing infrastructure, diffusion of information and access to public goods (Porter, 1998; Sanchez & Omar, 2012). As a result, clusters increase collaboration between their members by creating an ideal collaborative environment and by facilitating the participation of the networks members in sectoral or inter-sectoral projects and programmes.

Finally, strong clusters can attract foreign investments and key players from domestic or foreign markets which in turn boosts collaborations and synergies (Sanchez & Omar, 2012). Further researches have concluded to the fact that foreign-owned companies can contribute to the upgrading of the clusters and multiply the benefits connected with the clusters like the diffusion of knowledge and collaborations between actors (Birkinshaw, 2000).

2.2.4.3 Sales of new to market and new to firm innovations as percentage of total turnover

Supporting the findings from Porter (1998) regarding the benefits of sharing infrastructure and the availability of input and output markets through clustering, Braunerhjelm and Carlsson (1999) revealed with their research in Ohio and Sweden, that clusters create strong supply and demand channels which are used by participants like SMEs to distribute their products into the market. These linkages can be also used to distribute new to market or new to firm innovations.

A more recent paper from Sanchez and Omar (2012) supports that communities and regions have realized that the best way to achieve economic development and growth, is to support clusters of firms rather than trying to reach companies one by one to a specific area. This syllogism leads to the conclusion that clusters represent a portal which allows stakeholders to reach easier the firms in the cluster through cluster management. By applying a reverse thinking, clusters represent a platform which allows the companies within clusters to communicate equally easily with a larger proportion of the market outside the region. Acting like catalysts, clusters

adopt the role of the intermediate that facilitates the communication between the members of the cluster and other stakeholders, resulting into new partnerships and increased sales.

2.3 Summary of literature review

The existing literature on clustering and regional innovation has been reviewed and it is presented in this chapter in order to create a solid theoretical foundation for this paper. Demonstrated above with the help of the RIS 2017 tool, clusters seem to hold a central role to innovation capacity of regions strengthening in many ways and with many activities regional innovation performance. Nevertheless, this paper tries to go deeper and examine unexplored or barely explored areas like the contribution of the clusters in Innovation Leading + regions in the specific three areas described by the selected indicators. Literature review is used together with the results of the conducted research to critically synthesize the analysis and support the conclusion of this paper.

3 Methodology

In chapter 3, it is explained the context of the presented study. What tools of research were used, how they were applied and why these tools were selected to serve the purposes of this study, are only a few of the hypothetically addressed questions. More specifically, this chapter describes the research strategy and design of this study, the methods of collecting and analysing data and the criteria which will ensure a high-quality research and results.

3.1 Research strategy

Through this study, BRG aims to strengthen its knowledge in the ways that clusters contribute to regional innovation in the most innovative regions. The main focus of the assignor company is to gain a deeper understanding of the clusters' behaviour in innovative regions. In other words, this thesis adopts an inductive approach and targets to build a theory related to why clusters are important for regional innovation performance and what methods clusters of the most innovative regions use to support innovation in relation to the stated three indicators (1.2 Purpose). The formulated exploratory research questions aim to reveal and describe the main themes of the methods that clusters in the Innovation Leading + regions are used and how they are used to trigger, support and promote innovation performance taking always into consideration the three indicators. Therefore, the researcher chose to use a qualitative strategy based on interviews where interviewees can describe with words how these methods are applied in their regional context.

Atieno P. Orchieng (2009), in her article "*An analysis of the strengths and limitation of qualitative and quantitative research paradigms*", states the most important assumptions of a qualitative design in a research. According to the assumptions of Atieno, a qualitative design in this paper allows the researcher to examine processes regarding managing and supporting innovation rather than countable outcomes and products. Thus, the exploratory research questions like the formulated research questions of this study – guided by the qualitative approach – will be better answered with a theory based on the gathered data and empirics, (Bryman & Bell, 2011). As Barley (2006) argues, qualitative researchers tend to have greater potential to write interesting papers, because they "*have already departed from mainstream methods, [and] have less to lose … by taking theoretical risks.*" (Barley 2006: 19). That means that adopting a qualitative approach in this paper gives the opportunity to the researcher to step into unexplored areas and gain an understanding of a complex subject like clusters and how they contribute to the specific regional innovation areas.

Taking into consideration the information above and the purpose of this study, it is wise to base this research on a qualitative approach, with some references to quantitative measures to strengthen the quality of the research and its findings.

3.2 Research design

According to Bryman and Bell (2011), the framework that will guide the process of collecting and analysing data during a research is the research design. As explained in the introduction this study aims to examine why clusters are seen as important for regional innovation performance and how they contribute to it based in respect to the three pointed indicators. A case study with a multiple-case study design has been chosen for framing this research with a scope to allow the researcher to base the findings on more cases and increase their reliability and validity.

In accordance to Stake (1995), the complexity of a topic like the clusters and the abundancy of factors that influence innovation performance, can lead a researcher to use a case study research design and more specifically a multi-case study. As Bryman and Bell (2011) emphasize, a case study is usually used when researchers want to build theories, which is also the case in qualitative research and in this paper. This particular paper aims to gain a deeper knowledge and create a theory on how clusters support, promote and trigger regional innovation taking into consideration the pointed indicators for regional innovation performance. Furthermore, the case study framework is a popular design among researchers in business fields and it allows in-depth analysis of this particular topic on the activities and mechanisms that clusters use in each examined region (M. Eisenhardt & E. Graebner, 2007).

The concept of multiple-case study is used in this case because the researcher aims to grasp complex phenomena like the concept of clustering and the concept of regional innovation performance. This research targets to examine five cross-national and cross-cultural cases and therefore a multiple-case study structure will be used (Bryman & Bell, 2011). Both BRG and the researcher agreed that five cross-regional and cross-national cases with interregional and international references from five Innovation Leading + regions, will be sufficient to reveal the targeted information and create a solid theory answering the stated research questions

Bryman and Bell (2011) argue that a disadvantage of a case study design is that it is difficult to replicate and therefore lacks of external reliability. To manage this issue, the study hires the previously mentioned quantitative measures.

3.3 Research methods

Data collection is one of the most important parts of this research. The collected data are used to extract information related to the purpose of the research questions and they support the generated theory. As a main method to collect data, this study uses semi-structured interviews and more specifically one semi-structured interview (45 minutes each) for each of the five cases (Table 4). In addition to that, documents analysis method (memos, reports) has a supportive role and it is used as a source of additional information. Thus, it is very important for this

paper to use multiple sources of information to strengthen the validity of the findings given the fact that each case will be examined with only one semi-structured interview. According to Bryman and Bell (2011), using multiple research methods allows the research to cross-check the data and the findings and this is called *triangulation* (Bryman & Bell, 2011).

Among the most popular methods to collect data in a qualitative research are interviews (structured, semi-structured and unstructured) and document analysis. However, performing semi-structured interviews, adds more flexibility to the process of collection data (Bryman & Bell, 2011), and this is the reason why this method was chosen. Semi-structured interviews are usually combined with interview guides, which provide direction to the process of interview. The interview guide of the current thesis contains several questions grouped into pre-set topics derived from the four types of indicators that RIS 2017 uses to assess regional innovation performance (Appendix 2)(Appendix 3)(Appendix 7). During the semi-structure interviews the interview guide was used to give orientation to the process but also to allow the interviewer to steer the interview according to the answers of the interviewee and the unique characteristics of each case, which is useful here given the fact that the research involves five different cases.

The document analysis is used here as a complementary method to the main research method, to fill in potential gaps in empirical data. The documents are mainly internal documents, memos or information from the webpage of the cluster organizations and researcher has cautiously gathered and analysed these documents and the extracted information.

3.3.1 Sampling

Mentioned also in the introduction, this study uses three indicators from RIS2017 to go deeper and understand why clusters are important for regional innovation performance and how clusters contribute to regional innovation performance by addressing to the stated indicators above. The case of Västsverige and its indicators with low ratings for the region were used to give orientation to this study. The three indicators where Västsverige has low ratings are: 1) *SMEs introducing product or process innovations as percentage of SMEs, 2) Innovative SMEs collaborating with others as percentage of SMEs and 3) Sales of new to market and new to firm innovations as percentage of total turnover*. By addressing to these indicators this paper aims to achieve the formulated purpose and give solid answers to the formulated research questions.

Both BRG and the researcher agreed that five regions ranked as Innovation Leaders + and high ratings in the targeted indicators from RIS 2017 will be sufficient to provide the necessary information to give solid answers to the formulated questions. The selected regions are presented below to *Table 4*. According to the

regional innovation profile of each of the five regions and the regional profile of Västsverige from RIS 2017 (accessed through ec.europa.eu), the five regions have higher ratings from the region of Västsverige and their consecutive presence among the most innovative regions in Europe (EuropeanCommission, 2019d) indicates that they could provide answers to the research questions (Appendix 4). As mentioned also in the delimitation of this paper, it is of secondary importance whether the examined clusters operate in the same industry or not. This study aims to examine the non-industry-oriented methods and activities, which can indicate the contribution of a cluster in a top innovative region taking into consideration the formulated questions and the selected indicators. The cluster organizations and the participating interviewees were selected and contacted from BRG (Table 4). Most of the participating actors were already in the network of BRG and that increased significantly the probability of ensuring a high response rate which was 100% (5 executed interviews out of 5 invitations). Eventually, the selected clusters are seen as a key to understand how clusters from top innovation regions contribute to regional innovation performance in relation to the three targeted indicators from RIS 2017. This method of sampling is called purposive sampling and belongs to the non-probability forms (Bryman & Bell, 2011).

A negative aspect of using this method of sampling is that non-probability sampling method does not allow the researcher to generalize easily the findings because the sample is selected by having in mind the research purpose and the available resources and therefore it does not represent the total population (Bryman & Bell, 2011).

The selected regions with the corresponding clusters and the interviewees are presented to the table below. The names and the positions of the interviewees are not mentioned since some of the interviewees wished to remain anonymous. However, access to such information can be granted from the researcher upon request.

Region	Country	Sector	Cluster Organization	Interviewee	Position	Duration of interview	Date
Stockholm	Sweden	ICT	Kista Science City	Interviewee A	Director	50 min.	2019/04/11
Etelä-Suomi	Finland	Smart Mobility	Business Finland	Interviewee B	Director	30 min.	2019/04/24
Hovedstaden (Copenhagen)	Denmark	Health sciences	Biopeople	Interviewee C	Director	35 min.	2019/04/16
Stuttgart	Germany	Automotive	e-mobil BW GmbH	Interviewee D	Director	45 min.	2019/04/24
Zürich	Switzerland	Finance	The office of economy and Labour	Interviewee E	Head of Department	50 min.	2019/04/17

Table 4, *Sample & Interviews*

3.3.2 Semi-structured Interviews & Interview guide

Semi-structured interviews are usually combined with an interview guide and they are commonly used because they offer a fair trade-off to the interviewer between focusing on the topic and being flexible to steer the interview process according to the unique characteristics of each interviewee (Bryman & Bell, 2011).

It is worth mentioning that although face to face interviews tend to make participants feel more comfortable and open to the process, executing this type of interviews is quite difficult, especially in this case of an international research for a master thesis project due to high-cost and time-consuming procedures. Therefore, the interviews were executed through internet.

The duration of the interviews was approximately 45 minutes each (Table 4) to make sure that the researcher will extract successfully all the required information in order to answer the research questions. The questions of the interview guide were grouped into pre-set topics, aiming just to ensure that all topics will be discussed during a structured but also flexible interview process. As this research uses extensively the RIS 2017, the pre-set topics of the interview guide were formed after a brief literature review and by using the same groups of activities that EC uses in RIS 2017. Particular attention was given to the groups of indicators related to the three targeted indicators of this thesis targeting to reveal how clusters trigger, support and promote regional innovation.

The formulated questions and, in turn, the pre-set topics were tested in a pilot study (pilot interview) aiming to ensure the clarity and quality of the questions. Also, the pilot study is used to make sure that the questions will manage to extract the targeted information without putting in danger the reliability and the validity of the

data and the conclusions of the study. The final form of the interview guide is presented at the Appendix section (Appendix 3).

Region	Country	Sector	Cluster Organization	Interviewee	Position	Duration of interview	Date
Västsverige	Sweden	Innovation	BRG	Pilot Interviewee	Director	30 min.	2019/04/04

Table 5, *Pilot Interview*

3.3.3 Data analysis: Thematic analysis

Another very important part of a conducted research is the analysis of the collected data. As this research uses a qualitative research strategy, a thematic analysis approach can become a very useful guide to analyse the data.

The collected data were gathered and the researcher categorized the main concepts of the data to a few main themes. The themes offer a flexible context that should lead us to understand easily the main mechanisms behind the contribution of the clusters to regions. Given the fact that this research uses interviews but also secondary data (document analysis), the collected information need to be organized and examined carefully. Thematic analysis allows the researcher to analyse the vast amount of data and organize them in a clear and easily understandable way (Nowell, Norris, White, & Moules, 2017). Finally, this approach leads successfully to an explanatory theory behind the identified patterns in clusters' behaviour which represents also the main purpose of this study.

A common issue with thematic analysis is that the cases with small samples can lead to false generalization. Although, the sample of the research cannot be characterized as a small sample, it is not a representative sample from the whole population. As a result, the final conclusions can be generalized to the clusters with characteristics similar to those of the most innovative regions ranked as Innovation Leaders + from European Commission, located in the Central and Northern Europe.

3.4 Research quality

In this qualitative research, there are several issues that might affect the quality of the study described both in the delimitations and limitations sections and the researcher should be cautious. To ensure high quality and reliable results to a project with a complex topic like this one, the study should follow the criteria presented below (Lecompte & Goetz, 1982):

- *External reliability (replicability)*
  By definition, it is difficult in a qualitative research to ensure that the study can be replicated, as the social setting is changing all the time especially when it comes to a dynamic and constantly evolving concept like the clusters. Nevertheless, as stated in the introduction and described in the Methodology part, this study tries to define in detail the reasoning why the specific regions and the specific clusters were chosen for this study, which allows a future researcher to replicate it.

- *Internal reliability (inter-researcher consistency) & Internal validity (theory-observations)*
  Inter-researcher consistency ensures that possible observers will be able to agree upon what was observed during the research. Although, this research has only one researcher, recording and transcribing the interviews allows any researcher to access the information and examine the extracted information. At the same time, targeting to ensure internal validity the researcher should be able to "*translate*" the collected data into the same theories as any other researcher.

- *External validity (generalizability)*
  As mentioned also before, the findings of this study correspond to clusters with characteristics similar to the examined clusters. Taking into consideration that the whole population of this research cannot be examined through a master thesis project, this study constitutes a starting point for investigating the contribution of the clusters in relation to innovation performance in five the most innovative regions (Innovation Leaders + according to RIS).

4 Results

This chapter presents the case studies of the five regions ranked as Innovation Leaders + by the European Commission. The case of Västsverige was used as a point of reference to orient and guide this research by providing to the researcher the 3 mentioned indicators. The chapter is divided in two parts. The first part consists of secondary data which are used to strengthen the findings of this study. The collected information includes regions' characteristics and details about the selected industry found on clusters' reports or websites. The second part of this chapter contains empirical findings from the conducted interviews with key actors from the examined clusters.

4.1 Secondary data

4.1.1 Point of reference: Västsverige (SE)

Västsverige is located on the Western Sweden and includes Västra Götaland County and Halland County. With a population of 1,992 million Västsverige covers 30,934 km^2 (EuropeanCommission, 2019c). Västsverige focuses a lot on stimulating innovation and therefore there are several science parks supported both by public and private stakeholders. The most famous parks are *Innovatum Technology Park* in Trollhättan and an international park based in Gothenburg called *Lindholmen Science Park*. In 2015, the amount of €3.3bn was invested in R&D which represents 3.8% of the regional GDP (Appendix 5), showing the strong competence of the region in R&D and innovation. It is worth mentioning that the EU-28 average is 2.0% (EuropeanCommission, 2019c). According to European Commission, the two thriving sectors in the region are automotive manufacturing and trade. The region's focus on R&D innovation is guided from local cluster programmes, initiatives and organizations.

4.1.1.1 Sector and cluster organisation

European Commission refers to Västra Götaland, which is the biggest part of Västsverige, as the centre of the manufacturing industry, trade and logistics in Sweden (EuropeanCommission, 2019c). The region has a complete value chain in automotive sector from R&D to the final product (e.g. automobile vehicles). Almost 40 000 direct employees from 260 companies work for the automotive sector in Västra Götaland. As BRG emphasizes, important key to the region's success in automotive industry is the unique environment for collaboration composed of enterprises, academia and public sector (Triple Helix model). Local Science Parks act as platforms allowing the highly skilled workforce to collaborate and innovate within cross-disciplinary and cross-industry projects (e.g. AstaZero, ElectricCity and DriveMe) (BRG, 2019).

Business Region Göteborg is a non-profit organisation aiming to stimulate cooperation and optimize conditions for the region's business community. Owned by Göteborgs Stadshus AB, BRG represents 13 municipalities in Sweden targeting at bridging the gaps within industries. To achieve that BRG initiates industry partnerships leading to viable innovations, stimulates collaborations by facilitating the creation of sustainable networks and creates activities such as meeting places and projects, adapted to the unique needs of each industry.

BRG acts both locally and internationally trying to create new exciting cluster opportunities and long-term innovations. Finally, the organization bridges the gaps between key partners like companies, society, research, education, capital and other global markets.

Figure 3, *Key partners* (Source*: BRG, 2019*)

4.1.1.2 Cluster's contribution to regional innovation

Acting as a cluster organization, BRG contributes to regional innovation performance by bridging the gaps and creating the conditions for actors in automotive industry to connect and collaborate together. By analysing Västsverige's regional profile from RIS 2017 but also from previous editions of RIS (2007, 2009, 2011, 2014, 2016), we can spot two indicators for innovation performance, in which Västsverige has decreasing ratings and one indicator with low ratings over the years. The indicators are '*SMEs introducing product or process innovations as percentage of SMEs*', '*Innovative SMEs collaborating with others as percentage of SMEs*' and '*Sales of new to market and new to firm innovations as percentage of total turnover*' respectively (Paragraph 2.1.3, Weak indicators for Västsverige).

4.1.2 Overview of Stockholm (SE) region

From 2011, Stockholm is consequently being placed among the top 4 innovative regions according to the Regional Innovation Scoreboard and European Commission (EuropeanCommission, 2019d) and therefore a particularly interesting region for this paper. Ranked as "*Innovation Leader +*" and the most innovative region in the European Union from RIS 2017, the County of Stockholm covers an area of 6,779 km^2 on the Baltic Sea coast of Sweden. The region has 2,269 million inhabitants. Almost half of the county's population is concentrated to the municipality of Stockholm with approximately 1 million inhabitants (EuropeanCommission, 2019c). Indicating its focus on innovation, the County of Stockholm has many business start-ups, with 16.1 new companies per 1,000 inhabitants (EuropeanCommission, 2019c). As the entire worldwide business scenery is changing towards services, innovation is more and more connected to the competence in fields like Information and Communication Technologies (ICT). The region of Stockholm is worldwide known for the competence in knowledge intensive sectors like ICT, life sciences, financial services, and transportations (EuropeanCommission, 2019c). Finally, the region attracts huge amounts of investments in R&D. For example in 2015, the amount of €5.4bn was invested in R&D (3.78% of the GDP, Appendix 5) which 74.7% of these investments were assured by private companies (EuropeanCommission, 2019c).

4.1.2.1 Sector and cluster organisation

A pivotal factor for the region's strong competence in ICT is the strong presence of world famous multinational companies with particular focus on high-tech sector. According to Eurostat (Eurostat 2018 cited by European Commission 2019), in 2017 Stockholm was employing approximately 103.5 thousand people in high-tech related professions, which is more than 40% of the national employment in the sector. Government, industry, academia and research institutes collaborate on exploring and testing new ideas and future solutions. Urban ICT Arena is transforming the city environment into an open testbed which, according to Urban ICT Arena's webpage, aims to bring stakeholders closer to an environment where they will be able to explore new opportunities in smart technologies, digitalization, automation and innovation in general (KistaScienceCityAB, 2019).

Kista Science City is located to the city of Stockholm and according to Kista's website, the cluster is the largest ICT cluster in Europe and the third largest ICT cluster in the world. The shared responsibilities of the cluster include higher ICT education, growth and innovation, promoting and developing the region and finally operating like a business incubator allowing people like entrepreneurs, students and researchers to transform their ideas into actual businesses (KistaScienceCityAB, 2019). According to the information from the cluster, its network consists of around 1,000 companies and at least 400 of them are big multinational enterprises, SMEs

and research institutes in ICT sector, but also other entities like universities and supportive companies (e.g. cafeterias and restaurants) (KistaScienceCityAB, 2019).

4.1.3 Overview of Etelä-Suomi (FI) region

From 2012, Etelä-Suomi (Southern Finland) consists of five smaller regions: *Etelä-Karjala, Kanta-Häme, Kymenlaakso, Päijät-Häme and Varsinais-Suomi*. All the regions together cover an area of 35,378 km^2 to the Southern part of Finland. The population in the region of Etelä-Suomi is 1,159,174 people, which represents more than 20% of the total population of Finland. Even if the innovation performance of Etelä-Suomi region has slightly dropped through the last few years, the region is still among the most innovative regions in Europe ranked by European Commission and the RIS 2017 as Innovation Leader + (EuropeanCommission, 2019c). Worth-mentioning is that the R&D expenditure dropped significantly after crisis to 2% of GDP (Appendix 5). During the financial crisis of 2008 the region faced problems in the sector of maritime and therefore there is structural change from maritime and ICT sectors to biotechnology, clean technologies, circular economy, smart manufacturing and IoT solutions. Finally, region tries to strengthen the regional ecosystem by supporting new projects and by bringing companies closer and embracing the use of shared resources (BusinessFinland, 2019). For example, the examined cluster organization supports a project the *FISS (Finnish Industrial Symbiosis System)*, aiming to support and develop circular and discover new value chains (BusinessFinland, 2019).

4.1.3.1 Sector and cluster organisation

Although among the strongest sectors in Etelä-Suomi are maritime, ICT, biotechnologies and clean technologies, the region along with the country puts a lot of emphasis also on the Smart Mobility sector. In 2018, Business Finland launched a programme (2018-2022) focused on this sector aiming to taking advantage of the local strengths, particularly in ICT, and the radical changes in the transport sector towards a more digitalized environment. By creating a new ecosystem and by establishing strong connections between its network and companies from competitive countries in the industry e.g. Sweden, Germany, China, Japan and U.S., Business Finland aims to create new knowledge in the sector. The transition to a digitalized Smart Mobility sector is also supported by the government and the favourable policies. For example, in 2018 automated vehicles were temporary exempt from vehicle tax (*Interviewee B*). Even though Smart Mobility is not the best sector in Etelä-Suomi, region's strength in ICT offers a fertile soil for Smart Mobility to grow steadily (BusinessFinland, 2019).

The provided services from Business Finland actively help the 100 Finish mobility companies in its network to grow sustainably. The organisation acts like a cluster

organisation and supports activities in relation to innovation, networking, internationalisation, investments and also in relation to tourism. Through the two-fold strategy of Business Finland, the organisation aims to help regional companies to grow internationally but also to create world-recognized business ecosystems. That increases the innovation capacity and the competence of a region and its cluster globally (BusinessFinland, 2019).

4.1.4 Overview of Hovedstaden (Copenhagen) (DK) region

The region of Hovedstaden (Capital Region of Denmark) is the smallest geographically region of Denmark with just 2,560km^2 and according to the *Population quarterly* database from Statistics Denmark, it is home to 1,835 million people which is the 31.4% of the total Danish population (StatisticsDenmark, 2019). The cosmopolitan region of Hovedstaden is among the most educated and innovative regions of the second most innovative country of the EIS 2018 report. European Commission rates the region among the top 4 innovative regions of all the examined regions in 4 consecutive versions of the RIS (2011, 2013, 2015 and 2017). Hovedstaden is a powerful engine for the economic growth of the country accounting for the 40% of the Danish gross domestic product (GDP) which is over €111 billion (EuropeanCommission 2019) and the R&D expenditure is among the highest in Europe reaching 4.56% of GDP in 2015 (Appendix 5). In addition, the region attracts the 85% of all foreign investments placed in Denmark (EuropeanCommission 2019) creating prosperous conditions for innovation. According to European Commission and the official website of the region, the capital region has a strong competence in various areas including Green and Clean-tech technologies and Smart city solutions, however it is highly specialized in the healthcare sector (EuropeanCommission 2019) (Biopeople, 2019).

4.1.4.1 Sector and cluster organisation

The capital region of Denmark and its advanced competence in innovation has attracted many high-tech companies. Approximately 80% of the high-tech and welfare businesses in Denmark have a presence in the Capital region. Most of these companies are international and multinational companies operating in the sector of life sciences (Biopeople, 2019). Due to its unique environment with particular focus on life sciences, Hovedstaden is called "*Medicon Valley*" and it is known as one of the best clusters around the world in life sciences. According to the ministry of foreign affairs of Denmark, the strong competence of Denmark in the field of life sciences is based on several reasons and the top 3 reasons are that region has *World-Class research standards, Unique framework conditions for medical research and clinical trials (Danes' openness)* and *Efficient public authorities (quick processing of time-consuming clinical trials) (Investindk, 2019)*.

The cluster of life sciences and the collaborations between companies and public research in Hovedstaden is coordinated by the cluster initiative *Biopeople*. Funded by public government grants and EU grants, Biopeople operates as a cluster organization aiming to build competences and add value in collaboration with companies and educational institutes. Among many activities presented at their website, Biopeople participates also in support programmes like for example a programme called "*Boost4Health*" which aims to increase collaboration between bio-clusters in Europe and to grow sustainable SMEs in the sector (Biopeople, 2019) (Clustercollaboration, 2019).

4.1.5 Overview of Stuttgart (DE) region

Baden-Württemberg (BW) is a state of Germany located in the borders between Germany, France, Switzerland and Austria. The state of Baden-Württemberg is composed of 4 districts: Stuttgart, Karlsruhe, Freiburg and Tübingen. All of the districts have been ranked as "*Innovation Leaders*" by the EC and the RIS. Slightly more innovative district is the district of Stuttgart where also Stuttgart the capital of the Baden-Württemberg lies (EuropeanCommission, 2019d). This paper and the Regional Innovation Scoreboard focus on the district of Stuttgart. The district of Stuttgart covers 10,155 km^2 with a population of more than 4 million and it is divided to three smaller regions: Heilbronn-Franken, Ostwürttemberg and Stuttgart. The expenditure on R&D is outstanding in comparison to the rest of Germany and Europe. In 2015, R&D expenditure reached the amount of 4.92% of GDP (Appendix 5). As a result, the increased amount spent on R&D leads to increased generation of innovation and EPO patents application (EuropeanCommission, 2019c). According to *German Convention Bureau* (GCB), among the most interesting sectors of the region are automotive construction, production technologies, mechanical engineering, IT and electro mobility (GermanConventionBureau, 2019) (E-mobilbw, 2019).

4.1.5.1 Sector and cluster organisation

The key sector in the economy of the distinct of Stuttgart is the automobile construction. The advanced ICT sector in the region offers a great variety of new technologies with applications in automotive industry. For example, a few technologies particularly strong in the region are virtual reality, visualisation, satellite communication and open source software (GermanConventionBureau, 2019). The greater state of BW has over 1,000 suppliers in one of the biggest clusters in Germany (E-mobilbw, 2019). According to the responsible organization for the Economic Development of the region called Wirtschaftsförderung Region Stuttgart GmbH, approximately 200,000 are direct or indirect employees in the automotive sector just within the smaller region of Stuttgart. In addition, around 45% of the

total manufacturing revenues of the region are from automotive sector and approximately 64% of the automotive products of the area are being sold outside the country proving that the region is a strong exporter (Rogg, 2019).

The innovation agency "*e-mobil BW GmbH*" coordinates a cluster initiative called "*Electric Mobility South-West*" with a vision to drive sustainable, climate compatible and locally zero-emission mobility solutions. The network of the cluster consists of 140 partners – which approximately 50% of them are SMEs - from industry, academia and public institutions. They are primarily involved with advanced technologies and topics like automation, connected vehicles and electric mobility. Open dialog is what e-mobil BW and Electric Mobility South-West target in order to bring stakeholders from politics, industry, academy, employer associations, consumer organisations, environmental organisations and the civil society closer to fruitful collaborations. For that purpose, clusters use initiatives like the "*Strategic Dialogue for the Automotive Sector in Baden-Württemberg*", aiming to facilitate direct dialogue between partners (E-mobilbw, 2019).

4.1.6 Overview of Zürich (CH) region

The country of Switzerland represents a unique environment for innovation as all of the seven regions from the country are ranked as "*Innovation Leader +*". Particularly interesting for the purposes of this paper is the Canton of Zürich, which according to the RIS it is the most innovative region of all the examined regions in the last four editions of the scoreboard (2011, 2013, 2015 and 2017). The canton of Zürich is the third largest region in Switzerland and it characterized by EC as the "*economic powerhouse*" of the country (EuropeanCommission 2019). With an area of 1,729 km^2 strategically positioned in the heart of Europe and with over 1,500 million inhabitants, the region is known as a magnet for people from 176 different nationalities. The 57,000 companies are mostly small and medium-sized enterprises with some multinational companies accountable for the region's innovation capacity and strength in a variety of industries like for example ICT, life sciences, clean-tech and foremost financial services. High quality of life, top universities, finance excellence, stable Swiss currency, legal certainty, infrastructure and location are only few characteristics attracting talents (OfficeforEconomyandLabourZurich, 2019).

4.1.6.1 Sector and cluster organisation

According to the "*Cluster Data 2019*" official report from the Department for Economic Affairs of the Canton of Zürich, the largest cluster in the region is finance with 91,787 employees. A report from *Zürich financial centre* argues that Switzerland and the Canton of Zürich has one of the strongest finance clusters worldwide. The total value of the provided banking services is approximately 15 billion Swiss francs

per year for all clients abroad. We can realize that financial services represent the core strength for the Canton of Zürich but also for the Greater country of Switzerland. Many new technologies are constantly being tested and developed within the cluster of finance in Canton of Zürich. Fintech, block-chain technologies, bitcoins are a few examples of the topics that finance experts working on a regional, national and international level (OfficeforEconomyandLabourZurich, 2019).

The "*Office of economy and Labour*" from the economic affairs in the Canton of Zürich has adopted the role of a cluster organization aiming to connect partners from industry, academia and government within the finance sector. In addition to that task, this office aims to visualize and communicate the competencies of the region to all actors by using data and information material and finally accompanying and supporting the cluster actors in various projects. Among the goals of the office's activities are to strengthen resident companies, to increase diversity of the industry at the location and to increase innovation awareness and capacity (OfficeforEconomyandLabourZurich, 2019).

4.2 Empirical findings

4.2.1 Contribution of Kista Science City to regional innovation

It was 1986 in Stockholm city, when industry, academia and the public sector formed together the Electrum Foundation. Vital part of the Kista Science City, the foundation which from the 90's was aiming to bring closer the stakeholders from the three different areas, constitutes a true representation of the Triple Helix model. The board of the Electrum Foundation consists also of people from industry, academia and the public sector. For example, active members of the board are the Head of Development Practice at Ericsson AB, the CEO from IBM Svenska AB, the Head of Strategic Collaboration & Business Development at ABB AB, the Presidents from KTH & Stockholm University and the Mayor of City of Stockholm.

'*I believe that the clusters by themselves are the most important partner of a regional network*' says *Interviewee A* from Kista Science City underlining the value that clusters add to the regions. A special type of Triple Helix model called *Quadruple Helix* can be found today in Kista Science City. This model is a living lab and supports smart urban development by endorsing cooperation between industry, academia, public sector and the active participation of citizens. As the *Interviewee A* points out, Kista district in Stockholm offers the great advantage of close proximity among companies and many stakeholders. A smart urban environment like that, allows researchers, students and companies to introduce their prototypes, demonstrations or ideas and test them in an environment where they can also meet the citizens. According to the conducted interview, Kista Science City discerns endurance in creating new relations between stakeholders as one of the key success factors for the cluster allowing the region to emphasize on innovation and become the testbed

for anything that creates smartness for the city. In addition, by keeping stakeholders engaged and committed to region's network, drives regional innovation and sustainable development. As *Interviewee A* supports, clusters are probably the most important partner of a regional network, nevertheless each and every participant has its own unique way to contribute to regional innovation.

4.2.1.1 Introducing products or process innovation

Kista Science City tries to bring all its partners closer and facilitate collaborations that will lead to new products or processes. By incorporating the principles of the Triple Helix model to the region's culture, Kista Science City creates a channel though which the partners are able to exchange knowledge but also collaborate more. According to experts from Kista Science City, a classical way to do that is to organize round tables, seminars or conferences. Core to the vision of the cluster organization is the idea to open up closed (in-building) environments like science parks and allow researchers, entrepreneurs and companies to nurture the Triple Helix outside the building in the cityscape where interaction with citizens will create more ideas, it will trigger innovation and it will increase collaborations.

4.2.1.2 Facilitate collaborations among innovative SMEs

According to the *Interviewee A*, "*The important thing that we do is to offer the best quality of coffee, to create the meeting places where the industry can meet with academy and governmental institutions.*" Clusters need to foster an environment that will allow all partners to come closer and collaborate efficiently. By "*offering the best quality of coffee*" Kista Science City matches different actors from industry, academia and public sector in order to create solid foundations for harmonic and fruitful collaborations.

Since 2017, the cluster of Kista Science City is part of a bigger cluster connecting 4 clusters from different sectors. The four clusters are *Kista Science City, Södertälje science park*, *Flemingsberg Science* and *Stockholm Science City Foundation.* Representatives from each cluster participate to monthly meeting with a purpose of helping each other in regional innovation development and collaboration. Through this collaboration, the partners are able to exchange knowledge and increase their business network in new areas and new sectors. As a result, more opportunities for new ideas and new partnerships appear on interregional and inter-sectoral levels.

4.2.1.3 Sales new to market or new to firm innovations

Kista Science City has a great indirect impact to sales of innovative products created within the region. As the interviewee from the region of Stockholm supports, their

cluster attracts many people around the world (e.g. Europe, America, Asia, and Africa). The interviewee adds that the district of Kista in Stockholm takes at least 50 to 100 "*innovation visits*" in a year. The innovation tourists are visitors, individuals or companies, who are interested not only in the cluster's business model but also in the research coming from Stockholm or the introduced innovations.

Another impact coming from the important role of the cluster is the creation of new partnerships, new projects, new products and services. As Kista Science city argues, they try to foster relations between people and companies which will be more than just exchanging cards. They pursuit strong connection between committed partners which will result into more successful projects. In the eyes of Kista Science City, successful projects will involve at least one small and one big company, at least one researcher from academy and one governmental institution.

4.2.2 Contribution of Business Finland to regional innovation

In order to support regional innovation, Business Finland runs a variety of programmes in many interesting fields such as bio-economy and clean-tech, creative industries, health sciences, digitalization and of course smart mobility. In addition, the organisation assists companies from Finland to acquire information and apply to interesting European programmes which in turn will boost their economic growth and their innovation capacity. For example, *Enterprise Europe Network* (EEN) is a European programme funded by EC and targeting to help SMEs to internationalize. The programme offers internationalisation services to the partners of Business Finland and approximately 600 organisations in 50 countries. Research and development is also connected to the innovation capacity of the region. According to the interviewee and the website of Business Finland, R&D funded by public investments increases R&D activities for the companies but also leads these companies to increase their own investments and in turn, improve their know-how, new products, new patents, processes and services. Therefore, Business Finland strongly encourages companies to focus a lot on their R&D activities which ultimately will increase innovation and create value for the citizens.

4.2.2.1 Introducing products or process innovation

Business Finland supports companies in this ecosystem and make sure that they will have the resources they need to introduce new products, services, processes and business models. There are two main methods that the organisation uses to achieve that. First of all, Business Finland provides financial support to the companies of the network, and particularly SMEs, with various funding programmes or information regarding European funding programmes aiming to boost their R&D activities and their innovation performance. Also, the organisation tries to bridge the gap between the local and the global know-how in practices and methods of innovating

within the automotive sector. Even though Business Finland have spotted that most innovation usually come from a single company and really from the clusters, it is of significant importance the fact that companies which collaborate may push each other to increase their performance in terms of innovation. Of course, according to *Interviewee B* from Business Finland, regional advantages, like for example the strong competence in ICT which is highly correlated to Smart Mobility, can multiply exponentially the innovation capacity and by extension the introduction of new products and new processes in the sector especially in Smart Mobility. As the interviewee underlines, it is very important to have SMEs in an ecosystem because of their capability to generate plenty of innovative ideas.

4.2.2.2 Facilitate collaborations among innovative SMEs

Undoubtedly, creating new paths for collaborations and partnerships is something that most of the top innovative cluster organisations do to boost regional innovation performance. Business Finland tries to connect regional companies with other regional or international companies. As *Interviewee B* describes, Business Finland tries to match the Finish companies with strong multinational companies in the sector, like for example Volvo Group and Scania. Conferences, events, fairs, specialized programmes for different themes (e.g. Smart Mobility) and other similar methods are used from Business Finland to create new ecosystems with innovation as an epicentre and connect Finish companies - particularly SMEs - with new partners, international investors, new markets and new international opportunities.

4.2.2.3 Sales new to market or new to firm innovations

Business Finland indirectly promotes the sales of the new to firm or new to market innovations from the companies in its network. The cluster organisation tries to coach partners and train them on which is the best way to promote their innovations in the specific area of their interest. The methods may vary depending on the specific needs of the company, but in general the methods include face to face training sessions, conferences and round table meetings. Also, a significant impact on the volume of the sales of the new innovations, have the various programmes or information that Business Finland offers to the companies of its network for funding their ventures. Through funding, companies are able to invest more in R&D, collaborate though EU projects with many actors and create new partnerships for buying or selling new innovations. An expanded network is a key to increase the sales even if it is for new to market and firm innovations. Business Finland actively connects international investors and businesses with each other. The organisation provides advices regarding new markets and help companies in their networking activities with local businesses and operators. Finally, companies

get help into finding new markets and customers, and thereby increase their international networking, innovation activity and sales (BusinessFinland, 2019).

4.2.3 Contribution of Biopeople to regional Innovation

According to the interviewee of the cluster organization Biopeople, a strong cluster needs very strong foundations of stakeholders covering the full range of the value chain. Even though in a sector like life sciences, researchers hold the key role to the value chain, the efficient collaboration of all the partners is also very important in terms of regional innovation. According to the *Interviewee C*, innovation in relation to a cluster perspective is also about new processes, new procedures relationship and competence building. Biopeople is working in the so-called knowledge innovation support system. In that system, knowledge is oriented to innovation support systems. The cluster organisation supports and promotes programmes that bridge research and companies. In addition, the cluster's activities strengthen the relationship between actors within the cluster and build new relationships with the stakeholders where they can help each other through national or international cooperation and collaboration. As *Interviewee C* describes, cluster's network consists of 1,000 domestic or international actors from academia industry and public authorities (Triple Helix).

4.2.3.1 Introducing products or process innovation

The team from Biopeople is stimulating generation of innovation to the region by acting like a catalyst. As *Interviewee C* describes, Biopeople creates inspiring meeting places for public and private stakeholders within life sciences. The idea is that the future of healthcare takes many stakeholders jointly, even from other sectors and fields such as ICT and Artificial Intelligence (AI), to collaborate either in research or in business to produce the products and services within life sciences. In addition to connecting people and companies and in order to stimulate the creation and introduction of innovations, Biopeople tries to attract researchers with match-making programmes. The cluster creates the foundations in the process of generating innovation in products, services, processes and procedures by matching researchers and companies or by providing information regarding beneficial support programmes (e.g. Boost4Health for SMEs & Horizon 2020),.

4.2.3.2 Facilitate collaborations among innovative SMEs

Biopeople emphasizes slightly more into research either it comes from academia or from companies. Therefore, the cluster organization aims to inspire cross disciplinary collaborations and partnership that can generate more research power.

It recognizes that smaller companies (e.g. SMEs), public or private synergies and internationalization are major features of the innovation capacity to a region and that is why this is in the centre of the cluster's focus (Clustercollaboration, 2019). As the interviewee supports, there are times when the cluster organisation offers individual advices, training, pitching or coaching mostly to small companies. In addition, there are events and programmes where actors can establish new partnerships between researchers, companies and investors. Other programmes have as a goal to train companies how to find and establish successfully connections with other companies, researchers or investors. The various programmes embraced by Biopeople, aim to strengthen the relationship within the cluster and build new relationships with the stakeholders. For example, small companies (e.g. SMEs) might need access to clinical trials, or access to knowledge about specific technologies and they can get them through such programmes.

4.2.3.3 Sales new to market or new to firm innovations

According to the *Interviewee C,* Biopeople does not try to promote sales at all. The cluster organization offers only the channels where companies and researchers can come closer, connect and deal with innovations. Nevertheless, activities organized or supported by the cluster, such as support programmes, events and fairs allow companies to promote themselves and find new partners to collaborate with. By extension, that increases their research power, knowledge, production and sales. In addition, the cluster participates in support programmes like for example the "*Boost4Health*" which aims to increase collaboration between bio-clusters in Europe and to grow sustainable SMEs in the sector. Programmes like that can strengthen companies' presence in national or international markets and in turn their sales.

4.2.4 Contribution of Electric Mobility South-West to regional innovation

"*In Electric Mobility South-West we are working for new automotive solutions*" says *Interviewee D* from e-mobil BW GmbH. The cluster operates 100% financed by the state government and aims to promote the topics of new mobility solutions, electric mobility, connected drive but also supporting the regional industry, the regional automotive ecosystem and the technology swift from the combustion engines to new mobility solutions like electric mobility or autonomous and connected mobility. Today, the cluster of Electric Mobility South-West offers a platform where all partners are able to bring different technologies from different sectors together and discuss about new things. As the interviewee points out, in the centre of the cluster are the tasks that facilitate knowledge transfer, creation of projects but also support internationalization of the partners from cluster's network.

4.2.4.1 Introducing products or process innovation

According to Electric Mobility South-West, innovation is about bringing up new ideas, new components and new solutions. It is acknowledged by the cluster initiative that new, solutions and many times disruptive ones, may arise and implemented form inter-sectoral collaborations like for example when people from ICT, clean energies and automotive sectors cooperate. The main contribution of the cluster here is to identify key areas and future trends in the sector, organize projects and facilitate knowledge transfer and collaboration between the members of its network. As the interviewee describes, Electric Mobility South-West uses organized working groups in order to give direction to the studies and the projects within the automotive industry. The working groups connect several actors from different areas and the findings of these working groups can lead to innovative testbeds, where the actors have the chance to test, develop get a feedback for their ideas (e.g. autonomous vehicles and connected driving) directly from the citizens and the society. According to Electric Mobility South-West equally important sources of innovative products and processes are small and medium-sized companies based on the fact that small companies are keener to experiment, innovate and create disruptive products, processes or even business models.

4.2.4.2 Facilitate collaborations among innovative SMEs

The automotive cluster in Stuttgart believes that clusters have to bring people together in order to enable knowledge exchange between companies and research institutes. That can be achieved by creating joint R&D projects or consortia. Even if SMEs and start-ups are a great source of innovation, they usually need access to the big players like OEMs and Tier 1 suppliers to be able to distribute their innovations. Every two months there is a regular meeting lasting approximately 2 to 3 hours of all cluster members where they discuss about several interesting topics such as funding programmes, development, environment, new initiatives, new projects or new cluster partners. The same bonding effects have also the working groups that Electric Mobility South-West organizes and runs. As described previously, the working groups can connect actors from different areas and also welcome all actors (e.g. SMES) interested in innovation and these particular topics. In order to keep all the actors engaged and active, *Interviewee D* believes that cluster needs to diffuse knowledge and give orientation to the partners through interesting and innovative projects involving future solutions and megatrends of the sector.

4.2.4.3 Sales new to market or new to firm innovations

As the *Interviewee D* describes, the cluster of Electric Mobility South-West promotes the presence of the companies in its network to national or international fairs and

events, aiming to help them develop and subsequently increase their sales. That way, the members of the clusters are able to internationalize and form new partnerships in new markets where they will be able to distribute their products. Similarly, national or international joint projects may lead to increased sales for one or more partners in the region. Ultimately, the participating members will not only expand their network, but they will also get information regarding new trends and technologies in the industry.

4.2.5 Contribution of the Office of economy and Labour in Zürich to regional innovation

According to *Interviewee E,* the biggest goal of the Office of economy and Labour in Zürich is to connect actors from the industry, academia and the public authority together (Triple Helix). As the interviewee argues, SMEs, start-ups, big multinational corporations, policies, academia and research institutes are all important parts for the regional innovation capacity and economic development of the region. Close proximity between the actors in the finance cluster in Zürich allows partners to communicate and exchange information quite efficiently. For example, when policies in the region of Zürich are not in favour of specific types of actors and hinder specific operations and in turn innovation capacity, the cluster facilitates an open dialog between the industry actors and the public authorities, where the problem will be discussed and several solutions will be suggested. An example given by the interviewee involved practical issues regarding the taxation of start-ups in Zürich. On the other hand, there are other barriers that may affect or hinder innovation performance of the region. As the cluster management argues, barriers like rigid legislations or the high living cost are in many cases big issues when new talents and researchers want to inhabit in the region of Zürich. To the same dissuasive effect leads the fact there are strict regulations in order to enter the country and get a working permit.

4.2.5.1 Introducing products or process innovation

A quite effective way to bring partners closer and stimulate partnerships adopted the region of Zürich. As the interviewee from the Canton of Zürich describes, when the Bio-Technopark Schlieren-Zürich was built 50 minutes away from the city centre, the ETH University was looking to expand or maybe relocate university's R&D division and the Canton of Zürich decided to transfer University's R&D to the Bio-Technopark Schlieren-Zürich. The results of this decision were seen later when just out of sudden new innovative start-ups and spin-offs appeared. The responsible person of this Technopark said that the most important thing was actually that they built a cafeteria and a restaurant. Only then, people start discussing and they realized that their research was more or less on the same topic and that they had

similar problems. Blending the researchers from the Technopark with the R&D from the University gave birth to new start-ups, new products and new processes.

Sometimes new technologies emerge in clusters and they need to be tested in the regions. Regions, in association with cluster organizations and public authorities, need to embrace these technologies and adopt new policies that will allow actors to develop and expand these ideas. An example endorsed by the interviewee was when the city of Zug in Switzerland became the first town to accept bitcoins as a paying method for paying government services. Such efforts promote even more the generation and successful implementation of new ideas and ultimately they increase regional innovation capability.

As *Interviewee E* explains, the cluster of finance in Zürich promotes a so-called regulatory relaxation from the FinTech Strategy issued by the Swiss Federal Council in 2016 called "*sandbox*" to test new business models in the field of finance. The *sandbox* offers the opportunity to start-ups to test their business model for a limited amount of money, without being subjected to any regulatory restrictions. This measurement focuses on promoting innovation in financial services (Loyensloeff, 2017).

4.2.5.2 Facilitate collaborations among innovative SMEs

According to the finance cluster in Zürich, bring partners together is what generates innovation. The example of the Technopark in Schlieren-Zürich presented in the previous paragraph (paragraph, 4.2.5.1), indicates exactly how partners from different areas were brought closer and how that led them to collaborate under the same research topics. By combining their competences, they were able to innovate more, to generate new ideas and create unconventional solutions to their mutual problems.

As the Office of economy and Labour in Zürich observes, innovative products and processes, new business models and ideas, often start from academia. However, these actors need to be matched and successfully connected to each other to make sure that the results of the research and the studies will be transferred to the SMEs and big multinational organizations and they will be translated into innovation products and processes. This is what Canton of Zürich names as "*tech-transfer*". This direct connection of the actors allows more innovative products and processes to enter the market. Some effective ways to connect partners are regular meetings, conferences, networking events, suggesting and supporting new topics for research and projects.

Close proximity of the partners in the area offers an advantage of providing quick and direct communication channels between the three parts of the Triple Helix model in the Canton of Zürich. As mentioned before, public authorities are open to discuss the problems that emerge, like for example the policies around new types of

actors (e.g. start-ups). This open dialog between the actors in the cluster, allows the region to locate very fast issues that may hinder particularly economic development of the region and the implementation of new and sometimes disruptive technologies (e.g. bitcoin).

4.2.5.3 Sales new to market or new to firm innovations

According to *Interviewee E*, the cluster of finance in Zürich does not involve directly in the sales of their members. Nevertheless, regular networking events, conferences and cluster studies organised and executed by the administration of the cluster, allow the partners of the cluster to acquire more information regarding the topic of their interest and also connect with other companies, something that possibly can lead to a positive outcome over their sales.

Factors like high quality of life, top universities, finance excellence, stable Swiss currency, legal certainty, infrastructure and location are not only attracting brilliant talents but as the interviewee describes they also attract companies interested in the innovative products or services from the region. Even though it is hard to calculate the exact impact of these characteristics on sales, the cluster of finance in Zürich in collaboration with other partners (e.g. Universities) promote these characteristics regularly through social events.

5 Analysis

The chapter of Analysis examines and analyses the empirical findings, in relation to the literature review presented in this study. The purpose here is to provide adequate and solid answers to the formulated questions of the project based on both the empirical data and the theoretical background.

In the first part of the Analysis chapter is analysed the importance of the clusters and their key activities at regional level, taking always into consideration the related theoretical framework from the Literature Review chapter.

The second section of the Analysis Chapter is focused on the main themes of the clusters' methods to address to the following indicators from RIS 2017: 1) SMEs introducing product or process innovations as percentage of SMEs, 2) Innovative SMEs collaborating with others as percentage of SMEs and 3) Sales of new to market and new to firm innovations as percentage of total turnover.

Finally, to the last section the analysis becomes a little broader aiming to reveal a holistic view of the findings and give different perspectives and explanations to phenomena slightly detached from the purpose but related to the subject of this project.

5.1 The importance of cluster and the key activities supporting regional innovation performance

Clusters are dynamic and constantly evolving constellations of participants within a region. Over the years, these constellations of actors are unceasingly interacting with each other and they try to adapt to their environment, having also the ability to influence the development and the economic growth of the region (Cooke et al., 2007). Porter identified the importance of a proximate group of actors in a cluster and he imprinted it the *competitive advantage theory* (Porter, 1990). Ripping the benefits of their close proximity, actors are able to push higher innovation capacity of the regions and boost the development of the region. If we combine the theory from Porter (1990) and the Triple Helix model (Leydesdorff, 1995) under the purpose of this study, we see that close proximity and collaboration for the actors of Triple Helix model can be translated into increased innovation performance for the regions. As Sölvell, Lindqvist et al. (2003) describe there are some organized efforts, trying to bring the participants closer, support the development and increase the competitiveness of the clusters' members. These efforts usually take the form of a Cluster Organization. *Kista Science City* in the region of Stockholm in Sweden, *Business Finland* in the region of Etelä-Suomi in Finland, *Biopeople* in the region of Hovedstaden (Copenhagen) in Denmark, *Electric Mobility South-West* in the region of Stuttgart in Germany and the *Office for Economy and Labour* in the region of Zürich in Switzerland are five organizations who have adopted the role of a cluster

organization aiming to support and develop their regions' competence by focusing in one industry.

According to the interviewees from the five participating innovative regions, the importance of the clusters is imprinted in many activities in each region. Among the most common and obvious ways for the examined clusters to support and trigger regional innovation is to endorse cooperation and collaboration between the participants (Konstantynova & Lehmann, 2016; Sölvell et al., 2003). By attracting regional, national and international partners from different sectors, clusters represent a place where partners can get access to a global pool of information and discuss about new opportunities regarding the whole range of the value chain in the sector of their interest. In addition, through this network, partners are able to internationalize by initiating new regional, national or even international partnerships and boost not only their innovation capacity – and in turn the innovation capacity of the region – but also their growth and their sales.

In all five cases, the key players in clusters' networks are actors from Academia, Industry and Government (Triple Helix model). The Triple Helix model underlies the importance of the three core categories of actors within an innovative region and an innovative cluster. The effective collaboration of the three pillars in the Triple Helix model theorized in the 1990's by Etzkowitz Henry and Leydesdorff Loet (1995), has a significant impact in the generation of knowledge or in other words to the generation of localized learnings. In addition, localized learnings not only benefit firms within the regions but they also stimulate region's economic growth and prosperity in the long run.

According to the *Interviewee A* from Kista Science City, clusters themselves are the most important partner of a regional network because they facilitate knowledge transfer and collaboration between the members of its network. The interviewee from the cluster organization Biopeople in Hovedstaden acknowledges the importance of all the participating actors but for a knowledge intensive sector such as the life science sector, researchers both from universities and from companies seems to hold a little more central position on initiating the process of generating innovations without shadowing the important contribution of clusters. As *Interviewee E* from the Canton of Zürich describes, academia is usually the place where all innovations start. Nevertheless, through clusters, SMEs and big corporations take the initial idea generated from researchers and by using their resources, they develop innovations. Undoubtedly, public authorities in the Canton of Zürich are appraised for their openness to discuss about any issue in the regional policies which may trouble the participants of the network. The *Interviewee B* from Business Finland sees that industry is holding a significant role in their network in relation to innovation and especially SMEs. Finally, the interviewee from e-mobil BW identifies that for the region of Stuttgart, academia and industry are equally valuable groups of partners and it is important, in terms of innovation, to have strong links and close collaboration between these actors. Likewise Zürich, the

region of Stuttgart embraces an open dialog between partners from politics, industry, academy, employer associations, consumer organisations, environmental organisations and the civil society. Overall, all regions seem to acknowledge that generation of knowledge and innovation usually starts from cluster and specifically from academia and it continues with industry and particularly with SMEs. Unquestionably, the implemented policies have a significant impact on the overall innovation capacity, due to the fact that policies have the ability to hinder or support innovation (e.g. the case of bitcoins at Switzerland). Finally, clusters, operationalized by the cluster organizations, are equally important players like Academia, Industry and Government from the Triple Helix model. By transforming the Triple Helix model into a new Quadruple Helix model, Kista Science City - the largest ICT cluster in Europe – dignifies the connecting and leading role of the clusters in a regional network. *Interviewee A* from Kista Science City emphasizes the importance of clusters' work by saying that '*The important thing that we do is to offer the best quality of coffee, to create the meeting places where the industry can meet with academy and governmental institutions*'. In accordance to that, a representative from the Bio-Technopark Schlieren-Zürich, where the R&D division from the ETH University was transferred, said that the most important thing was actually that they built a cafeteria and a restaurant. The meaning behind these symbolic sentences is that it is very important in terms of collaboration and stimulation of innovation to connect different actors with common goals or challenges. One very simple but also effective way is by creating meeting places, like for example a cafeteria or a restaurant, where they will be able to discuss about their interests.

Among the core activities of a cluster organization is to organize, coordinate, support, inform and facilitate the participation of the partners in regional, national or even international projects. Porter (1998) and Sanchez & Omar (2012) indicate that among the srtong benefits of being part of one cluster is that clusters are able to promote collaborations (particularly between SMEs), cooperative research, sharing infrastructure, diffusion of information and access to public goods. An efficient way for the clusters to achieve that is to organize, support and facilitate the active participation of clusters' members to interesting programmes and projects. In the five cases of this thesis, all the clusters embrace that role. They support that their cluster organizations are aiming to reveal the key future trends in their sector and use them as a compass in order to create interesting and at the same time useful projects and programmes for the members of their network. In addition, cluster organizations, like for example the *Office for Economy and Labour* in Zürich, try to incorporate the regional competencies by visualizing and communicating them to the participating actors aiming to add value to the projects that their network participates. An example of a very good programme supported by the Biopeople organization is the '*Boost4Health*' designed specifically to increase collaboration and ultimately help companies to grow sustainably. The programme is targeting SMEs, in bio-clusters all over Europe, and SMEs, as mentioned before, are recognized as an important source of innovation. Another example of a similar

programme is the *Enterprise Europe Network* (EEN) funded by European Commission, targeting to help SMEs to internationalize. Business Finland is facilitating the participation of its partners to this programme by proving the necessary information. Sometimes, the programmes aim to provide or facilitate the process of finding the necessary resources for the companies in the network of the cluster. Financial support or access to information regarding financing is something that many clusters provide to the members of their network and according to Konstantynova (2016) is among the most important activities of a cluster organization. For example, Business Finland in Etelä-Suomi provides direct financial support to the companies - aiming particularly SMEs - with an ultimate purpose to boost their R&D activities and their innovation performance. It is possible that some projects or programmes either organized or supported by clusters and the local regions, may take the form of a test-bed or an urban arena. An example of such programmes is the *Urban ICT Arena* in the region of Stockholm. Entrepreneurs, students, SMEs, big multinational organizations, academy, public authorities and citizens are able to explore, test and develop innovations through a form of an urbanized joint R&D arena (Ketels, Lindqvist et al. 2006).

Overall, by analysing the information from the theoretical framework and the derived data from the interviews presented in the current paper, three main groups of activities revealed highlighting the importance of the clusters within a region. Clusters are creating value for the regions by:

- facilitating the efficient collaboration between Industry, Academia and Government (Triple Helix) by creating channels for open dialog
- providing access to a well-informed and extended network of partners
- organizing, coordinating, supporting and providing information regarding interesting for the network projects or programmes

Clusters, represented usually by the cluster organizations, have become a vital part of today's innovation performance of a region. Acting like catalysts to regional innovation capacity, clusters are able to connect people and companies, provide information regarding the current and future trends in the business world and support useful projects and programmes in their network.

5.2 The main themes of clusters' contribution to the three indicators

As explained in Chapter 2 (2.1.3 Weak indicators of Västsverige), this project focuses on 3 of the 18 indicators that European Commission uses at RIS 2017 to rate innovation performance of over 220 regions across Europe. The indicators are i) *SMEs introducing product or process innovations as percentage of SMEs*, ii) *Innovative SMEs collaborating with others as percentage of SMEs* and iii) *Sales of new to market and new to firm innovations as percentage of total turnover*. By examining the empirical findings from the conducted interviews and the secondary data from

clusters' reports and websites, the researcher is able to detect the main themes of how clusters at the targeted top innovative regions contribute to the selected indicators from RIS 2017.

5.2.1 SMEs introducing product or process innovations

As *Interviewee A* from Kista Science City argues, a successful innovative project according to Kista Science City is a project that involves at least one SME company, emphasizing the fact that SMEs are a great source of innovation either it is product, process or another form. *Interviewee B* from Business Finland supports that the most important hoop in Finland's ecosystem chain is SMEs because of their ability to generate more innovative ideas. In accordance to the first two interviewees, the interviewee from Biopeople in Denmark acknowledges that SMEs in collaboration with the researchers represent a major feature of the regional innovation capacity. The interviewee from the Canton of Zürich, underlines that innovations usually start from academia, but it should be transferred to SMEs or other organizations because only then the innovative ideas will become innovative products and processes. As we can understand from the provided answers, all the participating clusters have identified the importance of SMEs to the introduction of product and process innovations within regions and therefore they try to support actively their initiatives. A characteristic example represents the network of the Stuttgart's cluster organization e-mobil BW GmbH, as *Interviewee D* says this network is composed approximately 50% of SMEs, while the rest of the network consists of other actors from academia, government, associations and other big enterprises. By analysing the collected data, we can observe that all clusters have either direct or indirect influence on the efforts of SMEs to introduce products or process innovations. According to the five cases examined in this paper, clusters can support SMEs on introducing product or process innovations with the following three ways:

- Providing access to an extended and well-informed network
- Facilitating an open dialog between Government and SME's
- Embracing testbeds

5.2.1.1 Access to an extended and well-informed network

According to the answers of the five interviewees, all five clusters are organizing and supporting activities aiming to facilitate collaborations between the partners of their network and particularly collaborations including SMEs and academia. Derived also from theory from Baptista and Swann (1998), by including SMEs to an extended network of actors with researchers, big multinational companies and public authorities, SMEs are able to get access to useful information regarding ongoing projects, new trends and how they can take advantage of the regional strengths. In addition, the extended and experienced network of the clusters provides opportunities for the SMEs to collaborate with high skilled actors from academia or

big multinational companies, which according to Ozkanli and Akdeve (2006), eventually leads to knowledge transfer and generation of product and process innovations. As *Interviewee B* from Business Finland describes, it is important in terms of innovation to connect SMEs with a network of strong multinational companies, where they will have access to new partnerships and new markets.

5.2.1.2 Open dialog between Government and SMEs

Another way that clusters use to support SMEs to introduce more product and process innovations is to ensure a close relation between Government and SMEs. According to the interviewee from the region of Zürich, the regional cluster of Finance is trying to secure that there is an open channel for efficient communication between representatives of the public authority and the actors from the industry. As exemplified by *Interviewee E*, from the Canton of Zürich, there are times when taxation hinders the operations and in turn innovation performance of actors in the region especially when it comes to small and medium sized companies like SMEs and start-ups. Taking advantage of the close proximity of the participants, the cluster facilitates and ensures that the actors from the industry will be able to discuss any emerged issue with the representatives from the public authority and that a solution will be found. Even if Uyarra and Ramlogan (2012) remind us that regional policies are not directly connected to the concept of clusters and Enright's (2000) survey revealed that policies are seen as '*unimportant*' to the development of a cluster, we observe that for the case of Zürich clusters can affect indirectly the policies by securing a bidirectional communication channel between the entities of the cluster. In turn, this dialog has the ability to provide solutions to the raised issues from the industry, which allows them to grow and contribute to regional economic growth. As a result, the cluster itself will develop through the development of the region and its members. The cluster organization e-mobil BW in the region of Stuttgart is also embracing open dialog between all the stakeholders of the cluster through an initiative called '*Strategic Dialogue for the Automotive Sector in Baden-Württemberg*'. As observed from the research, most of the participating clusters are pursuing an open bidirectional communication channel between actors like SMEs and public authorities. This tendency is justified also from literature and the Triple Helix model (Leydesdorff, 1995), which dignifies the importance of the efficient collaboration between actors from Academia, Industry and Government at a regional level.

5.2.1.3 Introduction of innovation through Testbeds

Finally, clusters in the five innovation leading + regions help all actors to collaborate and generate more product and process innovation by organizing and supporting testbeds where actors and particularly researchers and small enterprises, who may not have access to organized labs, can explore, develop and test all types of

innovation. Urban ICT arena which is an initiative running in Kista transforms the city of Stockholm into a real outdoor living-lab. *Interviewee A* from Kista Science City comments that a smart urban testbed embraces the co-operation between researchers, students, companies, public authorities and citizens. This effort provides them with resources which they use to explore, develop and test new ideas. Initiatives like testbeds facilitate the generation of technological spill-overs (localized learnings) which originate mostly from innovation activities (Markusen, 2017). According to Malmberg and Maskell (2006) on the long run localized learnings (knowledge) help the companies in the region and the clusters to grow and develop. The case of bitcoins is another example of an attempted testbed. Switzerland became one of the first countries to accept bitcoins as a paying method for government services. Such efforts encourage entrepreneurial thinking and generation of innovations especially for the small and risk-taking companies like SMEs.

5.2.2 Innovative SMEs collaborating with others

According to European Commission, '*Innovative SMEs collaborating with others*' is an indicator among the 18 indicators used to the Regional innovation Scoreboard 2017 for measuring innovation performance of the regions. It is one of the core targets of the examined clusters to trigger and facilitate collaborations among the participants of the cluster's network. As the *Interviewee D* from Stuttgart describes, the automotive cluster in Stuttgart tries to connect all the actors together and particularly SMEs with other OEMs or Tier 1 suppliers. The interviewee supports that even if SMEs and start-ups are a great source of innovation, they usually need access to a greater network with more resources including OEMs and Tier 1 suppliers. As we can see also in the case of Zürich, transferring knowledge through collaborations between academia, SMEs and multinational organizations, is what generates innovation. Baring in their minds the Triple Helix model (Leydesdorff, 1995), all the examined clusters try to connect the different actors into effective collaborations and special attention is given to SMEs and start-ups. According to the collected information from the five cases, there are three main ways that allow clusters to support innovative SMEs collaborating with others.

- Organize and promote supportive programmes and projects
- Utilize regional strengths
- Collaborate within testbeds' context

5.2.2.1 Organize and promote supportive programmes and projects

Public synergies and internationalization are two major concepts when it comes to innovation performance of a region and therefore the cluster organization in life sciences from Denmark, Biopeople, puts these concepts in the heart of the cluster's focus. In addition, Biopeople and the health sciences sector is slightly more focused

on research and development. As a result, the cluster tries constantly to establish new cross disciplinary relationships with programmes that will successfully match researchers, companies and investors. This initiative not only aims to elevate the research power of the region, but also to help small companies and individual researchers to get access to facilities or specific technologies that they need. Business Finland in the region of Etelä-Suomi, tries also to match small, unexperienced companies with other SMEs or other strong companies like for example Volvo and Scania from Sweden. Also observed from Sanchez and Omar (2012), by supporting local, national or international programmes and projects, clusters are able to connect particularly SMEs to a global network, where they have access to a greater pool of information, resources and opportunities for new partnerships.

5.2.2.2 Utilize regional strengths

It is obvious so far that collaboration between partners possess a special position in the strategies of clusters to increase innovation performance of a region. Another way to support SMEs in collaborating more is to use and distribute information regarding the regional strengths and how they can be exploited by the actors to attract more partnerships regional, nationally or internationally. For example, close proximity is a regional advantage that brings closer actors in the Canton of Zürich and eventually, according to the interviewee from the cluster of Finance, leads to increased collaborations and innovations. Likewise, the close proximity of the companies in Kista district of Stockholm, offers a unique urban environment where researchers, students, SMEs and big multinational companies can introduce their prototypes, demonstrations or ideas and test them in an open-lab where citizens will have the chance to interact with them. Another example of regional strength is the strong global competence of a region in one sector. Denmark and particularly the region of Hovedstaden (Copenhagen) is worldwide known for the strong competence in health sciences. The cluster can use that to attract more key players (e.g. researchers) and connect them with its networks including local SMEs. Similarly, the canton of Zürich uses its regional strengths like, top Universities, high quality of life and finance excellence to attract particularly new talents and connect them to its network. Overall, by promoting and taking advantage of the regional strengths, clusters can grow stronger and that according to Baptista and Swann (1996) can attract new entrants such as entrepreneurs and SMEs.

5.2.2.3 Collaborate within Testbeds' context

As explained in the paragraph 5.2.1.3. (5.2.1.3 Introduction of innovation through Testbeds), testbeds are organized efforts targeting to convert real city environment into a platform where researchers, students, smaller or bigger companies are able to collaborate, test and develop new ideas and new solutions. The region of Stuttgart

through the cluster organization of Electric Mobility South-West facilitates collaborations and introduction of innovative products by organizing specialized working groups in specific topics. As *Interviewee D* exemplifies, these working groups can lead to innovative testbeds where companies, researchers and entrepreneurs collaborate constructively under innovative ideas like autonomous vehicles and connected driving.

5.2.3 Sales of new to market and new to firm innovations

According to the derived data from the five cases of this paper, clusters are not trying to support or promote sales of their partners directly. As the interviews revealed, the main actions from the cluster organizations aim to connect members with an international network where they will be able to promote themselves. Supported also by theory, an extended network from a strong cluster creates powerful supply and demand channels which are used from participants with small network, e.g. SMEs, to distribute their products Braunerhjelm and Carlsson (1999). Although it is not derived from the theory but only from the empirical data, clusters are using other methods to promote the companies of their network and increase the competitive advantage both for the regions but also for the companies. Reputation and regional strengths (e.g. Finance excellence and currency stability in Zürich) can attract new players and create new supply and demand channels. Finally, as the interviewees from the regions of Etelä-Suomi and Hovedstaden describe, they use individual advices, training, pitching or coaching methods to train companies on how they can promote their innovations. Overall, clustering effect leads to spill-over effects and diffusion of knowledge, which are translated into competitive advantage and increased sales (Hoen, 2001). Below are presented the two most common ways that clusters use to support companies of their network in their sales of new to market and new to firm innovations.

- Connect SMEs with international network
- Coaching and training

5.2.3.1 Connect SMEs with international network

As explained above, clusters, usually represented by the cluster organizations, are not directly involved to the sales of theirs partners. The reason behind that could be that they do not want to trespass ethical issues related to being biased or non-neutral. According to Kista Science City and *Interviewee A*, the ICT cluster in Stockholm takes at least 50 to 100 "*innovation visits*" in a year. The innovation tourists are usually stakeholders interested in the business model or innovations introduced from the local actors. These stakeholders might be interested in initiating new partnerships with local companies which eventually has the potential to increase the sales of the new to market or new to firm innovations. Likewise, the Finance cluster in Zürich does not get involved directly to the sales of the cluster's

members. In this case, an additional reason why the cluster management does not get involved in the sales would be that they are public entities from the economic department of the canton of Zürich. Therefore, it is even more likely for the management in the Finance cluster of Zürich to come across with ethical issues if they try to promote the sales of their network directly. As Porter described (1998), through clustering effect and a big network, partners are able to share infrastructure but also get access to input and output markets. As pointed out before, in all the examined cases, cluster managements try to connect actors and initiate new partnerships by offering regional but also international channels and by including their partners in international fairs, conferences, seminars and meetings. There, the partners themselves are able to pitch their work and expand their business by creating new partnerships.

5.2.3.2 Coaching and training

Partly connected to the previous methods, coaching and training is a service that clusters tend to offer to the actors of their network emphasizing on the small companies like SMEs and start-ups. As the interviewee from the Biopeole cluster in Denmark describes, clusters facilitate the participation of the partners in programmes where they are able to develop their competences and strengthen their national or international presence. Such programme is the "*Boost4Health*" presented in *Chapter 4*. Business Finland offers coaching and training sessions to the companies of its network. Coaching and training unexperienced companies to promote themselves can lead to the expansion of companies' network and by extension their sales. As Konstantynova (2016) describes, training and qualification is one of the seven bundles of clusters' activities and through training companies are able to promote better their innovative products and consequently increase their sales. Overall, Clusters act like catalysts to the sales of the companies within their network (Sanchez & Omar, 2012). By training and connecting the members with national and international stakeholders, they get the chance to promote themselves and their innovative solutions.

5.3 Serendipities

As explained in the introduction, this thesis focuses on five Innovation Leading + regions and how clusters support innovation performance of a region in relation to the three indicators from the RIS 2017. However, it is difficult for the researcher who uses a qualitative research to identify and isolate which activities of the clusters lead to specific results and specific impacts in the cluster and subsequently in each region. For example, *Interviewee A*, from Kista Science City, describes that the ICT cluster of Stockholm collaborates with three more cluster organizations (Södertälje Science Park, Flemingsberg Science and Stockholm Science City Foundation)

aiming to help each other in regional innovation development and collaboration without targeting specific areas or results. The four participants are focusing on different sectors, like for example ICT or health sciences, but they organize monthly meetings to exchange experiences and increase their network in more areas and new sectors. Thus, this Cluster of Clusters opens new paths for inter-regional and inter-sectoral collaborations between the members of the clusters. Even if Krugman (1991a) argues about the benefits of clustering and mainly on the benefits given the close proximity of the members, (e.g. low transportation costs, strong localized supply and demand), a lot of research hours should be spent to identify the actual results and impacts of this new type of clustering which may even reveal new innovative ways to collaborate on inter-regional and inter-sectoral level.

Sometimes other factors which are not related directly to the clusters' management or the clusters' activities may have a significant impact on the examined indicators of this paper. Demographic data, like the high density of population may have positive impacts on innovation performance of a region (Monteiro et al., 2011; Porter, 1990). A possible indicator to examine the proximity of the actors is population density. By analysing the data of the population the five cases of this paper and with no intention to go in depth to this analysis, we see that there are some significant differences in terms of population density. According to the table with the Demographics from the Appendixes, the Canton of Zürich has the highest population density with approximately 870 citizens/km2, followed by Hovedstaden (Copenhagen) with 717 citizens/km^2 (Appendix 6). Recognized also by the local management of the examined clusters, close proximity is an advantage for the regional innovation performance because companies, and particularly SMEs, are able to co-operate and collaborate easier and that lead to the introduction of more product and process innovations. Another example is R&D expenditure. RIS 2017 includes R&D expenditure as an indicator for rating the regional innovation performance. By analysing the *Share of R&D Total Expenditure (in % of GDP)* for each region from year 2010 to year 2015, we see that all five regions have very high values compared to the corresponding average values from European Union (28 countries) (Appendix 5). The average from European Union (28 countries) for the years 2010-2015 is 1.91% of GDP while the lowest corresponding value from the five cases belongs to the region of Etelä-Suomi (Finland) and it is 2.52% of the GDP. At the same period of time the total expenditure for the region of Stuttgart is 4.83% of the GDP (taking into consideration the limitation (*) mentioned at Appendix 5) and it is the highest among the examined regions. Even though such factors are not directly connected to the activities of the cluster, they seem to have a positive relation with innovation performance and therefore clusters could expand their portfolio of activities in relevant areas. Nevertheless, it is important for these cases to run a quantitative analysis and find out the real correlation between these variables and innovation performance of the regions.

6 Conclusions

The first part of final chapter summarizes the key points from the empirical findings and research aiming to provide with answers the formulated research questions. The second part of the chapter presents the research implications regarding the three examined indicators of innovation performance and how cluster organizations could increase innovation performance of a region based on the examined cases. As a third part of this chapter, there are presented the limitations of this research project. Finally, the chapter ends with recommendations for future research.

6.1 Conclusions

This study targets to identify the importance of clusters in terms of regional innovation performance, through a multiple-case study of five regions in Europe ranked by European Commission as Innovation Leaders +. In addition, the research project focuses on how the five clusters from each region contribute to regional innovation performance by addressing to three indicators in which Västsverige has low ratings according to Regional Innovation Scoreboard 2017 (1. *SMEs introducing product or process innovations as percentage of SMEs, 2. Innovative SMEs collaborating with others as percentage of SMEs and 3. Sales of new to market and new to firm innovations as percentage of total turnover*). The purpose of the thesis is to understand how clusters ranked as Innovation Leaders + by European Commission, support regional innovation performance and what methods, from the clusters, allow them to address successfully to the three targeted indicators from RIS 2017. By utilizing and applying the generated knowledge, BRG and the region of Västsverige could successfully improve its innovation performance and eventually raise innovation capacity of the region. Therefore, the following questions were formed and guided the conducted research:

Research Question 1: *Why clusters are important for regional innovation performance?*

Research Question 2: *How clusters at the targeted top innovative regions contribute to the following indicators from RIS 2017*?

- **I)** *SMEs introducing product or process innovations as percentage of SMEs,*
- **II)** *Innovative SMEs collaborating with others as percentage of SMEs and*
- **III)** *Sales of new to market and new to firm innovations as percentage of total turnover.*

Research Question 1:

Confirmed by theory and by this study as well, cluster initiatives have a catalytic role to growth and competitiveness of a cluster within a region (Sölvell et al., 2003). Usually, operationalized by cluster organizations, clusters are engaging to many regional activities aiming to support and promote regional innovation. By combining the theories from *Chapter 2* and the collected data from *Chapter 4* to the analysis of the study, three main groups of activities emerged, underlining the importance of clusters for regional innovation performance and regional innovation capacity and they are presented below.

- Facilitating the efficient collaboration between Industry, Academia and Government by creating channels for open dialog
- Providing access to a well-informed and extended network of partners
- Organizing, coordinating, supporting and providing information regarding interesting for the network projects or programmes

Research Question 2

i) SMEs introducing product or process innovations

All the interviews pointed out to the fact that small and medium-sized companies, e.g. start-ups and SMEs, are among the most important actors when it comes to introduction of product, process but also other types of innovation, such as innovative business models. As Baptista and Swann (1998) discovered after an 8-year study, companies included in a strong cluster have higher probability to innovate. The results from the five cases and the examined clusters convey towards the findings from Baptista and Swann (1998). In addition, against the study from Uyarra and Ramlogan (2012) saying that policies are seen as '*unimportant*' when it comes to cluster's development, the cases of this study proved that an open dialog between the members of the cluster's network and the public authorities may have positive impacts to the operational policies and regulations which in turn, allows companies within the clusters to develop and introduce new products. Finally, almost all clusters of the five cases organize and support testbeds. Testbeds, allow actors to explore, develop and test new ideas by sharing resources which facilitates the generation of technological spill-overs (localized learning) (Markusen, 2017). By interpreting what Malmberg and Maskell (2006) said, on the long run localized learnings from innovative activities create knowledge. Eventually, knowledge benefits all the actors of a region by boosting their development, which initiates from the start the cycle of the innovation process. Below are presented the three main categories of the activities that the examined clusters use to support SMEs either directly or indirectly, in their effort to develop and introduce to the market product and process innovations.

- Providing access to an extended and well-informed network
- Facilitating an open dialog between Government and SME's
- Embracing testbeds

ii) Innovative SMEs collaborating with others

The activities of a cluster organization target mainly to promote collaborations and connect the stakeholders in one industry (Porter, 1998; Sanchez & Omar, 2012). Also confirmed by the examined cases, a strong cluster benefits the regional network by facilitating co-operative research, diffusion of knowledge and information, sharing infrastructure and access to public goods (Porter, 1998). In the eyes of the interviewees, clusters can be likened to '*cafeterias*' where stakeholders can '*find the best quality of coffee*'. This is of course a metaphoric expression pointing out that the most important role for the clusters is to bring all the actors closer and initiate discussions and collaborations. As interviews revealed in conjunction with the literature, one way that clusters use to support innovative SMEs in collaborating with others, is to create and support programmes and projects. Almost all of the interviews indicated that creating and supporting programmes and projects facilitate collaborations especially among SMEs and start-ups. Through these initiatives, small companies are able to internationalize and expand their portfolio of partnerships. As Sanchez and Omar (2012) argue, engaging stakeholders in such programmes provide them with access to a global network, with information, resources and opportunities to meet new partners. Another way for the clusters to support innovative SMEs in collaborating with others is to grow a strong regions and strong clusters by exploiting the regional strengths for the benefit of their network. As Baptista and Swann (1996) pointed out, eventually strong regions with strong clusters can attract new entrants and new opportunities for collaborations. Finally, as mentioned in the previous paragraph, testbeds are organized and supported in order to bring all stakeholders closer and help them develop and test new ideas. Praising the value of the Triple Helix model (Leydesdorff, 1995), the clusters from the five cases focus on connecting different actors with particular interest towards SMEs and start-ups. The information from the conducted interviews has shown three main ways that clusters use to support innovative SMEs collaborating with others.

- Organize and promote supportive programmes and projects
- Utilize regional strengths
- Collaborate within testbeds' context

iii) Sales of new to market and new to firm innovations

Even though clusters act as catalysts to regional innovation performance, they are not involved directly to the sales of the firms within their network. In most of the cases, clusters try simply to connect firms with a global network where firms by

themselves are able to develop by creating new partnerships. Credited also by Porter (1998) and Braunerhjelm and Carlsson (1999), strong clusters influence companies from their network to create powerful channels of supply and demand though which they distribute their products and their services. In addition, few clusters offer to the firms of their network coaching and training services to strengthen their competence and their national and international presence. The two main methods that clusters use to promote and support the sales of the firms in their network are presented below.

- Connect SMEs with international network
- Coaching and training

6.2 Research implications

The research implications presented in this section are based on the findings of the conducted research and analysis of this paper leading to advices on how clusters can increase regional innovation performance and capacity. Bearing in mind that the research implications address to clusters with a similar profile to the profile of the examined regions and clusters, they are limited on the methods that clusters, usually operationalized by cluster organizations, could use to support successfully the areas described by the three indicators of RIS 2017.

SMEs introducing product or process innovations

Clusters could increase their activities in the following three areas:

- Providing access to an extended and well-informed network
- Facilitating an open dialog between Government and SME's
- Embracing testbeds

By supporting activities in the areas above, clusters could: i) *increase collaborations and the creation of new partnerships*, ii) *facilitate and stimulate open discussions between public authorities and SMEs regarding problems legislative/policy issues of the latter*, iii) *embrace, support and promote testbeds in the region.* Consequently, companies and entrepreneurs will be able to introduce more products or process innovations.

Innovative SMEs collaborating with others

To increase co-operation and collaboration between actors and SMEs, clusters could:

- Organize and promote supportive programmes and projects
- Utilize regional strengths
- Collaborate within testbeds' context

Underlined from literature but also from the findings of this paper, connecting actors like researchers, entrepreneurs, big multinational companies, academia,

public authorities, but most importantly SMEs and start-ups, has a stimulating effect to innovation performance of a cluster and a region. Focusing on the above areas, creates a positive effect on facilitating collaborations between innovative SMEs and other actors.

Sales of new to market and new to firm innovations

Finally, sales is an area that clusters choose not to engage directly. Nevertheless, there are some activities which have indirect impact on firms' sales. The activities are:

- Connect SMEs with international network
- Coaching and training

Connecting actors not only promotes generation of innovative ideas, but it also opens new opportunities for collaborations and increased sales. In addition, coaching and training can increase the competence of the firms and ultimately that leads to development and increased sales for the firms.

6.3 Limitations

It is important to make clear that there is no quantitative data revealing the correlation between the targeted indicators and the activities derived from the empirical findings of the study. The findings present the activities which, according to the interviewees, influence more the innovation performance in relation to the chosen indicators.

Due to time limitations, the researcher contacted and conducted only one interview from each region and each cluster and that affected the generalizability of the results. In addition, this paper used for the research a non-probability sampling method which does not allow the researcher to generalize easily the findings because the sample was selected by having in mind the research purpose and the available resources and therefore it does not represent the total population. However, the problem of generalizability was partially addressed from the high number of the examined cases which adds reliability and validity to the findings and the research.

6.4 Future research

Clusters are highly dynamic and constantly evolving constellations of participants. The unique characteristics of each region combined with the different dynamic of every participating actor, causes a great variety of effects and impacts in each region. This thesis according to the formulated purpose, examined five cases of the most innovative regions in Europe regardless the industry of the clusters or the

unique characteristics each region. Therefore, the following research proposals are suggested.

A future research could focus more on cases of clusters with similar characteristics and industries to extract results which can be compared and closely connected to the peculiarities of a specific type of environment (geography, sector, demographics, etc.). Also, another research with a broader timeframe could include more cases or more interviews and perhaps observations to collect data in order to increase the reliability and validity of the findings.

Another suggestion for a future researcher is to run a quantitative research in order to examine if the activities from the empirical findings are correlated with the specific indicators used in this study. Ultimately, the quantitative analysis will allow the researcher to include more indicators and more cases and extract more information regarding which factors are correlated with the selected indicators for rating innovation performance.

Although it was not targeted from the scope of this study, the selected indicators and the findings are touching upon aspects related to SMEs and start-ups. According to RIS 2017, two of the weakest indicators for innovation performance in Västsverige are related to SMEs. On top of that, the conducted interviews revealed that SMEs and start-ups represent an important part of the regional innovation capacity and therefore it would be interesting to understand better either with a quantitative or with a qualitative research the relation between SMEs or start-ups and regional innovation performance.

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8 Appendixes

Appendix 1 – Top 25 Regional Innovation Leaders

	2011 (RII 2011)	2013 (RII 2013)	2015 (RII 2015)	2017 (RII 2017)	RII 2017
1	Zürich (CH04)	Zürich (CH04)	Zürich (CH04)	Zürich (CH04)	178.3
2	Hovedstaden (DK01)	Hovedstaden (DK01)	Hovedstaden (DK01)	Nordwestschweiz (CH03)	166.4
3	Nordwestschweiz (CH03)	Stockholm (SE11)	Nordwestschweiz (CH03)	Stockholm (SE11)	165.1
4	Stockholm (SE11)	Nordwestschweiz (CH03)	Stockholm (SE11)	Hovedstaden (DK01)	155.0
5	Sydsverige (SE22)	Oberbayern (DE21)	Zentralschweiz (CH06)	Zentralschweiz (CH06)	154.9
6	Zentralschweiz (CH06)	Sydsverige (SE22)	Karlsruhe (DE12)	Ticino (CH07)	152.5
7	Östra Mellansverige (SE12)	Zentralschweiz (CH06)	Sydsverige (SE22)	Ostschweiz (CH05)	149.6
8	Karlsruhe (DE12)	Karlsruhe (DE12)	Région lémanique (CH01)	South East (UKJ)	148.2
9	Etelä-Suomi (FI1C)	Östra Mellansverige (SE12)	Ticino (CH07)	Région lémanique (CH01)	147.9
10	Oberbayern (DE21)	Tübingen (DE14)	Oberbayern (DE21)	Östra Mellansverige (SE12)	146.3
11	Tübingen (DE14)	Etelä-Suomi (FI1C)	Ostschweiz (CH05)	Espace Mittelland (CH02)	143.2
12	Région lémanique (CH01)	Stuttgart (DE11)	Västsverige (SE23)	Oberbayern (DE21)	143.0
13	Stuttgart (DE11)	Région lémanique (CH01)	Espace Mittelland (CH02)	Sydsverige (SE22)	141.9
14	Ostschweiz (CH05)	Västsverige (SE23)	Tübingen (DE14)	Tübingen (DE14)	141.8
15	Ticino (CH07)	Midtjylland (DK04)	Stuttgart (DE11)	London (UKI)	141.1
16	Västsverige (SE23)	Ticino (CH07)	Etelä-Suomi (FI1C)	Trøndelag (NO06)	139.6
17	Espace Mittelland (CH02)	Ostschweiz (CH05)	Berlin (DE3)	Etelä-Suomi (FI1C)	139.5
18	Freiburg (DE13)	Braunschweig (DE91)	London (UKI)	Stuttgart (DE11)	139.1
19	East of England (UKH)	Espace Mittelland (CH02)	South East (UKJ)	East of England (UKH)	139.1
20	South East (UKJ)	Berlin (DE30)	Östra Mellansverige (SE12)	Berlin (DE030)	139.0
21	Braunschweig (DE91)	Freiburg (DE13)	Midtjylland (DK04)	Karlsruhe (DE12)	138.8
22	Midtjylland (DK04)	Rheinhessen-Pfalz (DEB3)	Rheinhessen-Pfalz (DEB3)	Västsverige (SE23)	138.3
23	Mittelfranken (DE25)	South East (UKJ)	Braunschweig (DE91)	Utrecht (NL31)	136.6
24	Berlin (DE3)	Mittelfranken (DE25)	Utrecht (NL31)	East Midlands (UKF)	134.2
25	Rheinhessen-Pfalz (DEB3)	Darmstadt (DE71)	Övre Norrland (SE33)	Midtjylland (DK04)	133.3

Source: Report of Regional Innovation Scoreboard 2017

Appendix 2 – Indicators included in the RIS 2017. (Source: RIS 2017)

Themes	Indicators RIS 2017
FRAMEWORK CONDITIONS	
Human resources	Percentage of population aged 30-34 having completed tertiary education
	Life-long learning, share of population aged 25-64 enrolled in education or training aimed at improving knowledge, skills and competences
Attractive research systems	International scientific co-publications per million population
	Scientific publications among the top-10% most cited publications worldwide as percentage of total scientific publications of the country
INVESTMENTS	
Finance and support	R&D expenditure in the public sector as percentage of GDP
Firm investments	R&D expenditure in the business sector as percentage of GDP
	Non-R&D innovation expenditures as percentage of total turnover (Only for SMEs)
INNOVATION ACTIVITIES	
Innovators	SMEs introducing product or process innovations as percentage of SMEs
	SMEs introducing marketing or organizational innovations as percentage of SMEs
	SMEs innovating in-house as percentage of SMEs
Linkages	Innovative SMEs collaborating with others as percentage of SMEs
	Public-private co-publications per million population
Intellectual assets	EPO patent applications per billion GDP*
	European trademark applications per billion GDP*
	Design applications per billion GDP*
IMPACTS	
Employment impacts	Employment in medium-high and high tech manufacturing and knowledge-intensive services as percentage of total employment
Sales impacts	Exports of medium-high and high technology-intensive manufacturing industries as percentage of total product exports
	Sales of new to market and new to firm innovations as percentage of total Turnover (only for SMEs)

* GDP in Purchasing Power standards

Appendix 3 – Interview Guide

General Information

Country: ……

Region: ……

Industry: ……

Cluster/Organization: ……

Position: ……

Date: ……

Notes:

- Estimated time of each interview: 45´approx.
- The interviews will be conducted through Skype or similar software.

Briefing

- Presentation of myself
- Thank the interviewee
- Small introduction of the thesis
- Present to the interviewee the structure of the interview
- Ask the interviewee for the permission to record the interview

General Questions

- How do you define innovation in relation to a cluster?
- According to your opinion, how clusters (in general) could contribute to regional innovation? (in order to support, trigger, promote innovation)
- How your cluster actually contributes to the regional innovation? Could you briefly name the main ways? Why do you use those tools?
- What kind of bodies or organizations composes your cluster's network? (Academia, SMEs, incubators, public authorities, etc.)
- Which of them do you think is or are more important in terms of regional innovation? And why?

*These groups of indicators where used from RIS 2017 to evaluate the innovative performance of the regions

Framework Conditions*

(Human resources, Attractive research systems)

- Does your cluster try to attract researchers in your region (e.g. through partners like academia, or by offering R&D facilities)?
    - If yes, please describe how (from a regional up to an international level)
    - If not, do you believe it could have an impact on regional innovation and what that might be?

Investments*

(Finance and support, Firm investments)

- What methods/mechanisms does your cluster use to support financially R&D in your region (formal or not)? Please describe. (organize projects, finance it directly, find resources, coordinate, participate, etc)
- Do you use the same or different methods /mechanisms to attract public and private investments in R&D? Please, describe.

Innovation Activities*

(Innovators, Linkages, Intellectual assets)

- How the cluster in your region helps actors (e.g. SMEs, entrepreneurs) to introduce more innovations, processes or other intellectual assets? (sharing knowledge or facilities, testbeds, etc)
- How do you facilitate cooperation/alliances between all actors (triple helix) and especially between SMEs?

Impacts*

(Employment impacts, Sales impacts)

- How your cluster promotes exports of the high-tech products/services (especially new to market or new to firm innovations) produced in your region? (International collaborations, represent region and members of the cluster, etc.)

Follow-up Questions

- According to your opinion, what are the key advantages/factors driving success for your cluster? (Activities, partners, advantages of regions, etc.)
- In your opinion, where should your cluster focus in the future to trigger, support and promote even better regional innovation practices? Please, explain. (Barriers, gaps, problems, future trends, etc.)

*These groups of indicators where used from RIS 2017 to evaluate the innovative performance of the regions

Appendix 4 – Normalized Innovation Scores from RIS 2017

Region	Product/process innovations	Innovative SMEs collaborating	Sales new to market/firm innovations
Västsverige	0.386	0.307	0.364
County of Stockholm	0.862	0.350	0.423
Etelä-Suomi	0.638	0.596	0.367
Hovedstaden (Copenhagen)	0.527	0.427	0.333
District of Stuttgart	0.756	0.310	0.415
Canton of Zürich	0.843	0.467	0.592

Source: *RIS 2017*

Appendix 5 – Share of R&D Total Expenditure (in % of GDP)*

	Share of R&D Total Expenditure (in % of GDP)*						Avg.
Region/Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2010-2015**
European Union (28 countries)	**1.83**	**1.88**	**1.91**	**1.92**	**1.94**	**1.96**	**1.91**
Västsverige	..	3.77	..	3.62	..	3.81	**3.73**
County of Stockholm	..	3.53	..	3.87	..	3.78	**3.73**
Etelä-Suomi	2.77	2.72	2.67	2.44	..	2	**2.52**
Hovedstaden (Copenhagen)	4.86	4.96	4.98	4.73	4.63	4.56	**4.79**
District of Stuttgart**	..	4.79	..	4.77	..	4.92	**4.83**
Canton of Zürich***	..	..	3.19	..	..	3.37	**3.28**

Source: *stats.oecd.org* & *data.worldbank.org*, 2019

* Includes expenditures in: "*Business enterprise, Government, Higher education and Private non-profit. R&D covers basic research, applied research, and experimental development*".

** *The data correspond to the greater state of Baden-Württemberg*

*** *The data correspond to the country of Switzerland*

Appendix 6 – Demographics

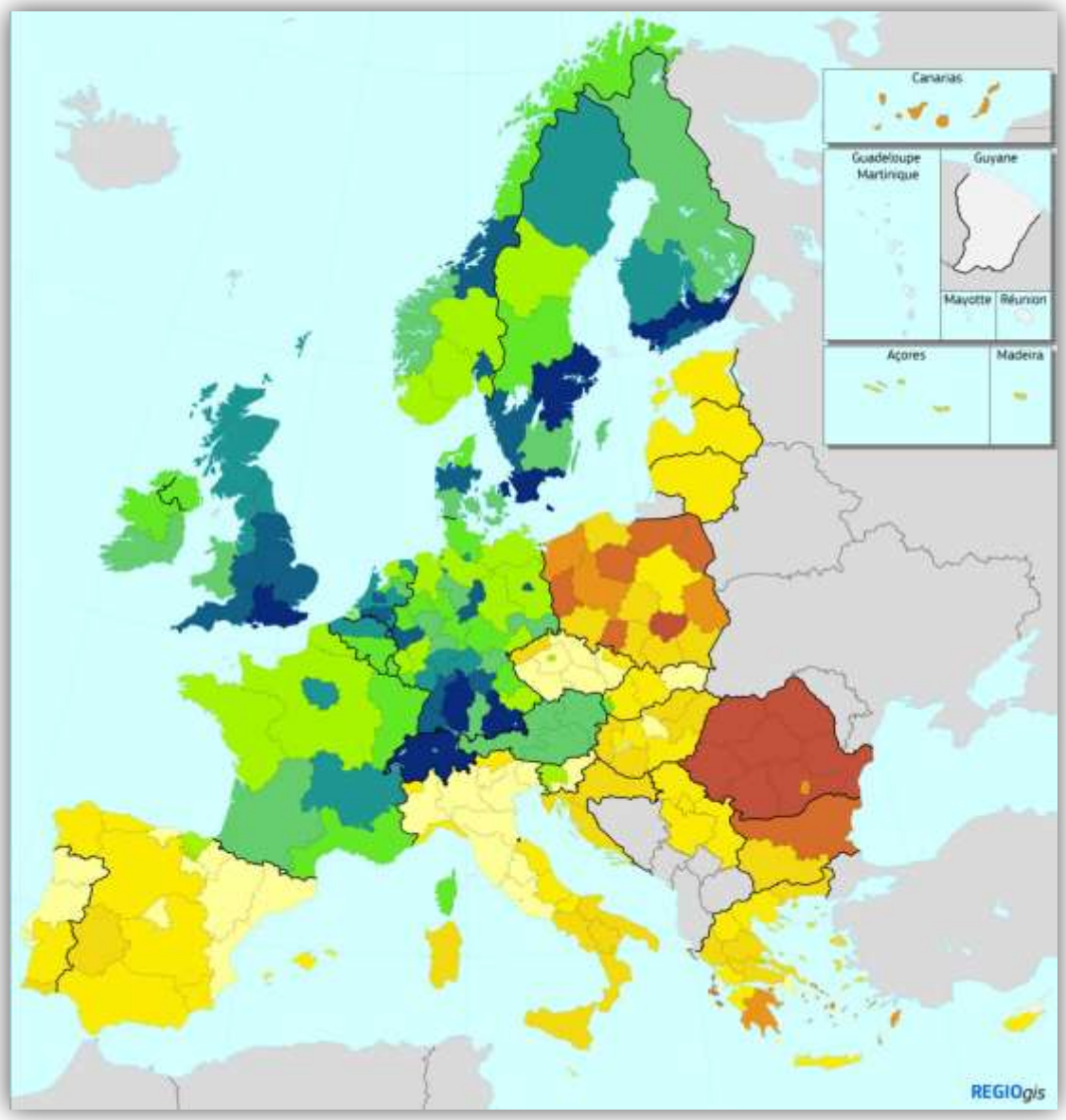
Region	Area (km^2)	Population (million)	Density (population/ km^2)
Västsverige	30,934	1.992	64
County of Stockholm	6,779	2,269	335
Etelä-Suomi	35,378	1,159	33
Hovedstaden (Copenhagen)	2,560	1,835	717
District of Stuttgart*	10,155	4,126	406
Canton of Zürich**	1,729	1,504	870

Source: *Eurostat cited by European Commission at Regional Innovation Monitor Plus database, 2019*

* *The data correspond to the greater state of Baden-Württemberg*

** *The data correspond to the country of Switzerland*

Appendix 7 – Regional performance groups



Source: Report of Regional Innovation Scoreboard 2017