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Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems

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Dedicatory

To my family and my true friends.

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Abstract

The general objective of this thesis is to "analyse the relationship between innovation, entrepreneurship and competitiveness in the context of Research and Innovation Smart Specialisation Strategies (RIS3)", following the quadruple helix network approach to regional economies in economic and social development. In order to reach the proposed objective, a typology of mixed research, presented in Chapters 2 to 5, was used.

In Chapter 2, two studies were carried out. The first study seeks, through a bibliometric analysis, to ascertain the developments that occur in the RIS3 studies to identify gaps and opportunities for future research. This bibliometric review was based on the SCOPUS database with the selected sample containing all the articles with the keywords "Research and Innovation Strategies for Smart Specialisation" or "RIS3". Our findings detail six clusters in RIS3 research, which help to contextualise literature review: 1) business discovery; 2) smart specialisation; 3) innovation; 4) specialisation; 5) regional policies; and 6) regional development. This study also establishes perspectives for future lines of research and, correspondingly, seeks to convey a broad theoretical basis that can serve as a starting point for future studies. In the second study in Chapter 2, a bibliometric analysis of academic entrepreneurship was sought. We carried out extensive research (1971 - 2017) in the Web of Science database that allowed us to identify seven clusters in the literature: 1) entrepreneurial universities; 2) university-industry interactions; 3) university-industry knowledge transfers; 4) university-industry innovation networks; 5) university entrepreneurship; 6) university-industry industrial property; and 7) innovation ecosystems. This study reinforces the coherence and scientific structure of the existing literature and serves as a starting point for future studies in this field.

In Chapter 3, the study sought to identify the variables which best explain the performance of innovative regions in Europe by implementing regional strategies for smart specialisation. We followed a quantitative methodology and applied linear regression as a method. To conduct this study, we collected data from the Regional Innovation Scoreboard. The results led to an explanatory model of invocation of performance for the moderate innovator regions. It also identifies some possible measures and suggestions to help decision-makers improve the innovation performance of these regions.

In Chapter 4, the study aimed to evaluate stakeholder perceptions regarding the adequacy of the smart specialisation strategies defined for their regions in RIS3. We adopted a quantitative methodology through questionnaires to the different stakeholders in the Portuguese regions, according to the VRIO model applied to the regions. The results of the study emphasise that stakeholder perceptions about the adequacy of defined smart specialisation strategies for their regions do not match the smart specialisation strategies defined by their policy makers in RIS3. This study attempts to contribute to an innovative framework that helps policy makers assess

and measure regional performance. The study also proposes measures to bridge the gaps found in regional strategies for smart specialisation.

Chapter 5 deals with two studies. The first study sought to analyse the dynamics underlying the mechanisms of transfer and commercialisation of university technology. We adopted a qualitative research methodology, which incorporates different case studies, interviews and applied research of the actors involved in universities, business incubators and startups. This work highlights the mechanisms of technology transfer and marketing support, including the identification of the difficulties and opportunities present in the context of cooperation networks. By examining the incubators in operation and the managers of incubated companies together with the analysis of cooperative research, development and innovation projects backed by European funding, we were able to gain insight into the different technology transfer and marketing processes. Falling within the framework of the third mission of universities, this study demonstrates not only the importance of cooperation networks in research, development and innovation, but also how the consequent commercialisation of new products and services has positive consequences for economic growth. In the second study in Chapter 5, resources and capacities were evaluated in island regions, and it was also intended to understand how value creation and commercialisation are carried out in existing ecosystems. A qualitative research methodology was followed through a case study, incorporating interviews with incubators managers from the island regions of Portugal (Azores and Madeira). The results show some difficulties as a result of the insularity of ecosystems. To shorten the asymmetry of island regions compared to other non-island regions, a new model is proposed to help these regions overcome their socio-economic problems.

Finally, in order to couple all the findings achieved in chapters 2 to 5, the Regional Helix Assessment Model was presented, clarifying the role of the different actors in the quadruple helix context and their potential contribution to increasing regional competitiveness.

Keywords

Innovation, Entrepreneurship, Smart Specialisation, RIS3, VRIO, Quadruple Helix, Competitiveness, Regional Development.

Resumo Alargado

A investigação nas áreas da inovação, empreendedorismo e competitividade tem vindo a intensificar-se ao longo do tempo. O surgimento de novas políticas de inovação regional na corrente geral das políticas públicas é consequência das recentes crises económicas, como também o resultado de mais de quatro décadas de investigação. A nossa perceção assume novas posições acerca do papel do empreendedorismo e da inovação no desenvolvimento económico e suas políticas, com particular ênfase no contexto regional, incluindo as redes colaborativas firmadas a este nível.

Atualmente, o mundo tem cada vez mais "regiões inteligentes" e "cidades inteligentes" (Kourtit & Nijkamp, 2018; Lopes & Franco, 2017; Markkula & Kune, 2015). Os ecossistemas regionais de empreendedorismo e inovação que estão a ser bem-sucedidos foram formados a partir de uma base de conhecimento sólido, conciliando uma rede de processos de inovação complementares com combinações de recursos de inovação (talento, financiamento e infraestruturas).

Os ecossistemas de empreendedorismo e inovação são definidos pelas combinações de elementos sociais, políticos, económicos e culturais numa região. Esses ecossistemas apoiam o desenvolvimento e o crescimento de startups inovadoras (Lopes, Farinha, & Ferreira, 2018; Spigel & Harrison, 2018) e encorajam os empreendedores na sua fase embrionária a assumirem os riscos para iniciarem a atividade (Spigel, 2017).

A tripla (universidade-indústria-governo) e quadrupla hélices (universidade-indústria-governo-Sociedade) são cada vez mais reconhecidas como uma fonte de inovação regional, que encoraja a transformação dos resultados em investigação científica e tecnológicos em resultados económicos. Pode afirmar-se que a inovação é cada vez mais baseada na interação entre os elementos que constituem a tripla hélice ou quadrupla hélice. Este pensamento tem tido uma crescente aceitação, como uma abordagem regional estruturada e promissora, numa economia baseada no conhecimento (Carayannis, Grigoroudis, Campbell, Meissner, & Stamati, 2018; Etzkowitz, 2003a; Etzkowitz & Leydesdorff, 2000).

Com a implementação das "Estratégias de Investigação e Inovação para uma Especialização Inteligente" (RIS3) na União Europeia (UE), é expectável que as economias mais desenvolvidas em sistemas de R&D sejam capazes de investir na criação de novas atividades intensivas com uma forte componente em ciência. Em oposto, as economias menos desenvolvidas devem orientar a sua R&D para áreas onde já tenham a indústria implementada (Foray, David, & Hall, 2009b; Foray et al., 2012). A RIS3 veio mudar a nossa compreensão acerca do papel desempenhado pela inovação no desenvolvimento económico, com foco nas regiões.

O “Valor, Raridade, Imitabilidade e Implementado na Organização” (VRIO) permite efetuar-se a análise interna das organizações sob a perspetiva dos recursos e capacidades e dos seus impactos na vantagem competitiva (Hesterly & Barney, 2010). O VRIO assume quatro condições para avaliar se um recurso tem potencial para gerar vantagem competitiva sustentada - os recursos têm de ser simultaneamente valiosos, raros, difíceis de imitar e exploráveis pela organização (Kozlenkova, Samaha, & Palmatier, 2014). O VRIO examina as atividades de uma organização e identifica as capacidades que podem melhorar a posição competitiva de uma empresa no mercado (Andersen, 2011).

Neste sentido, as características particulares de cada país ou região contribuem com recursos estratégicos para a aplicabilidade do VRIO às regiões contribuindo para o seu desenvolvimento económico e social.

A RIS3 veio destacar o papel fundamental desempenhado pelas Instituições de Ensino Superior (IES) no desenvolvimento regional (Secundo, Perez, Martinaitis, & Leitner, 2017). As IES representam fontes de atividades empreendedoras, através de liderança, transferência de conhecimento e tecnologia, bem como de sua comercialização (Klofsten & Jones-Evans, 2000; Lopes, Ferreira, Farinha, & Raposo, 2018).

Considerando as influências no envolvimento da transferência de conhecimento e tecnologia a um nível operacional, as descobertas são mais direcionadas para o empreendedorismo académico, nomeadamente em relação às características organizacionais das instituições de pesquisa e universidades. A fim de apoiar as atividades de transferência de conhecimento e tecnologia, várias organizações implementaram os escritórios de transferência de tecnologia, esperando que eles colmatem as lacunas entre a academia e a indústria (Sinell, Muller-Wieland, & Muschner, 2018).

No contexto regional, o empreendedorismo académico tem ganho um reconhecimento crescente como uma fonte de novos conhecimentos e tecnologias, além de servir como um leme para o desenvolvimento de uma sociedade baseada no conhecimento (Lopes, Ferreira, et al., 2018).

Assim, o objetivo geral desta tese consiste em “analisar a relação entre a inovação, empreendedorismo e competitividade, no contexto da RIS3”. A partir do objetivo geral foram definidos seis objetivos específicos: 1) Identificar as principais tendências da literatura na RIS3 e empreendedorismo académico; 2) Avaliar o impacto do desempenho da inovação das regiões europeias; 3) Analisar a perceção dos *stakeholders* regionais nos diferentes domínios da RIS3 na criação de vantagens competitivas regionais; 4) Analisar os processos de transferência e comercialização de conhecimento e tecnologia; 5) Avaliar os recursos e capacidades em regiões insulares no domínio da criação e comercialização de valor; 6) Encontrar um modelo de apoio para avaliar a perceção dos *stakeholders* regionais nos diferentes domínios da RIS3 no contexto dos ecossistemas regionais de inovação.

A partir do problema central do nosso estudo, e procurando dar cumprimento ao nosso primeiro objetivo específico, através da "identificação das principais tendências da literatura na RIS3 e empreendedorismo académico", foi desenvolvido o capítulo 2. Neste capítulo percebeu-se a necessidade de apoio de diagnóstico adicional em relação a ecossistemas de empreendedorismo e inovação em geral. Mais especificamente, com a análise dos clusters verificou-se a pertinência de investigar a inovação, a especialização inteligente, a RIS3 e a transferência de conhecimento e comercialização de tecnologia no contexto regional. O "empreendedorismo académico regional" foi um novo conceito desenvolvido e proposto por nós. O "empreendedorismo académico regional" consiste na criação de valor económico regional através da comercialização de propriedade intelectual gerada por recursos universitários, seja através da criação de *spin-offs* académicas ou *startups* académicas.

Partindo do segundo objetivo específico desta tese, que consiste em "avaliar o impacto do desempenho da inovação das regiões europeias", surgiu o capítulo 3. Os dados para o estudo foram coletados os dados no *Regional Innovation Scoreboard*. Através de uma regressão linear foi-se analisar a performance da invocação nas regiões inovadoras moderadas (83 regiões da União Europeia). Assim, chegou-se ao modelo explicativo no que concerne ao desempenho da inovação nas regiões consideradas moderadas. Verificou-se ainda que a variável "PMEs com inovações de produto ou processo" afeta positivamente o desempenho da inovação das regiões inovadoras moderadas. Em oposto, a variável "inovação interna das PMEs e PMEs inovadoras em colaboração com outras" afetam negativamente o desempenho da inovação. O estudo confirma que o investimento em R&D efetuado pelas empresas e governos das regiões inovadoras moderadas é insuficiente. As PMEs das regiões inovadoras moderadas precisam de investir mais em R&D.

O terceiro e sexto objetivos específicos da nossa investigação, foram desenvolvidos no capítulo 4, e centram-se na "análise da perceção dos *stakeholders* regionais nos diferentes domínios da RIS3 na criação de vantagens competitivas regionais" e em "encontrar um modelo de apoio para avaliar a perceção dos *stakeholders* regionais nos diferentes domínios de RIS3 no contexto de ecossistemas regionais inovadores". O modelo VRIO que inicialmente foi desenvolvido e aplicado a empresas, foi nesta investigação adaptado e testado em regiões. Foram efetuados questionários aos diferentes *stakeholders* nas 7 regiões portuguesas (Norte, Centro, Lisboa, Alentejo, Algarve, Açores e Madeira). Os resultados do estudo enfatizam que as perceções dos *stakeholders* sobre a adequação das estratégias de especialização inteligente definidas na RIS3 para suas regiões, não coincidem com as estratégias de especialização inteligente definidas pelos governos regionais. O estudo tenta contribuir para um quadro inovador que ajuda os decisores políticos a avaliar e medir o desempenho regional. O estudo propõe ainda medidas para colmatar as lacunas encontradas nas estratégias regionais de especialização inteligente.

De acordo com os nossos quarto e quinto objetivos específicos de "analisar os processos de transferência e comercialização de conhecimento e tecnologia" e "avaliar os recursos e capacidades em regiões insulares no domínio da criação e comercialização de valor",

desenvolveu-se o capítulo 5. Neste capítulo, analisaram-se as dinâmicas subjacentes aos mecanismos de transferência e comercialização de tecnologia universitária. Este capítulo contempla dois estudos. O primeiro estudo, do capítulo 5, incorpora diferentes estudos de caso, entrevistas e pesquisas aplicadas dos atores envolvidos em universidades, incubadoras de empresas e *start-ups*. Este trabalho destaca os mecanismos de transferência de tecnologia e o apoio à comercialização, incluindo a identificação das dificuldades e oportunidades presentes no contexto das redes de cooperação. Examinando as incubadoras em funcionamento e os gerentes das empresas incubadas em conjunto com a análise de projetos cooperativos de investigação, desenvolvimento e inovação respaldados por financiamento europeu, pudemos obter insights sobre os diferentes processos de transferência e comercialização de tecnologia. No que concerne à terceira missão das universidades, este estudo demonstra a importância das redes de cooperação em investigação, desenvolvimento e inovação, mas também como a consequente comercialização de novos produtos e serviços que geram consequências positivas para o crescimento económico. O segundo estudo, do capítulo 5, visa avaliar os recursos e capacidades em regiões insulares, e também entender como a criação de valor e comercialização ocorrem nos ecossistemas insulares. Foram realizadas entrevistas com os gerentes das incubadoras das regiões insulares de Portugal (Açores e Madeira). Os resultados do estudo mostram algumas dificuldades como resultado da insularidade do ecossistema. Para encurtar a assimetria das regiões insulares em comparação com outras regiões não insulares, um novo modelo é proposto para ajudar essas regiões a superar seus problemas econômicos e sociais.

Para facilitar a compreensão do leitor de toda a revisão de literatura e os resultados da investigação realizada nesta tese de doutoramento, ao longo dos capítulos 2 a 5, desenvolvemos o modelo "*Regional Helix Assessment Model*". Este modelo visa completar o sexto objetivo de "encontrar um modelo de apoio para avaliar a perceção dos *stakeholders* regionais nos diferentes domínios da RIS3 no contexto dos ecossistemas regionais de inovação" já abordado no capítulo 4. O modelo "*Regional Helix Assessment Model*" assenta em ecossistemas suportados pelas interfaces colaborativas da quadrupla hélice que precisam estar associados a outras ferramentas de medição de desempenho, incluindo perceção dos *stakeholders* regionais nos diferentes domínios da especialização inteligente. Este modelo enfoca a dinâmica de especialização inteligente das regiões e a valorização dos seus recursos e capacidades com ênfase nos ecossistemas de inovação e empreendedorismo regionais, através da transferência de conhecimento e comercialização de tecnologia.

Palavras-chave

Inovação, Especialização Inteligente, RIS3, VRIO, Quadrupla Hélice, Competitividade, Desenvolvimento Regional

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Part I

CHAPTER 1 – Introduction

1.1. Statement of the Problem

Research on innovation, entrepreneurship and competitiveness has been intensifying over the last decades. The emergence of new regional innovation policies in the mainstream of public policy is a consequence of the recent economic crises, as well as the result of more than four decades of research. Our perception assumes new positions on the role of the entrepreneurship and innovation in economic development and its policies, with particular emphasis on the regional context, including the collaborative networks established at this level.

Today, the world has increasingly "smart regions" and "smart cities" (Kourtit & Nijkamp, 2018; Lopes & Franco, 2017; Markkula & Kune, 2015). Successful regional ecosystems of entrepreneurship and innovation have been formed from a solid knowledge base, reconciling a network of complementary innovation processes with combinations of innovation (talent, financing, and infrastructure) resources

Entrepreneurship and innovation ecosystems are defined by combinations of social, political, economic and cultural elements in a region. These ecosystems support the development and growth of innovative startups (Lopes, Farinha, et al., 2018; Spigel & Harrison, 2018) and encourage entrepreneurs in their embryonic stage to take the risks to start the activity (Spigel, 2017).

Entrepreneurship and innovation ecosystems share an identical belief that certain attributes exist outside the boundaries of a company. These attributes will contribute to improving the competitiveness of a new venture. This belief highlights three key regional resources that contribute to increased entrepreneurship and economic growth: (1) shared cultural understanding and institutional environments; 2) social networks within the regions and 3) government policies (Gertler, 2003; Henry & Pinch, 2001; Spigel, 2017). The first resource consists of shared cultural understandings and institutional environments that facilitate cooperation among the various actors, fostering practices such as knowledge sharing and corporate mobility within the ecosystem (Gertler, 2003; Henry & Pinch, 2001). The second resource is social networks within regions, which create paths for knowledge spillovers between companies and universities (Owen-Smith & Powell, 2004). Knowledge among firms and universities helps to disseminate information about entrepreneurial opportunities (Arenius & Clercq, 2005), as well as to connect entrepreneurs with financiers (Powell, Koput, Bowie, & Smith-Doerr, 2002). The third resource concerns government policies and how universities may help in building new cultures and cooperation networks. In order to develop cooperation

networks, it is necessary that workers and entrepreneurs be qualified, have access to specific support programs such as networking events and incubators (Feldman & Francis, 2004).

Entrepreneurship and innovation ecosystems are constituted by actors who share the vision of value creation (Moore, 1993), even though sometimes partners cooperate and compete at the same time (Afuah, 2000; Lopes & Farinha, 2018). Partners need to leverage their individual capacities as well as ecosystem capabilities (resources in the network) to achieve the goals they have in common (Adner & Kapoor, 2010; Nambisan & Baron, 2013). Ecosystems follow the premise that both business members are very interdependent and dependent on each other for their survival (Overholm, 2015). Innovation ecosystems can be classified into four different types: 1) type of governance (centralised or decentralised); 2) degree of open borders (open / closed); 3) structure of the spatial aspect and 4) type of progressive innovation (incremental / radical) (Lopes & Franco, 2017; Pisano & Verganti, 2008). Through regional innovation ecosystems it is possible to accelerate the development of a particular region.

In relation to the open innovation sphere of regional innovation and entrepreneurship systems, interorganisational relationships between public research entities and industry play an important role in guiding innovation processes (Perkmann & Walsh, 2007). Regional innovation factors can be classified as demographic, economic, geographic, industrial, and institutional, affecting regional business activities (Kim, Kim, & Yang, 2012). The triple helix (university-industry-government) and quadruple helix (university-industry-government-society) are constantly evolving regional models that take these factors into account in a collaborative network perspective.

Triple and quadruple helices are increasingly recognised as a source of regional innovation, which encourages the transformation of results into scientific and technological research into economic results. It can be affirmed that innovation is increasingly based on the interaction between the elements that constitute triple helix or quadruple helix. This thinking has been increasingly accepted as a structured and promising regional approach in a knowledge-based economy (Carayannis et al., 2018; Etzkowitz, 2003a; Etzkowitz & Leydesdorff, 2000).

Regional development theories that do not include and consider business factors may fail to understand and identify the essential sources of regional innovation (Andersson & Ejermo, 2005). In this sense, it is important that entrepreneurs include regional innovation ecosystems, as they are more aware of opportunities and contribute positively to regional economic growth (Audretsch & Keilbach, 2004; Benneworth, 2004; Lee, Florida, & Acs, 2004).

The European Union (EU) has been a pioneer in the development of smart specialisation policies. The focus on smart specialisation has emerged in the EU since 2009. The first institutional actions of the EU consisted of setting up a consultative body, the “Mirror Group”. In 2011, the first findings of the “Mirror Group” gave rise to an official Smart Specialisation policy report in 2012 - Guide to research and innovation strategies for smart specialisation (RIS3) (Foray et al., 2012).

In academia, the first jobs related to smart specialisation emerged in 2013 and have been intensifying to date. However, articles published on RIS3 tend to be very focused on the process of creating RIS3 or its implementation (Camagni & Capello, 2013; Healy, 2016; McCann & Ortega-Argilés, 2014b). No studies have been identified in the literature to systematise, using bibliometrics, the domain of Smart Specialisation and in particular of RIS3. Thus, it becomes crucial to develop a study of this nature in order to understand the current state of the art in this field of research in order to identify gaps and opportunities for future research.

RIS3 has inherited the learning of regional innovation systems, which was the current policy for the development of regional economic development policy in recent years (Asheim & Gertler, 2005b; Cooke, 2001). It can be said that RIS3 is the evolution of regional innovation systems. With RIS3, it was intended to identify knowledge in selective "domains", as well as priorities, in areas where the region (or a Member State) has a relative advantage (Foray, 2014b; Foray et al., 2012), which can create a competitive advantage. RIS3 consists of investing in knowledge, human capital, industrial and technological capital, and the competences of the territories (Camagni & Capello, 2013). RIS3 highlights the role of knowledge, technology and innovation for economic development and social well-being. RIS3 has been designed to impart R&D to the creation of new policies, i.e. the concept focuses primarily on economic R&D returns (Tiits, Kalvet, & Mürk, 2015).

With the implementation of RIS3, it is expected that the most developed economies in R&D systems will be able to invest in the creation of new intensive activities with a strong component in science. On the other hand, less developed economies should orient their R&D to areas where they already have the industry in place (Foray et al., 2009; Foray et al., 2012). RIS3 has changed our understanding of the role of innovation in economic development, with a focus on the regions.

Regional governments should encourage the process of business discovery of new opportunities through research and innovation. The aim is to provide the conditions for achieving the Europe 2020 goals for smart, sustainable and inclusive growth (Tiits et al., 2015; Tiits, Kattel, Kalvet, & Tamm, 2008).

Thus, while policy actions reflect much of current political thinking in the EU, there is a need to improve knowledge and understanding of innovation processes and policy choices in the regions. In this context, there are great asymmetries in the performance of regional innovation from region to region (McCann & Ortega-Argiles, 2013a; Muscio, Reid, & Rivera Leon, 2015).

In this context, there is a need for future research currents to include institutional and political aspects, to identify the interaction between innovation and society (Rodriguez-Pose, 1999). It is necessary to reflect more on the weak capacity of innovation of different types of regions that present problems (Tödtling & Trippl, 2005). In this sense, it is important to have more complete information on improving innovation through quantitative measures of innovation performance (Nieto & Santamaria, 2010). In this alignment, the Regional Innovation Scoreboard

classifies regions into innovation leaders, strong innovators, moderate innovators, and modest innovators.

Therefore, a gap persists in the literature regarding the identification of the variables that generate impacts on the innovation performance of the European regions considered moderate innovators regions. In the last few years, research has focused only on the effects of the relationship between innovation and performance in the regions (Delgado-Marquez & Garcia-Velasco, 2018; Lamperti, Mavilia, & Castellini, 2017; Polednikova & Kashi, 2014). Although there are several theoretical models that relate the innovation and the performance of the companies, highlighting the importance of innovation as the main motor of the growth of the companies (Farinha, Ferreira, & Gouveia, 2016; Klette & Griliches, 2000; Klette & Kortum, 2004; Lopes & Franco, 2017), it is difficult to find any systematic and persistent effect on existing empirical studies. However, several studies highlight the positive effect that innovative activity has on R&D and economic growth (Lamperti et al., 2017). This finding occurs for the first time in the 1960s (Mansfield, 1962; Scherer, 1965). However, over time, this has been confirmed (Geroski & Machin, 1992; Stam & Wennberg, 2009; Storey, 1994).

R&D cooperation networks, when well implemented in real contexts, serve to create and develop technological projects that will have a positive impact on competitiveness (Farinha & Ferreira, 2016).

Some performance monitoring systems are already in place. However, in general, these systems use the Balanced Scorecard (BSC) instrument (Al-Ashaab, Flores, Doultsinou, & Magyar, 2011; Farinha & Ferreira, 2016; Ioppolo, Saija, & Salomone, 2012). Although there are different models for measuring regional performance, there is no model that takes into account the resources and capabilities of each region.

Thus, the adaptation of the Resource-Based View (RBV) and the "Value, Rarity, Imitability and Implemented in the Organization" (VRIO) model to the regions can serve to overcome the previously mentioned gap in the literature. The RBV and the VRIO model are frameworks created, tested and implemented in companies, and there is no study that adapts and applies to regions. In this context, the following research question is asked: How to apply the VRIO Model to regions?

With the VRIO framework, the internal analysis of organizations will be carried out under the perspective of resources and capabilities and their impact on the competitive advantage (Hesterly & Barney, 2010) of the regions. The VRIO framework assumes four conditions for assessing whether a resource has the potential to generate sustained competitive advantage - resources must be simultaneously valuable, rare, difficult to replicate and exploitable by the organization (Kozlenkova et al., 2014). The VRIO framework examines an organization's activities and identifies capabilities that can improve a company's competitive position in the marketplace (Andersen, 2011).

In this sense, the particular characteristics of each country or region contribute with strategic resources for the VRIO framework to the regions contributing to their economic and social development.

Therefore, it is important to investigate if the network structure of companies is influenced by the regional environment in which they are located (Huggins & Thompson, 2015). The need to use the RBV to define the strategies or policies to be implemented in the countries / regions is still verified (Mudambi & Puck, 2016).

The aim is to verify if the smart specialisation of the territories and domains in force in the RIS3 of each region of Portugal has been well selected and implemented. It also intends to know the broader opinion of regional stakeholders on the choice and implementation of RIS3. Thus, the following research questions were formulated: Are the RIS3 domains selected creators of sustainable competitive advantage for regions? Are there significant differences in stakeholder perceptions about RIS3 domains, between insular regions and continental regions?

It is expected that the regions (regional government) involved in research will verify the usefulness and applicability of the VRIO model in the regions. It is hoped that the organisations responsible for the definition and implementation of RIS3 in Portugal will be able to verify the strengths and weaknesses, as well as to make corrections that lead to the acceleration of regional development.

RIS3 highlighted the key role played by the Higher Education Institutions (HEI) in regional development (Secundo et al., 2017). HEI represents sources of entrepreneurial activity, through leadership, knowledge transfer and technology, as well as marketing (Klofsten & Jones-Evans, 2000; Lopes, Ferreira, et al., 2018).

Considering the influences involved in the transfer of knowledge and technology to an operational level, the findings are more directed towards academic entrepreneurship, namely in relation to the organizational characteristics of research institutions and universities. In order to support knowledge and technology transfer activities, several organisations have implemented technology transfer offices (TTO), hoping to bridge the gap between academia and industry (Sinell et al., 2018).

In the regional context, academic entrepreneurship has gained increasing recognition as a source of new knowledge and technologies, as well as serving as a driver for the development of a knowledge-based society (Lopes, Ferreira, et al., 2018). Several studies confirm the importance that the entrepreneurial universities (third mission) have in the regional economic development, through R&D and the commercialisation of new technologies (Guerrero, Urbano, Cunningham, & Organ, 2014; Kalar & Antoncic, 2015; Mariani, Carlesi, & Scarfo, 2018). Therefore, it is pertinent to make a state-of-the-art in relation to academic entrepreneurship from a regional perspective.

Regional ecosystems of entrepreneurship and innovation play an important role in the competitiveness of regions by serving as a bridge to promote interaction between HEI, enterprises, financing mechanisms, regional governments and institutions that provide support systems for the transfer and commercialisation of technology. In order to be innovative, regional companies and governments have to invest more in R&D.

In order to increase R &D returns, it is important that the university-industry technology transfer (UITT) interaction be more dynamic and constant (Abreu & Grinevich, 2017; Wright, Siegel, & Mustar, 2017). UITT is increasingly strategically important for most countries, as this is a source of resources for academic research, business innovation, and economic development for governments (Muscio, 2010). The UITT has been increasingly stimulated by pressure from policy makers, coming in the commercialisation of research a great key potential for innovation, regional / national competitiveness and economic development (Lam, 2011; Mansfield, 1998). HEI, with the reduction of public budgets for the investigation, had to look for alternatives for finance, the TTO being one of these alternatives.

Researchers point out that the problems in obtaining funding for research are mainly due to the lack of insight within HEI regarding UITT (Huyghe, Knockaert, Piva, & Wright, 2016). Despite UITT's relevance to economic development in the countries, little research has been done on the subject, especially in developing countries (Povoa & Rapini, 2010). In this sense, it is fundamental to carry out studies that involve other forms of UITT, besides patents, as well as to investigate other actors involved in this process (Closs, Ferreira, Sampaio, & Perin, 2012).

In this context, the TTO, start-up incubators, science and technology parks and entities with missions to support economic activities, help to develop academic economic activities (students, graduates and postgraduates, as well as members of the university team, combined to combat unemployment, and increase commercial returns on intellectual assets), so it is important to investigate the issue (Albahari, Barge-Gil, Perez-Canto, & Modrego, 2018; Fernández-Esquinas, Merchán-Hernández, & Valmaseda-Andía, 2016; Siemieniuk, 2016). Jonsson, Baraldi, and Larsson (2015) point out that more research is needed to understand the process of supporting academic innovation provided by specialized entities. The objective of this study was to clarify the mechanisms that are used to transfer and commercialize technology available to HEI in the context of regional innovation ecosystems.

Regional innovation ecosystems have been increasingly developed by regional governments. The development of regional innovation ecosystems aims to build the innovation capacity of regions as well as to improve innovation at national level. The concept of an innovation ecosystem is still a relatively new concept and is increasingly used to describe innovation contexts at national, regional and corporate levels (Bressers & Gerrits, 2015; Suseno & Standing, 2018).

Still in the context of the regional ecosystems of entrepreneurship and innovation, the difficulties in the implementation of a successful ecosystem are accentuated more in insular

regions. These regions have economic, environmental and social characteristics and problems. Most of them are structural in nature, over which the regions have no control (Lopes, Farinha, et al., 2018). Generally, the common characteristics of the island regions are: 1) insularity; 2) strong exposure to natural disasters and the effects of climate change; 3) limited institutional capacity; 4) open and poorly diversified economies; and 5) difficulties in accessing external capital (Meneses, Ribeiro, & Cristóvão, 2012). Since resources are so limited, the sustainable use of these resources becomes even more relevant.

Integrated and collaborative ecosystem management is not appropriate in all contexts, and can create problems over time (Biggs, Westley, & Carpenter, 2010). New research is pertinent in order to improve ecosystem management models so that they remain innovative and adapt to the specific difficulties of each region (Camarda & Pluchinotta, 2015; Chapin, Kofinas, & Folke, 2009; Malatesta, Friedberg, Pecorelli, Pietro, & Cajiao, 2015). Based on these arguments, the following research questions were formulated: In what resources and capabilities should stakeholders focus on creating value in an insular ecosystem? Who encourages, initiates and develops an insular ecosystem?

This is to develop a model specifically for island regions to solve their problems and to improve their economic and social performance in a sustainable way.

However, gap remains in the literature that focuses on the dynamics of innovation, RIS3, the transfer and commercialisation of knowledge, entrepreneurship and competitiveness in the regional context of quadruple helix interactions. In response, it is proposed to develop a model that assesses the performance of the resources and capacities of the regions. This model also aims to facilitate regional comparisons.

1.2. Unit of Analysis and Research Themes

As indicated by the title of this thesis, smart specialisation and regional innovation are the main focus of study. Theoretical knowledge about the importance of the factors of “innovation”, “entrepreneurship” and "politicians" in national and regional economies was obtained. This led to an explanatory model of innovation performance in the European regions considered moderate.

This thesis provides an innovative model for the regions based on the resources and capacities that the regions have, from the stakeholders’ perspective, suggesting several measures that can be implemented in the regions studied.

About entrepreneurship and innovation ecosystems in the context of the “regional triple and quadruple helix” empirical results contribute to improving the theory in collaborative networks embedded in the context of interactions and their respective contributions to regional competitiveness and development. These interactions are arranged in the context of regional

innovation ecosystems, regional clusters, and development of collaborative R&D projects between academia and industry. Through these interactions it is possible to generate more value for the regions, materialising through the transfer and commercialisation of knowledge and technology.

A model developed for island regions is also proposed in order to help these regions to accelerate their regional development process.

Thus, this analytical approach, reflected in the thesis core model (Figure 1.1), aims to contribute to the development of this field of research.

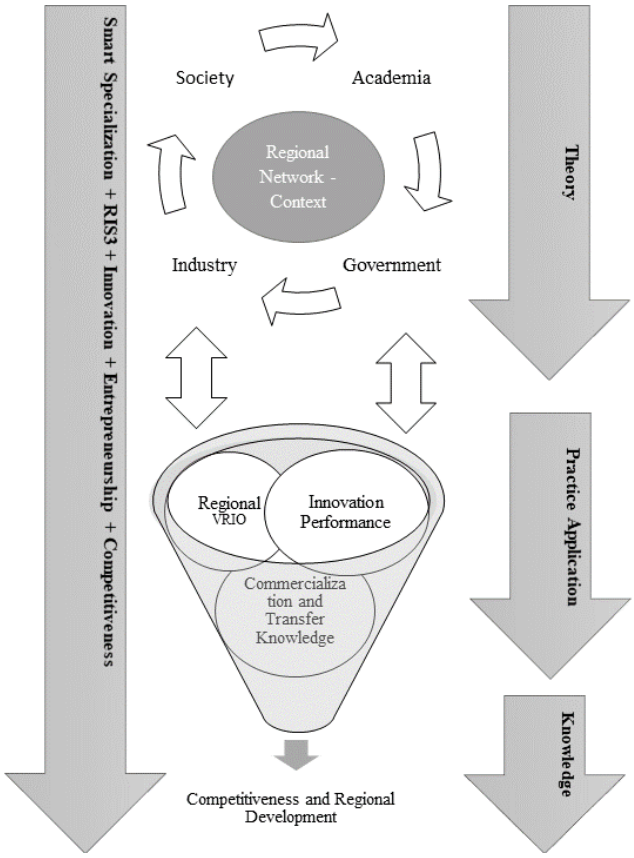

Figure 1.1 - Core Doctoral Thesis Model

Based on the model presented in Figure 1.1 and after the gaps found in the literature referred to in point 1, the general objective was to "analyse the relationship between innovation, entrepreneurship and competitiveness in the context of Research and Innovation Smart Specialisation Strategies" (RIS3), following the quadruple helix network approach to regional economies in economic and social development." Based on the main objective, the following specific objectives were defined: 1) Identify the main trends of the literature in RIS3 and academic entrepreneurship; 2) Assess the impact of innovation performance in European regions; 3) Analyse the perception of regional stakeholders in the different domains of RIS3 in

the creation of regional competitive advantages; 4) Analyse the processes of transfer and commercialization of knowledge and technology; (5) Assess resources and capacities in island regions in the area of value creation and marketing; 6) Find a support model for assessing the regional stakeholders perception in the different domains of RIS3 in the context of innovative regional ecosystems.

Given the problems that are to be investigated and the objectives to be achieved, a correspondence between the research questions and the proposed objectives can be established (Table 1.1).

Table 1.1 - Research objectives

Objectives/ Chapters / Research Questions	**Obj. 1**	**Obj. 2**	**Obj. 3**	**Obj. 4**	**Obj. 5**	**Obj. 6**
	Identify the main trends of the literature in RIS3 and academic entrepreneurship	Assessing the impact of innovation performance in European regions	Analyse the perception of regional stakeholders in the different domains of RIS3 in the creation of regional competitive advantages	Analyse the processes of transfer and commercialisation of knowledge and technology	Assess resources and capacities in island regions in the area of value creation and commercialisation	Find a support model for measuring the perception of regional stakeholders in the different domains of RIS3 in the context of innovative regional ecosystems
	Chapter 2	**Chapter 3**	**Chapter 4**	**Chapter 5**	**Chapter 5**	**Chapter 4 and Chapter 6**
What are the clusters found in the literature?	✓					
Which variables generate impacts on the innovation performance of European regions considered moderate innovator regions?		✓				
Are the RIS3 domains selected creators of sustainable competitive advantage for regions?			✓			
Are there significant differences in stakeholder perceptions about RIS3 domains, between insular regions and continental regions?			✓			

Objectives/ Chapters / Research Questions	Obj. 1	Obj. 2	Obj. 3	Obj. 4	Obj. 5	Obj. 6
	Chapter 2	**Chapter 3**	**Chapter 4**	**Chapter 5**	**Chapter 5**	**Chapter 4 and Chapter 6**
How to apply the VRIO Model to regions?			✓			
What mechanisms are used for the transfer and commercialisation of technology accessible to HEIs in the context of regional innovation ecosystems?				✓		
In what resources and capabilities should stakeholders focus to create value in an insular ecosystem?				✓	✓	
Who encourages, initiates and develops an insular ecosystem?				✓	✓	
How can we measure the perception of regional stakeholders in the different domains of RIS3 in the context of innovative regional ecosystems?			✓			✓

1.3. Methodology

The scientific methodology applied in the thesis is presented in section 1.3.1, while the framework and the specific methodological approaches for each chapter are discussed in section 1.3.2.

1.3.1. Scientific method

As far as epistemology is concerned, discussions of methodology in economics and management are common in the analysis of how economists develop and create knowledge (Johnson, 1996). There are three types of logic used in reasoning (deductive, inductive and abduction) (Bradfield, 2016; Fogelin, 2007; Haig, 2005; Salmon, 2014). These three types of reasoning are used in the construction of arguments and share the property that their conclusions derive from their bases.

Abduction is concerned with explaining observations or causes of events and is often referred to as inference for the best explanation (Fogelin, 2007; Haig, 2005; Shelley, 1996). Abduction was defined by Chares Peirce in the year 1903. Chares Peirce defined abduction as the stage of investigation in which theories or explanatory hypotheses are created in an attempt to explain the perceived phenomena (Bradfield, 2016). Abduction reasoning has not been used by researchers.

Deductive and inductive reasoning are currently the ones most used in investigations (Goel & Dolan, 2004; Overmars, Verburg, & Veldkamp, 2007; Sivertsen, 2005).

In the twentieth century, the philosophy of science began on a positivist note, based on scientific explanation and the hypothetical-deductive framework (Mahootian & Eastman, 2009). Deductive reasoning is defined as the way in which we reason from the general to the particular (Blachowicz, 2009). The inductive method has been around for more than 400 years ago via Francis Bacon. This began to strongly oppose the current of deductive reason, which was dominant in those years (Mahootian & Eastman, 2009). Induction or "inductive generalisation" is a general-specific rationale, that is, the opposite of the inductive method (Blachowicz, 2009).

Today, philosophers of science debate the relative merits of each approach. However, the main question is: To what extent do these types of reasoning contribute to the scientific process? (Berhouma, 2013; Brown, 2011; Jean & Simard, 2013; Kidd, 2013; Lee & Lo, 2014; Parvin, 2011).

The present thesis follows the process of deductive reasoning, with construction based on the logic of a chain of reflection in descending order, from the general theoretical framework for case studies in particular (Figure 1.2).

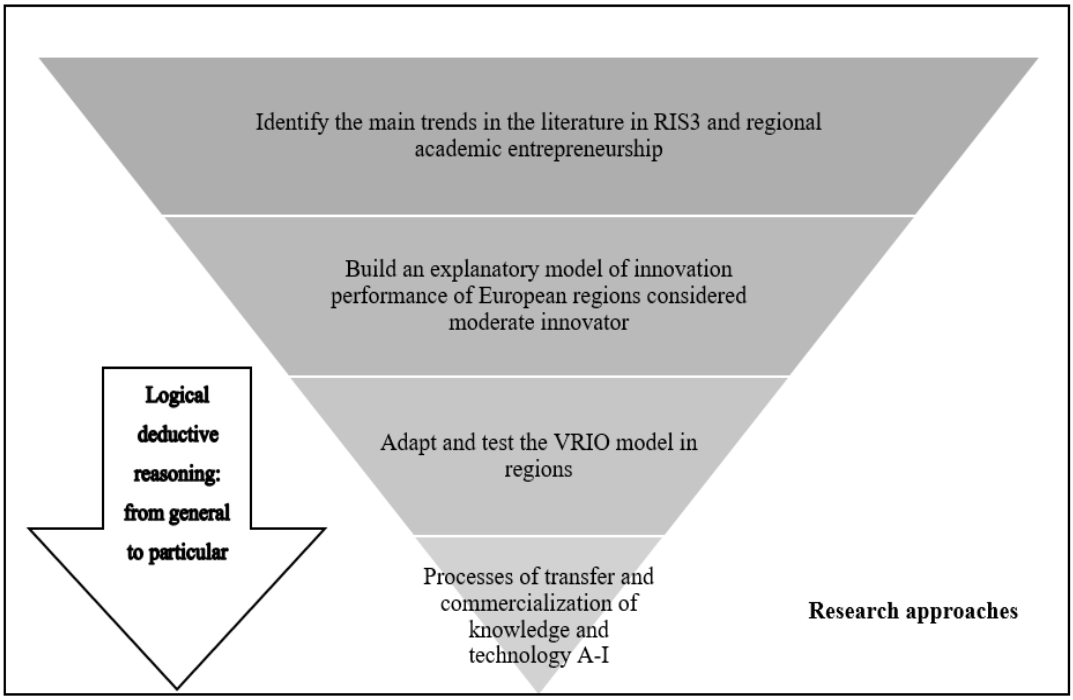

Figure 1.2 - Research scientific method

1.3.2. Approaches in individual chapters

The fundamental basis of the research model of this thesis lies in the regional development and smart specialisation, which are explained by the new European policies denominated by RIS3. RIS3 is based on a strong commitment to R&D coupled with innovation and business sophistication. These are key concepts that, when well sedimented in the regions, lead to the acceleration of regional development. In this context, R&D, innovation and entrepreneurship are considered engines of socioeconomic development in the context of different geographies (Block, 2012; Lopes & Franco, 2017; Sahut, 2014).

Chapter 2 is based on conceptual research through bibliometric analysis. Bibliometrics is a field of librarianship and information science that uses statistical and mathematical methods to analyse and construct indicators on the dynamics and evolution of scientific and technological information in some disciplines, areas, organisations or countries. Bibliometry uses two methods, both based on a structural analysis of patterns of relations in the form of vectors. The bibliographic coupling will give outputs regarding the internal and static connection of documents (in this case in particular, of scientific articles collected in the Web of Science (WoS) and SCOPUS), while the co-citation analysis has a dynamic and external linkage (Rost, Teichert, & Pilkington, 2017). This research intends to identify the main trends of the literature in RIS3 and academic entrepreneurship.

The empirical analysis in Chapter 3 follows a quantitative approach, applies to multiple linear regression. The Regional Innovation Scoreboard 2016 covers 214 regions in 22 EU countries, with Norway, Cyprus, Estonia, Latvia, Lithuania, Luxembourg and Malta also being included.

The research in Chapter 4 was oriented from the regional triple helix model. This research was based on a business-oriented model, we adapt it, we operate it and we test it within the regions. This research is pioneering in the RBV theme, with the data collected through a questionnaire to stakeholders (universities, municipalities, companies, incubators) in the 7 regions of Portugal (North region, Lisbon region, Central region, Alentejo region, Algarve region, Madeira region, Azores region).

Chapter 5 follows a qualitative approach based on multiple case studies. This methodology incorporates the argument that exclusive use of quantitative methods does not capture the essence of the phenomenon in areas where knowledge is highly complex (Beach, Muhlemann, Price, Paterson, & Sharp, 2001; Lee & Lo, 2014). The processes of transfer and commercialization of knowledge and technology in Portugal are studied. Finally, a model is proposed to help the Portuguese island regions and their ecosystems of innovation to overcome the problems of creation and commercialisation.

1.4. Thesis Outline

The chapters of this thesis consist of six articles that interrelate with the main themes of research, summarised in the thesis model. The thesis is structured in three parts (Figure 1.3).

The first part corresponds to Chapter 1 that contemplates the introduction. In the second part, Chapters 2 to 5 discuss each of the six articles, which can also be read individually.

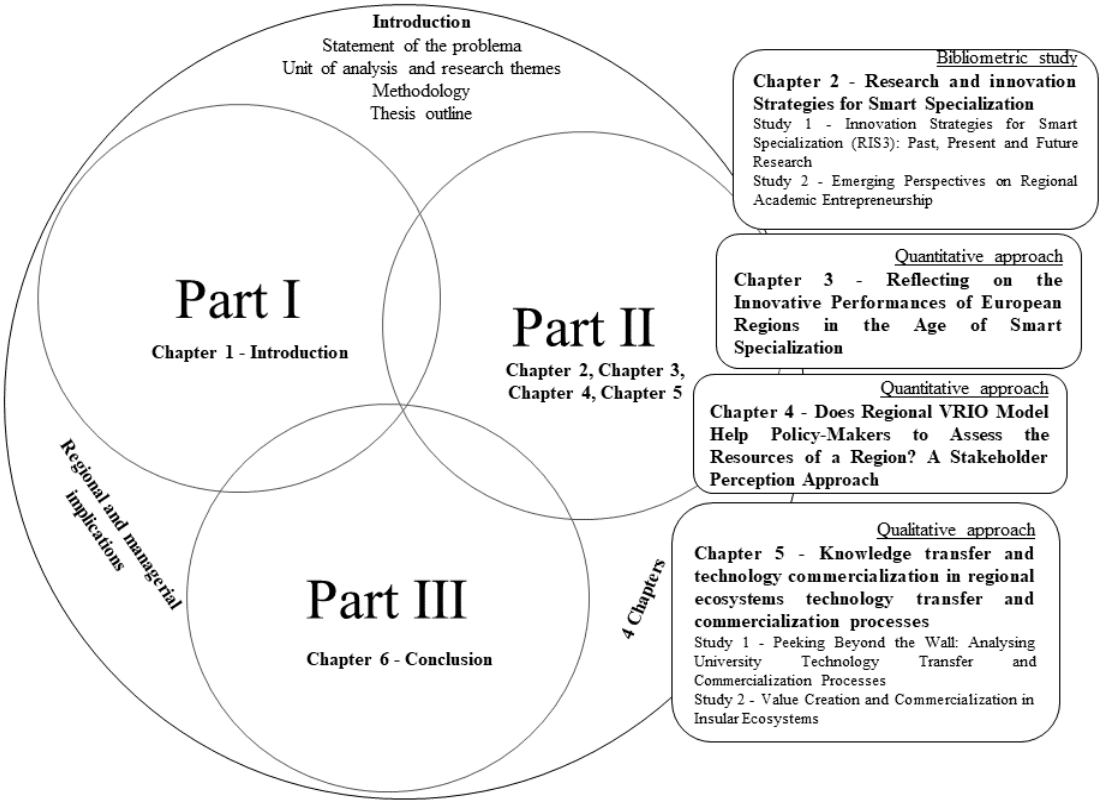

Figure 1.3 - Thesis design

Finally, Chapter 6 presents the main conclusions of the thesis and discusses additional observations and insights obtained from the research.

Part II

CHAPTER 2 - Research and Innovation Strategies for Smart Specialization

2.1. Study 1 - Innovation Strategies for Smart Specialization (RIS3): Past, Present and Future Research

Abstract

The recent change in the regional development strategy of the European Union (EU) results in an important need to study the terms of change and their respective implications. This study seeks, through a bibliometric analysis, to ascertain the developments taking place in studies on research and innovation strategies for smart specialisation (RIS3) to identify shortcomings and opportunities for future research. This bibliometric review drew upon the Scopus database with the sample selected containing all the articles containing the keywords "Research and Innovation Strategies for Smart Specialisation" or "RIS3". This correspondingly reports how some authors maintain that the path the EU should take involves imitative innovation. Meanwhile, others propose that each region should specialise in those industries that are already established there and thus avoid targeting any areas they do not already know/specialise in. Our findings detail six clusters in RIS3 research, which help in contextualising the literature review: 1) business discovery; 2) smart specialisation; 3) innovation; 4) specialisation; 5) regional policies; and 6) regional development. This study furthermore sets out perspectives for future lines of research and correspondingly seeks to convey a vast theoretical basis that may serve as the point of departure for future studies.

Keywords

RIS3, Smart Specialisation, Entrepreneurial Discovery, European Union, Bibliometric Analysis

2.1.1. Introduction

In recent years, Europe has experienced a serious financial and economic crisis even while the subsequent recession hit hardest in less competitive regions (Tiits, Kalvet, & Mürk, 2015). Additionally, these regions also return poor rates of growth in their exports, low levels of internal consumption and still furthermore, high unemployment.

The concept of research and innovation strategies for smart specialisation (RIS3) has taken an increasingly critical role as regards European regional innovation and its development policies (Capello, 2014). Dominique Foray served as one of the founders of the European regional innovation strategy and development policy as a member of the specialist group known as “Knowledge for Growth” (Capello, 2014). This group was set up in order to advise the European Commission (Capello, 2014). Studying RIS3 inherently involves approaching the European regional policy. In this alignment, the EU deploys a national strategy for smart specialisation and that requires implementation in order to ensure the access of regions/countries to the 2014-2020 Structural Funds (Foray et al., 2012; Paliokaite, Martinaitis, & Reimeris, 2015). Following the global financial and economic crisis that broke in 2008 Landabaso (2014b) maintains that the concept of smart specialisation has generated repercussions across various European and world economic institutions such as the Organization for Economic Cooperation and Development (OECD).

The focus on smart specialisation emerged in the EU from the year 2009. The first institutional actions of the EU consisted in the creation of a consultative body, the "Mirror Group". In 2011 the first conclusions of the "Mirror Group" gave rise to an official smart specialisation policy report in 2012 - Guide to research and innovation strategies for smart specialisation (RIS3). At the Academia, the first works related to the smart specialisation emerged in 2013 and have been intensifying to date. The ideas and principles underlying the creation of smart specialisation in Europe are very consistent with the work previously developed by several authors in the USA (eg Hausmann & Rodrik 2003; Audretsch & Feldman 1996; Storper & Scott 2009; Acs, Anselin, & Varga 2002).

Originally, the smart specialisation concept emerged from discussions around the differences in trans-Atlantic productivity rates (Foray, David, & Hall, 2009b). According to Estensoro and Larrea (2016), this initially focused upon the trans-Atlantic differences observed in terms of the intensity of the ongoing research and development (R&D) and this respectively explained differences in growth. Other authors explained this situation through recourse to the “structural effect”, which highlights trans-Atlantic differences in industrial structures. The EU industrial structure is disproportionately characterised by traditional sectors, with average or low technology levels that result in lower levels of ability to transform R&D developments into productivity gains. These authors subsequently explain this as due to the “intrinsic effect”, which conveys how even within the same sectors, European companies demonstrate lesser abilities in converting R&D progress into productivity or other types of gains (McCann & Ortega-

Argilés, 2014a). McCann and Ortega-Argilés (2014a) argue that there are limitations to the knowledge transfer mechanisms between sectors and companies and also between different regions. They refer to how these stem from the heterogeneity in the EU integration process, which serves to complicate the capacity to spread the various benefits of new but already generated R&D to all sectors and industries.

Academic studies applying bibliometric reviews of the literature enable the understanding of patterns in the themes and writing as well as in the articles deploying statistical analysis (Lancaster, 1991; Souza, 1988). The bibliometric approach involves a research technique that analyses the size, growth and distribution of the bibliography on a particular field of knowledge. According to Freire (2013), bibliometrics is a technique for evaluating and measuring the results of bibliographic research into a specific research question or about a specific variable.

The articles published about RIS3 tend to be very centred on either the process of designing RIS3 or on its implementation (Morgan, 2016; Camagni & Capello, 2013). Hence, this led to the identification of a shortcoming in the literature with the lack of any bibliometric studies on the theme here under analysis. These studies hold great relevance both to grasping the concept and its development and progress over time.

The RIS3 theme remains relatively recent having first emerged in 2013. As stated above, the existing studies tend to approach the design and implementation of RIS3 and we are therefore not yet able to clearly understand this concept and its implications for regional development. The contribution of the article is to undertake a bibliometric analysis to demonstrate how conceptual and policy ideas develop and spread and are interpreted or emphasized in different ways by different scholars. In order to carry out this bibliometric review, we made recourse to the Scopus database and applied certain filters in order to exclude those publications not of relevance to our study. The selection filter applied considered both the articles and the scientific fields of greatest relevance to this theme.

Thus, the objectives include verifying changes and trends in this field as well as identifying the most prominent subthemes. This correspondingly seeks to open up new horizons for future publications as well as also revealing the most relevant authors and journals on this theme. Identifying the authors that have produced the most studies and articles clearly answers the important need to grasp just how, when and where interest in this theme emerged. This additionally pinpoints those studies that served as the foundations for building research on this theme. Following this study, future researchers in this field may access details about just which journals have published what articles as well as visualising the quality of those articles.

This also extends to a literature review to ensure a better understanding of this theme. This review approaches the subthemes such as “regional development”, “smart specialisation” and “entrepreneurial discovery” in addition to any others encountered within the framework of undertaking this review.

The structure of this article is as follows: following this introduction, we move onto setting out the literature review. Thirdly, we detail the methodology applied before analysing and discussing the results returned. Finally, we provide our conclusions while identifying limitations to this study alongside future lines of research.

2.1.2. Literature Review

2.1.2.1. The smart specialization concept and RIS3

Economic growth represents the final goal of specialisation and development, which in turn require the generation and development of knowledge. Tiits et al. (2015) detail how the objective of this development encapsulates the establishing of unique advantages that competitors find difficult to copy. The concepts of knowledge, technology, innovation and specialisation interconnect with the core concepts for the growth and development of any economy (Fagerberg, 2005; Schumpeter, 1950). Hence, we may state that smart specialisation includes a process of developing a vision, identifying the strengths and weaknesses of the surrounding territory, defining the strategic priorities and making use of intelligent policies to maximise the scope for the progress and advancement of knowledge in regions (Iacobucci, 2014).

The Strategy for Europe 2020 defines and measures intelligent growth according to the conceptual frameworks in effect, thus, according to the role of technological evolution in human capital and of knowledge to economic growth and regional convergence (Jaffe, 1989; Rauch, 1993). This growth strategy, in turn, inherently casts its focus upon innovation, knowledge and technology (Naldi, Nilsson, Westlund, & Wixe, 2015). It might be said that the idea of specialisation has existed for as long as economic theory, with its foundational works featuring lengthy discussion of the specialisation and learning ongoing in the pin factory (Smith, 1991). However, the first recorded reference to the term smart specialisation took place in 2008 (Foray, David, & Hall 2011). According to Foray et al. (2011), this also extends to the needs for political decision makers to make choices, through public policies, as regards the technologies and the sectors that should be supported. McCann and Ortega-Argilés (2014a), in turn, refer to how when the concept first emerged, it was independent of any regional dimension or explicit geographic reference.

Both the European Union and the United States of America work to develop specific smart specialisation policies and strategies to improve existing opportunities, change economic institutions, and improve the competitiveness of countries and regions (Falcomatà, Nucera, & Tripodi, 2014). In the alignment of the smart specialisation strategy policy, the formation of industrial clusters makes an important contribution to the development of the regions (Titze, Brachert, & Kubis, 2014; Yu & Jackson, 2011). According the Barroeta, Prieto, Paton, Martinez,

and Giraldez (2017), policy makers of Latin America are considering the Smart Specialisation concept as an inspirational driver of RIS. In addition, smart expertise at the regional level serves to strengthen innovation processes with local stakeholders.

Regions or countries with small economies are encountering ever more difficulties in competing with the large economies deploying state of the art technology (Tiits et al., 2015). Some authors also maintain that small economies attain only more limited levels of diversification, innovative capacity and production (Tiits, Kattel, Kalvet, & Tamm, 2008; Walsh, 1988).

RIS3 took over from the learning built up on regional innovation systems, which constituted the basis for the development of regional economic policies over recent years (Asheim & Gertler, 2005a; Cooke, 2001). Indeed, RIS3 effectively represents an evolution of regional innovation systems. Some authors consider this change in paradigm in Europe to have been rather abrupt (Foray, 2014b; Kroll, 2015b).

RIS3 effectively complements everything set out above for the smart specialisation concept. RIS3 seeks to identify knowledge in selective "domains", alongside the priorities, in areas in which the regions (or a member state) holds a relative advantage (Foray, 2014b; Foray et al., 2012), which may turn into a competitive advantage. Camagni and Capello (2013) indicate how RIS3 consists of investing in knowledge and human capital, industrial capital and technology and as well as in the competences of territories. Hence, RIS3 highlights the role played by knowledge, technology and innovation in economic development and social wellbeing (Tiits et al., 2015). Tiits et al. (2015) portray RIS3 as designed as a means to transform R&D into the creation of new policies, thus, the concept fundamentally focuses on the economic returns generated by R&D.

The implementation of RIS3 in economies with better developed R&D systems may thus result in the production of new and intensive activities containing a strong science component (Foray et al., 2009b; Foray et al., 2012). On the other hand, the lesser developed economies should focus their R&D strategies on areas where they already have industries in operation (Foray et al., 2009b; Foray et al., 2012). According to Healy (2016), one of the main characteristics of the RIS3 approach stems from its territorial focus, whether at the national or regional level. Healy (2016) correspondingly maintains that this led to a multifaceted approach with some member states putting forward national strategies, others proposing regional strategies and still others combining a mixture of the two.

According to Foray et al. (2011), political policies and theories have experienced a growing distancing. The concept has furthermore come in for criticism due to its approaching all regions as equal (Torre & Wallet, 2013). For example, Cooke (2012) criticises both the theoretical and the implementation of RIS3, pointing to an exaggerated emphasis on science and technology resulting in innovation overly focused on high technology sectors. Other authors opt in favour of imitation based innovation as the most appropriate approach (Capello & Lenzi, 2013), thus, through benchmarking. Despite these two divergent opinions, there is also a set of authors that

deem taking a strong orientation towards the definition of the traditional priorities represents the best path forward rather than returning to priority objectives selected in accordance with more general categorisations (Iacobucci, 2014).

2.1.2.2. Entrepreneurial discovery

Inherent to any approach to RIS3 is understanding and encapsulating the concept underlying the process of entrepreneurial discovery. Thus, we may correspondingly state that the concept of entrepreneurial discovery lies at the core of RIS3 (Santini, Marinelli, Boden, Cavicchi, & Haegeman, 2016). Santini et al. (2016) maintain that this concept also spans the need to ensure both private and public R&D in any particular territory. Mutual collaboration also emerges as an objective within the framework of identifying the key sectors for sustainable development (Santini et al., 2016). Furthermore, according to Hausmann and Rodrik (2003), the process of entrepreneurial discovery constitutes a business process of trial and error, success and, most relevantly, failure.

Tiits et al. (2015) structure RIS3 in accordance with the priorities prevailing and with its key decisive characteristics emerging from this process of entrepreneurial discovery. Entrepreneurial discovery differentiates smart specialisation in the traditional industries from innovation policies (Landabaso, 2014b). Foray (2013) describes this process as depending on the capacities for observation, detection and filtering on behalf of political decision makers. Foray (2014b) then details entrepreneurial discovery as a dynamic and decentralised process that should certify the transformation in productive structure through continuously drawing upon the ongoing research and innovation. Santini et al. (2016) refer to how entrepreneurial discovery requires the interaction between thinkers and doers, thus, this interaction has to arise out of the shared identification by the respective stakeholders of the core priorities for regional development. This expects the regions or countries undertaking entrepreneurial discovery processes to focus upon the already existing national / regional strengths (Asheim, Boschma, & Cooke, 2011). Asheim et al. (2011) affirm how these need to nurture a variety of relations and, based upon the competences, means and capacities existing, to develop new paths for growth, sectors and alongside the modernisation of “traditional” industries.

The entrepreneurial discovery process requires governments and authorities play a distinct role in the performance of their industrial policies and in traditional innovation (Coffano & Foray, 2014; Foray et al., 2009b). Thus, according to Coffano and Foray (2014), a large proportion of regions are already engaged in change through moving on from structural analysis of the “easy to do” to that of entrepreneurial discovery (“difficult to do”). Various authors have also approached this challenge (Kroll, 2015a; Ortega-Argiles, 2012).

Ahlqvist, Valovirta, and Loikkanen (2012) affirm that what differentiates between smart specialisation or RIS3 based industrial policies and traditional innovation arises out of this focus on entrepreneurial discovery. They convey how this represents a process of collective bottom-

up reflection that attributes a key role to market forces and private actors, thus, those providing information on new activities and strategies for specialisation able to return social and economic impacts on regions.

2.1.2.3. Difficulties in implementing RIS3

Smart specialisation did not get originally designed as a strategy but was rather planned on a top-down basis, from the government to the companies (Estensoro & Larrea, 2016; McCann & Ortega-Argilés, 2014a).

According to Estensoro and Larrea (2016), there are inherent difficulties to developing these processes.

One difficulty emerging out of the implementation of RIS3 relates to learning as there have been inconsistencies in academic outputs. Thus, this may well reflect how the regional authorities experienced confusion when actually attempting to put the concept into practice (Capello, 2014; Kroll, 2015a).

Foray et al. (2011), based on the work produced by Hausmann and Rodrik (2003), conclude that smart specialisation has to derive from a process of entrepreneurial discovery undertaken by companies and the other organisations acting upon the economy. The process of discovery necessarily has to involve the companies as they constitute the only entities able to effectively identify just what may or may not be competitively produced in a particular time and place (Healy, 2016). However, as regards the discovery process, the bulk of the literature emphasises the importance of the regions or member states identifying in economic terms just what and where are the potentials for obtaining this sought after competitive advantage (Boden, Marinelli, Haegman, & Dos Santos, 2015). Some authors affirm that any strategic process planned on a bottom-up basis incurs the risk of poorly investing public resources (Camagni, Capello, & Lenzi, 2014; Capello, 2014). Iacobucci (2014), however, maintains the contrary, thus, concluding that the companies and firms better know the realities of the market than government members of staff are able to spot opportunities. Therefore, even when the stakeholders are invited to participate in the process, a top-down approach is always effectively present in the choices over the "domains" for the specialisations selected, thus, correspondingly always dependent on whoever is leading the strategy – the regional government (Estensoro & Larrea, 2016).

McCann and Ortega-Argilés (2015) affirm the need for smart specialisation strategies to incorporate the local elites as a means to obtain local knowledge and thereby tailor the policies implemented.

Some authors propose that the reason for which RIS3 encounters these implementation difficulties stems from the role of the government and, in particular, from the lack of a public business sector (Landabaso, 2014b).

McCann and Ortega-Argilés (2014a) approach the institutional challenges resulting from implementing more flexible governance in conjunction with how the promotion, enhanced awareness and the diffusion of knowledge serves to improve technology and adaptation. This implementation problem in conjunction with the lack of capacities of regional actors and administrators to plan the strategic processes inherent to RIS3 also raises concerns (Estensoro & Larrea, 2016).

Iacobucci (2014) highlights how R&D and innovation are subject to the innovation performance prevailing in the region and the general lack of core factors for smart specialisation may indeed condition the capacity for implementation.

2.1.3. Research Objectives and Methodology

Being RIS3 a recent concept and still little explored by researchers, it is important to understand how, when and where the interest in this topic arose. The articles published on RIS3, as a rule, focus on the RIS3 design process or its implementation (Camagni & Capello, 2013; Morgan, 2016).

The table 2.1.1 shows the analyses that will be carried out to reach the proposed objectives.

Table 2.1.1 - Objectives and applied analyses

Objectives	Applied analyses
Uunderstand when and where the interest in RIS3	Graphic with the evolution of publications
Check the authors and magazines that publish more in the subject	Tables with number of published articles and citations
Verify “Co-Author Network”	VosViewer analysis
Verify changes and trends in RIS3	VosViewer analysis

2.1.3.1. Method

In order to be able to study this theme, we carried out an extensive search of the Scopus database applying the keywords of Research and Innovation Strategies for Smart Specialisation and its abbreviation RIS3 (figure 1). This search took place on 10 October 2016 and correspondingly returning a compilation of all the bibliography of all the articles published on this research theme, in this database. We then classified the 51 publications in accordance with their respective thematic fields: social sciences, business, management and accountancy, economics, econometrics and finance, engineering, decision making sciences, agriculture and biology, computer sciences, environmental sciences, medicine, physics and astronomy, biochemistry, genetics and molecular biology, chemical engineering, energy, pharmacology, toxicology and pharmaceutics, psychology and veterinary science.

In order to analyse all of the information gathered, the data were exported into Microsoft Excel 2016 in conjunction with all of their respective recorded details (authors, title, journal, country, keywords, summary and citations) (Zhi et al., 2015). To define and exclude publication without any interest to analysis of this theme, we then applied some filters.

From the selected keywords (RIS3 and Research and Innovation Strategies for Smart Specialisation), 51 publications were extracted from the Scopus database. From this universe of publications (which includes articles, chapters of books, books, lecture presentations, etc.), we methodologically have obtained a total of 42 articles (Pelletier, Gill, Shi, Birch, & Karmali, 2013). Of the total of 42 articles, 7 articles were excluded after the second filter, which includes the scientific fields related to the central scope of this study: "Social Sciences", "Business, Management and Accounting", "Economics, Econometrics and Finance", "Decision Sciences" and "Environmental Science" (Maziak, Meade, & Todd, 1998). Thus, a total of 35 articles were selected for the review (Figure 2.1.1 and Table 2.1.2).

Figure 2.1.1 – Summary of methodology

Table 2.1.2 - Articles selected for the review

Title	Authors	Journal	Title	Authors	Journal
Large cultural networks and smart specialization: What is new in regional policy diagnostic analytics?	Vittoria, M.P., Napolitano, P. (2016)	Social Network Analysis and Mining	Efforts to Implement Smart Specialization in Practice - Leading Unlike Horses to the Water	Kroll, H. (2015)	European Planning Studies
Bringing owls to Athens? The transformative potential of RIS3 for innovation policy in Germany's Federal States	Kroll, H., Böke, I., Schiller, D., Stahlecker, T. (2016)	European Planning Studies	Smart specialisation in cohesion economies	Tiits, M., Kalvet, T., Mürk, I. (2015)	Journal of the Knowledge Economy
Collective entrepreneurship: the Basque model of innovation	Morgan, K. (2016)	European Planning Studies	Facilitating an entrepreneurial discovery process for smart specialisation. the case of Poland	Mieszkowski, K., Kardas, M. (2015)	Journal of the Knowledge Economy
New rules, same game: the case of Lithuanian Smart specialization	Reimeris, R. (2016)	European Planning Studies	Smart specialisation in Croatia: Between the cluster and technological specialisation	Bečić, E., Švarc, J.(2015)	Journal of the Knowledge Economy
How smart is England's approach to smart specialization? A policy paper	Marlow, D., Richardson, K. (2016)	European Planning Studies	Regional ICT innovation in the European Union: Prioritization and performance (2008–2012)	Kleibrink, A., Niehaves, B., Palop, P., Sörvik, J., Thapa, B.E. P. (2015)	Journal of the Knowledge Economy
Four minutes to four years: the advantage of recombinant over specialized innovation – RIS3 versus 'smartspec'	Cooke, P. (2016)	European Planning Studies	Industrial preconditions for smart specialization of Lithuania regions	Kuleševičiute, A.O., Rybakovas, E. (2015)	Public Policy and Administration
Smart specialization in a centralized state: strengthening the regional contribution in North East Romania	Healy, A. (2016)	European Planning Studies	Research Driven Clusters at the Heart of (Trans-)Regional Learning and Priority-Setting Processes: The Case of a Smart Specialisation Strategy of a German "Spitzen" Cluster	Clar, G., Sautter, B. (2014)	Journal of the Knowledge Economy
Overcoming policy making problems in smart specialization strategies: engaging subregional governments	Estensoro, M., Larrea, M. (2016)	European Planning Studies	Path dependence in policies supporting smart specialisation strategies: Insights from the Basque case	Valdaliso, J.M., Magro, E., Navarro, M., Aranguren, M.J., Wilson, J.R. (2014)	European Journal of Innovation Management

Title	Authors	Journal	Title	Authors	Journal
Relevance and utility of European Union research, technological development and innovation policies for a smart growth	Capello, R., Lenzi, C. (2016)	Environment and Planning C: Government and Policy	Is eco-innovation a smart specialization strategy for Andalusia? One approach from the multivariate analysis	Álvarez, M.J., Fernández, R.I., Romera, R. (2014)	Revista de Estudios Regionales
Smart specialisation in Malta: A bibliometric look at aquaculture	McMillan, G.S., Bezzina, F., Casey, D.L. (2016)	International Journal of Technology Intelligence and Planning	Smart specialisation strategies in south Europe during crisis	Komninos, N., Musyck, B., Reid, A.I. (2014)	European Journal of Innovation Management
Quadruple innovation Helix and smart specialization: Knowledge production and national competitiveness	Carayannis, E., Grigoroudis, E. (2016)	Foresight and STI Governance	Designing and implementing a smart specialisation strategy at regional level: Some open questions	Iacobucci, D. (2014)	Scienze Regionali
Strategic planning and foresight: the case of Smart Specialisation Strategy in Tuscany	Fabbri, E. (2016)	Foresight	Adapting smart specialisation to a micro-economy – the case of Malta	Georghiou, L., Uyarra, E., Scerri, R.S., Castillo, N., Harper, J.C. (2014)	European Journal of Innovation Management
Foresight methods for smart specialisation strategy development in Lithuania	Paliokaite, A., Martinaitis, Ž., Reimeris, R. (2015)	Technological Forecasting and Social Change	Guest editorial on research and innovation strategies for smart specialisation in Europe: Theory and practice of new innovation policy approaches	Landabaso, M. (2014)	European Journal of Innovation Management
How TOI and the Quadruple and Quintuple Helix Innovation System Can Support the Development of a New Model of International Cooperation	Casaramona, A., Sapia, A., Soraci, A. (2015)	Journal of the Knowledge Economy	Smart specialisation in European regions: Issues of strategy, institutions and implementation	McCann, P., Ortega-Argilés, R. (2014)	European Journal of Innovation Management
Promoting innovation in EU regional and cohesion policy 2014-2020: Implementation in Spain	Mestanza, G.C. (2015)	Investigaciones Regionales	From smart specialisation to smart specialisation policy	Foray, D. (2014)	European Journal of Innovation Management
What is smart rural development?	Naldi, L., Nilsson, P., Westlund, H., Wixe, S.(2015)	Journal of Rural Studies	Smart specialisation in the tangled web of European inter-regional trade	Gianelle, C., Goenaga, X., Vázquez, I.G., Thissen, M. (2014)	European Journal of Innovation Management
A foresight toolkit for smart specialization and entrepreneurial discovery	Gheorghiu, R., Andreescu, L., Curaj, A. (2015)	Futures	Regional innovation patterns and the eu regional policy reform: Toward smart innovation policies	Camagni, R., Capello, R. (2013)	Growth and Change
Smart specialization and entrepreneurial discovery: Theory and reality	Del Castillo Hermosa, J., Elorduy, J.P., Eguía, B.B. (2015)	Revista Portuguesa de Estudos Regionais	-	-	-

We applied the VosViewer and Nvivo11 software programs for undertaking the bibliometric analysis. VosViewer served both for establishing the "Network of Co-Authors" and for verifying which were the most relevant subthemes to the study of this field. In turn, Nvivo11 provided the means to verify just which words were most frequently repeated across these 35 articles.

2.1.4. Analysis and Discussion of the Results

2.1.4.1. Trends in publications

With a total of 35 articles resulting from the selection criteria applied to the Scopus database, we may report the following trend in publications. Figure 2.1.2 thus displays the growth in publications on the theme under study over recent years.

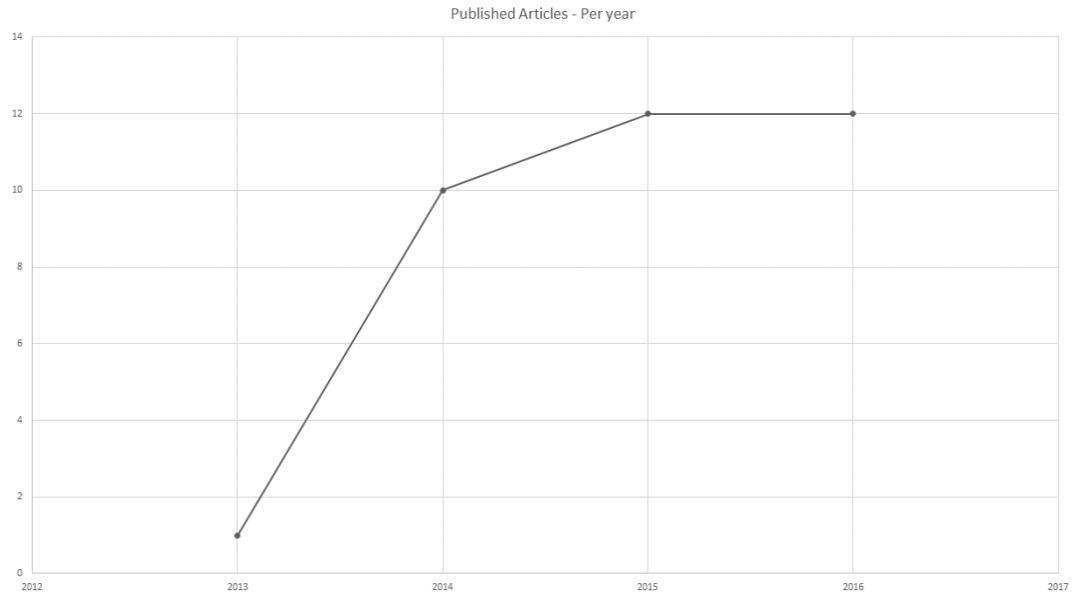

Figure 2.1.2 - Evolution of publications - per year

Through the figure 2.1.2, we are able to clearly understand how the first study on this theme entered the public domain in 2013. We may furthermore assert that 2013 was the year when the authors Camagni and Capello (2013), with their article "Regional innovation patterns and the EU regional policy reform: Toward smart innovation policies", began triggering interest in this theme. In 2014, the number of publications rose exponentially up to ten before finishing 2015 with twelve articles. We would highlight how 2016, despite not then having come to a close, already accounted for twelve articles.

The interest in this theme boomed following the unveiling of a new European strategy for the 2014-2020 period. Correspondingly, the European Regional Development Fund and the European

Commission set as a pre-requirement that all EU member states and regions draft an RIS3 plan prior to the approval of their operational programs (EC, 2014). The formal responsibility for complying with this condition was set at the member state level (Valdaliso et al., 2014). According to Valdaliso et al. (2014), there has also been diversity in the level of regional involvement depending on the level of political autonomy experienced by regions across different countries. These represent the main motives that led researchers to begin studying this theme.

2.1.4.2. Contributions by country

To grasp just which countries have most contributed with publications on this theme, we verified the nationalities of the authors and co-authors of the 35 selected articles (Figure 2.1.3). Thus, we here seek to evaluate the contribution made by the respective countries to deepening the literature on this area.

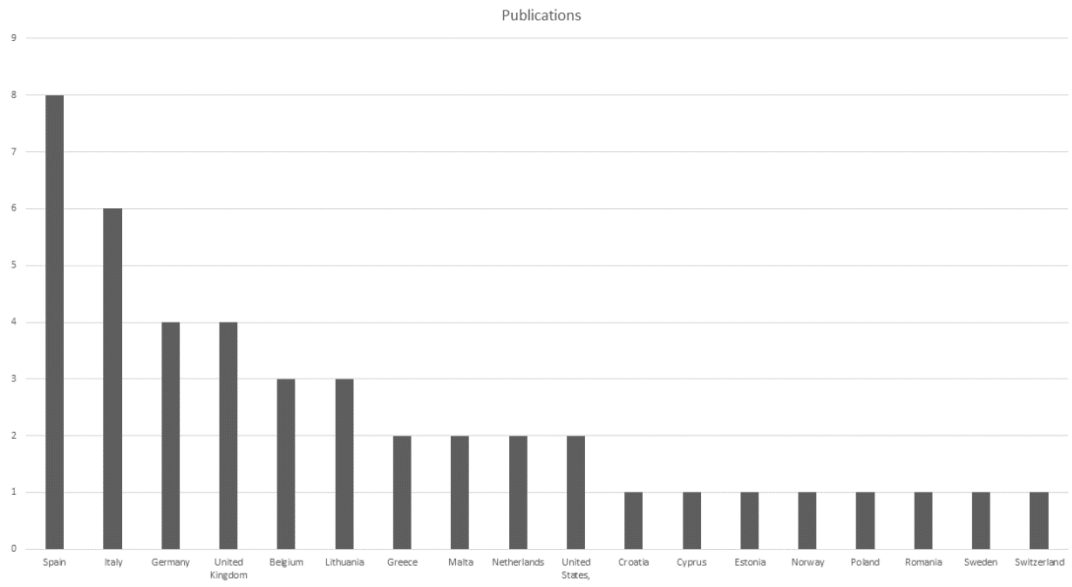

Figure 2.1.3 - Contributions by country

As set out in figure 2.1.3, the country that most contributes to advancing the literature on this theme was Spain with a total of eight articles. This stems from three different reasons (McCann & Ortega-Argiles, 2014b): (1) following the global financial crisis of 2008, Spain faced problem of the sheer disparities existing in its labour market; (2) There is ongoing criticism of the modernisation of many of the employment market profiles in Spain. To this end, technological training and the information and communication technologies, both in the private and the public sectors, require profound improvement; and (3) many Spanish regions need to foster a

stronger sense of business culture as well as deeper connections between entrepreneurship and the regional innovation systems.

In second place came Italy with a total of six publications followed by Germany and the United Kingdom with four articles apiece. Standing on three publications apiece were Belgium and Lithuania, followed by Greece, Malta, the Netherlands and the United States with two articles. Finally, there were a number of countries with but one publication (Croatia, Cyprus, Estonia, Norway, Poland, Romania, Sweden, and Switzerland).

2.1.4.3. Performance of authors

This analytical procedure seeks to identify the patterns and trends through studying the citations (Ferreira, 2011; White & Griffith, 1981; White & McCain, 1998). In order to ascertain just which authors and co-authors published these 35 articles, we drafted the following table displaying both the number of articles published and their respective citations (Table 2.1.3).

Table 2.1.3 - Performance by author

Author and Co-Author(s)	Number of publications	Citations	Author and Co-Author(s)	Number of publications	Citations
Camagni R.,	1	51	Bečić, E.,	1	0
Capello R.,	2	51	Bezzina F.,	1	0
Iacobucci D.,	1	12	Böke, I.,	1	0
Kroll H.,	2	9	Carayannis E.,	1	0
Aranguren M.J.,	1	8	Casaramona A.,	1	0
Magro E.,	1	8	Casey D.l.,	1	0
Navarro M.,	1	8	Curaj A.,	1	0
Valdaliso J.M.,	1	8	Del Castillo Hermosa J.,	1	0
Wilson J.R.,	1	8	Eguía, B. B.,	1	0
Komninos N.,	1	6	Elorduy J.P.,	1	0
Musyck B.,	1	6	Estensoro M.,	1	0
Reid A.I.,	1	6	Fabbri E.,	1	0
Landabaso M.,	1	5	Fernández, R. I.,	1	0
Mccann P.,	1	4	Gheorghiu R.,	1	0
Ortega-Argilés, R.,	1	4	Grigoroudis E.,	1	0
Castillo N.,	1	3	Healy A.,	1	0
Foray D.,	1	3	Kalvet T.,	1	0
Georghiou L.,	1	3	Kleibrink A.,	1	0
Harper J.C.,	1	3	Kuleševičiute, A. O.,	1	0
Naldi L.,	1	3	Larrea M.,	1	0
Nilsson P.,	1	3	Lenzi C.,	1	0
Scerri R.S.,	1	3	Marlow D.,	1	0
Uyarra E.,	1	3	Mcmillan G.S.,1	1	0
Westlund H.,	1	3	Mestanza G.C.,	1	0
Wixe S.,	1	3	Mürk, I.,	1	0

Author and Co-Author(s)	Number of publications	Citations	Author and Co-Author(s)	Number of publications	Citations
Gianelle C.,	1	2	Napolitano P.,	1	0
Goenaga X.,	1	2	Niehaves B.,	1	0
Martinaitis, Ž.,	1	2	Palop P.,	1	0
Paliokaite A.,	1	2	Richardson K.,	1	0
Reimeris R.,	2	2	Romera R.,	1	0
Thissen M.,	1	2	Rybakovas E.,	1	0
Vázquez, I. G.,	1	2	Sapia A.,	1	0
Clar G.,	1	1	Schiller D.,	1	0
Cooke P.,	1	1	Soraci A.,	1	0
Kardas M.,	1	1	Sörvik, J.,	1	0
Mieszkowski K.,	1	1	Stahlecker T.,	1	0
Morgan K.,	1	1	Švarc, J.,	1	0
Sautter B.,	1	1	Thapa B.E. P.,	1	0
Álvarez, M. J.,	1	0	Tiits M.,	1	0
Andreescu L.,	1	0	Vittoria M.P.,	1	0

As shown by table 2.1.3, there are 80 authors/co-authors for these 35 articles that generate a total of 112 citations. We would highlight how Camagni and Capello (2013) each account for 51 citations apiece as they were the first to study this theme as stated above. The majority of the studies by Capello R. approach issues surrounding economic and regional development, for example: Camagni, Capello, and Nijkamp (1998), Capello (2009) and Capello (2007). In the case of Camagni R., the research focus also primarily falls upon the area of economic and regional development, for example: Camagni (2002), Camagni (1998) and Camagni (2009).

We may also observe that there are a group of authors standing out with two published articles: Camagni R., Kroll H., and Reimeris R. with all other authors or co-authors having published but a single article. We may also state here that those articles receiving the most citations also constitute those holding the greatest influence over the theme here under study (Tahai & Meyer, 1999).

In order to verify the networks that the authors form, as well as if they prefer to work in groups or individually, to better study RIS3, the "Co-Author Network" will be elaborated. In order to grasp the interconnections among the authors and co-authors, we set out the “Co-Author Network” through recourse to VosViewer software (Figure 2.1.4).

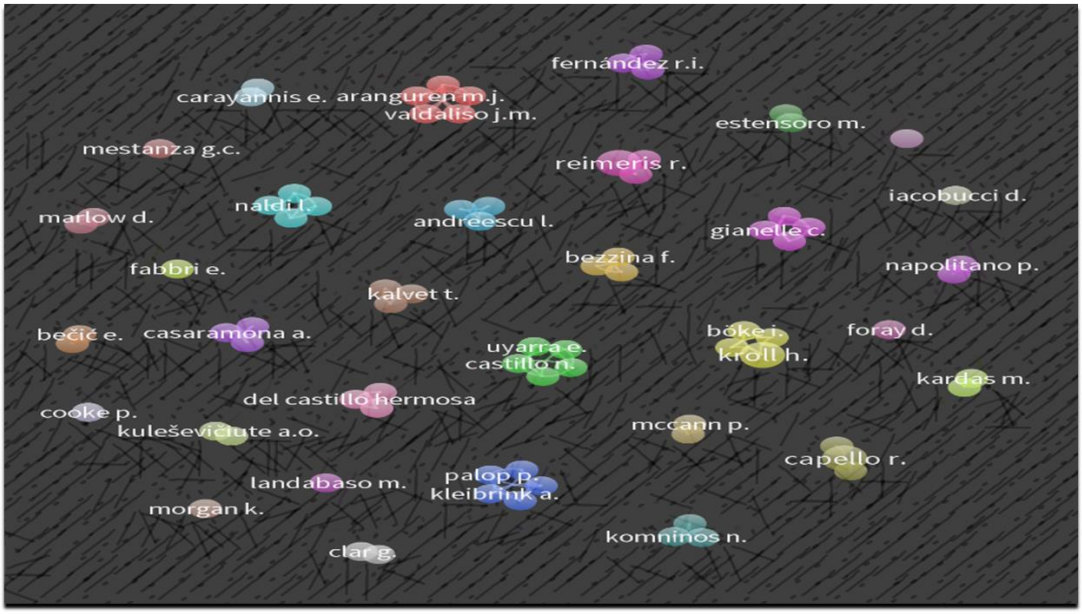

Figure 2.1.4 - Co-Author Network

As displayed in figure 2.1.4, the VosViewer software program returned 32 clusters. There are three clusters containing five authors with this representing the maximum number of authors present in any article from among the 35 selected (Aranguen M.J.; Castillo N.; Georghiou L.; Harper J.C.; Kleibrink A.; Magro E.; Navarro M.; Niehaves B.; Palop P.; Scerri R.S.; Sörvik J.; Thapa B.E. P.; Valdaliso J.M.; Wilson J.R.). In turn, there are four authors gathered into three clusters (Böke I.; Kroll H.; Schiller D.; Stahlecker T.; Gianelle C.; Goenaga X.; Thissen M.; Vázquez I.G.; Naldi L.; Nilsson P.; Westlund H.; Wixe S.). In turn, there are a total of nine clusters with either three authors or two authors. Finally, single authors constitute another eight clusters, thus, authors preferring to work on an individual basis (Cooke P.; Fabbri E.; Foray D.; Healy A.; Iacobucci D.; Landabaso M.; Mestanza G.C.; Morgan K.). Therefore, we may hereby state that these authors most commonly approached their studies in groups of two or three.

Of the authors that have two published articles (Reimeris R and Kroll H.) among the 35 selected, we may not conclude that they preferred to work either individually or in group. The author Capello R. has two published articles with one as an author and the other as a co-author. This author worked in group for the two respective articles.

2.1.4.4. Performance by journal

In this section, we approach the performance of the journals turning their attentions to this theme. We started out by verifying the number of articles published in each journal and then followed by the respective citations (Table 2.1.4). This seeks to reflect the quality of the journals and their respective countries of origin.

Table 2.1.4 - Performance by journal

Journal	Articles	Citations	Quartile (2016)	Country
Growth and Change	1	51	Q3	United Kingdom
European Journal of Innovation Management	7	31	Q2	United Kingdom
European Planning Studies	8	11	Q1	United Kingdom
Scienze Regionali	1	11	Q2	Italy
Journal Of Rural Studies	1	3	Q1	United Kingdom
Technological Forecasting and Social Change	1	2	Q1	United States
Journal of the Knowledge Economy	6	2	Q2	Germany
Environment and Planning C: Government and Policy	1	0	Q1	United Kingdom
Foresight	1	0	Q3	United Kingdom
Futures	1	0	Q2	United Kingdom
International Journal of Technology Intelligence and Planning	1	0	Q4	United Kingdom
Investigaciones Regionales	1	0	Q3	Spain
Public Policy and Administration	1	0	Q3	United States
Revista De Estudios Regionales	1	0	Q4	Spain
Revista Portuguesa de Estudos Regionais	1	0	Q3	Portugal
Social Network Analysis and Mining	1	0	-	Switzerland
Foresight and STI Governance	1	0	-	Russia

As table 2.1.4 duly details, 17 journals account for the 35 articles analysed. The "*European Planning Studies*" journal is the single most relevant source for the theme. This journal published eight of the articles with a total of eleven citations. Secondly, there comes the "*European Journal of Innovation Management*" with seven articles published and 31 citations with the "*Journal of the Knowledge Economy*" also playing a prominent role with six articles published with two citations.

In terms of citations, there is also the "*Growth and Change*" journal with its 51 citations for but one single article. This situation stems from its publication of the first study on the theme "*Regional innovation patterns and the EU regional policy reform: Toward smart innovation policies*" by Camagni and Capello (2013). Furthermore, another journal, "*Scienze Regionali*", also stands out for the 14 citations achieved by "*Designing and implementing a smart specialisation strategy at the regional level: Some open questions*" by Iacobucci (2014).

As regards journal quality, they rank from Q1 to Q4. However, Q3 attains the highest level of incidence in accounting for five of the journals.

In terms of the host countries of each journal, the United Kingdom stands to the fore and accounting for 8 of the 17 journals identified. The journals do contain a Portuguese publication, the "*Revista Portuguesa de Estudos Regionais*" that has but a single article, without any citations entitled "*Smart specialisation and entrepreneurial discovery: Theory and reality*" by the authors Del Castillo Hermosa, Elorduy, and Eguía (2015).

2.1.4.5. Subthemes and keywords

This research technique, through the analysis of densities, allows the researcher to focus the object of study of his research on the most used keywords. We verified the words most frequently repeated over the course of these 35 articles via the Nvivo11 software program (Figure 2.1.5).

Figure 2.1.5 – Keywords

Figure 2.1.5 displays the 50 most used words in the 35 articles. There follows below a description of the five words that returned the highest level of frequency. Derivative words were considered as holding an equivalent value.

Firstly, the word "*Innovation*" got repeated a total of 617 times. Secondly came the word "*Regional*" with 518 different repetitions and trailed by the word "*policy*" used on 419 occasions. Fourthly, with 389 repetitions, comes the word "*Smart*" before the word "*Specialisation*", repeated 269 times, closes the list of the most common five words. We would emphasise that "*RIS3*" also makes it into the top 50 most utilised words with a total of 92 usages.

In order to grasp the most relevant subthemes to this theme, we again turned to VosViewer software, to analyse the most outstanding themes from the analysis of densities.

To understand the results of the VosViewer analysis, we need to understand the meaning of the colours. As figure 2.1.6 features, there are three colours displaying different levels of density. The green colour indicates that the subtheme has broadly been overlooked by RIS3 studies and hence displays a minimum density level. The colour yellow identifies an intermediate level for the subtheme identified and therefore average density. Finally, the colour red highlights how this is a subtheme on which researchers have most closely focused and therefore attaining the highest level of density.

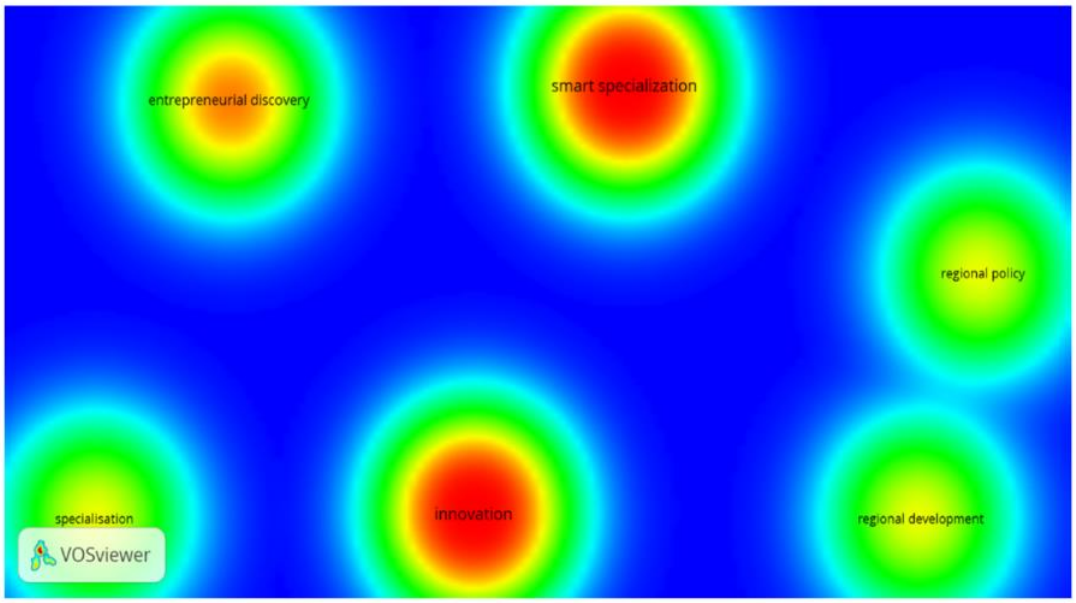

Figure 2.1.6 - Clusters – Density

As seen in figure 2.1.6, the VosViewer results portray six clusters of subthemes that are relevant to the theme of study (smart specialisation; innovation; business discovery; specialisation; regional policies; regional development). This thus clearly displays how smart specialisation and innovation, coloured red, attain the highest levels of density followed by the entrepreneurial discovery cluster with an average density. These three clusters take on great importance to the theme under analysis and should receive still greater focus. Green is the colour characterising the remainder of the clusters that, despite only attaining a low level of density, also requires consideration by studies on this theme. The clusters with weak density levels (coloured green) may also pinpoint new trends that are emerging in the literature.

In order to identify the ways in which these clusters fall into the framework made up of the 35 articles, we then analysed all the titles and summaries. We would reference that the majority

of the articles fall within the scope of more than one subtheme (table 2.1.5). The cluster numbers are the following: cluster 1 – business discovery; cluster 2 – smart specialisation; cluster 3 – innovation; cluster 4 – specialisation; cluster 5 –regional policy and cluster 6 – regional development.

Table 2.1.5 - Articles within the framework of each cluster

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Vittoria and Napolitano (2016)	Álvarez, Fernández, and Romera (2014)	Álvarez et al. (2014)	Álvarez et al. (2014)	Vittoria and Napolitano (2016)	Vittoria and Napolitano (2016)
Kroll, Böke, Schiller, and Stahlecker (2016)	Bečić and Švarc (2015)	Bečić and Švarc (2015)	Bečić and Švarc (2015)	Kroll et al. (2016)	Healy (2016)
Cooke (2016)	Capello and Lenzi (2015)	Capello and Lenzi (2015)	Capello and Lenzi (2015)	Reimeris (2016)	Morgan (2016)
Healy (2016)	Camagni and Capello (2013)	Camagni and Capello (2013)	Camagni and Capello (2013)	Cooke (2016)	Kroll et al. (2016)
Vittoria and Napolitano (2016)	Carayannis and Grigoroudis (2015)	Carayannis and Grigoroudis (2015)	Carayannis and Grigoroudis (2015)	Estensoro and Larrea (2016)	Estensoro and Larrea (2016)
Kroll et al. (2016)	Casaramona, Sapia, and Soraci (2015)	Casaramona et al. (2015)	Casaramona et al. (2015)	Capello and Lenzi (2015)	Capello and Lenzi (2015)
Healy (2016)	Clar and Sautter (2014)	Clar and Sautter (2014)	Clar and Sautter (2014)	Fabbri (2016)	Fabbri (2016)
Estensoro and Larrea (2016)	Cooke (2016)	Cooke (2016)	Cooke (2016)	Paliokaite et al. (2015)	Casaramona et al. (2015)
Capello and Lenzi (2015)	Del Castillo Hermosa et al. (2015)	Del Castillo Hermosa et al. (2015)	Del Castillo Hermosa et al. (2015)	Naldi et al. (2015)	Naldi et al. (2015)
Paliokaite et al. (2015)	Estensoro and Larrea (2016)	Estensoro and Larrea (2016)	Estensoro and Larrea (2016)	Kroll (2015a)	Kleibrink, Niehaves, Palop, Sörvik, and Thapa (2015)
Gheorghiu, Andreescu, and Curaj (2015)	Fabbri (2016)	Fabbri (2016)	Fabbri (2016)	Bečić and Švarc (2015)	Kroll (2015a)
Del Castillo Hermosa et al. (2015)	Foray (2014a)	Foray (2014a)	Foray (2014a)	Del Castillo Hermosa et al. (2015)	Kuleševičiute and Rybakovas (2015)
Mieszkowski and Kardas (2015)	Georghiou, Uyarra, Scerri, Castillo, and Harper (2014)	Georghiou et al. (2014)	Georghiou et al. (2014)	Kuleševičiute and Rybakovas (2015)	Carayannis and Grigoroudis (2015)
Bečić and Švarc (2015)	Gheorghiu et al. (2015)	Gheorghiu et al. (2015)	Gheorghiu et al. (2015)	Mieszkowski and Kardas (2015)	Clar and Sautter (2014)
Kroll (2015a)	Gianelle, Goenaga, Vázquez, and Thissen (2014)	Gianelle et al. (2014)	Gianelle et al. (2014)	McCann and Ortega-Argiles, (2014b)	McCann and Ortega-Argiles, (2014b)
Clar and Sautter (2014)	Healy (2016)	Healy (2016)	Healy (2016)	Iacobucci (2014)	Landabaso (2014a)
McCann and Ortega-Argiles, (2014b)	Iacobucci (2014)	Iacobucci (2014)	Iacobucci (2014)	Komninos, Landabaso, Musyck, and Iain Reid (2014)	Valdaliso et al. (2014)
Komninos et al. (2014)	Kleibrink et al. (2015)	Kleibrink et al. (2015)	Kleibrink et al. (2015)	Georghiou et al. (2014)	Komninos et al. (2014)

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
-	Komninos et al. (2014)	Komninos et al. (2014)	Komninos et al. (2014)	Gianelle et al. (2014)	Foray (2014a)
-	Kroll (2015a)	Kroll (2015a)	Kroll (2015a)	Valdaliso et al. (2014)	Camagni and Capello (2013)
-	Kroll et al. (2016)	Kroll et al. (2016)	Kroll et al. (2016)	Álvarez et al. (2014)	-
-	Kuleševičiute and Rybakovas (2015)	Kuleševičiute and Rybakovas (2015)	Kuleševičiute and Rybakovas (2015)	Camagni and Capello (2013)	-
-	Landabaso (2014a)	Landabaso (2014a)	Landabaso (2014a)	-	-
-	Marlow and Richardson (2016)	Marlow and Richardson (2016)	Marlow and Richardson (2016)	-	-
-	McCann and Ortega-Argiles, (2014b)	McCann and Ortega-Argiles, (2014b)	McCann and Ortega-Argiles, (2014b)	-	-
-	McMillan, Bezzina, and Casey (2016)	McMillan et al. (2016)	McMillan et al. (2016)	-	-
-	Mestanza (2015)	Mestanza (2015)	Mestanza (2015)	-	-
-	Mieszkowski and Kardas (2015)	Mieszkowski and Kardas (2015)	Mieszkowski and Kardas (2015)	-	-
-	Morgan (2016)	Morgan (2016)	Morgan (2016)	-	-
-	Naldi et al. (2015)	Naldi et al. (2015)	Naldi et al. (2015)	-	-
-	Paliokaite et al. (2015)	Paliokaite et al. (2015)	Paliokaite et al. (2015)	-	-
-	Reimeris (2016)	Reimeris (2016)	Reimeris (2016)	-	-
-	Tiits et al. (2015)	Tiits et al. (2015)	Tiits et al. (2015)	-	-
-	Valdaliso et al. (2014)	Valdaliso et al. (2014)	Valdaliso et al. (2014)	-	-
-	Vittoria and Napolitano (2016)	Vittoria and Napolitano (2016)	Vittoria and Napolitano (2016)	-	-
14 articles	**35 articles**	**35 articles**	**35 articles**	**22 articles**	**20 articles**

As shown, the 35 articles all form into a total of 6 clusters as displayed in figure 6. Cluster 1 incorporates 14 articles with clusters 2, 3 and 4 each including all 35 articles while cluster 5 spans 22 articles and with cluster 6 including 20 articles.

Cluster 4, although it appears in figure 6 with colour green, can be considered to be part of cluster 2. In this specific topic, specialisation is usually associated with smart specialisation. Thus, it can be affirmed that clusters 1, 5 and 6 are less studied than the others. In this sense, it becomes pertinent that future investigations be developed in these subthemes.

The sub-points below select and describe some of the articles that attain the greatest relevance to the theme under analysis and that effectively summarise it. Thus, the articles selected are those that most clearly and explicitly focus on the six subthemes/clusters identified above whilst also taking into consideration the non-repetition of the articles in the different sub-points. As clusters 2, 3 and 4 encapsulate all of the articles, there is only one sub-point for these three clusters.

2.1.4.5.1. Business discovery (cluster 1)

The "Smart specialisation strategies in south Europe during crisis" article by Komninos et al. (2014) identifies three paths to a more intelligent productive diversification as well as five critical phases to the business discovery process. Komninos et al. (2014) also put forward a model for the entrepreneurial discovery process based on their evaluation of the fields and areas of future productivity and boosting the aggregate value and correspondingly proposing productive diversification as a means of overcoming the crisis and recession.

The article "Facilitating an entrepreneurial discovery process for smart specialisation. The case of Poland" by Mieszkowski and Kardas (2015) approaches question around the extent to which initiatives such as prospective programs, strategic research and development programs, and sector based research development programs simplify the process of entrepreneurial discovery for specialisation. By prospective, these authors mean the context of regional development, the study of the technical, scientific, economic and social causes that accelerate the development of the modern world as well as forecasting those situations that may derive from their combined influences. This study concludes that sectorial research programs are more closely related with upwards approaches and structured towards demand in which the role of leadership is undertaken by entrepreneurs and business owners; thus, those most familiarised with the terms and conditions for entrepreneurial discovery processes (Mieszkowski & Kardas, 2015).

The article "Smart specialisation and entrepreneurial discovery: Theory and reality" by Del Castillo Hermosa et al. (2015) contributes towards clarifying the concept of entrepreneurial discovery both in theoretical and in practical terms. This study also contributes with a set of recommendations about the role of entrepreneurial discoveries within a smart specialisation

strategy, more specifically about the requirements for policies tailored to identifying and encouraging entrepreneurial discovery processes (Del Castillo Hermosa et al., 2015).

The article "A foresight toolkit for smart specialisation and entrepreneurial discovery" by Gheorghiu et al. (2015) presents a set of prospective tools for smart specialisation and entrepreneurial discovery as well as setting out a detailed and complete plan.

We would reference how some articles, despite not directly approaching the other subthemes, do refer to them as important. For example, whenever some authors describe the smart specialisation process, they always mention entrepreneurial discovery (Komninos et al., 2014).

2.1.4.5.2. Smart specialisation, innovation and specialisation (clusters 2, 3 and 4)

As regards the subthemes underpinning smart specialisation, innovation and specialisation (clusters 2, 3 and 4), as detailed above, these are present in all of the articles in the sample. The RIS3 concept thus proves implicit to the smart specialisation and innovation concepts and the reason explaining why these subthemes feature in all of the articles. Despite the word specialisation appearing as a subtheme, this emerges both in isolation and in conjunction with intelligent specialisation. Thus, we only consider smart specialisation in this analysis.

The article "Designing and implementing a smart specialisation strategy at the regional level: Some open questions" by Iacobucci (2014) discusses some of the theoretical justifications for and the problems to implementing RIS3. Furthermore, this also conveys suggestions about how to improve the design and implementation of RIS3.

Another article, with the title "Efforts to Implement Smart Specialisation in Practice - Leading Unlike Horses to the Water" authored by Kroll (2015a) deals with implementing the RIS3 political agenda. This details how the main merit of RIS3 processes resides in their contribution to the change in governance practices and routines, however, these do not yet attain any measurable effects on policy (Kroll, 2015a).

The "Smart specialisation in European regions: Issues of strategy, institutions and implementation" article by McCann and Ortega-Argiles, (2014b) seeks to demonstrate the various different approaches to smart specialisation under adoption by the different EU regions /countries. McCann and Ortega-Argiles, (2014b) furthermore refer to how susceptible these are to moulding by the respective institutional and governance contexts as well as by the specific regional economic characteristics prevailing. They arrive at the conclusion that smart specialisation is undergoing implementation in very different ways depending on the respective case across both the national and the regional levels. They also refer to how the different regional actions strongly depend on the governance relationships ongoing between the regional and local authorities (McCann & Ortega-Argiles, 2014b).

The article "Four minutes to four years: the advantage of recombinant over specialized innovation – RIS3 versus "smartspec"" by the author Cooke (2016) explores the political

transition between the FEDER and RIS3 financing methodologies and identifying their various strengths and weaknesses. This also studies the ways in which RIS3 has been received, understood and implemented across three regions in Portugal (Cooke, 2016).

The article "Smart specialisation in Croatia: Between the cluster and technological specialisation" by Bečić and Švarc (2015) discusses the particularities to implementing the concept of smart specialisation in innovation follower countries and taking Croatia as the example. This study leads to the conclusion that the smart specialisation concept is a useful tool for replacing surplus policies (Bečić & Švarc, 2015). Thus, there emerges a new set of policies based upon the concept of interconnecting specific areas subject to prior identification and structured by order of priority (Bečić & Švarc, 2015).

Finally, the article "Collective entrepreneurship: the Basque model of innovation" by Morgan (2016) focuses upon the Basque Country. This region held a track record of success for regional transformation in the 1980s and 1990s. Morgan (2016) describes the objective of the article as explaining this experience and evaluating the implications for both within and beyond the Basque Country. The study examines how the Basque model of success is undergoing adaptation to the new smart specialisation strategy, thus, the most recent EU regional innovation program for RIS3. Hence, the article sets out four key questions that need consideration within the scope of regional innovation policies: 1) a balance between continuity and novelty; 2) the problem of policy complexity; 3) the interactions between intra-regional and extra-regional learning processes; and 4) centred versus oriented strategies for approaching innovation through locally based networks.

2.1.4.5.3. Regional policies (cluster 5)

The article "Regional innovation patterns and the EU regional policy reform: Toward smart innovation policies" by Camagni and Capello (2013) triggered the interest of the research community in this theme. According to Camagni and Capello (2013), the article fits within the debate on smart specialisation strategies and highlights the need to overcome the simplistic dichotomy between core and periphery in the EU and between an advanced "research field" (the core) and an "area of co-application". The article sets out a critique of the smart specialisation debate before suggesting a new taxonomy for innovative regions in the EU based upon their patterns of innovation (Camagni & Capello, 2013). This further proposes innovation policies for each regional mode of innovation (Camagni & Capello, 2013).

The article "Path dependence in policies supporting smart specialisation strategies: Insights from the Basque case" by Valdaliso et al. (2014) focuses upon the Basque Country. According to Valdaliso et al. (2014), the article's objective involves applying the theoretical structure of trajectory dependence to the policies enacted in support of research and innovation strategies for smart specialisation. This article aims to contribute towards the operationalisation of analysis focusing on the continuity of changes in innovation based technological policies in support of RIS3 policies (Valdaliso et al., 2014). Valdaliso et al. (2014) state that other

regions/countries learn about the challenges that European regions face from the analysis of the Basque case to the extent that they advance with the implementation of RIS3. This implementation should take place in accordance with the degree of maturity of the technological and innovation policies in effect in the region.

Finally, the article "Relevance and utility of European Union research, technological development and innovation policies for a smart growth" by Capello and Lenzi (2015) sets out an evaluation of the relevance and utility of technological development and innovation to research (Capello & Lenzi, 2015). The results convey how research funding, technological development and innovation generally hold relevance to boosting innovation (Capello & Lenzi, 2015).

2.1.4.5.4. Regional development (cluster 6)

The article entitled "Smart specialisation in a centralized state: strengthening the regional contribution in North East Romania" by Healy (2016) analyses the introduction of the RIS3 approach to Northeast Rumania. Healy (2016) states that "while the experience of developing a regional RIS3 provides strong benefits to learning, its effectiveness depends on support from institutional structures".

In turn, the article "What is smart rural development?" by Naldi et al. (2015) conceptually approaches and gathers together the ideas underpinning intelligent growth policies. This centres on intelligent growth from the perspective of rural regions (Naldi et al., 2015). The article also sets out a series of indicators deemed appropriate to intelligent rural development (Naldi et al., 2015).

2.1.5. Conclusions, Study Limitations and Future Lines of Research

As noted throughout this study, the theme under analysis remains fairly recent and more research is necessary. RIS3 is of extreme importance to the EU and constituting the foundations for the strategy defined and under implementation through to 2020.

The literature review clearly demonstrates how RIS3 is an agenda for economic development adapted to the level of regions/countries. This strategy rests upon the concept of smart specialisation, innovation and sustainable development. The departure for RIS3 comes with the identification of the characteristics and specific assets of each region or country, a process in which all stakeholders should participate within the objective of establishing a vision of a sustainable future for the territory.

We verified through the literature that this theme is not consensual among all the opinions and decisions of the authors. Some opinions propose that imitative innovation represents the most appropriate path for the EU (Capello & Lenzi, 2013), hence, benchmarking within the framework of implementing in regions those projects that have had or are having success in other regions (good copying). Other authors indicate how regions should specialise in the already established industries, thus they should not specialise in areas in which they do not already hold knowledge (Foray et al., 2009b; Foray et al., 2012). Another opinion more diverging from that above maintains that regions should specialise and innovate in previously identified fields (Iacobucci, 2014; McCann & Ortega-Argilés, 2014b).

Four key issues have been identified that need to be considered in the context of regional innovation policies: 1) a balance between continuity and novelty; 2) the problem of policy complexity; 3) the interactions between intra-regional and extra-regional learning processes; and 4) centred versus oriented strategies for approaching innovation through locally based networks (Morgan, 2016). The smart specialisation policies in regions or countries with small economies must create a strong synergy that includes innovation, knowledge and technology. Thus, they will create a strong and sustained growth strategy (Naldi et al., 2015). As a priority, policy makers and regional stakeholders should carefully define which sectors should specialize and which should be supported. Then, for a continuous implementation of an intelligent specialisation strategy, economic policies and regional structures need to be adapted to the new policies (Foray & Goenaga, 2013). It is necessary to transform R&D into the creation of new policies, so the concept will focus essentially on economic returns generated by R&D (Tiits et al., 2015). Increasingly R&D investment is important for innovation to emerge more naturally and more frequently. Finally, it is necessary to measure the performance of the impact of the implemented measures, to add corrective measures in the case of necessity, as well as to implement new measures, so that the R&D findings can generate a greater competitiveness and a greater economic performance.

The VosViewer results identified six subthemes/clusters. These subthemes also incorporate the results returned for the 50 most repeated words. We would note that a significant majority of these 35 articles fall within the framework of any of the six subthemes. Furthermore, we found that the subthemes made up of smart specialisation and innovation (clusters 2 and 3) were the widest reaching and most important for the study of RIS3. All of the articles approach these subthemes to a greater or lesser extent, which also reflects in the high density that they attain in figure 4 (the red). The subtheme specialisation (cluster 4) gets classified under cluster 3 (smart specialisation). The subtheme business discovery (cluster 1) contains a total of 14 articles and hence attaining an average density level (yellow). Despite not reaching the same level of relevance as the first three subthemes, the latter always requires taking into consideration. In the regional policies (cluster 5) and regional development (cluster 6) subthemes, there are 22 articles in the first and 20 in the second. They display only a weak density level (green) (figure 4). Thus, these constitute subthemes approached in a large

proportion of the articles even while the focus never proves especially deep. We may therefore also state that all of these six subthemes duly interrelate with RIS3.

It was also concluded that the clusters 1, 5 and 6 are less studied than the others, and is pertinent that future research be developed in these subthemes.

We would also point to how the majority of the 35 articles in this study sample closely interconnect with business discovery as regards smart specialisation and hence to the process of selecting the strategies to be followed in the regions within the framework of the EU policy of governance through specialising in RIS3. There have already been a series of studies in various countries /regions on the RIS3 theme (Lithuania, the Basque Country, Malta, Northeast Rumania, Germany, the United Kingdom, Tuscany – a region in western Italy, Spain, Portugal, Poland, Croatia), however, many others still require study's. We would correspondingly mention that Portugal has already been subject to study by Cooke (2016) as regards RIS3. This article explores the transition of the FEDER policies to RIS3 and the respective prevailing strengths and weaknesses. This also details the ways in which three regions of Portugal (the Algarve, Centro and Norte regions) received, understood and implemented RIS3.

Some articles also include potential future lines of research on RIS3, which we summarized below. Hence, some mention the importance of regions displaying identical characteristics mutually learning about the best and worst practices in terms of strategies and implementation processes (Kleibrink et al., 2015). Others, in turn, point to specific policies as those for adoption at the region/country level (Casaramona et al., 2015). There are also recommendations as regards future research, advocating qualitative (and even inductive) study methodologies for the field of business spirit and confidence that shapes the entrepreneurial discovery process, which is itself increasingly interrelated with smart specialisation and RIS3 (Vittoria & Napolitano, 2016). As regards R&D, Reimeris (2016) poses a question for future research work: might the changes currently observed in the Lithuanian R&D system be replicated and generalised to other regions/countries? (Reimeris, 2016). Another suggestion stems from studying the emergence and development of innovative partnerships and ideas as the immediate results from these prospective processes (Paliokaite et al., 2015). Other suggestions for future studies target the policies proposed by the EU and testing their effectiveness, potential impact and capacity to stimulate efficient knowledge transfer processes in Mediterranean partner countries (Casaramona et al., 2015) and the drafting of studies comparing the performances of economies before and after the implementation of RIS3. The proposals also identified comparing the RIS3 directives by region and comparing the performances returned by regions with similar characteristics.

As specifically regards bibliometric studies, future analysis might for example approach the articles in accordance with their methodologies (conceptual, quantitative, qualitative, and mixed) and thereby quantify them. For instance, to analyse the literature applying conceptual, and qualitative methods of analysis and to develop the tendencies of the literature based on

these methodologies. It may also include other areas underlying the theme that were not included in this research. These quantifications might then be handled by SPSS in order to reach more conclusions, for example verifying publications and thematic sub-areas. As limitations to this study, we would draw attention to how the methodology excluded publications other than scientific articles and correspondingly running the risk of having overlooked some relevant themes not otherwise approached in the published research articles. Furthermore, other keywords interrelated with this field might have been applied, such as “smart specialisation” and “regional policies” and as well as including other the areas underlying this theme.

2.2. Study 2 - Emerging Perspectives on Regional Academic Entrepreneurship

Abstract

Academic entrepreneurship currently features as a leading topic in the field of entrepreneurship. This research study aims to carry out bibliometric analysis on this topic through recourse to cluster analysis. We carried out extensive search (1971 – 2017) of the *Web of Science* database that identified seven clusters in the literature: Entrepreneurial universities, University-industry interactions, University-industry knowledge transfers, University-industry innovation networks, University entrepreneurship, University-industry industrial property, and Innovation ecosystems. This study reinforces the coherence and scientific structure of the existing literature and serves as a starting point for other studies on this field. We close with debate about the future research agenda for academic entrepreneurship.

Keywords

University Entrepreneurship, Third University Mission, University-Industry Interaction, Entrepreneurship.

2.2.1. Introduction

Nowadays, the university role reaches far beyond its traditional teaching and research activities (Audretsch, 2014). Universities represent sources of entrepreneurial activities, through leadership, knowledge and technology transfers, as well as their commercialization (Klofsten & Jones-Evans, 2000).

Several studies confirm how entrepreneurial universities effectively encourage regional economic development by bringing together several complementary stakeholders, including researchers dedicated to the development and commercialization of new technologies, and the

entrepreneurial communities integrated into the entrepreneurial landscape in which the universities are embedded (Guerrero & Pena-Legazkue, 2013).

As regards regional development, the European Union recently defined its regional research and innovation strategies for smart specialization (RIS3). The effective implementation of RIS3 importantly requires analysis of a number of indicators in order to assist regions to distinguish their distinctive territorial characteristics from amongst their economic and innovative diversity. Thus, RIS3 correspondingly highlights the key role played by Higher Education Institutions (HEI) in regional development (Secundo, Perez, Martinaitis, & Leitner, 2017). Furthermore, entrepreneurs have yet to fully understand how technology is constantly evolving, and consequently ensuring the acquisition of new knowledge becomes fundamental to long term survival. Academia, through its third entrepreneurial mission, may also nurture opportunities to launch partnerships, thereby helping regions to generate wealth and become more competitive. Studies about entrepreneurial universities are not only in themselves important but also able to advance the knowledge of agency theory by analyzing the key conditions under which university scientists act in opportunist ways (Gianiodis, Markman, & Panagopoulos, 2016). Thus, there is a clear need to better understand the role played by regional and national stakeholders, as well as the barriers existing to entrepreneurial initiatives and the means to overcome them within the context of the entrepreneurial academy (Davey, Rossano, & Sijde, 2016). For instance, Davey et al. (2016) recommend systematically reviewing academic entrepreneurship in order to provide a more complete understanding of this subject. Thus, researching university entrepreneurship is fundamental given its extreme importance to the economic development and growth of countries/regions.

We would note that the literature returned five bibliometric/systematic studies of academic entrepreneurship. They are: i)“The bibliometric portrait of the evolution, scientific roots and influence of the literature on university-industry links” (Teixeira & Mota, 2012); this review applied data collected from the Scopus database between 1986 and 2011; ii) “Bibliometric Analysis on Research Trends of Service Management” (Hong, 2016); with only the abstract of this study written in English with full text written in Korean; iii) “Scientific production in the field of academic spin-off: A bibliometric analysis” (Segui-Mas, Sarrion-Vines, Tormo-Carbo, & Oltra, 2016); with this paper also only presenting its abstract in English with the rest of the study written in Catalan and the study data collected from the Web of Science database for the period between 1990 and 2014; iv) “30 years after Bayh–Dole: Reassessing academic entrepreneurship” (Grimaldi, Kenney, Siegel, & Wright, 2011); with this article selecting only eight articles to review according to an otherwise unspecified methodology; and v) “University entrepreneurship: a taxonomy of the literature” (Rothaermel, Agung, & Jiang, 2007); with this article analysing 173 articles and applying the Proquest ABI / Inform, Business Source Premier, and EconLit databases.

The present research differs entirely from the five mentioned above. This study approaches academic entrepreneurship in a regional perspective. Addressing academic entrepreneurship

from this perspective holds importance as academic entrepreneurship represents one of the greatest sources of wealth to regional economies. The study covers articles from 1971 to February 2, 2017, incorporating seven keywords in the search in order to embrace a wider time line. As the information source, we made recourse to the Web of Science database in keeping with it's the widespread acceptance of the quality as to the scientific publications contained.

Thus, this systematic review focuses on academic entrepreneurship not only in order to assess its intellectual structure through the visualization of the spatial distances between the issues interconnected with this theme but also to identify the content and the evolution of academic entrepreneurship research and their contributions to the evolution of the field in addition to its future trends. The paper thus strives to contribute a guideline for academic entrepreneurship researchers enabling them to better position their future research efforts.

The structure of this paper is as follows: following the present introduction, we set out a literature review on the subject. We then detail our method, and its results before presenting the respective discussion. Finally, we put forward our conclusions, study limitations and our suggestions for the future research agenda.

2.2.2. Academic Entrepreneurship: The Conceptual Background

Interest in Academic Entrepreneurship has risen over the years. At the regional level, the policies adopted by regional policy makers have focused on encouraging the production and usage of knowledge in the private sector (Jacob, Hellström, Adler, & Norrgren, 2000; Jones-Evans, 1998; Lundvall, 1999; Spencer, 2001). The aim of such policies involves boosting the economic growth and competitiveness of regions. Thus, in the regional context, Academic Entrepreneurship gains increasing recognition as a source of new knowledge and technologies as well as serving as a driver for the movement towards a knowledge based society.

In this research, we consider regional academic entrepreneurship to involved the creation of regional economic value that results in the commercialization of intellectual property generated by university resources (Etzkowitz, Asplund, & Nordman, 2001), whether through the creation of academic spin-offs (Meyer, 2003) or academic startups (Davey et al., 2016).

Traditionally, the university mission focused solely on research and non-teaching (Etzkowitz, 1998). However, an unprecedented methodology of learning processes was reinforced and diffused in the field of academia by government policy (Etzkowitz, Webster, Gebhardt, & Terra, 2000). Over time, ever more academic participants have engaged in entrepreneurial activities (Etzkowitz, 1998). These activities were considered as a "third mission" by universities and the means for their qualifying as entrepreneurial universities (Laredo, 2007).

Universities are thus involved in spin-off processes that incorporate interactions between the generation of regional knowledge and the exploitation of its subsystems (Asheim & Gertler, 2005a), which stems from RIS (Gunasekara, 2006). In this way, university spin-offs participate in the system and take on the role of knowledge producers (Cooke, 1998). In this context, spin-offs represent part of the regional institutional context (Cooke, 1998) as they not only provide commercially exploitable knowledge but also the human resources to undertake this exploration (entrepreneurs and employees) (Smith, Chapman, Wood, Barnes, & Romeo, 2014).

Governments and research agencies have in the meanwhile provided backing for the growth of university-industry relations within the aim of fostering the economic impacts of university research (Harrison & Leitch, 2010). According to Fernández-Esquinas, Pinto, Yruela, and Pereira (2015), the industrial and governmental sectors increasingly foster inter-university collaborations alongside university-industry collaborations. There are also factors potentially associated with internal changes in universities, such as the political reasons interrelated with the commercialization of university research, or internal missions (Clark, 1998), as well as the characteristics of participant researchers (Wright, 2007).

Universities, however, are also able to set up units, centers and programs for research and technology transfers that transpose their traditional boundaries, and correspondingly creating active links with groups, interests and organizations. These units correspond with what Clark (1998) refers to as an expanded institutional periphery. In particular, these units promote new skills and nurture the benefits that help higher education institutions diversify their cost bases (Lyytinen & Hölttä, 2011).

Regarding academia-industry interaction, a major proportion of past studies on knowledge transfers focus on patents, licensing and setting up startup companies (Cohen, Nelson, & Walsh, 2002), highlighting these as the main university contributions to disseminating technology (D'Este & Patel, 2007).

Table 2.2.1 systematizes the key concepts on this theme.

Table 2.2.1 – Key concepts

Concept	Definition
Entrepreneurial academia or entrepreneurial university	Consisting of the creation of economic value through the commercialization of intellectual property created by university resources. Marketing may come about through the creation of spin-offs or university start-ups (Davey *et al.*, 2016).
University third mission	All activities aimed at reflecting the contributions of universities to society, entitled "entrepreneurial activities" (Etzkowitz, 1998).
University-industry interaction or academia-industry collaborations or university-industry links	Consisting of the interactions between universities and industry. This reflects the various ways in which funded research carried out benefits industry and the wider economy (Salter & Martin, 2001).
Knowledge and technology transfer	Patents, licensing and the formation of start-ups or spin-offs.

2.2.3. Method and Data

We carried out the search on February 2, 2017 and incorporating the main collection of the Web of Science database without any chronological filter and searching by the following seven key words: 1) entrepreneurial academia; 2) entrepreneurial university; 3) university third mission; 4) university-industry interaction; 5) academia-industry collaborations; 6) knowledge and technology transfer; and 7) university-industry links. Figure 2.2.1 portrays the filters and criteria applied in this review.

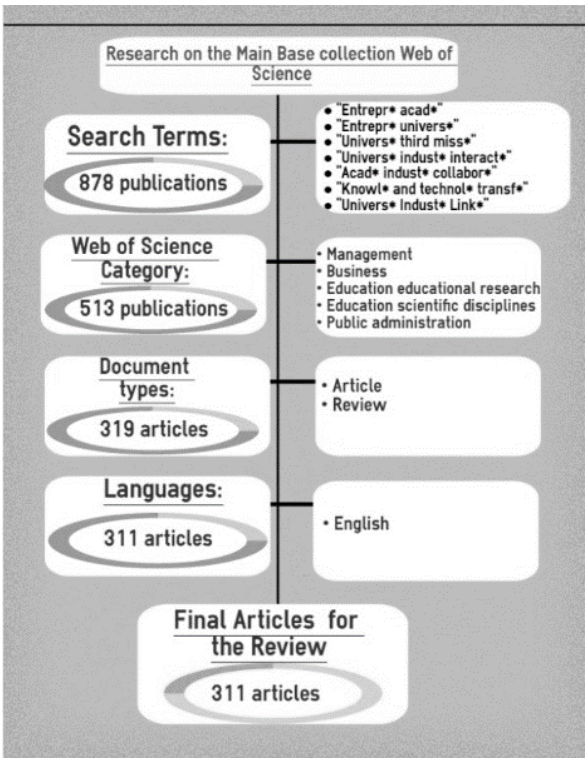

Figure 2.2.1 – Methodology

There were 911 publications of which 33 were duplications and therefore excluded (table 2.2.2).

Table 2.2.2 – Number of publications found by term

Terms	Publications
"Entrepr* acad*"	43
"Entrepr* univers*"	326
"Univers* third miss*"	15
"Univers* indust* interact*"	115
"Acad* indust* collabor*"	147
"Knowl* and technol* transf*"	113
"Univers* indust* link*"	152
Total	911

We then exported all the publications to Microsoft Excel 2016 along with their complete records (authors, title, journal, country, keywords, abstract and quotations) (Zhi et al., 2015). The classifications of the 878 publications fell into different thematic areas.

As the 878 publications encompassed study areas beyond the scope of the present research, we then applied some filters. For the first filter, we selected Web of Science categories according to their relevance to the subject under analysis (Maziak, Meade, & Todd, 1998): "management", "business", "public administration", "educational research", "education scientific disciplines" and "education scientific disciplines". With the first filter, our database retained 513 publications.

The second filter considered only two categories of publication: articles and revisions. Consequently, when analysing the abstracts, we excluded all publications that were neither articles nor reviews falling under the auspices of the theme (Pelletier, Gill, Shi, Birch, & Karmali, 2013). The third filter included only articles written in the English (Shehata et al., 2007). Thus, we correspondingly excluded eight articles and with 311 articles left for analysis.

2.2.4. Discussion of Results

2.2.4.1. Evolution of publications

Figure 2.2.2 sets out the evolution in the number of articles on the subject under study over the years.

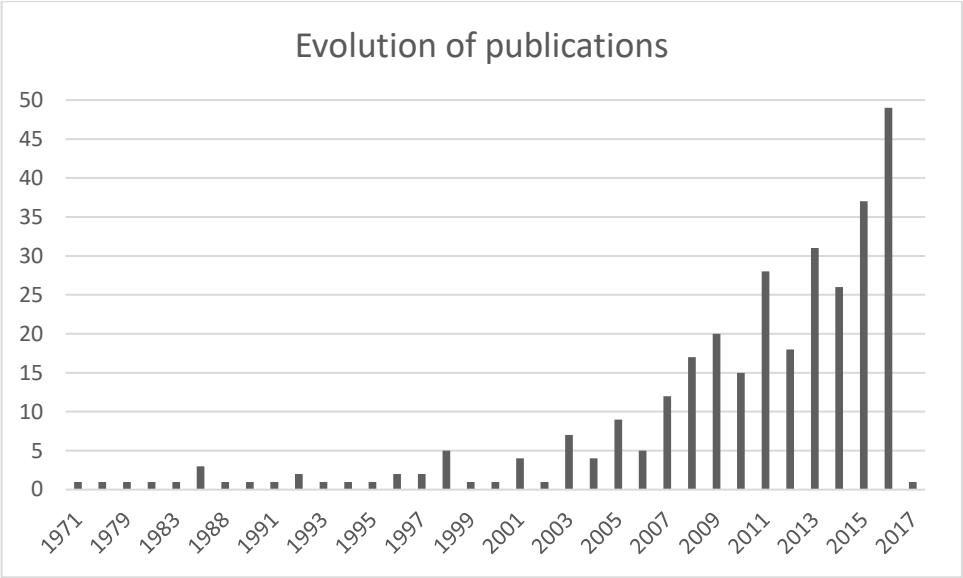

Figure 2.2.2 – Evolution of publications

The first article published on the came out in 1971 under the title “Program for University - Industry Interaction” (Krasnow, 1971).

Interest in this subject first emerged at the end of the 19th century associated with an entrepreneurial academic dynamic originating in North American universities (Etzkowitz, 2003b). The American entrepreneurial university thus emerged from the bottom up in contrast to Europe where the introduction of academic entrepreneurship represents a top-down phenomenon launched in response to the innovation gap between the US and Europe (Soete, 1999).

In the 1980s, some successful entrepreneurship based universities, such as MIT and Stanford, emerged in the United States. These universities began to stimulate local hi-tech entrepreneurship and correspondingly demonstrating to the world the potential of research universities for promoting innovation-led development (Bagchi-Sen & Smith, 2012). Thus began exploration of the role of universities as agents for regional development, which took on an operational facet following the passing of the University's Law and Small Business Patent Procedures Act (Bayh-Dole Act) in 1980. This assumption effectively drove a key structural change in terms of the relationships ongoing between universities and the surrounding economy (Kenney & Patton, 2009).

However, only in the 1990s did the number of articles on this theme begin to rise. In the early 1990s, Clark Kerr defined the problem as spanning five phrases: 1) an international and highly competitive learning world is emerging for the first time; 2) whoever wishes to participate in this world must do so by merit; 3) entrepreneurs are not able to rely on political or any other such factors; 4) institutions require increasing autonomy in order to remain dynamic and agile

in the face of international competition; and 5) entrepreneurs must develop the entrepreneurial leadership that accompanies this institutional autonomy (Clark, 1998).

Boucher, Conway, and Meer (2003) were the first to propose an association between academic entrepreneurship and regional development in 2003. This article sets out a taxonomy based on the functional role of universities in territorial development but failed to return the desired effects. The article classified the functional role of universities in territorial development as: individual universities in peripheral regions, multiplayer universities in peripheral regions, traditional universities in central regions, new technically oriented universities in the main regions and other categories. There was then the hope that researchers would henceforth begin investigating these new classifications but this nevertheless did not happen. Researchers instead focused on topics such as the heterogeneity of universities, the transdisciplinarity of researchers among the different fields in universities, the characteristics of team leadership and strategic intent, organizational flexibility and experience in cross-disciplinary and institutional scenarios, and the pre-existing economic conditions in regional economies (Bagchi-Sen & Smith, 2012).

Interest in the subject accelerated in 2007-2009 (49 publications) when some United States universities began raising large revenues from research results (Bagchi-Sen & Smith, 2012). Public investment in research has somewhat advanced around the world since then. In the years 2010-2015, journals published 155 articles. The reasons behind this growth in publications stem from how countries / regions were then increasingly setting up research centers. Most research centers, as a rule, operate under the auspices of universities. These universities are now increasingly aware of the importance of competing for research projects, which also enables them to raise funds for research (Zhu, Zhang, & Ogbodo, 2017).

The year of 2016 witnesses the peak of publications on the theme with a total of 49 articles. Several studies also report a marked increase in cooperation between university and industry (Meyer-Krahmer & Meyer-Krahmer, 1998). This arises from the growing recognition of the importance of university research to innovative industrial activities, as well as structural changes, such as budget constraints related to public funding (Chaves, 2009). Therefore, universities have prioritized a more aggressive and entrepreneurial stance in their search for new sources of research funding (Mowery, Nelson, Sampat, & Ziedonis, 2015).

2.2.4.2. Most relevant publications: top 50

Based on the 311 articles obtained, we then verified which receive the most citations with the 311 papers getting collectively cited 6998 times, which returns an average of 22.50 citations per article. Table 2.2.3 features the 50 most cited articles on this topic.

Table 2.2.3 – Articles cited by the co-creation field (position and year in parentheses)

Authors	Article title	Citations	Authors	Article title	Citations
(1) Etzkowitz, H; Webster, A; Gebhardt, C; Terra, BRC (2000)	The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm	465	(26) Rasmussen, EA; Sorheim, R (2006)	Action-based entrepreneurship education	73
(2) Etzkowitz, H (1998)	The norms of entrepreneurial science: cognitive effects of the new university-industry linkages	322	(27) Balconi, M; Laboranti, A (2006)	University-industry interactions in applied research: The case of microelectronics	65
(3) Etzkowitz, H (2003)	Research groups as 'quasi-firms': the invention of the entrepreneurial university	300	(28) Fiet, JO (2001)	The theoretical side of teaching entrepreneurship	65
(4) Meyer-Krahmer, F; Meyer-Krahmer, F (1998)	Science-based technologies: university-industry interactions in four fields	275	(29) Martinelli, A; Meyer, M; von Tunzelmann, N (2008)	Becoming an entrepreneurial university? A case study of knowledge exchange relationships and faculty attitudes in a medium-sized, research-oriented university	62
(5) D'Este, P; Patel, P (2007)	University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?	269	(30) Boardman, PC; Ponomariov, BL (2009)	University researchers working with private companies	61
(6) Laursen, K; Salter, A (2004)	Searching high and low: what types of firms use universities as a source of innovation?	260	(31) Venkataraman, S; Van de Ven, AH (1998)	Hostile environmental jolts, transaction set, and new business	61
(7) Perkmann, M; Walsh, K (2007)	University-industry relationships and open innovation: Towards a research agenda	231	(32) Lam, A (2011)	What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'?	57
(8) Lockett, A; Wright, M (2005)	Resources, capabilities, risk capital and the creation of university spin-out companies	208	(33) O'Shea, RP; Allen, TJ; Morse, KP; O'Gorman, C; Roche, F (2007)	Delineating the anatomy of an entrepreneurial university: the Massachusetts Institute of Technology experience	57
(9) Balconi, M; Breschi, S; Lissoni, F (2004)	Networks of inventors and the role of academia: an exploration of Italian patent data	185	(34) Van Looy, B; Landoni, P; Callaert, J; van Pottelsberghe, B; Sapsalis, E; Debackere, K (2011)	Entrepreneurial effectiveness of European universities: An empirical assessment of antecedents and trade-offs	55
(10) Bruneel, J; D'Este, P; Salter, A (2010)	Investigating the factors that diminish the barriers to university-industry collaboration	147	(35) Arvanitis, S; Kubli, U; Woerter, M (2008)	University-industry knowledge and technology transfer in Switzerland: What university scientists think about co-operation with private enterprises	53
(11) Deem, R (2001)	Globalisation, New Managerialism, Academic Capitalism and Entrepreneurialism in Universities: is the local dimension still important?	140	(36) Zeller, C (2011)	Clustering biotech: A recipe for success? Spatial patterns of growth of biotechnology in Munich, Rhineland and Hamburg	52
(12) Bekkers, R; Freitas, IMB (2008)	Analysing knowledge transfer channels between universities and industry: To what degree do sectors also matter?	128	(37) Philpott, K; Dooley, L; O'Reilly, C; Lupton, G (2011)	The entrepreneurial university: Examining the underlying academic tensions	50
(13) Etzkowitz, H (1983)	Entrepreneurial scientists and entrepreneurial universities in American academic science	111	(38) Eom, BY; Lee, K (2010)	Determinants of industry-academy linkages and, their impact on firm performance: The case of Korea as a latecomer in knowledge industrialization	48

Authors	Article title	Citations	Authors	Article title	Citations
(14) Cooke, P (2005)	Regionally asymmetric knowledge capabilities and open innovation exploring 'Globalisation 2' - A new model of industry organization	110	(39) Giuliani, E; Arza, V (2009)	What drives the formation of 'valuable' university-industry linkages? Insights from the wine industry	48
(15) Etzkowitz, H; Klofsten, M (2005)	The innovating region: toward a theory of knowledge-based regional development	105	(40) Yusuf, S (2008)	Intermediating knowledge exchange between universities and businesses	48
(16) D'Este, P; Perkmann, M (2011)	Why do academics engage with industry? The entrepreneurial university and individual motivations	102	(41) Stromquist, NP (2007)	Internationalization as a response to globalization: Radical shifts in university environments	48
(17) Geuna, A; Muscio, A (2009)	The Governance of University Knowledge Transfer: A Critical Review of the Literature	101	(42) Bishop, K; D'Este, P; Neely, A (2011)	Gaining from interactions with universities: Multiple methods for nurturing absorptive capacity	44
(18) Wright, M; Clarysse, B; Lockett, A; Knockaert, M (2008)	Mid-range universities' linkages with industry: Knowledge types and the role of intermediaries	96	(43) Mian, Sa (1994)	United States university-sponsored technology incubators - an overview of management, policies and performance	43
(19) Jacob, M; Lundqvist, M; Hellsmark, H (2003)	Entrepreneurial transformations in the Swedish University system: the case of Chalmers University of Technology	93	(44) Ylijoki, OH (2005)	Academic nostalgia: A narrative approach to academic work	41
(20) Grimaldi, R; Kenney, M; Siegel, DS; Wright, M (2011)	30 years after Bayh-Dole: Reassessing academic entrepreneurship	92	(45) Czarnitzki, D; Glanzel, W; Hussinger, K (2009)	Heterogeneity of patenting activity and its implications for scientific research	40
(21) Bramwell, A; Wolfe, DA (2008)	Universities and regional economic development: The entrepreneurial University of Waterloo	88	(46) Loof, H; Brostrom, A (2008)	Does knowledge diffusion between university and industry increase innovativeness?	39
(22) Vedovello, C (1997)	Science parks and university-industry interaction: geographical proximity between the agents as a driving force	83	(47) Edler, J; Fier, H; Grimpe, C (2007)	International scientist mobility and the locus of knowledge and technology transfer	36
(23) Massa, S; Testa, S (2008)	Innovation and SMEs: Misaligned perspectives and goals among entrepreneurs, academics, and policy makers	77	(48) Azagra-Caro, JM (2007)	What type of faculty member interacts with what type of firm? Some reasons for the delocalisation of university-industry interaction	36
(24) Meyer, M (2003)	Academic entrepreneurs or entrepreneurial academics? Research-based ventures and public support mechanism	76	(49) Ziedonis, AA (2007)	Real options in technology licensing	36
(25) Meyer, M (2006)	Are patenting scientists the better scholars? An exploratory comparison of inventor-authors with their non-inventing peers in nano-science and technology	73	(50) Guerrero, M; Urbano, D (2012)	The development of an entrepreneurial university	35

Table 2.2.3 identifies how the most cited article was “The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm” with 465 citations by (Etzkowitz et al., 2000). The paper examines developments in the university role in societies, which are increasingly based on knowledge. According to Etzkowitz et al. (2000), the “entrepreneurial university” is a universal phenomenon with a path of isomorphic development, despite different starting points and modes of expression.

In second place comes the article “The norms of entrepreneurial science: cognitive effects of the new university-industry linkages” with 322 citations by Etzkowitz (1998). The article addresses economic and social developments within the framework of the university mission. This study debates how “Knowledge capitalization” takes on many different forms (Etzkowitz, 1998).

In third place is the article “Research groups as 'quasi-firms': the invention of the entrepreneurial university”, with 300 citations, also by Etzkowitz (2003b). The article indicates that academic enterprise emerged from internal and external impulses.

We would emphasize that the 50 articles featuring in table 2 represent about 77% of the total citations from the 311 articles total.

2.2.4.3. Emerging perspectives on academic entrepreneurship: cluster analysis

The VosViewer software both detailed the network of references and identified the most relevant clusters of studies on the theme. A different color identifies each cluster (Figure 2.2.3).

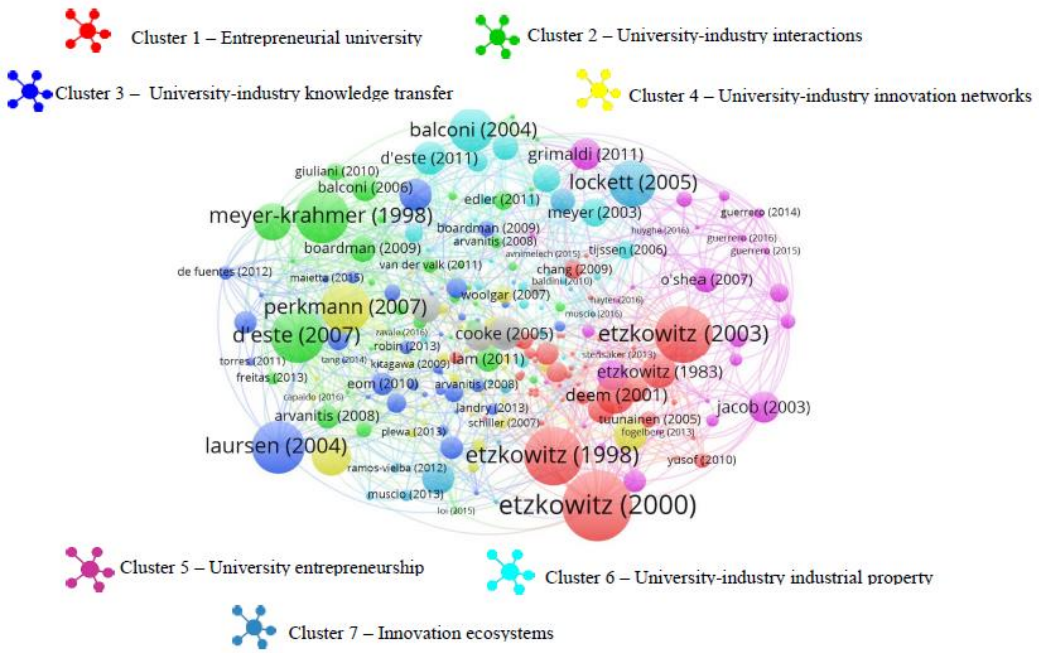

Figure 2.2.3 - Network of references and clusters

A total of 569 authors wrote these 311 articles. Henry Etzkowitz was the most cited author by other authors, with 1321 citations, trailed by the author D'Este, P, with 565 citations. There are three authors with 465 citations (Gebhardt C, Terra BRC and Webster A). All other authors received 407 citations or less.

As for the largest number of published articles, the top three authors with seven articles are Etzkowitz, H, Guerrero, M and Urbano. With six articles emerges the author Woerter, M before three authors with five articles apiece (D'este, P, Muscio, A and Arvanitis, S). All other authors have four or fewer published articles.

To identify the clusters all 311 articles fit into, analysis focused on all titles and abstracts. After this analysis, we found seven clusters: Cluster 1 – Entrepreneurial university (46 articles); Cluster 2 – University-industry interactions (38 articles); Cluster 3 – Transfer of university-industry knowledge (38 articles); Cluster 4 – University-industry innovation networks (34 articles); Cluster 5 – University entrepreneurship (30 articles); Cluster 6 – University-industry industrial property (25 articles); and Cluster 7 – Innovation ecosystems (15 articles).

Next, we describe the articles most cited by each cluster while also analysing the future lines of research found in the most recent literature (published in 2016) of each cluster.

2.2.4.3.1. Entrepreneurial university (Cluster 1)

An entrepreneurial university, in a regional context, drives the creation of regional economic value that stems from the commercialization of intellectual property generated by university resources (Etzkowitz et al., 2001).

The authors contained in cluster 1 (Figure 2.2.4) include Etzkowitz et al. (2000) (437 citations), Etzkowitz (1998) (327 citations) and Etzkowitz (2003b) (305 citations).

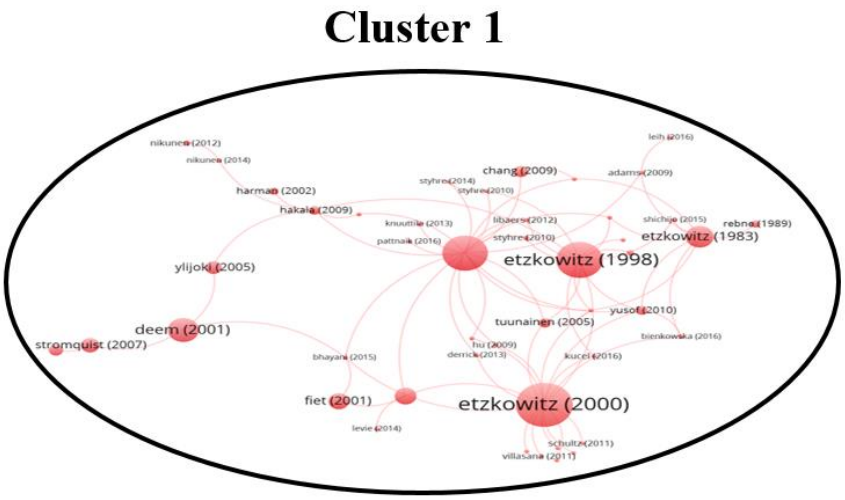

Figure 2.2.4 – Cluster 1

Etzkowitz et al. (2000), The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm, is the most cited publication in this cluster (cited 437 times). These authors examine the university role in societies based on the "triple helix" model. The authors then conclude that the "entrepreneurial university" is a global phenomenon with a path of isomorphic development, despite different starting points and modes of expression (Etzkowitz et al., 2000).

Etzkowitz (1998), The norms of entrepreneurial science: cognitive effects of the new university-industry linkages, represents the second most cited publication in this cluster (cited 328 times). The authors address the "second revolution" of universities, which have incorporated economic and social development into their mission. The article furthermore discusses the different forms of "knowledge capitalization" (Etzkowitz, 1998).

Etzkowitz (2003b) discusses the emergence of internal and external impulses for the entrepreneurial university. The author points out how the internal organization of research universities consists of a series of research groups that display the qualities of firms and companies, especially under conditions in which research funding is awarded on a competitive basis. He concludes that the research university shares similar qualities with a start-up company, even before directly engaging in entrepreneurial activities.

Cluster 1 returned six future research lines: 1) examine how national culture or other external environmental factors influence the development of research in entrepreneurial universities among countries, regions and universities (Chang, Yang, Martin, Chi, & Tsai-Lin, 2016); 2) evaluate individual leaders and universities to draw conclusions (Leih & Teece, 2016); 3) apply the model suggested by the authors to real environments, involving universities, research centers and university managers (Secundo, Dumay, Schiuma, & Passiante, 2016); 4) carry out a multiple case study incorporating two universities that have measured their intellectual capital (Secundo et al., 2016); 5) examine the role of autonomous organizations in intellectual capital (Balduzzi & Rostan, 2016).

2.2.4.3.2. University-industry interactions (Cluster 2)

University-industry interactions consist of the ongoing relationships (formal or informal) between university and industry (Salter & Martin, 2001). The goals of university-industry interactions involve challenging university research outputs and developing new knowledge. This new knowledge has subsequently to be explored and marketed by industry.

Cluster 2 (Figure 2.2.5) "university-industry interactions" contains articles by D'Este and Patel (2007) (282 citations) and Meyer-Krahmer and Meyer-Krahmer (1998) (278 citations).

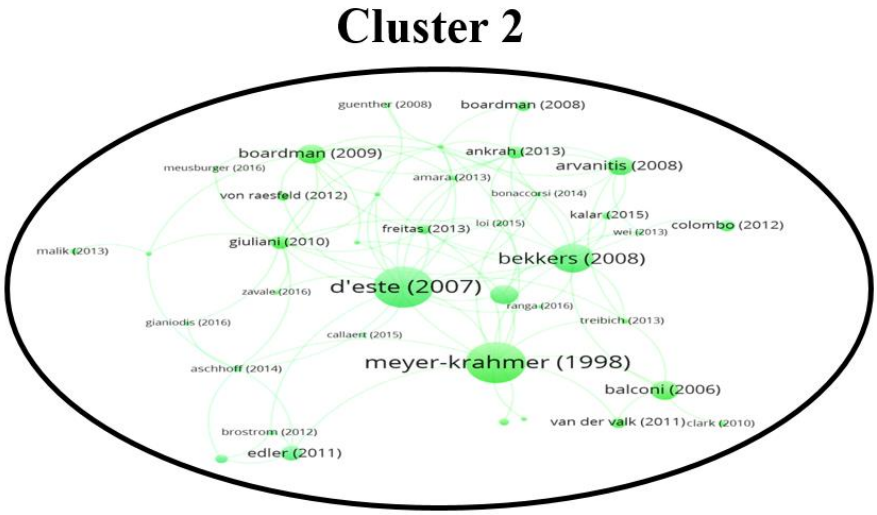

Figure 2.2.5 – Cluster 2

A highly influential article in this cluster is university-industry linkages in the UK: What are the factors underlying the variety of interactions with industry? by D'Este and Patel (2007), which was cited 282 times. D'Este and Patel (2007) examine the different channels through which academic researchers interact with industry and the factors influencing the involvement of researchers in a variety of interactions. The results show that university researchers interact with industry through a broad range of channels, most often through consultancy, contracted research and joint research or training, in comparison with patenting or spin-out activities (D'Este & Patel, 2007). With this research, D'Este and Patel (2007) argue that by paying more attention to the wide range of knowledge transfer mechanisms (in addition to patents and spin-outs), policy initiatives might contribute to building up the skills needed to integrate the worlds of scientific research and the application of the results arising.

Meyer-Krahmer and Meyer-Krahmer (1998), with their article "science-based technologies: university-industry interactions in four fields", received 278 citations. The authors focus on the interactions of different technological fields and describe a considerable increase in cooperation between industrial companies and universities. Meyer-Krahmer and Meyer-Krahmer (1998) argue that the particular combination of a long-standing cooperative culture and economic success in the mechanical industry can be interpreted in terms of the path dependent evolution of a stable sector of system innovation even while with a tendency to block the resulting effects.

Cluster 2 identifies a total of five future research lines: 1) to study spin-off management teams (the role of scientist-inventor), as well as the managers and entrepreneurs who commercialize technology (Gerbin & Drnovsek, 2016); 2) to compare the performance of systems that depend on the institutional management of knowledge transfer activities between industry (academic-industrial) and individual researchers (Gerbin & Drnovsek, 2016); 3) to investigate the influence of intentionality and motivation on opportunistic scientist behaviors (Gianiodis et al., 2016); 4)

empirical work to delineate perceptions between scientists and organizational realities within entrepreneurial universities (Gianiodis et al., 2016); 5) to examine whether research findings apply to other types of organizations in other regional contexts (Gianiodis et al., 2016).

2.2.4.3.3. University-industry knowledge transfer (cluster 3)

University-industry knowledge transfer refers to all forms of transfer of knowledge between universities and industry (for example: patents, licensing and launching start-ups or spin-offs). The two major publications in this cluster (Figure 2.2.6) focusing on university-industry knowledge transfer are: Laursen and Salter (2004) (545 citations) and Wright, Clarysse, Lockett, and Knockaert (2008) (99 citations).

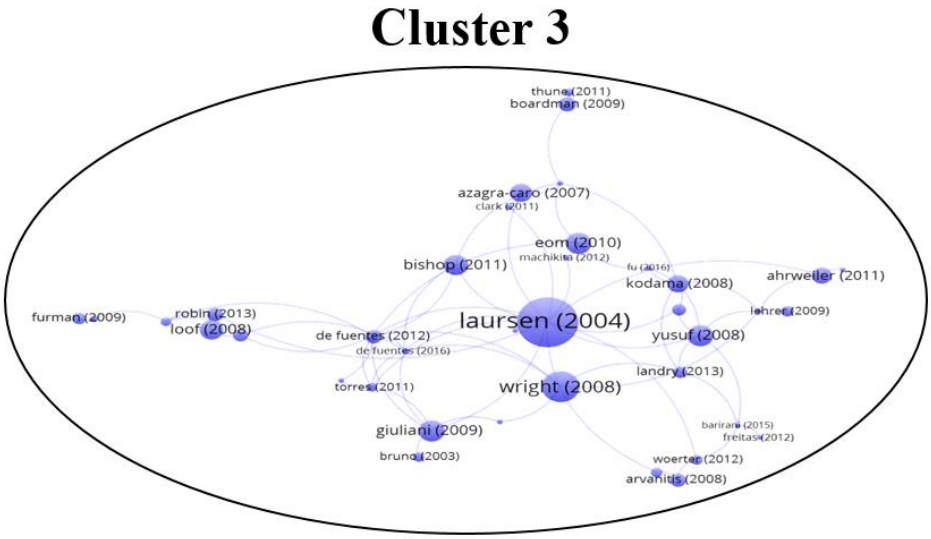

Figure 2.2.6 – Cluster 3

With 545 citations, Laursen and Salter (2004), Searching high and low: what types of firms use universities as a source of innovation? accounts for the most cited article in this cluster. The research analyzes the factors influencing companies interacting with universities in their innovative activities. The results indicate how the companies that adopt "open" research strategies and invest in R&D are more likely than other firms to interact and transfer knowledge with universities (Laursen & Salter, 2004).

The other leading article in this cluster is Mid-range universities' linkages with industry: Knowledge types and the role of intermediaries, by Wright et al. (2008), cited 99 times. The authors analyze how medium-sized universities contribute to industrial change by transferring tacit and codified knowledge in spin-off areas; licensing and patents; contract research, consulting and outreach; and postgraduate and researcher mobility. Wright et al. (2008) conclude that midsize universities need to primarily focus on creating world-class research and critical mass in areas of expertise, as well as developing different types of intermediaries.

Medium-sized universities may also need to develop a portfolio of university-industry links in terms of their scope of activities and the types of firms with which they interact as well as detailing how different intermediaries play important roles for universities in developing their links with industry (Wright et al., 2008).

Cluster 3 furthermore reports three future lines of research: 1) studies to focus on the interactions of public research organizations (PROs) in Mexico, based on a more inclusive set of data, such as the national survey on innovation or the survey on innovation and technological development (Fuentes & Dutrénit, 2016); 2) to explore the role of geographic proximity from the perspective of PROs (Fuentes & Dutrénit, 2016); 3) to develop further studies to ascertain whether universities collaborate with research firms (Fu & Li, 2016).

2.2.4.3.4. University-industry innovation networks (Cluster 4)

University-industry innovation networks consists of innovation networks set up between university and industries. These networks enable the establishing and maintain of partnerships based on a win-win strategy. Cluster 4 (Figure 2.2.7) correspondingly focuses on university-industry innovation networks with the most cited references from Perkmann and Walsh (2007) (240 citations), Bruneel, D'Este, and Salter (2010) (151 citations) and Etzkowitz and Klofsten (2005) (110 citations).

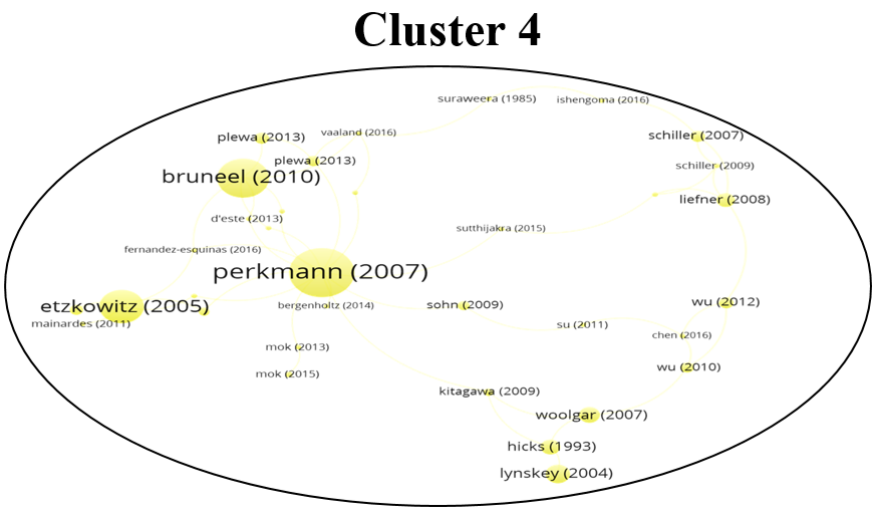

Figure 2.2.7 – Cluster 4

Perkmann and Walsh (2007) (240 citations), with their article university-industry relationships and open innovation: towards the research agenda, explore the diffusion and characteristics of the collaborative relationships between universities and industry before developing an informed research agenda from an “open innovation” perspective. The authors suggest that university-industry relationships are widely and commonly practiced even while there are

differences between industries and scientific fields. However, most existing research approaches the effects of university-industry linkages on specific innovation variables, such as patents or business innovation with the organizational dynamics of these relationships still requiring research (Perkmann & Walsh, 2007).

Bruneel et al. (2010), investigating the factors that diminish the barriers to university–industry collaboration (151 citations), aim to uncover the nature of the obstacles to collaboration between university and industry, exploring the influences of different mechanisms for reducing barriers related to university orientations and the transactions involved in working with university partners. The authors demonstrate both how previous experience of collaborative research reduces guidance-related barriers and how higher confidence levels reduce both types of previously indicated barriers (Bruneel et al., 2010). They further conclude that the amplitude of interactions decreases the orientation-related issues but raises the barriers faced by these transactions (Bruneel et al., 2010).

The last major article in this cluster is that of Etzkowitz and Klofsten (2005), the innovating region: toward the theory of knowledge-based regional development (110 citations). The authors establish a knowledge based model of regional development, conceived as a set of dynamics, based on alternative technological paradigms (Etzkowitz & Klofsten, 2005). The results of this research stem from the self-sustaining dynamic initiatives in which the roles of academia and government seem to fade away as industrial actors come to the fore through the launching of a line of firms (Etzkowitz & Klofsten, 2005). However, as one technological paradigm runs out, new economic activities need another source and the role of academia and government once again becomes prominent in establishing the conditions for the next wave of innovation (Etzkowitz & Klofsten, 2005).

Cluster 4 also returns a total of three future research lines: 1) to study the differences between "local" academic cultures of knowledge creation and their intersection with international journals (Chen, Patton, & Kenney, 2016); 2) are local knowledge cultures important? If so, in what way? (Chen et al., 2016); and 3) to deepen in what ways Chinese universities transfer knowledge, as well as whether they are already vital for researchers and policy makers at the global level (Chen et al., 2016).

2.2.4.3.5. University entrepreneurship (cluster 5)

The definition of university entrepreneurship incorporates the commercialization of university inventions (Damsgaard & Thursby, 2013). For inventions to meet the needs of companies, the recommendation made is that university human resources form part of the research group or, alternatively, researchers integrate into the companies for which inventions are under development.

The "university entrepreneurship" (Figure 2.2.8) cluster relies on two articles by Jacob, Lundqvist, and Hellsmark (2003) and Grimaldi et al. (2011).

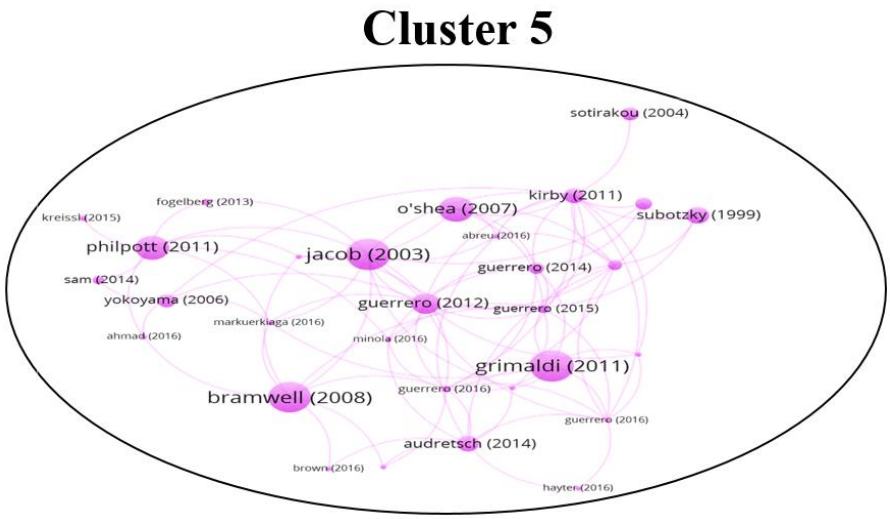

Figure 2.2.8 – Cluster 5

Grimaldi et al. (2011) (98 citations) describe the role of research commercialization as under evolution in universities. The article summarizes articles from a special selection and outlines an agenda for future research on various aspects of university entrepreneurship. Grimaldi et al. (2011) furthermore emphasize the need to discuss and evaluate the effects of legislative reform in several OECD countries on academic activities and spirit of entrepreneurship.

Jacob et al. (2003), entrepreneurial transformations in the Swedish University system: the case of Chalmers University of Technology (96 citations), provide a case study of a Swedish university where the national policy involves turning cutting edge research into innovation policy. The authors conclude that establishing an entrepreneurial university takes several years as changes are necessary to both infrastructure and culture in order to achieve success (Jacob et al., 2003). They also point out that, despite the university's long history in Sweden, the new emphasis on commercialization and knowledge transfers creates a degree of uncertainty in the university' role.

Cluster 5 was the most complex and correspondingly identifying a diversity of future lines that we present here the most relevant for this theme: 1) what are the theoretical foundations and empirical evidence on the interlinkage between the internationalization strategy and the role of the entrepreneurial university as the engine of innovation/entrepreneurship activities? (Guerrero, Urbano, & Fayolle, 2016); 2) what are the theoretical foundations and empirical evidence for the impact of opportunistic behaviors on the role of the entrepreneurial university as the engine of innovation/entrepreneurship? (Guerrero et al., 2016); 3) what are the environmental factors (formal: policies and incentives; and informal: attitudes and culture) and internal factors (resources and capacities) that affect the development of entrepreneurial universities in the new social and economic scenario? (Guerrero et al., 2016); 4) to explore the

links between technology transfer offices (TTOs) and acceleration programs, i.e., whether academics ignore TTOs and head directly to acceleration programs (Huyghe, Knockaert, Piva, & Wright, 2016); 5) to examine the effects either of the incentive systems existing at universities, or the collective engagement of researchers in marketing activities at the departmental or research group level (Huyghe et al., 2016); 6) to explore the processes through which marketing activities within departments do or do not develop into partnerships with TTOs (Huyghe et al., 2016); 7) to expand the sample of university entrepreneurs and extend the study to various US regions (Hayter, 2016); 8) to validate and strengthen the conceptual models of corporate university ecosystems as well as undertaking additional examinations of the composition, contributions and evolution of entrepreneurship networks in other university contexts in other regions of the USA (Hayter, 2016); 9) to what extent does the geographic location of a university require a specific strategy to support entrepreneurship? What is this strategy? (Hayter, 2016); 10) what is the role of entrepreneurial universities in their host societies and economies? What is the potential impact of entrepreneurial universities on the regions? Do the host region's and entrepreneurial university characteristics influence the local economic and social contexts? (Zhang, MacKenzie, Jones-Evans, & Huggins, 2016); and 11) to compare the entrepreneurial activities of academics at universities that define themselves entrepreneurial and those that do not while verifying the levels of economic and social development in different regions (Abreu, Demirel, Grinevich, & Karatas-Ozkan, 2016).

2.2.4.3.6. University-industry property (cluster 6)

University-industry property refers to a right protected by law. The protected right, as a rule, is issued in the form of a patent. This patent allows the entity that holds this right to block other entities from using it (Drozdoff & Fairbairn, 2015).

In Cluster 6, the articles generally address university-industry industrial property (Figure 2.2.9). We would highlight two articles in this cluster: Balconi, Breschi, and Lissoni (2004) (185 citations) and D'Este and Perkmann (2011) (109 citations).

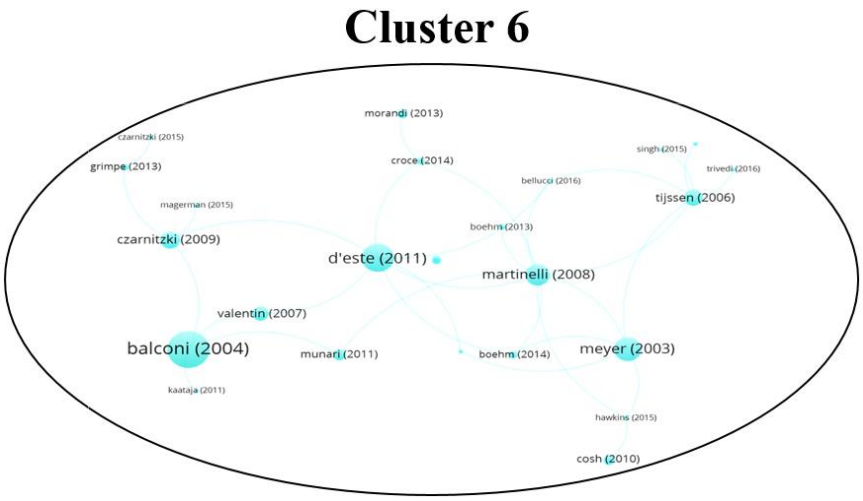

Figure 2.2.9 – Cluster 6

Balconi et al. (2004), Networks of inventors and the role of academia: an exploration of Italian patent data, wrote the leading paper (185 citations) in this cluster. This study provides a quantitative analysis of the social distance between open science and technological property. The authors conclude that academic inventors are more united than non-academics (Balconi et al., 2004).

The article by D'Este and Perkmann (2011), Why do academics engage with industry? The entrepreneurial university and individual motivations, received the second most citations (109) in this cluster. D'Este and Perkmann (2011) put forward evidence based on research data covering a large sample of UK researchers in the physical and engineering sciences. The authors suggest that most academics engage with industry in order to promote their research rather than market their expertise (D'Este & Perkmann, 2011). The study concludes that policy must refrain from focusing excessively on monetary incentives for industry involvement and consider a broader range of incentives to foster interactions between academia and industry (D'Este & Perkmann, 2011).

Cluster 6 identifies a total of four future research lines: 1) to produce empirical research on contexts in which academics have access to fewer innovation and entrepreneurship related national and institutional resources (Davey et al., 2016); 2) to study the role of supranational, national, and regional factors that inhibit or facilitate university-industry cooperation (Davey et al., 2016); 3) to carry out qualitative studies verifying university motivations and university-industry intentions, incorporating the perceptions of specialists capable of providing overviews of the national business environment (Davey et al., 2016); and 4) to empirically analyze additional countries such as the USA or Japan and compare them with countries in Europe, where university-industry interactions are underdeveloped (Bellucci & Pennacchio, 2016).

2.2.4.3.7. Innovation ecosystems (cluster 7)

The innovation ecosystems concept originally emerged as the "business ecosystem" (Moore, 1993). Innovation ecosystems consist of bringing together several interdependent and interconnected actors that share common goals. Innovation ecosystems are focused on innovation and evolve over time within certain, particular environments (Ritala, Agouridas, Assimakopoulos, & Gies, 2013).

This last cluster thus addresses innovation ecosystems (Figure 2.2.10) with but a single article standing out significantly from its peers, "resources, capabilities, risk capital and the creation of university spin-out companies", authored by Lockett and Wright (2005).

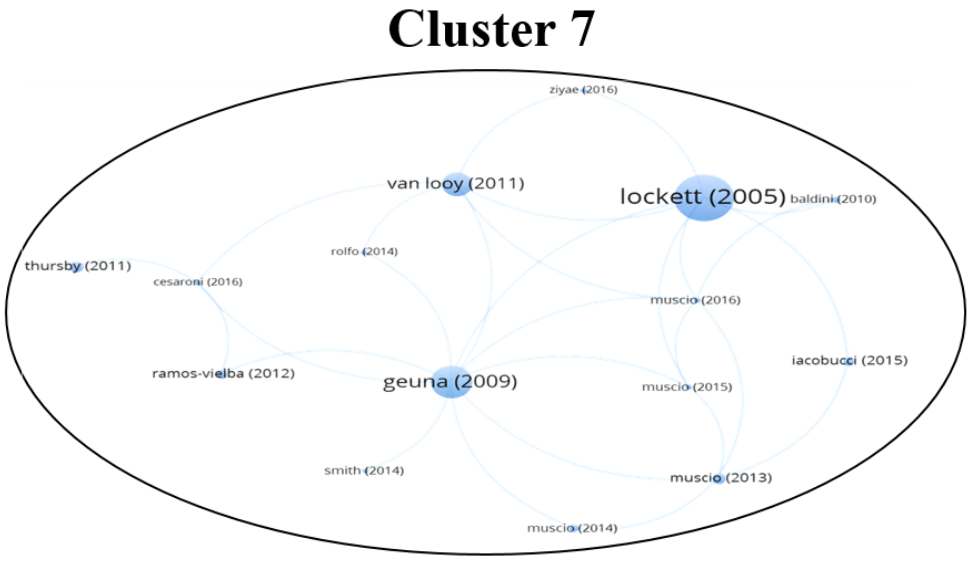

Figure 2.2.10 – Cluster 7

The Lockett and Wright (2005) article reports 212 citations and assesses the impact of university resources and routines/capabilities for creating spin-out firms. The authors note that the number of spin-out firms launched reflects in the highest costs for intellectual property protection, the development of capabilities for business technology transfers, and the university royalty regimes (Lockett & Wright, 2005). Universities and policy makers need to devote attention to the training and recruitment of technology-savvy employees with and business skills (Lockett & Wright, 2005).

In cluster 7 generates three future lines of research: 1) how does the creation of spinoffs influence the dimensions of university performance, such as its research activities and capacity to attract research contracts? (Muscio, Quaglione, & Ramaciotti, 2016); 2) to explore the consequences of university variations in spinoff activities over time (Muscio et al., 2016); and 3) to study the impact of regulation whether on the different university departments or on the individual level in order to distinguish different types of spinoffs (service sector, manufacturing, etcetera) (Muscio et al., 2016).

2.2.5. Conclusions, Study Limitations and Future Research Agenda

The objectives of this study included mapping out the scientific publications, the intellectual structure and research trends relating to the regional academic entrepreneurship field. We may correspondingly report that universities traditionally held only two missions (research and

teaching). However, over time, the need for them to participate in entrepreneurial activities has emerged (Etzkowitz, 1998) and thus concluding that the contributions of universities to society now constitute their "third mission".

In this research, we define a new concept; "regional academic entrepreneurship". Through regional academic entrepreneurship, we seek to approach academic entrepreneurship from a regional perspective. Through bibliometric analysis, we furthermore identified seven clusters: Entrepreneurial university; university-industry interactions; university-industry knowledge transfers; university-industry innovation networks; university entrepreneurship; university-industry industrial property; and innovation ecosystems.

This research maps the authors and the most relevant approaches, as well as detailing the future research lines recently published about university orientations and objectives. Hence, we analyzed the main lines of future research pointed out by the respective lead authors within each cluster. Based on the literature, we point out several future lines of research for each cluster. For the total of seven clusters, this amounts to 35 future research lines as the basis for further research.

We would note that cluster 5 contained the largest number of future research lines. This may indicate the need for future research to address the theme of university-industry innovation networks either because of their potential complexity or because of the current pertinence of this topic.

In overall terms, this research presents the mapping of publications and the intellectual structure of the theme and therefore of huge interest to the search for a holistic view on this field of study. In this way, we are able to deepen and extend our understanding of the relations between the paradigms and the subjects most analyzed as well as identifying any existing gaps in the literature (Casillas & Acedo, 2007; McMillan, 2008; Teixeira, 2011). This also endows greater scientific coherence and structure to the existing literature.

In terms of the study's limitations, with regard to the methodology, we would mention that only the Web of Science was taken into consideration for the data search, thus excluding publications not indexed to this database.

As regards future research lines, we need to reflect on the origins of academic entrepreneurship and the changes observed throughout the evolution of this research field and approached through other methodologies. For instance, this might analyze the literature by applying conceptual and qualitative methods of analysis and developing the trends in the literature based on these methodologies. This may also include other areas underlying this theme that fell beyond the scope of this research.

Furthermore, scholars, policy makers and practitioners in the field of academic entrepreneurship need to perceive and reach beyond their immediate interests and encourage dynamism and growth in this research community. This is particularly relevant due to the

increasing rate of publications on this field in 2016, the complexity of review processes and the constantly changing methodological trends.

CHAPTER 3 - Reflecting on the Innovative Performances of European Regions in the Age of Smart Specialization

Abstract

This study seeks to identify the variables that best explain the performances of innovative regions of Europe deploying regional strategies for smart specialization. We follow a quantitative methodology and applied linear regression as a method. To conduct this study, we collected data from the Regional Innovation Scoreboard 2016. The results led to an explanatory invocation performance model for Moderate Innovator Regions, and while also identifying some potential measures and suggestions in order to help decision-makers improve on the innovation performance of these regions.

Keywords

Innovation, Regions, Smart Specialisation, RIS, RIS3.

3.1. Introduction

The development of territorial entities or regional economic authorities has been ongoing since the second half of the 20th century. More recently, the European Union (EU) has experienced a serious financial and economic crisis. In less competitive areas, that crisis was more ephemeral (Tiits, Kalvet, & Mürk, 2015) with these regions displaying poor growth in exports, low internal consumption rates as well as high levels of unemployment.

As a regional context in itself, the EU has also generated constant and vigorous debate about its nature, scope and limits (Kuus, 2005) to the extent that this challenge, which is inherently incorporated into the European integration process and reflects especially in enlargement

related dilemmas, has become one of the essential characteristics of the EU (Ciută, 2008). In the EU, the region's builders maintain the idea that the regions are historically contingent and in different ways interrelated with political, governmental, economic and cultural practices and speeches (Paasi, 2003).

The European Commission (EC) has deployed a group of scholars to develop smart specialisation in order to provide policy-makers with a clear logic for their innovation policies (Foray, David, & Hall, 2011). This smart specialisation includes innovation policies specific to a particular region based on their different capabilities and potentials (Foray et al., 2011). The concept of smart specialization assumes innovation systems hold different potential evolutionary paths that are clearly dependent on the existing legacy structures and dynamics, ranging from increased and widespread changes through to even the radical transformations of the system (McCann & Ortega-Argiles, 2015b).

Two other concepts interrelate with smart specialisation: regional innovation systems (RIS) and research and innovation strategies for smart specialisation (RIS3). The concept of RIS arises from a set of private and public interests, formal institutions and other organizations that mutually interact. These are based on agreements, organizational and institutional relationships that disclose knowledge among themselves (Doloreux, 2003). RIS also emerges as a social innovation system resulting from the social interactions ongoing among the actors in the innovation system (Doloreux & Parto, 2005). Hence, the tools and actions supported by the innovation policy system approach must focus not only on the traditional input-output relations but also on the social and institutional factors affecting the region's economic development (Kautonen, 2006).

RIS3 has inherited the accomplished legacy of learning on regional innovation systems, which provided the basis for the development of regional economic policies in recent years (Asheim & Gertler, 2005b; Cooke, 2001). We may add that the RIS3 represents an evolution of the RIS.

We furthermore encountered certain gaps in the literature that we aim to offset by the findings of this research project. Rodriguez-Pose (1999) draws attention to the need for future studies to include the institutional and political dimensions in order to better portray the interactions between innovation and society. Tödtling and Trippl (2005), in turn, mention the need to reflect upon the weak innovation capacities of different types of regions and the problems they display. Additionally, Nieto and Santamaria (2010) mention the desirability of accessing more complete information about improvements to innovation captured through quantitative measurement of the innovation performance.

Through applying the Regional Innovation Scoreboard 2016 database, the present research strives to put forward an explanatory model for Moderate Innovator regions as regards their respective innovation performances. The Regional Innovation Scoreboard 2016 classifies regions into Innovation Leaders, Strong Innovators, Moderate Innovators, and Modest Innovators. Innovation Leader regions are those recording innovation performance levels of 20% or more

above the EU average. Strong Innovators are regions registering between 90% and 120% of the EU average While their Moderate Innovator peers are regions with between 50% and 90% of the EU average. Finally, Modest Innovators regions turn in innovation performance levels that are below 50% of the EU average (EC, 2016a).

The Regional Innovation Scoreboard 2016 includes several variables that explain the innovation performances of 214 regions of 22 EU member states. This article adopts the following structure: after the present introduction, section 2 discusses the literature review on smart specialisation and RIS3. Section 3 describes the methodology adopted in the study before section 4 presents the results and section 5 discusses the key results. Finally, section 6 sets out our conclusions, limitations and future research lines.

3.2. Literature Review

3.2.1. Smart specialization

Specialisation and development share economic growth as their common purpose, which in turn stems from the knowledge developed and applied. Tiits et al. (2015) detail how the core objective of such development involves creating unique, and difficult to copy, competitive advantages. Knowledge, technology, innovation and expertise are key concepts to the growth and evolution of any economy (Fagerberg, Mowery, & Nelson, 2005; Schumpeter, 1950). In this way, we may state that smart specialisation includes a vision developing processes, identifying strengths and weaknesses, defining strategic priorities and deploying smart policies to maximize the potential advancement of knowledge at the regional level (Martínez-López & Palazuelos-Martínez, 2014).

Coffano and Foray (2014) argue that implementing smart specialisation policies must meet two fundamental requirements: (1) good institutions and (2) strong political capacities at the regional level. According to Healy (2016), the smart specialisation concept is more suitable for applying and developing in advanced regions, with their research and innovation systems already in effect, rather than less developed regions.

According to Kroll (2015b), the EC lacks the ability to duly recognize regional specializations. This author mentions that regional or national governments hold this responsibility that requires meeting through a “bottom-up” procedure of discovery entrepreneurship, benefiting from the knowledge of local businesses, knowledge institutions and public actors (Kroll, 2015b).

McCann and Ortega-Argilés (2014a) note that smart specialisation needs serious analysis and consideration about the assets, strengths and weaknesses of the respective regions. Camagni, Capello, and Lenzi (2014) also hold the same opinion, and indicate that regional innovation is only ever highly dependent on the territory's origins, history, culture and learning processes.

The Strategy for Europe 2020 defines and measures the concept of smart growth, according to established conceptual frameworks, i.e., about technological evolution, human capital, knowledge for economic growth and regional convergence roles (Jaffe, 1989; Rauch, 1993). This growth strategy focuses on innovation, knowledge and technology (Naldi, Nilsson, Westlund, & Wixe, 2015).

To implement smart specialisation policies, politicians foster the achievement of scale economies (Healy, 2016). Healy (2016) states that through attaining a critical mass, differentiated paths may thus develop based on areas of competitive advantage. The implementation of any smart specialisation strategy must align both with ongoing economic changes and structural funds as well with as the emergence of new factors (Foray & Goenaga, 2013; Martinaitis, 2013).

3.2.2. Research and innovation strategy for smart specialization (RIS3)

RIS3 serves to complement everything listed above for the smart specialisation concept. In turn, RIS3 aims to identify both the knowledge existing in selective "domains" as well as the priorities prevailing in areas where the region (or member state) holds a relative advantage (Foray, 2014b; Foray et al., 2012), which might amount to a competitive advantage. Camagni and Capello (2013) indicate that RIS3 requires investing in knowledge and human capital, industrial and technological capital, and the locally prevailing skills. Thus, RIS3 emphasizes the roles of knowledge, technology and innovation in economic development and social well-being (Tiits et al., 2015). Tiits et al. (2015) indicate how the design of RIS3 primarily emphasises the transmission of R&D for the purpose of creating new policies, i.e., the concept mostly focuses on the economic returns of R&D.

In the more developed economies, implementing RIS3 in R&D systems involves investing in creating new activities with a strong emphasis on science. In opposition, less developed economies need to focus their R&D on those areas where they have already industrialised (Foray et al., 2011).

According to Foray et al. (2011), political theory and practice are increasingly distant with the RIS3 concept also criticized for its design that treats all regions as equals (Torre & Wallet, 2013). Cooke (2012) furthermore criticized both the concept and the implementation of RIS3 and targeted the undue emphasis on science and technology for leading to innovation becoming overly focused on high technology sectors. Other authors suggest imitative innovation as a more correct path (Capello & Lenzi, 2013), i.e., “benchmarking”.

According to Cooke (2016), from the point of view of countries/regions, RIS3 implementation amounted to an excuse for the austerity and hard times that EU had passed through. This author states that the implementation of RIS3 at least concentrated industrial policy on the strengths of national and regional authorities, which might potentially generate innovation.

3.2.3. How to rethink smart specialization after 2020?

Despite RIS having now been studied for over two decades, there still remains no consensus among researchers. Nevertheless, the concept has also undergone evolution. However, what is the actual difference between RIS, smart specialisation and RIS3? Throughout the literature review, these concepts are confusing to less attentive readers. Meanwhile, each concept does have its own specificities and differences.

Thus, RIS was the first of these three concepts to emerge following its proposition by the author Cooke (1992). RIS reflects an interactive learning process able to very quickly produce evidence on institutional reactions, though there remains a time lag before achieving the harmonisation of the economic performance and the business dynamism between the regions (Cooke, 1992). The smart specialisation concept first emerged to facilitate the political agenda and direct its attention towards results (McCann & Ortega-Argiles, 2013b). Thus, smart specialisation correspondingly consists of promoting the efficient utilisation, leveraging the effective and synergistic effects of public investment in order to boost economic growth and the prosperity of countries and regions.

RIS3 derives from the EC proposal for regulating the next structural funding programming period (2014-2020). These regulations include the adoption of research and innovation strategies for smart specialisation (RIS3) as one of the conditions for the approval of partnership contracts with the United States, as well as their operational programs. We may state that RIS3 represents both the evolution of the RIS concept and encompasses the concept of smart specialisation.

As regards RIS3 implementation within the EU, this is an issue that also fails to gain any consensus among researchers. Smart specialisation did not get designed as a specialization strategy and was planned from top to bottom, i.e., by the government for businesses (Estensoro & Larrea, 2016; McCann & Ortega-Argilés, 2014a; McCann & Ortega-Argilés, 2015).

In terms of the discovery process, a greater proportion of the literature emphasizes the importance of regions or member states to identifying, in economic terms, just what and where are their potentials for gaining competitive advantages (Boden, Marinelli, Haegman, & Dos Santos, 2015). Some authors claim that any strategic bottom up process runs the risk of ending up only poorly investing public resources (Camagni et al., 2014; Capello, 2014). Meanwhile, Iacobucci (2014) takes the opposite view, i.e., he maintains entrepreneurs not only know the market reality better than government officials but also recognize opportunities more effectively. Nevertheless, even when stakeholders are invited to share in the process, a top-down approach still always prevails in the "domains" chosen for selected specializations, i.e., depending always upon just who leads the strategy - the regional government (Estensoro & Larrea, 2016).

McCann and Ortega-Argilés (2015) point to a need for smart specialisation strategies that involve the local elites, thus able to obtain local knowledge and tailor such strategies to the

policies implemented. However, Boschma (2014) believes we must prevent local elites from attaining monopoly positions and instead opting for a process of implementing flexible policies, even while undertaking constant monitoring.

Having verified these contradictions in the research findings, we arrive at the following question: What interest is there in discussing whether strategies are better implemented according to strategic processes designed from the bottom up or vice versa? Who might benefit from this discussion? The EU decision identified the primary need as working on these assumptions by developing models and strategies able to enable regions to improve their efficiency and effectiveness across the economic, social and environmental levels. We may now embark on discussions of relevance, for example: What RIS3 strategies to adopt for the period after 2020? It is at this point that researchers may contribute strongly and hence explaining the importance of measuring the performance of the strategies implemented in the regions over the period 2014-2020.

Science and industry constitute important factors for the independence of regions and their cultural and economic sustainability (Mets, Kelli, Mets, & Tiimann, 2016). The regional economic and social development strategy and the policies resulting integrate different social areas throughout the entire system of innovation indicators (Adekola, Korsakiene, & Tvaronaviciene, 2008; Daugeliene & Juocepyte, 2012; Freeman, 1995; Lundvall, 2007; Vigier, 2007).

Some studies do address some of the variables present in the Regional Innovation Scoreboard, for example verifying whether intellectual property influences the economies of lesser developed countries, or assessing the impact of the cluster policy on a particular country (e.g. Mets et al., 2016; Gkypali, Kokkinos, Bouras, & Tsekouras, 2016; Kutsenko, Islankina, & Abashkin, 2017; Pater & Lewandowska, 2015). Gkypali, Kokkinos, Bouras, and Tsekouras (2016) applied eight variables (business expenditures, employment in high and medium-high tech sectors, government expenditures on R&D, innovative sales, patent applications, product/process innovation, publications, and a regional specificities dummy) to assess the contributions made by a science and technology park towards the performance of the Regional Innovation Scoreboard.

3.2.4. Regional innovation scoreboard

The employment in high and medium-high tech sectors variable relates to employment in the high-tech sectors present in the respective regional economy. The government expenditures on R&D variable assesses the innovation performance in terms of the efficiency and effectiveness of the innovation mechanisms operating primarily on public funding, with investment in this area becoming ever more essential. The innovative sales variable encapsulates sales of products/services by businesses in the region. The patent application variable spans the patents registered by companies and organizations in the region. The innovation product/process

variable approaches the percentage of regional companies that have already introduced innovations into products or processes (Gkypali et al., 2016). Pater and Lewandowska (2015), with the purpose of analysing and classifying the EU regions in accordance with their respective levels of human capital and innovation, take 18 variables into account.

This research therefore aims to identify just which variables return a positive impact on the innovation performance levels of those European regions ranked as Moderate Innovator regions.

Although some studies do apply pertinent variables to measure regional innovation performance standards, there is no study focusing on a set of regions with particular characteristics. Given the purpose and the research question of this study, we deployed the twelve variables included in the Regional Innovation Scoreboard 2016. Thus, the key aim involves identifying, through these variables, an explanatory model of innovation performance for the Moderate Innovator regions (Figure 3.1).

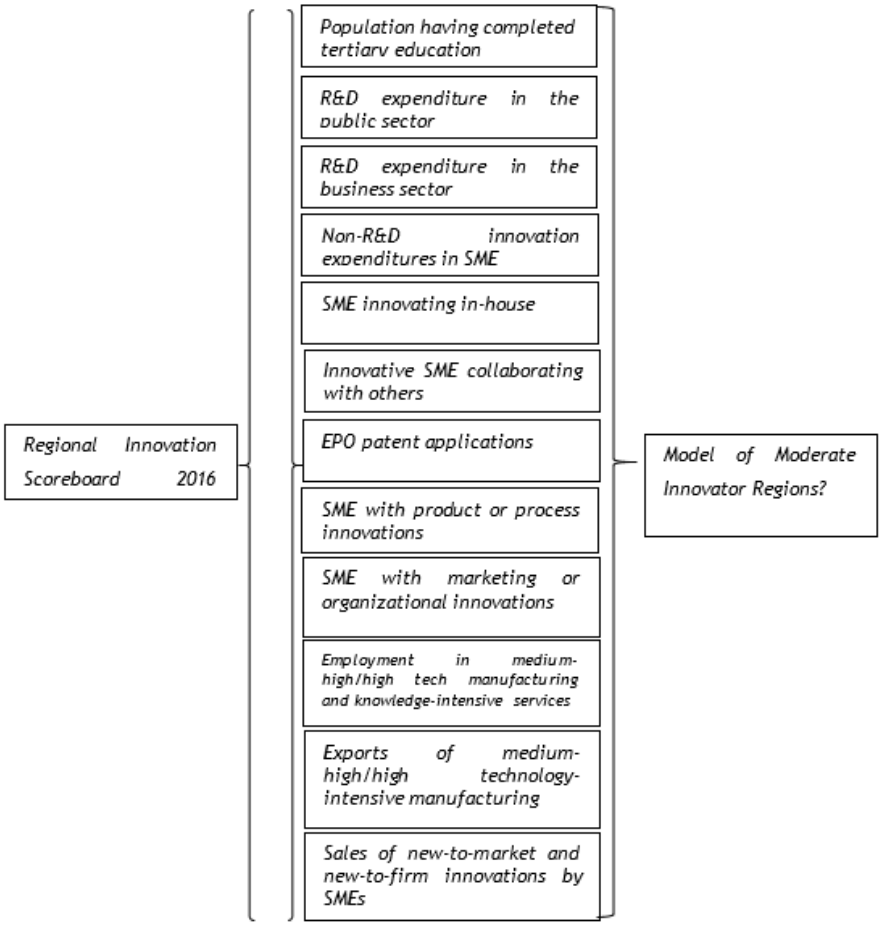

Figure 3.1 - Model of Moderate Innovator Regions

The Regional Innovation Scoreboard 2016 involves the following 12 variables: i) Population having completed tertiary education (%); ii) R&D expenditure in the public sector (%); iii) R&D

expenditure in the business sector (%); iv) Non-R&D SME innovation expenditures (%); v) SME innovating in-house (%); vi) Innovative SMEs collaborating with others (%); vii) EPO patent applications (per billion GDP); viii) SME with product or process innovations (%); ix) SME with marketing or organizational innovations (%); x) Employment in medium-high/high tech manufacturing and knowledge-intensive services (%); xi) Exports of medium-high/high technology-intensive manufacturing (%); and xii) Sales of new-to-market and new-to-firm innovation by SMEs (%). We may correspondingly observe how the variables listed in the Regional Innovation Scoreboard 2016 place more emphasis on the data for small and medium-sized enterprises (SME) than large companies.

Table 3.1 characterizes these 12 variables in summary form.

Table 3.1 - Regional Innovation Scoreboard - Variables

Regional Innovation Scoreboard - Indicators	**Definition**
Population having completed tertiary education	Corresponds to the number of people in a particular age range with some type of post-secondary education. The indicator focuses on the population aged between 30 and 34 years.
R&D expenditure in the public sector	Represents expenditure on research and development (R&D), one of the key drivers of economic growth in a knowledge-based economy.
R&D expenditure in the business sector	Captures the formal creation of new knowledge within companies.
Non-R&D innovation expenditures by SMEs	Quantifies the cost of non-R&D innovation as a percentage of total turnover.
SMEs innovating in-house	Based on the introduction of new products or production processes in SMEs, whether products or production processes, significantly improved by internal company innovation
Innovative SMEs collaborating with others	Measures the degree of SME participation in cooperation for innovation.
EPO patent applications	Measures the number of patent applications at the European Patent Office.
SMEs with product or process innovations	Reflects technological innovation measured by the introduction of new products (goods or services) and processes, which are the key ingredients for innovation in manufacturing.
SMEs with marketing or organizational innovations	Captures the extent to which SMEs innovate through non-technological innovation.
Employment in medium-high/high tech manufacturing and knowledge-intensive services	Indicates the role of employment in high technology manufacturing.
Exports of medium-high/high technology-intensive manufacturing	Measures the technological competitiveness of a region, i.e., the ability to commercialize the results of R&D and innovation in international markets.
Sales of new-to-market and new-to-firm innovation by SMEs	Measures the turnover of new or significantly improved company products as a percentage of total turnover.

Source: Adapted from EC (2016b)

3.3. Methodology

We collected the data for analysis from the Regional Innovation Scoreboard 2016 (http://ec./growth/industry/innovation/facts-figures/regional_pt) before entering and processing them in the SPSS 23.0 software program.

The Regional Innovation Scoreboard 2016 provides a comparative assessment of the innovation performance in the 214 regions of 22 Member States of the European Union (EU) and Norway. In addition, Cyprus, Estonia, Latvia, Lithuania, Luxembourg and Malta are included at the national level (EC, 2016a). The Regional Innovation Scoreboard 2016 classifies the regions into four types: 1) Innovation Leaders (36 regions); 2) Strong Innovators (65 regions); 3) Moderate innovators (83 regions) and 4) Modest Innovators (30 regions).

The Regional Innovation Scoreboard joins the European Panel for the Evaluation of Innovation (EIS), which marks the performance of innovation at the member state level (Figure 3.2). This research takes into account only those Moderate Innovator regions (83 regions of Europe in 2016).

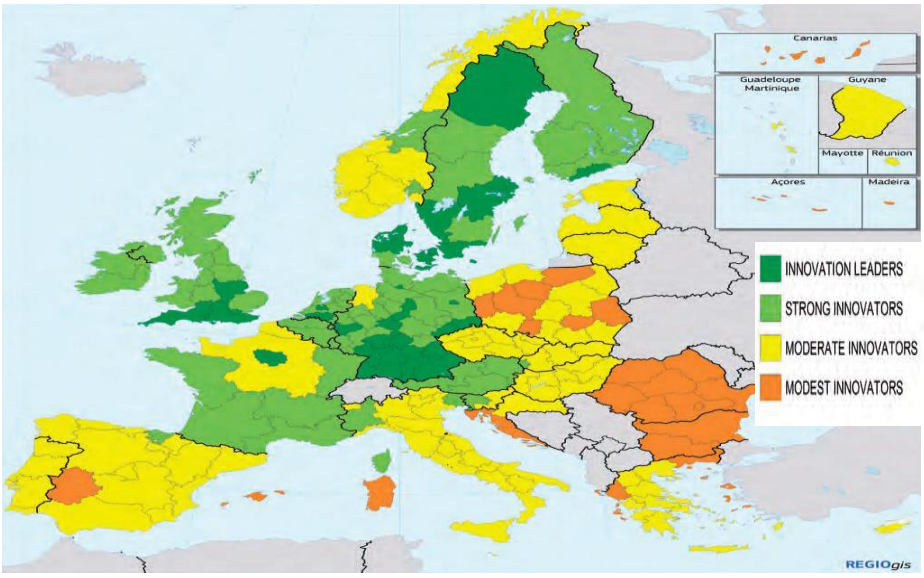

Figure 3.2 - Innovation performance at the member state level; Source: EC (2016a)

The data were subject to multivariate analysis in accordance with the linear regression method. The linear regression analysis assumes that errors meet four assumptions: 1) follow a normal distribution – with this condition checked by plotting a graph of normal probability (Normal Probability Plot – whenever the errors display a Normal distribution, all points on the graph position themselves approximately in a straight line; 2) attain a zero mean; 3) homoscedasticity (constant variance); and 4) are independent. These assumptions effectively graphically represent the residual values according to the estimated dependent variable values (residual

graph) or based on the values of one of the independent variables. Thus, the points of the graph should attain a random distribution around the straight line that corresponds to zero residuals, creating a wide and uniform tunnel. Thus, we my report that the errors here are independent, achieve a mean of zero and with constant variance.

3.4. Results

Based on the information obtained through the Regional Innovation Scoreboard 2016, we estimated the parameters for the Moderate Innovator regions model.

This applied the linear regression method through the Stepwise procedure for data analysis. The dependent variable with the highest level of significance according to SPSS is SMEs Innovating In-House. As Table 3.2. displays, the SPSS program considered two models.

Table 3.2. - Model Summary[c,d]

Model	R		R Square	Adjusted R Square	Std. Error of the Estimate
	Regional innovation performance groups = Moderate (Selected)	Regional innovation performance groups ~= Moderate (Unselected)			
1	.989[a]		.978	.978	.022921
2	.990[b]	.980	.980	.979	.022342
a. Predictors: (Constant), SME with Product or Process Innovations					
b. Predictors: (Constant), SME with Product or Process Innovations, Innovative SMEs Collaborating With Others					
c. Unless noted otherwise, the statistics stem only from cases of Regional innovation performance groups = Moderate.					
d. Dependent Variable: SMEs Innovating In-House					

Analyzing the R Square of table 3.2, model 1 returns a result of 0.978 and model 2 stands at 0.980. As the R Square of the upper model 2, it is this that requires consideration. Whenever the stepwise method enters a new variable into the model, the significance of each variable gets analysed before eliminating whichever variables do not return any meaningful explanatory capacity. This process is then repeated until the variables not included in the model do not have any capacity for meaningful explanation while all those included in the model do have.

Hence, to ascertain the Moderate Innovator regions model, we have to delete the variables that do not hold statistical significance (sig < 0.05) one by one, always starting with whichever variable holds statistically least significance in the model.

Table 3.3. reports the coefficients applied to find the linear regression equation.

Table 3.3. - Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	ig.
		B	Std. Error	Beta		
1	(Constant)	-.021	.007		-3.177	,002
	SME With Product or Process Innovations	1.038	.017	.989	60.999	,000
2	(Constant)	-.012	.008		-1.626	,108
	SME With Product or Process Innovations	1.046	.017	.997	61.758	,000
	Innovative SME Collaborating With Others	-.054	.023	-.037	-2.314	,023
a. Dependent Variable: SMEs Innovating In-House						
b. Selecting only cases with regional innovation performance groups = Moderate						

To finalize this analysis of results, we produced table 3.3 in order to ascertain the linear regression equation. Thus, the linear regression equation results from the following expression: SMEs Innovating in House = -0.12+1.046* SMEs with Product or Process Innovations -0.054* Innovative SMEs Collaborating with Others.

The application of the linear regression verified the assumptions as demonstrated in figure 3.

We verified the normality assumptions through analysis of the residual standardized graphs, and the Kolmogorov-Smirnov test.

3.5. Discussion of Results

The results obtained excluded a total of nine of the twelve variables in the Moderate Innovator regions explanatory model. Correspondingly, the excluded variables were as follows: 1) Population having completed tertiary education; 2) R&D expenditure in the public sector; 3) R&D expenditure in the business sector; 4) Non-R&D innovation expenditure by SMEs; 5) EPO patent applications; 6) SMEs with marketing or organizational innovations; 7) Employment in medium-high/high tech manufacturing and knowledge-intensive services; 8) Exports of medium-high/high technology-intensive manufacturing; 9) Sales of new-to-market and new-to-firm innovations by SMEs.

The "Population having completed tertiary education" variable has received particular attention from EU countries over time (Fragoulis, Masson, & Klenha, 2004). Most EU countries have free schooling, whether organized by public or private institutions. However, in general, companies in countries considered Moderate do not yet provide training in workplace contexts. Companies thus seem to expect their human resources to proactively acquire such training away from the workplace or, alternatively, for other institutions to provide them with training. Although adult access to education in countries considered Moderate borders on the EU average, their

unemployment rates are higher. The average population receiving training in the last four weeks in the EU stands at 8.4% (Fragoulis et al., 2004). However, taking at a few particular examples, we find Bulgaria and Greece have rates of about 1.5%, Hungary, Latvia, Slovenia and Portugal stand on about 3.5% while Estonia, Poland, the Czech Republic and Spain report rates of between 5% - 6% (Fragoulis et al., 2004). In this sense, the results returned by this study align with those previously indicated and hence the reason the variable does not enter the model constructed.

Relative to the "R&D expenditure in the public sector" and "R&D expenditure in the business sector" variables, these have accounted for major investments by the EU. The R&D costs register at about 88% of the EU-27 average (Nečadová, 2013). Camagni and Capello (2013) maintain that the smart specialisation approach emerged out of the aim of finding an explanation and a rational strategy for the great gap in R&D between Europe and some trading partners. According to these authors, the reason most directly related to the knowledge gap was stemmed from the lack of scale of high-tech sectors with intensive R&D within the overall framework of the European economy (Camagni & Capello, 2013). Other reasons for this shortcoming interrelate with the spatial dispersion of R&D efforts, leading to a lack of critical mass and the duplication of investment, the inefficient allocation of resources and consequent poor learning processes (Pontikakis, Chorafakis, & Kyriakou, 2009). Given we excluded the R&D expenditure in the public sector and R&D expenditure in the business sector variable from the model constructed, this indicates how R&D focused investments in Moderate Innovator regions remain insufficient.

The "non-R&D innovation expenditures by SMEs" variable is another of the variables excluded from the model returned. According to Nečadová (2013), innovation performances in Slovakia negatively affect the sharp decline in Expenditures on Non-R&D Innovation, Foreign Patent Licenses and Revenues. Thus, this gasps and attests to the lack of impact this variable has on Moderate Innovator regions.

The "EPO patent applications" variable did not get included in the Moderate Innovator regions explanatory model, which is again in keeping with with the literature. According to Adam (2011), EPO patent applications return no impact on regional economic growth.

As regards the "SME with marketing or organizational innovations" variable, according to Nylund et al. (2016), companies reporting high growth rates based in low growth regions do not especially involve marketing based innovations. These companies do not strive to promote and develop branding for example. However, Nylund et al. (2016) state that given the rapid increase in their internationalization, it is understandable that these companies lag behind in some strategic aspects and still need further development. Therefore, the analytical procedure excluded this variable from the model, which also corroborates with the findings of the literature. The employment in medium-high / high tech manufacturing and knowledge intensive services variable does not present a significant level of significance in the model reported here.

Stocker, Grossmann, Hinterberger, and Wolter (2014) conclude that, for employment in general, the lower the region's economic growth, the greater be the unemployment. Thus, in order for these regions to create more Employment Medium-High/ High Tech Manufacturing employment, it is necessary however to ensure human resources attain high levels of qualification.

The model produced for the Moderate Innovator regions also excluded the exports in medium-high / high tech manufacturing variable. Nylund et al. (2016) argue that high growth companies based in low growth regions tend to seek out this growth in international markets. However, these companies do not engage in the branding efforts that would align and support their internationalization strategies. Nevertheless, given the rapid expansion in the international business done by companies, it is understandable that some strategic aspects end up lagging behind (Nylund et al., 2016).

The sales of new-to-market and new-to-firm innovations variable also failed to gain inclusion in the Moderate Innovator regions model. However, according to Balycheva (2016), small businesses tend to display a higher level of motivation over such innovations, i.e., small businesses hold a greater tendency to commercialize more innovative products than their medium and large peers. The market role of innovations among small businesses is also much higher than among other larger companies. Balycheva (2016) describes how despite these innovations incorporating considerably high levels of quality, small businesses focus on local and national markets and do not specifically aim at international growth opportunities. There is a growing trend for the diffusion of innovation among small businesses as they gain in scale. In spite of the significant rise in goods of merchantable quality, innovative products account for a smaller share of the turnover of micro-enterprises (Balycheva, 2016). Balycheva (2016) confirms the grounds for excluding this variable from the model as it represents only a small percentage of company turnover. Having discussed the results of those variables excluded from the explanatory model for Moderate Innovator regions, we shall now move onto the variables included in this explanatory model. Correspondingly, the Moderate Innovator regions model contains three explanatory variables: 1) SMEs Innovating In-House; 2) SMEs with Product or Process Innovations; 3) Innovative SMEs Collaborating with Others.

The "SMEs Innovating In-House" variable emerges as the constant for this model. Thus, this represents an important variable that explains the Moderate Innovator regions model. In general, companies located in Moderate Innovator regions stand out because of the weak internal capacities of the SME sector. This stems from how the SMEs in such regions deploy only low levels of intellectual assets, which demonstrate the limited resources available to these SMEs. SMEs experience difficulties in adapting to increasingly dynamic environments, which also impacts negatively on regional competitiveness (Zygmunt, 2017).

There has been a decrease in the number of "SMEs with Product or Process Innovations" in the years 2007-2014. On average, SMEs with Product or Process Innovations shrank by 1.7% while

the number of companies innovating in their organizational operations fell back by over 3%. These numbers naturally reflect on the subsequent sales and entrepreneurship as SMEs that innovate internally declined by about 1% (Osuch-Rak & Holnicki-Szulc, 2015). Despite these numbers, the "SMEs with Product or Process Innovations" variable returns a positive impact on Moderate Innovator regions.

The "Innovative SME Collaborating with Others" variable also verified that detailed above, with this variable however returning a negative impact on the model. Most countries have seen a slight worsening in their performance over the last twelve years (Osuch-Rak & Holnicki-Szulc, 2015; Zygmunt, 2017). For example, Poland, which was a Moderate Innovator in the year of 2014, registered a 12% decline in the "Innovative SMEs Collaborating with Others" indicator. On the other hand, innovation leaders improved their performance by about 2% (Osuch-Rak & Holnicki-Szulc, 2015).

3.6.Conclusions, Limitations and Future Lines of Research

Based on the results obtained, we may now put forward some final considerations in order to suggest concrete measures capable of improving on the weak innovation and economic performance levels. Choosing any such measures requires guidance by the ambition to minimize the eventual negative consequences inherent to low growth scenarios without the need to revert to interventions focusing only on increasing economic growth (Stocker et al., 2014).

However, the regional policy best suited to the European 2020 Agenda also needs additional reflections on how to direct and target these policies to achieve the goal of smart growth (Camagni & Capello, 2013). These policies have revealed problems in adapting to the industrial dimension (excellence in knowledge, support for R&D, technological innovation) at the regional level (Camagni & Capello, 2013). This present study sought to answer the following research question: Which variables generate impacts on the innovation performance of European regions considered Moderate Innovator regions? The results led to an explanatory model for Moderate Innovator regions, composed of three variables, with eight other variables returning different impacts: SMEs Innovating In-House, SMEs with Product or Process Innovations, Innovative SMEs Collaborating with Others.

Thus, we arrived at the model that explains the innovation performance of Moderate Innovator regions as follows: SMEs Innovating in House = -0.12 + 1.046 * SMEs with Product or Process Innovations -0.054 * Innovative SMEs Collaborating with Others.

As demonstrated by this model, the SMEs Innovating in House and Innovative SMEs Collaborating with others variables adversely affect the Moderate Innovator regions. In contrast, SMEs with

Product or Process Innovations becomes the only variable that positively impacts on Moderate Innovator regions.

The research results therefore reinforce the findings of Zygmunt (2017). The results returned by this research reveal insufficient R&D investment by the companies and governments of Moderate Innovator regions. The Moderate Innovator regions are notable for the weak internal performances of their SMEs. For Moderate Innovator regions to approach Strong Innovator regions, SMEs need to invest more in R&D (Zygmunt, 2017). SMEs correspondingly have to stop considering R&D investment as an expense, and view it as a medium-term investment. As these SMEs deploy more limited resources, their interactions with other SMEs have to be more proactive and dynamic. The results presented here recommend regional and national policies should focus on establishing networks and interactions between the actors and provide support to labour mobility and the institutional incorporation of actors. As regards companies, they need to intensify their actions in order to strengthen their ability to adapt to the rapid and uncertain changes of increasingly competitive markets (Zygmunt, 2017). This also extends to advocating for the strengthening of networks between universities, research centers, companies and regional governments.

The combination of micro and macroeconomic approaches, as applied in this research, enables the determining of the strengths and weaknesses of the moderate innovator regions within the innovation framework. This also enabled the proposal of concrete measures in support of the economic development of moderate innovator regions.

Thus, this research also strove to contribute with proposed measures for application by organizations and by policy makers in order to ensure better interactions among the various actors involved in innovation. Hence, policy makers in the regions ranked as moderate innovators should focus more on these measures and correspondingly channel more specialized resources and policies that enable their regions to improve on their growth and development rates. Making improvements to such indicators shall certainly assist in solving low economic growth and innovation related problems as well as fostering differentiation.

As study limitations, we should again point out that this model only considers those EU regions classified as moderate innovators, thereby excluding the innovation leaders, strong innovators and modest innovators regions from the study. Thus, we would suggest that future lines of research approach the study of other typologies of European regions and undertaken comparative analysis. Deepening the results obtained in this research through the development of qualitative studies able to grasp how these regions behave would ascertain the reasons for such behaviours. Research studies might also compare the four regional types, noting which variables generate greater or lesser impacts on these regions before proposing different measures for boosting the development of innovation and the economies of these regions.

CHAPTER 4 - Does Regional VRIO Model Help Policy-Makers to Assess the Resources of a Region? A Stakeholder Perception Approach

Abstract

This study aims at assessing stakeholder perceptions regarding the suitability of smart/intelligent specialisation strategies defined for their framework regions. We adopted a quantitative methodology through questionnaire surveys of the different stakeholders in Portuguese regions in keeping with the VRIO model applied to the regions. The study results emphasise that stakeholder perceptions of the appropriateness of the smart specialisation strategies defined for their framework regions does not coincide with the intelligent specialisation strategies defined by their policy makers. This study attempts to contribute to an innovative framework which helps policy-makers assessing and measuring the regional performance. The study furthermore proposes measures to bridge the gaps found in the regional smart specialisation strategies.

Keywords

VRIO, Resource-Based View, RIS3, Smart Specialisation, Regional Development

4.1. Introduction

Smart specialisation has begun to play an increasingly core role in the reforms of the European Union (EU) Cohesion Policy and has served to break the regional investment paradigms that the EU had held in the past. Given the gravity of the financial crisis that first took effect in 2008, the EU accelerated debates around smart specialisation and its eight constituent concepts and key stages: (1) knowledge about the economic and innovation ecosystem; (2) business discovery

(involving the private sector); (3) specialisation in specific technological sectors; (4) an interlinking strategy for diversification so as to guarantee a sustainable economic environment; (5) openness to other European regions; (6) definition of an action and budget plan; (7) establishing the coordination of the ecosystem for sustainable innovation; and (8) implementing a monitoring and evaluation system (Peltier, 2015). Thus, in 2009, the EU founded a consultative body to study smart specialisation, which produced its first conclusions in 2011 before presenting its official report in 2012 (Guide to research and innovation strategies for smart specialisation (RIS3)).

The Research and Innovation Strategies for Smart Specialisation (RIS3) requires a diagnosis process of territorial level innovation. It is thus important for regions to analyse the diverse indicators so as to be able to aid in regional economic development and innovation. The characteristics and traditions of the regions also need taking into consideration in the definition of the domains for smart specialisation (Camagni, Capello, & Caragliu, 2013). Therefore, developing an RIS3 strategy requires approaching as an activity structured by its process (Muller et al., 2017; Woronowicz et al., 2017).

The focus of most literature on measuring the international competitiveness of firms in a country or region (eg, Buckley et al. 1990, Coviello et al. 1998, Doyle & Wong 1998, Özçelik & Taymaz 2004, Tiits et al. 2015, Silva 1996), which ignores the specific features and resources of regions, represents an identifiable gap. To what extent is the network structure of companies influenced by the regional environment in which they are located? In order to bridge these inefficiencies, regions and their policy-makers have to increase their competitiveness, based on the characteristics and resources of regions, with innovation advanced by adapting a business model to the regions. To that end, we deployed the resource-based view (RBV) approach as the main framework for the identification of competitive strategies and public policies implemented in countries/regions (Mudambi & Puck, 2016).

Thus, the goal of this research is to adapt the model “Value, Rarity, Imitability and implemented in the Organization” (VRIO) to regions from the perception that stakeholders have of RIS3 in the Portuguese regions. This model was originally designed for the context of organizations. The theoretical approach followed in this research proposes an alternative view, according to which strategies must be formulated from the internal resources and capabilities (of each region). Other works have also adapted organizational indicators to regions and territories (Ioppolo, Saija, & Salomone, 2012).

The study structure is as follows. After this introductory section, section 2 is reviewed with regard to the RIS3 intelligent specialisation, the RBV approach and the VRIO model. Section 3 describes the methodology applied, explaining the data collection process, the units of analysis and how we adapted the VRIO model to these regions. Section 4 presents the results and their discussion before finally presenting the conclusions, study limitations and future research lines.

4.2. Literature Review

4.2.1. Smart specialization and RIS3

The European Commission developed smart specialisation through appointing a group of academics to provide policymakers with a rationale for innovation policies. Smart specialisation includes innovation policies tailored to each region in particular. These policies derive from the capabilities and potentials of the different regions (Foray, David, & Hall, 2009a). Smart specialisation focuses on the idea that regions should focus their investment in knowledge on previously defined areas of expertise. The regional government thus has a key role to play in the strategy of smart specialisation and should therefore carry out a rigorous self-assessment of the knowledge assets, skills and competences of each region, and the main players, among them the knowledge transfers ongoing (Benner, 2014).

RIS3 is the most recent version of the proposed EU Cohesion Policy reform for the period 2014-2020 (Kotnik & Petrin, 2017). The Strategy for Europe 2020 defines and measures the concept of smart growth, according to the established conceptual frameworks, i.e. about the role of technological evolution, human capital, and knowledge for economic growth and regional convergence (Jaffe, 1989; Rauch, 1993). Although RIS3 is a strategy designed and implemented initially for the EU, other countries have already applied it, Mexico for example (Solleiro & Castañón, 2016).

RIS3 intends to identify knowledge in selective "domains", as well as priorities, in areas where the region (or a Member State) has a relative advantage (Foray, 2014); which may give rise to a competitive advantage. Some authors (Camagni & Capello, 2013; Muller et al., 2017) indicate that RIS3 consists of investing in knowledge and human capital, industrial and technological capital, and in territorial competences. Thus, RIS3 highlights the role of knowledge, technology and innovation for economic development and social well-being (Radosevic & Stancova, 2018; Tiits, Kalvet, & Murk, 2015).

Question 1: Are the RIS3 domains selected creators of sustainable competitive advantage for regions?

Question 2: Are there significant differences in stakeholder perceptions about RIS3 domains, between insular regions and continental regions?

The implementation of RIS3 therefore expects most developed economy R&D systems are able to invest in the creation of new intensive activities with a strong science component. On the other hand, less developed economies should orient their R&D to areas where they already have an industry in place (Foray et al., 2009). In the literature, there are already theoretical models proposed to foster less developed economies (eg. Lopes & Franco, 2017, Virkkala et al., 2017, Peris-Ortiz et al., 2016, Lopes & Farinha, 2018), although many of these models still need testing in practice.

4.2.2. Performance monitoring systems as applied to regions

Nowadays, regional policy increasingly perceives business networks and cooperation as key to success in this field (Semlinger, 2008). Correspondingly, R&D cooperation networks, when appropriately applied to real contexts, serve to create and develop technological projects that impact positively on competitiveness (Farinha & Ferreira, 2016).

Some performance monitoring system are already in effect. However, these systems, in the majority, make recourse to the balanced scorecard (BSC) method. The literature conveys certain different examples of such performance monitoring systems (collaborative BSC, territorial BSC and the regional helix scoreboard).

Al-Ashaab, Flores, Doultsinou, and Magyar (2011) proposed collaborative BSC as a tool for measuring, sampling and improving the impact of collaborative projects between industry and university. This model enables companies to carry out the evaluation of their open innovation models.

In turn, territorial BSC represents a strategic tool developed for the regional public sector for the measurement of the competitive potential of a territorial system through means of a classification. The territorial BSC enables the interpretation of the characteristics of the territory's supply through applying an ad-hoc approach and planning the increases necessary to the functions engaged in by the regional public sector and the competences thereby associated. The territorial BSC returns profit oriented indicators so as to highlight the strategic and economic benefits associated with the heritage assets interlinking with competitiveness. This strategic tool also enables the restructuring of local economic systems (Ioppolo et al., 2012).

The regional helix scoreboard arose out of the objective of measuring the dynamic interactions ongoing in the triple/quadruple helix. The regional helix scoreboard adopts the innovation and entrepreneurship related initiatives as the pillars of regional competitiveness (Farinha & Ferreira, 2016).

As we verified above, despite the models existing for measuring regional performance, there is no model taking into account the resources and capacities of each region. Hence, adapting the Resource-Based View (RBV) and the "Value, Rarity, Imitability and implemented in the Organization" (VRIO) model to regions might serve to overcome this gap.

4.2.3. The resource-based view and VRIO framework

Resource-Based View (RBV) theory emerged out of the objective of developing tools to study the positioning of companies associated with their resources and capabilities. Resources and capabilities are essential aspects of strategic development playing a perceivable role in the relationship between resources, capabilities, competitive advantages and performance (Grant, 1991; Wernerfelt, 1984).

RBV explains the competitive disadvantages of companies, their competitive parities, temporary competitive advantages and sustained competitive advantages (Barney, 2014). Thus, a company creates economic value when revenues created by the use of its resources and capabilities are greater than the cost of acquiring or developing those resources and capabilities and the cost of their application. Organizations that fail to create value with their resources and capabilities rank as having a competitive disadvantage. An organization creates competitive advantage when it generates more economic value than at least some of its competitors (Peteraf & Barney, 2003). This competitive advantage may be either temporary or sustained.

Temporary competitive advantages exist when organizations without the necessary resources can obtain or develop them without disadvantages in relation to companies that already have them. Correspondingly, sustained competitive advantages reflect the situation when competing companies, to acquire the necessary resources, have to incur higher costs. Sustained competitive advantages are not infinite because, for example, changes in technology or consumer preferences can not only reduce the value of those capabilities but also disseminate and spread the capacity to acquire them (Barney & Mackey, 2016).

According to RBV, the theoretical and practical importance of identifying the value of an organization's resources and capabilities obliges managers to accurately identify the value of each of their resources and capabilities. A resource being valuable to an organization at any given time does not mean that the resource is always valuable. This correspondingly also maintains that just because a resource holds no value at a particular given moment does not mean that it cannot attain value in the future (Barney & Mackey, 2016). In short, this conveys how the value of a resource changes over time.

The RBV theory does not attempt to provide a general theory of value creation, that is, it cannot be considered a theory that specifies which resources create value and which resources do not create value, regardless of contexts. However, RVB can provide practical and critical guidance to researchers and managers to understand whether a given resource, in a context, really does or does not create economic value (Barney & Mackey, 2016).

From this perspective, organizations can be observed as a collection of productive resources, identifying the basis for creating competitive advantages (Backman, Verbeke, & Schulz, 2017; Barney, 1991; Dubey et al., 2018), as well as value for the company and the creation of barriers to new firms that might compete as competitors (Ayuso & Navarrete-Báez, 2018; Grant, 1991; Wernerfelt, 1984).

The VRIO model serves as a means of applying RBV. This model is made up of four dimensions of relevance to resources achieving real sustainable advantages: “Value, Rarity, Imitation and Implementation in the Organization” (Barney & Hesterly, 2007; Barney & Wright, 1998). The VRIO model emphasises the question of value as this arises in the first place (Barney, 1986, 1996) before then approaching the types of impact that a resource or capability must have to

create value. The choice and prioritization of resources and capabilities make all the difference to the results of organizations. Choosing and implementing strategies should increase a company's net revenue, or lower net costs. If a firm's capabilities or capabilities do not have these effects, they cannot be a source of competitive parity (Barney & Mackey, 2016).

In applying the VRIO model, after defining a resource as “valuable”, the next question deals with its “rarity”. Subsequently, the focuses to the “inimitability” of this feature by comparing it with the competitors. When a resource is identified as “rare,” then the resource becomes a source of “temporary competitive advantage.” When the resource is not “rare”, it becomes a source of “competitive parity”. Resources considered “rare” receive a greater weighting as regards the issue of “inimitability” in terms of defining the likely duration of competitive advantages. High-cost resources that competitors buy or replace represent sources of “sustained competitive advantage” (Barney & Mackey, 2016).

These dimensions, in addition to creating advantages for organisational strategy, cannot be replicated in different contexts. The VRIO model acts in the identification of internal organizational strengths and weaknesses and takes into account the potential that each resource or capability has in order to improve the organization's competitive position (Barney, 1991; Barney & Hesterly, 2007; Wernerfelt, 1984).

In this context, most of the dimensions indicated above are applicable to regions. The regions have particular domains of specialisation, unique characteristics, differentiated human resources and different infrastructures.

Question 3: How to apply the VRIO Model to regions?

From these questions, an extensive and detailed research was developed in order to obtain the best way of doing so.

4.3. Methodology

4.3.1. Research design

The approach taken by this research is quantitative in nature. With this quantitative approach, the numerical values are produced by counting, measuring or verifying, thus allowing the discovery, verification or identification of symmetrical (or not symmetrical) concepts derived from a theoretical framework developed according to the criteria that govern each of the situations under study (Sanchez-Algarra & Anguera, 2013).

We define the seven Portugal regions (North region, Lisbon region, Central region, Alentejo region, Algarve region, Madeira region, Azores region) as our unit of analysis. The current research is a pilot study and thus exploratory in nature. In this sense, and having verified the

RIS3 for each region, we concluded that seven questionnaires (one for each region) needed to be developed. We then pre-validated the questionnaires and sent them electronically to the stakeholders of each region (municipalities, incubators, technology parks, higher education institutions (HEIs) and companies).

We then collected answers during the period from May 2017 to May 2018, obtaining a total of 535 validated answers for the seven regions. The respective response rates feature in table 4.1.

Table 4.1 – Response rate

Region	**No. Stakeholders invited to respond**	**No. of Stakeholders who did not respond**	**No. responses**	**Response rate**
North region	336	278	58	17.28%
Lisbon region	280	208	72	25.71%
Central region	952	802	150	15.76%
Alentejo region	336	248	88	26.19%
Algarve region	448	347	101	22.54%
Madeira region	336	305	31	9.22%
Azores region	616	581	35	5.66%
Total	**3304**	**2769**	**535**	-

4.3.2. Applying the VRIO model to regions

According to the literature review, the VRIO model (Barney, 1991) was designed and tested for an organizational context. However, it remains relevant and innovative to adapt and apply the VRIO Model to regions (Table 4.2 and Figure 4.1).

Table 4.2- Regional VRIO

Valuable?	Rare?	Costly to imitate?	Exploited in the region?	Competitive implications	UCA Score or SCA	Performance	SWOT Category
No	-	-		Competitive Disadvantage	>3.0	Below Normal	Weakness
Yes	No	-		Competitive Parity	>3.0	Normal	Strength or Weakness
Yes	Yes	No		Temporary Competitive Advantage	>3.0	Above Normal	Distinctive Strength and Competence
Yes	Yes	Yes	No	Unused Competitive Advantage	>3.0	Above Normal	Distinctive Strength and Competence
Yes	Yes	Yes	Yes	Sustainable Competitive Advantage	>3.0	Above Normal	Strength and Distinctive Competence Long-term

UCA: Unused Competitive Advantage; SCA: Sustainable Competitive Advantage
Source: Adapted from Barney (1991)

The original model studies the performance of resources and capabilities at the internal level of an organization, from the perspectives of "Valuable", "Rarity", "Costly to imitate" and "Exploited in the organization". With our adaptation of the model to the regions (by analysing the perceptions of stakeholders), the evaluation process remains unchanged, however what we seek to ascertains here involves whether a region effectively exploits a given resource or capability rather than approaching the context of a particular organization. This concept is also applicable to a city or even a country.

Analysing the application of a questionnaire addressed to stakeholders, based on a panel of resources and capabilities, through the application of a 5-point Likert scale concordance (Croasmun & Ostrom, 2011), validation achieved for each resource or capability (with an average of over three), the region reaches the Unused Competitive Advantage (UCA) or Sustained Competitive Advantage (SCA) position for that resource or capability, making it possible to compute the respective scores and their comparison with other regions (Figure 4.1).

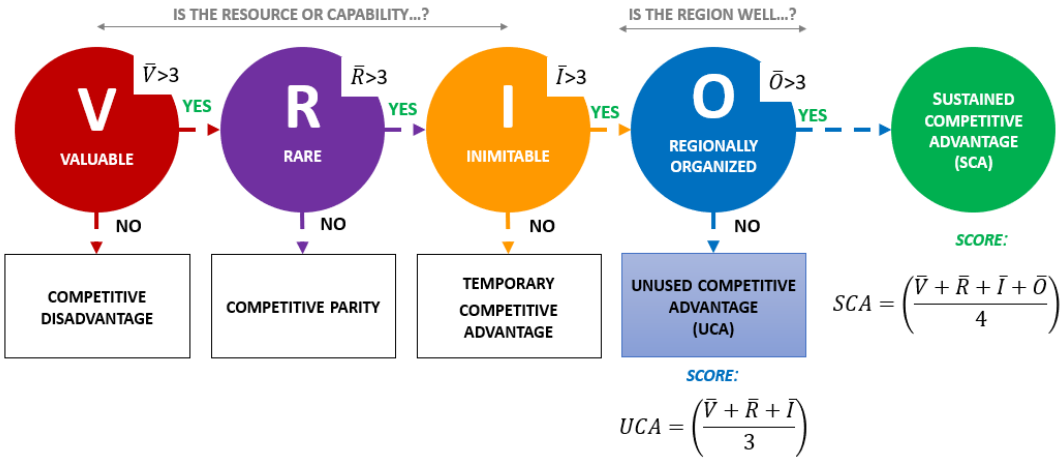

Figure 4.1 - Regional VRIO - Source: Adapted from Barney (1991)

The RIS3 defined by the respective regions of Portugal (North region, Lisbon region, Central region, Alentejo region, Algarve region, Madeira region, Azores region) served to identify the resources and capabilities. For all questions, we deployed a 5-point Likert scale, adapted to each question, where 1 corresponds to "no value" or "no rarity" or "easy to imitate" or "nothing exploited by the region" and 5 to "total value" or "total rarity" or "hard to imitate" or "fully exploited by the region". The value of more than 3 ranked as "yes". VRIO is an initialism for the four-question framework to survey a resource or capability and determine its competitive potential: the questions of Value, Rarity, Imitability (Ease/Difficulty to Imitate), and Region (ability to exploit the resource or capability). The Unused Competitive Advantage Score (UCA) allows for measuring the temporary competitive advantage of a region and make comparisons with other regions. In any case, this does not amount to a sustained competitive advantage. When there is a regionally organized competitive advantage, the Sustained Competitive Advantage Score (SCA) score allows us to measure the level of permanent competitiveness of a given region, also comparable to other regions. The UCA score, the SCA score and the "RIS" score thus aid in the interpretation of the results. The calculation of the "RIS" score results from adding the mean values of the responses collected for "Valuable", "Rare", "Costly to imitate" and "Exploited in the region". In this way, we are able to obtain another indication in which the minimum is zero and the maximum 20. Thus, we are able to operationalise the Regional VRIO.

4.3.3. RIS3 Portugal

In order to define the smart specialisation strategy for the North region, we identified distinctive characteristics alongside the existing and emerging potential for achieving international competitiveness (CCDRN, 2014). We carried out an evaluation of the critical scientific mass of the region, its core business structure and the existence and potential for interactions with advanced users. From this evaluation there came the identification of eight

priority domains (table 4.3), then subject to discussion, improvement and validation by regional actors (CCDRN, 2014).

The Lisbon region takes on an important position at the strategic level in addition to its role as the national capital and assuming a central economic role. The region concentrates a significant proportion of the national resources in terms of production, innovation and research and is the Portuguese region with the greatest capacity within the global economic framework. The region attracts investment and hosts qualified resources and thus needs to act as the driver of the integrated development of Portugal (CCDR_LVT, 2014). This process led to the identification of six priority domains for smart specialisation in the Lisbon region (table 4.3).

Based on analysis of the specific characteristics of the Central region, both as regards its capacity to produce knowledge and for the creation of economic value and regional experiences of successive cycles of innovation policy, eight differentiating fields were subject to discussion and received a consensus for the Central region (table 4.3) within the RIS3 context (CCDRC, 2014).

There were five differentiating domains identified for the Alentejo region (table 4.3). Innovation or inclusion within the scope of globalisation interact with the regional potential of the scientific and technological systems, having also received support from the results of a survey of the potential of this scientific and technological system (CCDR_Alentejo, 2014).

The Algarve region produced six differentiating domains (table 4.3). The region is specialist or registers greater dynamics of growth and innovation in these fields that interlink with the potential of the regional scientific and technological system. These domains also gained the backing of the survey carried out of the regional scientific and technological system (CCDR_Algarve, 2015).

In terms of Madeira region, we identified six fields of smart specialisation. These results received almost consensual backing both by the results and by the statistical data available that portray the six dynamics prevailing in the region, including endogenous resources that make sense to value within the context of the RIS3 strategy (ARDITI, 2014) (table 4.3).

The Azores returned a total of three smart specialisation domains. The identification of the regional priorities stemmed from the preliminary definition of broad reaching thematic areas, selected in accordance with aspects such as the assets existing, the regional political priorities and the potential reach of these sectors in terms of economic development and the generation of employment in the Azores Region (GRRAA, 2014) (Table 4.3).

Table 4.3 – Domains of Smart Specialisation

Region	Smart Specialisation Domains
North region	Sea resources and the economy
	Human capital and specialised services
	Culture, creation and fashion
	Mobility and environment industries
	Agro-environment and foodstuff systems
	Life and health sciences
	Symbolic technological capital and tourism services
	Advanced production systems
Lisbon region	Tourism and hospitality
	Mobility and transports
	Creative means and cultural industries
	Health research, technologies and social services
	Prospecting and valuing marine resources
	Advanced company services
Central region	Agriculture
	Forestry
	Sea
	Tourism
	ITCE (information technology, communications and electronics)
	Materials
	Biotechnology
	Health and wellbeing
Alentejo region	Foodstuffs and Forestry
	Economy and Mineral, Natural and Environmental Resources
	Heritage, Cultural and Creative Industries and Tourism Services
	Critical Technologies, Energy and Smart Mobility
	Social Economy Technologies and Specialist Services
Algarve region	Tourism
	Sea
	Agro-food / Agro-industrial
	ICTs (information and communication technologies) and Creative Activities
	Renewable Energies
	Health Activities and Live Sciences
Madeira region	Bio-sustainability
	Energy, mobility and climate change
	Agro-food quality
	Health and wellbeing
	Sustainability, maintenance and management of infrastructures
	ICTs
	Tourism, Resources and Sea Technologies
Azores region	Agriculture, Livestock and Agro-industry
	Fishing and Sea
	Tourism

Source: Adapted from ARDITI (2014), CCDR_Algarve (2015), CCDR_LVT (2014), CCDRC (2014), CCDRN (2014), GRRAA (2014), CCDR_Alentejo (2014)

4.4. Results and Discussion

In order to interpret the results obtained, both figure 4.1 and table 4.2 are extremely important. We produced a table for each region under analysis. Table 4.4 displays the results returned for the North region.

Table 4.4 - North region results

Regional Perception					Regional Competitiveness					Score		
Resources and capabilities	Valuable	Rare	Costly to imitate	Exploited in the region	Competitive Disadvantage	Competitive Parity	Temporary Competitive Advantage	Unused Competitive Advantage	Sustainable Competitive Advantage	UCA Score	SCA Score	RIS Score
Sea and Economy	4.09	3.26	3.76	2.41	No	No	No	Yes		3.70		13.52
Human Capital and Specialised Services	3.84	3.19	3.43	2.84	No	No	No	Yes		3.49		13.30
Culture, Creation and Fashion	3.97	3.26	3.40	3.16	No	No	No	No	Yes		3.45	13.79
Mobility and Environment Industries	3.67	3.22	3.10	2.69	No	No	No	Yes		3.33		12.68
Agri-environmental systems and food	3.98	3.19	3.34	3.12	No	No	No	No	Yes		3.41	13.63
Life Sciences and Health	4.03	3.28	3.31	2.90	No	No	No	Yes		3.54		13.52
Symbolic Capital Technologies and Tourism Services	4.02	3.16	3.33	3.14	No	No	No	No	Yes		3.41	13.65
Advanced Production Systems	3.72	3.09	3.22	2.59	No	No	No	Yes		3.34		12.62

As table 4.4 shows, not all resources and capacities are capable of classification as able to generate “Sustainable Competitive Advantages”.

Sea and Economy, Human Capital and Specialized Services, Mobility and Environment Industries, Life Sciences and Health, Advanced Production Systems rank as “unused competitive advantages”. In turn, the performance ranking is “above normal” and in the SWOT category of “distinctive strength and competence”. In analysing the “UCA Score”, we find that there are resources and capacities that are closer to becoming “sustainable competitive advantages”; Sea and Economy (3.70) and Life Sciences and Health (3.54).

The Culture, Creation and Fashion, Agri-environmental Systems and Food, Symbolic Capital Technologies and Tourism Services do rank among the resources and capacities considered as a “sustainable competitive advantage”. Thus, these resources and capacities fall within the performance framework category of “above normal” and in the SWOT category of “strength and distinctive competence long-term”. Analysing the “SCA Score” of these three resources and capacities returns no significant differences in the results.

Analysing the “RIS Score” reports how all resources and capacities return scores of above 10. However, there is no resource and capacity that displays statistically significant differences when subject to comparison.

According to the results generated by the regional stakeholders, the North region plays host to the largest number of sustainable competitive advantages (table 4.4).

Smart specialisation is a fundamental concept that underpins the Europe 2020 strategy. This specialisation stems from local policies able to foster economic transformation and innovative activities in selected areas of the socioeconomic system. The involvement of stakeholders and local actors lies at the foundation of RIS3 as the means to guarantee that development priorities align regionally and therefore receive a local consensus (Rinaldi, Cavicchi, Spigarelli, Lacche, & Rubens, 2018). However, the North region defined eight smart specialisation domains, which may therefore disperse the resources and capacities available to the region. Hence, these results suggest the allocation of some resources to the Mobility and Environment Industries (UCA Score = 3.33), Advanced Production Systems (UCA Score = 3.34), to the resources and capacities invested in Sea and Economy, Human Capital and Specialized Services, Life Sciences and Health, so that they may attain the capacity to generate sustainable competitive advantages.

We below present the results for the Lisbon region (table 4.5).

Table 4.5 - Lisbon region results

Regional Perception					Regional Competitiveness					Score		
Resources and capabilities	Valuable	Rare	Costly to imitate	Exploited in the region	Competitive Disadvantage	Competitive Parity	Temporary Competitive Advantage	Unused Competitive Advantage	Sustainable Competitive Advantage	UCA Score	SCA Score	RIS Score
Tourism and Hospitality	4.04	2.90	3.22	3.50	No	Yes						13.66
Mobility and Transport	3.67	2.69	2.57	2.86	No	Yes						11.79
Creative Media and Cultural Industries	3.58	2.99	3.15	3.07	No	Yes						12.79
Research, Technologies and Services Health	3.61	2.74	2.89	2.71	No	Yes						11.95
Prospecting and Enhancement of Marine Resources	3.44	3.01	3.14	2.63	No	No	No	Yes		3.20		12.22
Advanced Business Services	3.39	2.92	2.78	2.85	No	Yes						11.94

As detailed in table 4.5, no resource and capability attains the classification of “sustainable competitive advantage”. Nevertheless, five of the six resources and capacities ranks as “competitive parity” (Tourism and Hospitality, Mobility and Transport, Creative Media and Cultural Industries, Research, Technologies and Services Health, and Advanced Business Services). Thus, the evaluation of the performance of these resources and capacities considers them “normal” and in the SWOT category of “strength or weakness”.

The Prospecting and Enhancement of Marine Resources represents the only resource capacity to emerge as an “unused competitive advantage”. Therefore, the performance stands at “above normal” and classified by the SWOT category of “distinctive strength and competence”. This resource and capacity returns a “UCA Score” of 3.20 and may turn into a “Sustainable Competitive Advantage” in the short term.

Following analysis of the “RIS Score”, we may state that all resources and capacities rank above 10 (with a minimum of zero and a maximum of 20). Tourism and Hospitality is the resource and capacity that best performs according to this indicator (13.66). Thus, we may also state that despite Tourism and Hospitality not ranking as a “Sustainable Competitive Advantage”, this nevertheless holds great relevance to the region.

The Lisbon region stands in opposition to the North region. Not one of its six resources and capacities rank as having become a sustainable competitive advantage. The results suggest the allocation of the majority of resources in this region to Prospecting and Enhancement of Marine Resources as this is the resource with capacities that most closely border upon becoming a sustainable competitive advantage (UCA Score = 3.20). Regarding the other five domains, stakeholder perceptions maintain that these are not rare. Therefore, strategies able to differentiate these resources need defining and implementing. Currently, there is a trend towards regional differentiation strengthening through geographic protection. The location may, for example, convey a series of benefits, such as proposing a clear and attractive regional brand (Silva, Monico, Porfirio, & Almeida, 2014). As an alternative to the strategies that differentiate these resources, we may identify new and differentiating resources and capacities as regards competitiveness and correspondingly channelling investment into such areas.

Table 4.6 displays the results for the Central region.

Table 4.6 - Central region results

Regional Perception					Regional Competitiveness					Score		
Resources and capabilities	Valuable	Rare	Costly to imitate	Exploited in the region	Competitive Disadvantage	Competitive Parity	Temporary Competitive Advantage	Unused Competitive Advantage	Sustainable Competitive Advantage	UCA Score	SCA Score	RIS Score
Agriculture	3.99	2.81	2.83	2.89	No	Yes						12.52
Forest	4.19	2.85	3.04	2.92	No	Yes						13.00
Sea	3.77	2.74	3.22	2.20	No	Yes						11.93
Tourism	4.29	2.88	3.04	3.02	No	Yes						13.23
ITCE	3.94	2.64	2.77	2.71	No	Yes						12.06
Materials	3.27	2.71	2.86	2.73	No	Yes						11.57
Biotechnology	3.42	3.07	3.23	2.10	No	No	No	Yes		3.24		11.82
Health and wellness	4.30	3.24	3.29	3.05	No	No	No	No	Yes		3.47	13.88

Through table 4.6, we grasp how only one resource and capacity attains the "sustainable competitive advantage" classification. Nevertheless, there are also the six out of the eight resources and capacities that stakeholders consider as holding "competitive parity" (Agriculture, Forest, Sea, Tourism, ITCE, and Materials). Hence, these six resources and capacities in terms of performance rank as "normal" and within the scope of the SWOT "strength or weakness" category.

The Biotechnology resource and capacity emerged as an "unused competitive advantage". Therefore, its performance stands out as "above normal" and falling into the SWOT category of "distinctive strength and competence". This resource and capacity returns a "UCA Score" of 3.24. With some focused investment, this resource and capacity might in the short term come to classify as a "Sustainable Competitive Advantage".

The Health and wellness resource and capacity was the only factor ranked by stakeholders as a "Sustainable Competitive Advantage". This attained an "SCA Score" of 3.47. Hence, in terms of performance, Health and wellness ranks in the category of "above normal" and in the SWOT "strength and distinctive competence long-term" category.

Analysing the "RIS Scores", we find that all resources and capacities achieve scores of above 10. The resource and capacity with the highest "RIS Score" is Health and wellness (13.88), trailed by Tourism (13.23). Hence, the "RIS Scores" serve to reinforce the results detailed above and maintaining how Health and wellness does rank as a "Sustainable Competitive Advantage". Tourism, despite not attaining this level, ranks in second place for the Central region "RIS Scores". Correspondingly, the results obtained convey how this resource and capacity holds an important social and economic impact on the region.

As regards Central region, this displays problems identical to those of Lisbon. Of the eight resources and capacities defined, five do not class as rare (Agriculture, Forest, Sea, Tourism, ITCE, Materials). The results furthermore indicate how these resources require the definition of strategies for their differentiation. Political decision makers might also allocate some resources from these five resources and capacities to Biotechnology (UCA Score = 3.24). Biotechnology stands out as the area closest to turning into a sustainable competitive advantage. A reduction in the number of resources and capacities might also provide a feasible solution. The region might not host sufficient resources to maintain an RIS3 strategy for eight fields of smart specialisation. The combination of good ideas with pragmatic stages of implementation is, as a rule, a formula for success in appropriately designing policies and ensuring their efficient and effective implementation (McCann & Ortega-Argilés, 2014b). Furthermore, this region already contains the Health and wellness resource and capacity (SCA Score = 3.47) as a sustainable competitive advantage.

We now move onto the results returned by the Alentejo region (table 4.7).

Table 4.7 - Alentejo region results

Regional Perception					Regional Competitiveness					Score		
Resources and capabilities	Valuable	Rare	Costly to imitate	Exploited in the region	Competitive Disadvantage	Competitive Parity	Temporary Competitive Advantage	Unused Competitive Advantage	Sustainable Competitive Advantage	UCA Score	SCA Score	RIS Score
Food and Forest	4.15	3.34	3.68	3.05	No	No	No	No	Yes		3.56	14.22
Mineral, Natural and Environmental Resources	3.83	3.42	3.53	2.99	No	No	No	Yes		3.59		13.77
Heritage, Cultural and Creative Industries and Tourism Services	3.97	3.40	3.52	2.93	No	No	No	Yes		3.63		13.82
Critical Technologies, Energy and Intelligent Mobility	3.27	2.91	2.89	2.16	No	Yes						11.23
Specialized Technologies and Services of the Social Economy	3.48	2.89	2.74	2.74	No	Yes						11.85

Table 4.7 set out how only one resource and capacity classifies as a "sustainable competitive advantage". Furthermore, stakeholders rank two of the five resources and capacities as holding "competitive parity" (Critical Technologies, Energy and Intelligent Mobility; Specialized Technologies and Social Economy Services). Correspondingly, these two resources and capacities return "normal" performances and enter the SWOT category of "strength or weakness".

The evaluation of the Mineral, Natural and Environmental Resources and Heritage, Cultural and Creative Industries and Tourism Services resources and capacities, in terms of their competitiveness, came out as "unused competitive advantages". Therefore, there is an "above normal" level of performance that falls into the SWOT category of "distinctive strength and competence". These resources and capacities return "UCA Scores" of 3.59 (Mineral, Natural and Environmental Resources) and 3.63 (Heritage, Cultural and Creative Industries and Tourism Services) with these values indicating that they are verging on becoming "Sustainable Competitive Advantages".

Thus, stakeholders identified only the Food and Forest resource and capacity as holding "Sustainable Competitive Advantage". This resource and capacity received a "SCA Score" of 3.56 and thereby registering the Food and Forest performance in the "above normal" category and in the SWOT "strength and distinctive competence long-term" category.

In turn, the respective "RIS Scores" identify how all these resources and capacities rank above 10. The resources and capacities generating the highest "RIS Scores" are: Food and Forest (14.22), Heritage, Cultural and Creative Industries and Tourism Services (13.82) and Mineral, Natural and Environmental Resources (13.77). These "RIS Scores" further identify the results reported above with Food and Forest emerging as a "Sustainable Competitive Advantage" all the while Cultural and Creative Industries and Tourism Services and Mineral, Natural and Environmental Resources remain "unused competitive advantages".

As regards the case of the Alentejo region, the results indicate that the resources allocated to the Specialized Technologies and Services of the Social Economy and Critical Technologies, Energy and Intelligent Mobility resources and capacities be reinvested in Mineral, Natural and Environmental Resources (UCA Score = 3.59) and Heritage, Cultural and Creative Industries and Tourism Services (UCA Score = 3.63). The Mineral, Natural and Environmental Resources and Heritage, Cultural and Creative Industries and Tourism Services resources and capacities are correspondingly those closest to attaining sustainable competitive advantage status. The RIS3 strategy requires consideration as a continuous learning exercise in which the stakeholders seek to forge new paths for their organisations in support of the transformation of local economies. The RIS3 regional process, based on the activities prevailing in the regions, fosters a positive learning ambience through means of action. Hence, deepening the understanding of the regional economy, grasping the role of innovation in economic development and with certain new combinations with the potential for innovation may then take place. However, in order to

attain the results expected, there is a need to gather sufficient resources (Healy, 2016). Despite that previously proposed for the Alentejo region, the Food and Forest (SCA Score = 3.56) resource and capacity represents the only sector able to return sustainable competitive advantage.

Table 4.8 sets out the results for the Algarve region.

Table 4.8 - Algarve region results

Regional Perception					Regional Competitiveness					Score		
Resources and capabilities	Valuable	Rare	Costly to imitate	Exploited in the region	Competitive Disadvantage	Competitive Parity	Temporary Competitive Advantage	Unused Competitive Advantage	Sustainable Competitive Advantage	UCA Score	SCA Score	RIS Score
Tourism	4.50	2.58	2.95	3.70	No	Yes						13.73
Sea	4.62	3.33	3.93	3.37	No	No	No	No	Yes		3.81	15.25
Agro-Food/Agribusiness	3.49	2.98	2.91	2.54	No	Yes						11.92
ICT	3.82	2.99	2.79	2.54	No	Yes						12.14
Renewable energy	4.12	3.17	2.98	2.62	No	No	Yes					12.89
Health Activities and Life Sciences	3.86	3.06	3.00	2.64	No	No	Yes					12.56

Table 4.8 reports how the Algarve region contains only a single resource and capacity that returns a "sustainable competitive advantage". Correspondingly, stakeholders perceive three of the six resources and capacities as holding "competitive parity" (Tourism, Agro-Food/Agribusiness, ICT) with the three resources and capacities turning in performances deemed "normal" and falling into the SWOT category of "strength or weakness".

In terms of their competitiveness, the Renewable Energy and Health Activities and Life Sciences resources and capacities rank as "Temporary Competitive Advantages". In relation to their performance, they stand out as "above normal" and fall into the SWOT category of "distinctive strength and competence".

The stakeholders only considered the Sea resource and capacity as returning any "Sustainable Competitive Advantage". Within this scope, this resource and capacity turns in a performance in the "above normal" category and in the SWOT category of strength and distinctive competence long-term". The "SCA Score" results clearly reflect how the Sea constitutes the category with the greatest relevance to the Algarve region according to the perceptions of stakeholders (3.81).

In terms of their "RIS Scores", all resources and capacities return results of above 10. The resource and capacity with the highest "RIS Score" is the Sea (15.25), which serves to reinforce the findings stated above. Subsequently comes Tourism (13.73) which, despite not ranking as a "Sustainable Competitive Advantage", is nevertheless a resource and capacity of relevance to the regional social and economic performance.

In the Algarve region, three of the six resources and capacities defined present problems over rarity (Tourism, Agro-Food/Agribusiness, and ICT). The results suggest that this needs the application of strategies able to ensure differentiation. With Tourism one of the resources and capacities that the Algarve region best explores, stakeholders do not rank it as a factor for generating sustainable competitive advantage. This might derive from how, across the south of Europe, economic development has been especially dependent on service industries such as tourism (Vaz, Nainggolan, Nijkamp, & Painho, 2011). This may represent one motive for stakeholders not classifying tourism in the Algarve as rare. However, two of the six resources (Renewable energy and Health Activities and Life Sciences) classify as temporary competitive advantages. Within this scope, these two resources reflect those most closely verging on becoming a sustainable competitive advantage. In order to facilitate these two resources more swiftly becoming generators of sustainable competitive advantage, these results advocate the allocation to these two resources and capacities, some of the resources currently attributed to Tourism, Agro-Food/Agribusiness, and ICT. We would also emphasise how stakeholders consider the resource and capacity of the Sea (SCA Score = 3.81) as the only area able to return sustainable competitive advantages.

Table 4.9 below shows the results for Madeira.

Table 4.9 - Madeira region results

Regional Perception					Regional Competitiveness					Score		
Resources and capabilities	Valuable	Rare	Costly to imitate	Exploited in the region	Competitive Disadvantage	Competitive Parity	Temporary Competitive Advantage	Unused Competitive Advantage	Sustainable Competitive Advantage	UCA Score	SCA Score	RIS Score
Tourism	4.61	3.13	3.55	4.10	No	No	No	No	Yes		3.85	15.39
Resources and Technologies of the Sea	3.90	3.42	3.32	2.87	No	No	No	Yes		3.55		13.51
Health and Wellness	3.81	3.03	3.06	2.77	No	No	No	Yes		3.30		12.67
Agro-food Quality	3.61	3.19	2.97	2.94	No	No	Yes					12.71
Sustainability, Management and Maintenance of Infrastructures	3.48	2.94	2.68	2.71	No	Yes						11.81
Bio-sustainability	3.48	3.03	3.00	2.48	No	No	Yes					11.99
Energy, Mobility and Climate Change	3.68	3.00	3.06	2.74	No	Yes						12.48

As seen from table 4.9, the findings convey how respondents do not consider all resources and capabilities as “Sustainable Competitive Advantages” in terms of regional competitiveness.

Thus, sustainability, management and maintenance of infrastructures and energy, mobility and climate change classify as holding “competitive parity”. For these two resources and capabilities, the “competitive parity” ranks as “normal” regarding performance, and falls into the SWOT category of “strength or weakness”.

Agro-food quality and bio-sustainability are considered “temporary competitive advantages”. Thus, regarding their performance, they are “above normal” and in the SWOT “distinctive strength and competence” category.

Resources and sea technologies and health and wellness emerge as “unused competitive advantage”. In this sense, as in “temporary competitive advantage”, the performance rank as “above normal” and entering the SWOT category of “distinctive strength and competence”. Analysing the "UCA Score", we may verify how the resource and capability factor closest to consideration as a “Sustainable Competitive Advantage” is Resources and Technologies of the Sea (3.55).

Tourism represents the only factor considered as a “sustainable competitive advantage”. In terms of performance, Tourism fits into the “above normal” category and the SWOT category of “strength and distinctive competence long-term” (“SCA Score”- 3.85).

Since only tourism ranked as a “sustainable competitive advantage”, we verified the “RIS Score” score. In the “RIS Score”, we should note that all resources and capabilities return results of above 10. Sustainability, management and maintenance of infrastructures reports the lowest rating (11,8). On the opposite side, there is tourism that achieves 15.39.

In the island region of Madeira, Tourism alone was considered a “sustainable competitive advantage”. Correspondingly, the Resources and Sea Technologies and Health and Wellness rank as unused competitive advantages and Agri-food Quality and Bio-sustainability emerge as temporary sustainable advantages.

Since the Madeira region defines seven areas of smart specialisation in RIS3, this recommends revising the positions taken on Sustainability, Management and Maintenance of Infrastructures and on Energy, Mobility and Climate Change be revised. For the various stakeholders, these two smart specialisations do not account for sources of differentiation able to generate competitive advantages, whether temporary or sustained, for the region. RIS3 aims to support new activities and projects at a finer granularity level (Foray, 2016).

The results of the study suggest that Madeira region should direct its resources primarily to tourism. This domain will return the most benefits within the domains identified in RIS3. Secondly, this recommends channelling resources towards the areas of Resources and Sea

Technologies and Health and Wellbeing. Finally, this includes the Agri-food Quality and Bio-sustainability fields.

Based on the results obtained, we would further recommend reviewing the position taken on Sustainability, Management and Maintenance of Infrastructures and on Energy, Mobility and Climate. The region may be mobilizing significant resources in these two areas and instead investing the resources allocated to these two domains to those of the Sea, Health and Wellbeing, Agri-food Quality and Bio-sustainability so that they return sustainable competitive advantages.

Table 4.10 presents the results for the Azores region.

Table 4.10 - Azores region results

Regional Perception					Regional Competitiveness					Score		
Resources and capabilities	Valuable	Rare	Costly to imitate	Exploited in the region	Competitive Disadvantage	Competitive Parity	Temporary Competitive Advantage	Unused Competitive Advantage	Sustainable Competitive Advantage	UCA Score	SCA Score	RIS Score
Agriculture, Livestock and Agro-industry	4.06	2.69	3.00	3.63	No	Yes						13.38
Fisheries and Sea	3.94	2.80	2.77	3.11	No	Yes						12.62
Tourism	4.14	3.23	3.40	2.94	No	No	No	Yes		3.59		13.71

As displayed in table 4.10, the Azores region reports no resource and capability considered as a “sustainable competitive advantage”.

Agriculture, Livestock and Agro-industries and Fisheries and Sea attain “competitive parity”. Thus, in terms of performance, these resources and capacities are “normal” and fall into the SWOT category of “strength or weakness”.

As regards tourism, this appears as an “unused competitive advantage”. In this sense, the performance stands out as “above normal” and ranking in the SWOT category of “distinctive strength and competence”. This resource and capability factor is that closest to classifying as a Sustainable Competitive Advantage ("UCA Score" - 3.59).

Although competitiveness is different in tourism, the differences are not significant in terms of the “RIS Score” score. Agriculture, Livestock and Agro-industries returns an “RIS Score” of 13.38, Fisheries and Sea of 12.62 and Tourism of 13.71. The three resources and capacities therefore rank above 10, i.e. in the upper half of the “RIS Score”.

For the Azores region, not one of the three RIS3 domains attained any sustainable competitive advantage. However, this did identify tourism as an “unused competitive advantage” with the other two areas holding competitive parity. For this region, the recommendation involves allocating most of its resources to tourism. Tourism is the domain closest to becoming a sustainable competitive advantage. For the other two areas, this recommend disinvestment. Alternatively, this might attempt to identify new and differentiating domains in terms of competitiveness, with investment correspondingly channelled into them.

Since the Azores region has only three RIS3 domains, this does not recommend that they specialize only in tourism. There may be two situations. The first concerns the investment potentially taking place in the region. That investment may not be enough to develop the three domains and, in this sense, may not leverage the selected domains as defined. Thus, none of the domains will generate temporary or sustainable competitiveness. In a second situation, this allocates resources only to tourism. Most of the region's resources thus get channelled only into tourism, leaving the other two domains in the background.

RIS3 raises some issues and poses some risks. When choosing and selecting some priority domains, micro-innovation systems will emerge that receive substantial support from the concentration of significant resources. Thus, prioritizing certain domains always involves a risk because it involves predicting the future development of technologies and markets (Foray, 2016).

In this sense, stakeholder perceptions maintain that the Azores region should not only focus on tourism because, should this strategy might not achieve the expected results, the region requires other alternatives. This therefore recommends that policy makers invest more resources in the Agriculture, Livestock and Agroindustry and Fisheries and Sea domains. Alternatively, the region may consider including other domains in its RIS3 and, as soon as

possible, adjust them to the region's needs. These new domains need to play their roles as differentiators and generators of competitive advantage.

Smart specialisation strategies better reflect the ability of a region's economic system to generate new development areas. They can also generate new options by discovering new domains of opportunity and local concentrations and crowding of resources and skills in these domains (Foray, 2016).

In order to deepen the results returned by this research, we opted to verify Gross Domestic Product (GDP) per capita per region (table 4.11). GDP per capita serves as an effective indicator as the greater the wealth of a region, the greater the quality of life of its population. By ascertaining GDP per capita per region, we aim to determine whether there are significant differences between the regional development prevailing between mainland Portugal and its offshore archipelagos (the Azores and Madeira).

Table 4.11 - GDP per capita

Portuguese Regions	**2016 GDP per capita (thousands of €)**
Mainland	17 990.3
Azores	15 994.9
Madeira	17 028. 6

Source: www.pordata.pt, accessed on 28 May 2018

As table 4.11 sets out, there is a higher level of GDP per capita on the mainland than on the archipelagos. The island regions display characteristics and problems very different to non-island regions. The island regions share common characteristics and encounter identical economic, environmental and social problems, the majority of which are structural in nature, over which they have no control. The characteristics that, as a rule, island regions share in common are: (i) insularity; (ii) heavy exposure to natural disasters and the effects produced by climate change; (iii) limited institutional capacities; (iv) open and poorly diversified economies; and v) difficulties in accessing external capital. With limited resources, the sustainable usage of these resources becomes correspondingly extremely important (Lopes, Farinha, & Ferreira, 2018). Thus, when the fields of smart specialisation define such characteristics, regions simply have to take them into consideration (Camagni & Capello, 2013).

The Madeira region, despite its island region status, as regards GDP per capita, remains close to the values of mainland Portugal. Thus, this indicator serves to strengthen the findings resulting from the VRIO model for the regions. The research results furthermore suggest various measures eligible for implementation (set out above). Through these measure, the GDP per capita of the Madeira region might be able to match that of mainland Portugal.

In relation to the Azores region, GDP per capita, is nevertheless some distance from the level prevailing on the mainland. Therefore, this indicator again emphasises the findings resulting from applying the VRIO regional model. This is the poorest region of Portugal and where no field of smart specialisation ranked as having attained "sustainable competitive advantage".

The stakeholder perceptions of RIS3 are clearly not the same as those of the selected policy makers or the selective group of stakeholders invited to contribute to these decisions.

There are still some open research questions that may lead to future research lines, such as: Does Madeira region justify havings seven defined RIS3 areas? What is the reason for the Azores only having three defined RIS3 domains? In order to complement the empirical evidence of this research, it would be important to assess the actual impact that each selected domain has on its respective region. In the specific case of the Azores, it is important to study other areas eligible for RIS3 consideration.

4.5. Conclusion

The present research aimed to adapt the VRIO model to the regional level. We thus formulated three research questions: *Are the RIS3 domains selected for the region creators of sustainable competitive advantage? Are there significant differences in stakeholder perceptions about the RIS3 domains between insular regions and mainland regions? How to apply the VRIO Model to regions?*

In general, all seven regions reveal problems in identifying the domains of intelligent specialisation for RIS3. The domains of intelligent specialisation, before their selection, requires a detailed and thorough diagnosis of the territorial innovation capacities. It is crucial that policy makers carefully analyse various indicators to help with economic development and innovation in their respective regions. Poor diagnosis might lead to the expected results for the regions not being reached. In order to avoid this, the characteristics and traditions of the regions require taking into account in the definition of the intelligent specialisation fields (Camagni et al., 2013). The results suggest that the regions should re-evaluate the areas of selected smart specialisation. A search for new fields of smart specialisation to replace those that are not delivering the expected results is also a hypothesis for due and crucial consideration.

The present study also reveals that the number of areas allocated to Madeira region is somewhat excessive. It will duly disperse the available resources, especially critical given that island region resources are scarcer than those of other regions (Meneses, Ribeiro, & Cristóvão, 2012) and hence the recommendation that they specialize in fewer domains. The Azores region focuses on fewer areas, but the results of the study indicate that it is pertinent for policymakers in this region to rethink the strategy outlined. Studies should target the identification of new

domains; alternatively, the strategies outlined to develop these domains need reviewing. This may also extend to implementing a combination of these two measures.

As regards the second research question, the results confirm the existence of asymmetries in the GDP per capita between the mainland and the archipelago regions. These asymmetries result from the particular characteristics and peculiar problems resulting from insularity (Lopes et al., 2018). These characteristics need taking into consideration in the selection of the domains for smart specialisation (Camagni & Capello, 2013). The Azores region returns the lowest GDP per capita at the national level and where the results would point to the necessity of reviewing the prevailing domains of smart specialisation.

As for the third research question, we developed and applied the regional VRIO model. We should remember that the VRIO model originally applied to organizational contexts (Barney & Hesterly, 2007). In this sense, we needed to adapt the model in order to enable its application to regions. The model conceived within this research is thus unique to regions. The first challenge that arose in developing this model was to identify the process of applying resources and capabilities in the regions. The solution was to use RIS3 as this is under implementation in all regions of Europe (Foray, 2016).

The current research is both pertinent and innovative. However, there is a need to apply and test the proposed model against other regions. The RIS3 perceptions held by stakeholders differ to those of political decision makers, at least in the selected group of stakeholders invited to contribute towards these decisions. This research sought to evaluate the true perceptions that stakeholders hold about each region in relation to RIS3 and thereby excluding individual and/or institutional interests.

CHAPTER 5 - Knowledge Transfer and Technology Commercialization in Regional Ecosystems

5.1. Study 1 - Peeking Beyond the Wall: Analysing University Technology Transfer and Commercialization Processes

Abstract

This paper sought to analyse the dynamics underlying university technology transfer and commercialisation mechanisms. We adopt a qualitative research methodology, which incorporates different case studies, interviews and applied research of the actors involved in universities, business incubators and start-ups. While limited to three case studies, this paper does highlight the technology transfer mechanisms and the support provided to commercialisation, including the identification of the difficulties and opportunities present within the context of cooperation networks. By surveying those running incubators and incubator company managers in conjunction with analysis of research, development and innovation (RDI) cooperative projects backed by European funding, we were able to gain insights into the different processes of transferring and commercialising technology. Falling within the framework of the third component of universities' mission, this article demonstrates not only the importance of RDI cooperation networks but also how the consequent commercialisation of new products and services generates positive consequences for economic growth.

Keywords

Knowledge and Technology Transfer, University Technology Transfer and Commercialisation, Technology Transfer Officers (TTO), Triple Helix.

5.1.1. Introduction

The transfer of scientific and technological knowledge to companies and societies now ranks as a leading issue on many political agendas (Debackere & Veugelers, 2005). University and other higher education institutions (HEIs) are today considered key actors in the regional innovation system through their 'third mission' grounded in the transfer of knowledge and technology to companies and society (Jaeger & Kopper, 2014; Predazzi, 2012; Rolfo & Finardi, 2014). Establishing wider and deeper involvement with industry and society has correspondingly become a core concern of HEIs (Carayannis, Rozakis, & Grigoroudis, 2016; Cesaroni & Piccaluga, 2016).

Over the last decade, various studies have identified not only the importance HEIs hold for the productive sector but also how companies themselves turn to such entities as sources of innovation (Ramos-Vielba, Fernandez-Esquinas, & Espinosa-de-los-Monteros, 2010; Sanchez-Barrioluengo, 2014; Wang, Hu, Li, & Pan, 2016). Reductions in public funding have also driven universities to seek out alternative and complementary strategies to ensure the financing for their own research (Ambos, Mäkelä, Birkinshaw, & d'Este, 2008; Shane, 2004).

In the academic field of entrepreneurship, spin-off companies gain recognition as an important opportunity for HEIs and correspondingly also demonstrating their capacity to transfer scientific knowledge to the commercial sector (Salvador, 2010). Hewitt-Dundas (2012) maintains that Technology Transfer Officers (TTOs) perform an important role in the transfer of knowledge and, to the extent that the TTOs are able to grow, mature and evolve, they are able to raise the volume of technology transfer activities and contributing positively to spin-off activities. D'Este and Patel (2007) defend that HEIs differ in terms of the level of participation of their researchers with industry in accordance with their own respective founding missions and the experienced accumulated in the technology transfer field. According to Viale and Etzkowitz (2010), the TTOs are now adopting strong and pro-active policies over intellectual property rights (IPR), the sale of licenses and setting up and launching spin-off companies.

Currently, university-industry technology transfers (UITTs) are of increasing strategic importance in many countries as they generate resources applied to academic research, to

innovation in companies and as a means of economic development to governments (Muscio, 2010). Within this context, political decision makers have fostered UITTs within the scope of the great potential perceived for innovation and competitiveness whether at the regional or the national levels (Audretsch, 2007; Lam, 2011; Mansfield, 1998). Furthermore, Closs, Ferreira, Sampaio, and Perin (2012) detail the need to undertake different studies involving different forms of UITTs, in addition to patents, and as well as studying the other actors involved in these processes.

Regional innovation and entrepreneurship systems play an important role in the competitiveness of regions through serving to foster interactions among HEIs, companies, financing mechanisms and political decision making processes, including those institutions that ensure support systems for the transfer and commercialisation of technology. Within this framework come the TTOs, start-up incubators, science and technology parks, entities with missions to support economic activities, especially academic economic activities – students, graduates and post-graduates as well as university members of staff, combining to combat unemployment and raise the commercial returns on intellectual assets (Asheim, Smith, & Oughton, 2011; Farinha, Ferreira, & Gouveia, 2014, 2016; Fernández-Esquinas, Merchán-Hernández, & Valmaseda-Andía, 2016; Jauhiainen & Moilanen, 2012; Salvador, 2010; Siemieniuk, 2016). Within this approach, Zhou, Tijssen, and Leydesdorff (2016) argue that the intensity of the collaboration ongoing between universities and companies gets determined by the quality of the research ongoing with those HEIs with strong company research links performing critical roles in both the innovation and the publication systems.

Further research is necessary to grasp the support process for academic innovation provided by specialist entities as well as better clarifying the knowledge and technology absorption capacity of society (Jonsson, Baraldi, & Larsson, 2015). In this sense, the main objective of this study derives from offsetting some of the shortcomings identified in the literature and clarifying which mechanisms serve for the transfer and commercialisation of the technology accessible to HEIs within the context of their respectively prevailing regional innovation systems. To this end, we sought to understand the respective perceptions of the incubator managers as well as the entrepreneurs and company managers working within those incubators in addition to analysis of a European funded project undertaken by an academic spin-off incubated in cooperation with an HEI in Portugal.

The remainder of this paper is structured as follows. Section 2 presents the literature review before detailing the methodology in section 3 and the case studies in section 4. Finally, section 5 sets out the conclusions, limitations and future lines of research.

5.1.2. University-Industry Technology Transfer and Commercialization Mechanisms

The university-industry technology transfer (UITT) process spans those technologies designed and developed by universities and subsequently applied by industry (Siegel, Waldman, Atwater, & Link, 2004). This thus includes those university researchers who discover new technologies; university technology managers who establish bridges between academic researchers and companies and correspondingly undertaking the management of intellectual property; and the entrepreneurs commercialising university technological outputs.

The UITT process generally incorporates seven separate phases: (1) scientific discovery; (2) dissemination of the invention by the researchers; (3) evaluation of the invention for patenting; (4) registering of the patent (whenever the evaluation proves favourable); (5) marketing/supply of the technology by the researchers and TTOs to companies or entrepreneurs; (6) licensing negotiations; and (7) formal (or informal) commercialisation (Siegel et al., 2004). The UITT process may take place via different channels, whether by oral communication, the physical transfer of the results of some tangible research or through an intellectual property licensing program (Parker & Zilberman, 1993).

According to O'Kane, Mangematin, Geoghegan, and Fitzgerald (2015), the TTOs interlink two of the fundamental stakeholders within any university – academics and managers. Hence, the motivations of university academics arise out of originality and discovery and rewarded through means of their open dissemination and the resulting citations, professional awards (Merton, 1957; Partha & David, 1994) scientific priorities (Merton, 1957) and recognition (Latour & Woolgar, 1979).

Research undertaken with the purpose of commercialisation may drive higher levels of secrecy in science (Campbell, Weissman, Causino, & Blumenthal, 2000), reflected in delays to releases and publications (Blumenthal, Campbell, Causino, & Louis, 1996; Huang & Murray, 2009) and thereby lowering both the pace of technological advance (Jung & Lee, 2014) and the dissemination of knowledge (Toole & Czarnitzki, 2010). In some cases, university researchers focus upon knowledge and hence become less receptive to opportunities for the commercialisation of their research and correspondingly less likely to be aware of the potential for support from the TTOs in their universities (Huyghe, Knockaert, Piva, & Wright, 2016).

Huyghe et al. (2016) identify the importance of not only acquiring knowledge stemming from research carried out within the university environment but also attribute importance to working experiences outside of the academic environment. Consequently, this enables research to extrapolate beyond the range of academic knowledge and to identify and leverage other sources of information.

According to O'Kane et al. (2015), university deans and presidents perceive TTOs in accordance with their effectiveness and strategic importance. Additionally, universities serve as fundamental institutions to economies and societies and are simultaneously becoming ever more knowledge intensive (Martin, 2012). Public-private research projects generate the intellectual capital and technology transfers able to contribute to knowledge based industrial innovation and economic and social development (Etzkowitz, 2003a; Feller, 1990; Mangematin, O'Reilly, & Cunningham, 2014; Rothaermel, Agung, & Jiang, 2007; Sörlin, 2007).

In general terms, the researchers undertaking the greatest level of research and consultancy contracts with industry are understandably those with greater orientations for the application of scientific knowledge than those primarily research focused (Perkmann & Walsh, 2008). Therefore, the former hold a better grasp of the needs of companies and the potential for discoveries and breakthroughs (Gulbrandsen & Smeby, 2005; Krabel & Mueller, 2009; Murray, 2004). The interactions between universities and industries enable researchers to expand their networks beyond academic fields and interlinking with possible clients or partners (Perkmann et al., 2013), clarifying the awareness of the benefits and difficulties bound up with the commercialisation of research results and findings (Fritsch & Krabel, 2012). These researchers require higher levels of capacity for the identification of commercial opportunities for research results as well as a greater awareness about the roles and the support available from the TTOs in their universities (Huyghe et al., 2016).

HEIs have all interest in ensuring their TTOs facilitate university research commercialisation processes and thereby contributing towards boosting regional and national competitiveness through the creation of both wealth and employment (Bozeman, 2000; Mowery & Ziedonis, 2002). With ever rising competition for increasingly scarce public financing, public and private HEIs grasp how TTOs may assist not only in seeking out new revenue streams, such as licensing fees for example, but also simultaneously supporting research activities (Bozeman, 2000).

Sengupta and Ray (2017) address the gap in the knowledge transfer literature around how universities choose specific organizational models for their TTOs. Academic engagement (AE) channels involve knowledge related collaborations by academic researchers with other non-academic organisations. The transfer of university knowledge does not advance down but a single path and may indeed take on multiple forms and heading off in various different alternative directions. The most prominent of these channels include contracted research, collaborative research and consultancy, and contextualised AE (Sengupta & Ray, 2017) (Figure 5.1.1).

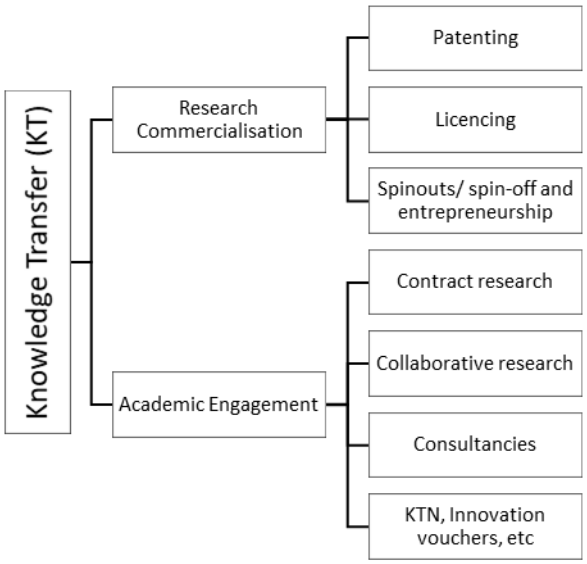

Figure 5.1.1 - Categorisation of KT from universities, Source: Sengupta and Ray (2017)

According to Sengupta and Ray (2017), research commercialisation comprises strategies applied to commercially exploited intellectual property generated through market mechanisms, involving patenting, licensing, spinouts, spin-offs and other related entrepreneurial activities. The AE channels mostly involve 'collaborations interrelated with knowledge by academic researchers with non-academic organisations' to the contrary of a clearly defined market mechanism. The AE concept spans the collaborative research dynamics and extending to include the co-creation of knowledge in conjunction with strategic partners and thereby underpinning Knowledge Transfer Networks (KTN). These include such initiatives as 'Innovation vouchers', which provide small and medium sized companies with short credit lines for the acquisition of services from public knowledge providers within the scope of introducing innovations (new products, processes or services) into their operations (OECD, 2010).

In terms of the obstacles hindering the transfer and commercialisation of technology, academic capitalism (Slaughter & Leslie, 1997), the 'triple helix' (the interconnections between Academia-Industry-Political Decision Making) (Slaughter & Leslie, 1997) and the progress of university entrepreneurship (Etzkowitz, 1983) may nevertheless encounter some barriers between science and business (O'Kane et al., 2015), especially through the maintenance of 'research secrecy'.

The technological parks associated with some universities also represent UITT intermediaries. These sometimes get referenced as incubators as they reduce the costs of the discoveries resulting from research whether in terms of marketable products or processes (Closs et al., 2012). Geographic proximity between researchers and companies facilitates the transfer of tacit knowledge and generates a positive impact on commercial success (Agrawal, Kapur, & McHale, 2008). Additionally, the concentration of high-tech companies at the local level enhances the valuation of academic research (Caldera & Debande, 2010).

Both start-ups and spin-offs also feature among the UITT intermediaries. Commonly founded within the framework of incubators, they function by providing low cost services, enabling networking among entrepreneurs and as well as facilitating access to new forms of financing. According to (Marques, 2005), the launching of start-ups and spin-offs constitutes the ideal means for universities and incubators to commercialise technology. Company incubators form one dimension to a global model for the management of knowledge and technology at the level of regional development and with the entrepreneurial role often attributed to universities within the scope of their third mission (Cesaroni & Piccaluga, 2016).

5.1.3. Methodology

5.1.3.1. Research design

The approach adopted in this study is qualitative and exploratory in nature, which enables the development, clarification and modification of concepts and ideas. This approach particularly suits studies of actor perceptions (in this case, incubator managers, entrepreneurs and researchers), providing for the generation and deepening of new perspectives on knowledge and also contributing to enriching the theory, in this case, on the mechanisms for the transfer and commercialisation of academic technology (Eisenhardt, 1989). Furthermore, the singular application of quantitative methods does not prove able to capture the essence of the phenomena prevailing in certain fields displaying added levels of complexity (Jonsson et al., 2015).

The research recourse to a case study ensures its own 'grounding' in a particular reality and therefore enabling a better understanding of the facts through the thorough study of its operations and thus reflecting an alternative research methodology that is currently experiencing a rising incidence of application (Barratt, Choi, & Li, 2011; Baxter & Chua, 2003; Yin, 2015)

What are the university technology transfer and commercialisation mechanisms? Through the three case studies, this study aims to clarify which mechanisms serve for the transfer and commercialisation of the technology accessible to HEIs within the context of their respectively prevailing regional innovation systems (Kirchberger & Pohl, 2016; Nilsson, Rickne, & Bengtsson, 2009; O'Kane et al., 2015). Another perspective stems from grasping the operational dimensions to a research project in which a university serves as co-promoter and thus helping to perceive the dynamics and role of HEIs in transferring and commercialising technology from a more operations-based perspective (Niedergassel & Leker, 2011).

We developed two questionnaire-based surveys of Portuguese incubator managers and incubated company managers respectively. The questionnaires, mostly containing the open question format, were subject to prior validation before their subsequent distribution by email.

We received 15 valid questionnaires from incubator managers and 28 questionnaires from incubated company managers over the course of March 2017. In addition, we also carried out an interview with a manager of an academic spin-off running a research project approved and financed by European funding (H2020; Open Call 2 of the project WHISFUL – Wireless Software and Hardware platforms for Flexible and Unified radio and network control).

5.1.3.2. Unit of analysis

As regards the unit of analysis, we take into consideration three different levels but all within the framework of the national ecosystem for the transfer of knowledge and technology: (1) company incubators distributed across mainland and archipelago Portugal; (2) companies hosted by these incubators; and (3) academia-industry projects approved for an academic spin-off (Figure 5.1.2).

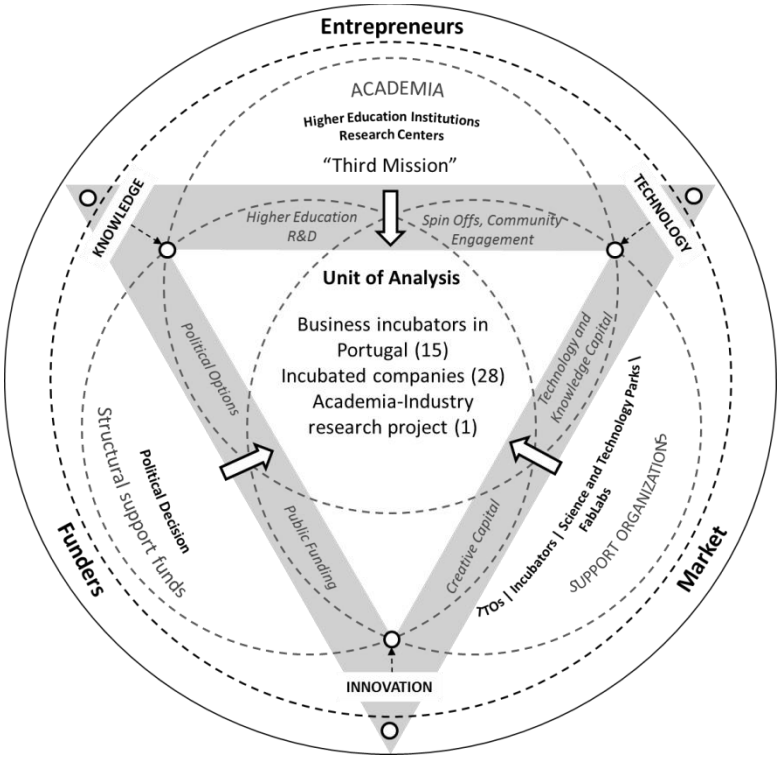

Figure 5.1.2 - Knowledge and technology transfer ecosystem

The transfer of knowledge and technology ecosystem rests upon the interactions among Academia-Industry-Political Decision Making (Leydesdorff & Etzkowitz, 1996, 1998) actors; fostered by the entrepreneurial spirit prevailing in academia in keeping with its 'third mission' (Chang, Yang, & Chen, 2009; Jaeger & Kopper, 2014; Sengupta & Ray, 2017). Falling within the scope of this dynamic analysis are the HEIs and their research centres, the TTOs, company incubators, science and technology parks and fabrication laboratories (FabLabs), as well as

KTNs (Carayannis & Von Zedtwitz, 2005; Debackere & Veugelers, 2005; Huyghe et al., 2016; Minguillo, Tijssen, & Thelwall, 2015; Sengupta & Ray, 2017).

This analytical context applies deductive reasoning in order to clarify the study object and departing from the general to the particular (Bryman, 2004; Petty, Thomson, & Stew, 2012; Viale & Etzkowitz, 2010).

5.1.4. Case Studies

The three case studies set out below interlink in order to reflect on the core research objective: understanding university technology transfer and commercialisation mechanisms.

5.1.4.1. Company incubators in Portugal

Company incubators contribute positively to local development and provide the driving strength and a source of motivation for young entrepreneurs and researchers facing up to new challenges (Siemieniuk, 2016). The academic start-up and spin-off incubators perform an important role in UITTs, providing space and low cost services to companies undergoing incubation and serving as an important means for the commercialisation of technology (Cesaroni & Piccaluga, 2016; Marques, Caraça, & Diz, 2006). These incubators commonly provide physical facilities as well as opportunities to build up KTNs and support for innovative projects and ideas still at their embryonic phase. In general terms, these incubators fall under the auspices and are in close proximity to universities, laboratories and research institutes in order to benefit from the knowledge generated by these organisations (Hansen, Chesbrough, Nohria, & Sull, 2000).

While company incubators are more advanced infrastructures in the United States than in Europe, the etymologic roots of the incubation concept nevertheless reside in Europe (Aernoudt, 2004). Thus, the company incubation concept emerged at the beginning of the 1980s (Mian, 1996). From around that point in time, the European Union started providing incentives for setting up support networks for the launch of new companies. In Europe, one of the first incubators was set up in the United Kingdom in 1975 when British Steel launched a subsidiary called British Steel Industry (BSI) to nurture employment opportunities (Aernoudt, 2004). In Portugal, the first incubator, the BIC (Business and Innovation Centre), opened its doors in 1987.

Company incubators are thus organisations rendering support to companies in their first years of existence with the core role of enabling companies to attain success and leaving the incubator environment when financially stable and independent within reasonable timeframes (Aernoudt, 2004).

This study contains the responses from 15 incubators to the open question format questionnaire and distributed across mainland and archipelago Portugal (Table 5.1.1).

Table 5.1.1 - List of Incubators

Incubator Name	Date of Founding	Legal Status	University Incubator	Incubator integrated and located in a Science and Technology Park infrastructure	Centres of Business Innovation	Independent Incubator	Sector based focus	No. of Companies Incubated
Startup Lisboa	2012	Non-profit private institution	No	No	No	Yes	Technology	100
OPEN - Oportunidades Especificas de Negócio	2002	Non-profit private institution	No	No	No	Yes	Industry	11
Agência DNA Cascais	2006	Non-profit private institution	No	No	Yes	Yes	No	60
MADAN Parque	1995	Non-profit private institution	Faculty of Science and Technology - NOVA University of Lisbon	MADAN Parque	No	No	Technology	53
Incubadora GO-ON	2015	Non-profit private institution	No	Nonagon - São Miguel Science and Technology Park	Yes	No	Technology	7
IPN Incubadora - Associação para o Desenvolvimento de Actividades de Incubação de Ideias and Empresas	1996	Non-profit private institution	University of Coimbra.	Pedro Nunes Institute	Yes	Yes	Technology	Physical Incubation: 38. Coworking Incubation: 9. Virtual Incubation: 70
Praia Links - Incubadora Local da Praia da Vitória	2016	Municipal Incubator	No	No	No	Yes	Agro-commercial, sea, local, tourism and technology	22

Incubator Name	Date of Founding	Legal Status	University Incubator	Incubator integrated and located in a Science and Technology Park infrastructure	Centres of Business Innovation	Independent Incubator	Sector based focus	No. of Companies Incubated
Incubadora BLC3	2010	Non-profit private institution	No	BLC3- Technology and Innovation Campus	Yes	Yes	Technology	25
Laboratórios Criativos da Plataforma das Artes and Criatividade	2012	Municipal Incubator	No	No	No	Yes	Arts and creativity	12
Incubadora Municipal do Avepark	2007	Municipal Incubator	No	AVEPARK – Guimarães Science and Technology Park	No	No	Science and Technology	15
Startup Angra	2016	Municipal Incubator	No	No	No	No	No	5
Fundação da Juventude (Startup Juventude)	1989	Non-profit private institution	No	No	No	Yes	Services	3
Startup Braga	2014	Municipal Incubator	No	No	No	No	Digital Economy, Healthtech and Nanotech.	60
Startup Madeira	2006	Quota held company	No	Yes	Yes	Yes	Incubation of technology and service companies	11
IEUA - Incubadora de Empresas da Universidade de Aveiro		Other	Yes, University of Aveiro	No	No	No	Technological area – Technology and innovation projects arising from the university community (students, ex-students, professors, researchers)	21 – Technology field (software, hardware), tourism, optics, agro-tech

The core objective of company incubators is the rendering of support to companies throughout their initial, start-up and early stages and to this end providing office space and other resources at lower cost (Cesaroni & Piccaluga, 2016). In Portugal, four types of entity commonly manage and run these company incubators in accordance with their own respective different objectives: (1) University company incubators, with the core purpose of supporting university spin-offs; (2) Municipal company incubators focused on supporting locally based entrepreneurship; (3) Company incubators managed by business associations; and (4) Private sector company incubators.

Very often, there are also additional services provided, whether reception and telephone answering services, Internet access, meeting rooms, networking and training activities in addition to the access to an entrepreneurial and technology transfer favourable ecosystem. Some incubators also run virtual office services in conjunction with partners rendering other services. Furthermore, technology parks also host some of the incubators and correspondingly focused upon technologically based firms and start-ups.

In our study, we would reference how nine out of the fifteen incubators have local municipalities as their associate partners, which also reflects on their legal status (non-profit making) and correspondingly corroborating the thesis proposed by (Aernoudt, 2004) when stating that Europe primarily hosts incubators within non-profit frameworks that actively contribute towards regional development. Out of the set of fifteen incubators studied, only three are academic based entities (the University of Aveiro incubator; IPN – the University of Coimbra incubator; and MADAN Parque – the Nova University of Lisbon incubator). Furthermore, six incubators stem from Science and Technology Parks, with 33% of these interconnected with business innovation centres (BICs). Hence, the results of this study are aligned with the theory put forward by Sengupta and Ray (2017), who state that the transfer of knowledge by universities may head off in multiple directions and emphasise the role played by collaborative networks (Farinha et al., 2016; Leydesdorff & Ivanova, 2016; Minguillo et al., 2015).

According to Mian (1996), technologically based company incubators are normally located within or on the boundaries of university campuses. Of the fifteen incubators under analysis, eleven are either technologically based or hold technological sector orientations (Table 5.1.1). However, there are incubators focusing upon other sectors (e.g., arts and creativity, services, agribusiness, sea and tourism). Again, the study results prove in keeping with the literature review that details how incubators may also serve non-technological sectors of activity (Lamperti, Mavilia, & Castellini, 2017).

According to Berry and Taggart (1998), incubators should maintain both strategic plans and annual business management plans for their respective activities. In the field of strategic management, all the incubators observed stated that they followed either a strategic plan or an annual activity plan with the exception of Startup Juventude, which reported not having any such instrument. Within the context of their activities, the incubators support start-ups in

various ways (e.g., office working space, consultancy, accounting, financial and juridical services), as well as providing an environment shared between entrepreneurs and researchers through charging very competitive monthly fees. Figure 5.1.3 sets out the services provided by the Portuguese incubators here under study.

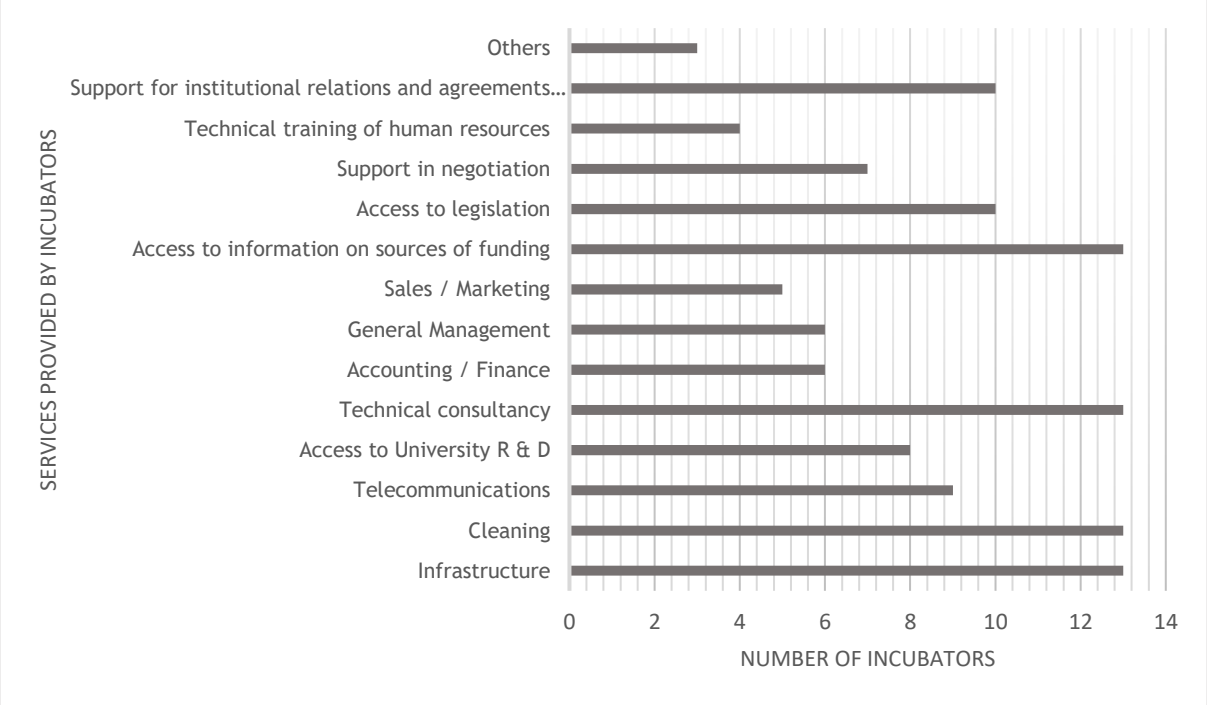

Figure 5.1.3 - Main services provided by incubators

As Figure 5.1.3 displays, all the incubators provide the following: infrastructures, technical consultancy and access to information on sources of funding. The majority also make available access to legislation (10), support for institutional relations and agreements between companies (10), telecommunications (9) and access to university R&D (8). Furthermore, some incubators add on other services such as: accounting/finance, general management, sales/marketing, support in negotiation, reception, mentors, partners, networking events, privileged exposure to the best business angels and venture capital firms (national and international). However, there are also other important services for incubators to provide (e.g., photocopier, facsimile, conference room, security and personal computer) (Mian, 1996).

There are also virtual incubators and correspondingly providing managed support services, support for applications to structural funds, juridical advice, among others. There is a diverse range of sources of incubator financing with six entities part-financed by municipalities as well as by European Union funding. Furthermore, other sources of income include rents (location and service provision contracts) and the annual fees paid by members.

The fifteen incubators analysed in this study provide support to around 522 companies, which clearly demonstrates their importance to their host regions and the country as a whole (Carayannis & Von Zedtwitz, 2005; Minguillo et al., 2015). As regards the formally established university spin-offs, these still remain limited in number. However, in some cases, the projects accepted have to necessarily include at least one backer with a university connection, which in turn reveals the fundamental role played by the HEIs in this process.

As regards the selection of companies for incubation, the criteria rest upon: (1) innovations in products/services; (2) capability of implementation by the team; (3) business idea in keeping with the sector strategy for the region and the incubator; (4) market size/trends; (5) prospects for sustainable financing, competitiveness and potential growth; and (6) job creation, impact on the territory and the capacity to foster networks.

In terms of their cooperation networks (Brescia, Colombo, & Landoni, 2016; Papagiannidis, Li, Etzkowitz, & Clouser, 2009; Siegel et al., 2004; Smith & Bagchi-Sen, 2006), the incubators analysed develop various activities through fostering bonds of cooperation among the companies hosted by the incubator as well as among university students and companies. These activities incorporate the organisation of workshops and visits, promoting the companies in the universities, bilateral meetings, staging events and training programs. Some incubators report maintaining both partnerships with lawyers specialising in corporate law and industrial property and strong links with municipal entities.

As regards the transfer of knowledge and technology, some incubators specialise in this field and accompany their incubated companies through the stage of requesting and registering brands and patents. Some respondent incubators work in close cooperation with the TTOs belonging to different HEIs. Within this domain, Van Weele, Van Rijnsoever, and Nauta (2017) argue that the sometimes weak performance of incubators in terms of UITTs derives from the start-ups remaining unable to take full advantage of the resources provided by the incubator. They furthermore add that entrepreneurs are commonly not aware of their lack of resources, hesitate to move beyond their comfort zones and are especially overly focused on the short term. Nevertheless, there were some cases in which incubators affirmed the lack of mechanisms for supporting the transfer of knowledge and technology and indicating that they only carry out promotional and dissemination activities. Startup Braga additionally highlighted the provision of management and technology transfer consultancy services and regularly holding clarification sessions for entrepreneurs and reputable investors.

As for the commercialisation of technology, Aernoudt (2004) identifies the importance of interactions between business angel networks and incubator managers. We would reference that the respondent incubators generally do report connections with business angel networks within the scope of facilitating entrepreneur access to new sources of financing. Aernoudt (2004) furthermore argues in favour of developing combined actions, promoted across the networks maintained with other companies, incubators and as well as European and

international organisms in order to encourage the emergence of technologically based companies, fostering entrepreneurship and the transfer and commercialisation of technology and also equally interrelated with boosting the number of projects hosted by the incubators. Regarding the R&D connections with other incubator or research institutions, 53.8% run this type of cooperation with 60% of the respondent incubators also making reference to connections with national and international organisms. Within the latter framework, some of the institutions engaged with include TIE Manchester, Madrid Emprende, Skolkovo Technopark (Moscow, Russia), 3IE (Valparaíso, Chile), SVG (California), ESTGOH and Microsoft. In this field, the incubators also express an understanding that they need to still further improve networks of collaboration and a factor emphasised in their responses.

The incubator respondents also evaluate the current, ongoing cooperation between higher education institutions and incubated companies as insufficient. Of all the respondent incubators, only four rank the cooperation existing between the aforementioned entities as adequate/positive/very good (Startup Braga, Avepark, Laboratórios Criativos da Plataforma das Artes and Criatividade and BLC3). Furthermore, within the scope of cooperation, the majority of the incubators deemed the networks set up among the incubated companies for such purposes as of extreme importance. The main incubator activities stem from fostering relations between industry and universities so that there is the ongoing mutual exchange of resources as a result of joint R&D projects as well as public and private research (Westhead & Storey, 1995).

5.1.4.2. Incubated start-ups and spin-offs

Recent years have seen significant investments in raising the qualification levels of human resources, in infrastructures (including the incubators themselves) and in technology, generating countless opportunities for whoever seeks to launch or invest in a new business (Farinha, Gouveia, & Nunes, 2015; Marques et al., 2006; Schwab, 2015).

In Portugal, the first incubator founded (BIC) went on to produce companies such as Novabase, Link, TecMic and Buzdrect, which are today national references and with strong presences in international markets. The incubators provide the recently founded start-ups with an environment appropriate to their growth and development with the incubation period constituting the time necessary to transform an idea into a stable business able to make its own way forward into the future (Dornelas, 2002). Hence, within this context, we sought to understand which transfer and commercialisation of technology support mechanisms the incubators made available to their hosted companies. 28 start-ups responded to the open question style questionnaire with Table 2 detailing the sample of respondent companies and their respective characteristics.

Table 5.1.2 - Companies participating in the research

Name of the company	Year of launch	Sector(s) of activity (high-tech. industry)	Sector(s) of activity (high-tech. service providers)	Core products (goods or services)	Target product markets	No. employees
Identprint	2015	IT equipment and electronic office equipment and components	Telecommunications, other IT service	Solutions for logistics (readers/terminals and bar code printers, picking by voice, rfid, etc.)	Healthcare, retail, logistics, production, state	5
Javali	2002	-	Software development, consultancy and commercialisation, web / Internet services	Purpose designed web services	Public sector	15
Allbesmart	2015	Electronic equipment and components, communications equipment	Telecommunications, software development, consultancy and commercialisation, web / Internet services, R&D – natural sciences	Intelligent irrigation system development; Wifi network installation in public spaces; lte network benchmarking systems; industrial systems 4.0	Operators of telecommunications networks, industrial factory floors, tourism, municipalities and inter-municipal communities	10
Cruzinformatica	1993	Management software (erp)	Software development, consultancy and commercialisation, web / Internet services	Implementation of erp primavera	Portugal, Cape Verde and Mozambique	4
Modo distinto	2007	Electronic publication, IT and office equipment	Software development, consultancy and commercialisation, web / Internet services	Consultancy	Hotels and tourism	16
Vihu	2004	-	Telecommunications, architecture and engineering, and related technical consultancy	Installation of electronic security systems and fibre optic communications networks	Industry; residential; solar and wind parks	2
Cimbalino filmes	2008	-	-	Films	Fashion, music, hotel, footwear	3
Criterdestaque	2014	Restaurants, hotels, data-centres	-	Automatic fire extinguisher systems	Professional kitchens, archives, data centres, industrial machinery	2
Quant-ux	2015	-	Web / Internet services	Software	External markets	1
Squatter factory	2014	-	-	Film production	Cinematography	1
Help u2b it	2013	-	Web / Internet services	Products for improving healthcare and well-being (wymbe)	Healthcare and training	3
Graphenest	2015	Nanotechnology	R&D – natural sciences, engineering & related technical consultancy, testing and technical analysis	Graphene and graphene dust dispersions as well as their application methods	Advanced composites, energy and electronics	3
Parque health club	2016	-	-	Sports activities	Gymnasiums, health clubs	30
Splendida weddings	2016	-	-	Wedding planning services, wedding design & styling	Wedding industry	2
Wecul	2015	-	Software development, consultancy and commercialisation	Library management software and automated library systems	Universities, public reading networks, schools, cultural institutions	5

Name of the company	Year of launch	Sector(s) of activity (high-tech. industry)	Sector(s) of activity (high-tech. service providers)	Core products (goods or services)	Target product markets	No. employees
Invisible cloud	2016	-	Software development, consultancy and commercialisation, architecture & engineering	Saas - software as a service	Retail, financial sector, hospitals	3
Soft institut	1997	-	Software development, consultancy and commercialisation	Erp sage x3; Dimomaint maintenance management; Audros documental management	Industry, commerce and services	6
Be a place	2015	Cultural and creative industries	-	Consultancy services	Cultural sector and municipalities	2
Geosite	2014	Geo-conservation	-	Inventories and managing geodiversity	Natural areas	5
Phosphorland	2014	-	Software development, consultancy and commercialisation	Software	Agro-foodstuffs	11
Happiness announce	2014	-	-	Mental health clinic; business development centres, appointments, training and teambuilding	Final consumers and companies (automobile sector, springs industry and technical packaging and protection, etc.)	6
Taipas turitermas	1985	-	-	Supplier of healthcare services to springs, thermal spas, healthcare clinics, rehabilitation gyms and sports facilities	Thermal spas and medical clinics, tourism facilities	39
Latitude colorida	2015	-	-	Backrest for the beach, swimming pool or country - kupy	Direct sales, online, word of mouth, stores, markets	1
Ilustramemorias	2015	-	-	Design; production management; gift & merchandising	Tourism/merchandising	2
Connect robotics	2015	Automatized & robotic machinery, aerospace industry and related activities	Web / Internet services	Drone delivery services	Multiple markets: retail, e-commerce, pharmaceutics	2
Livetech	2010	-	Software development, consultancy and commercialisation, web / Internet services	Website/e-commerce	Textile and footwear industries, service provision	4
Maranus	2013	-	Multimedia	Photography, video	Internet	1
André Silva Rocha	2015	-	-	Jewellery; photography; modelling / design	Individual clients and industry / commerce	1

According to Kohler (2016), there are important benefits from interlinking corporate workforces with new talents and ideas in order to nurture innovative thinking and effective change processes. Our study reveals that the incubated start-ups, as a rule, employ staff with baccalaureate or undergraduate degrees (84). They also commonly recruit human resources with Master's Degrees (26), MBAs and post-graduate (24) or professional qualifications (20). Finally, they also provide employment to doctoral degree holders (11). In overall terms, 67.7% of these firms report having no problems in recruitment. The remaining 32.1% however do indicate having experienced difficulties in recruitment, especially in areas that require specific knowledge and also due to encountering financial difficulties in paying the wages of staff with more appropriate qualifications.

We also found that a large percentage of the products/services developed by these start-ups do not finish development in the incubator. Only eight companies totally develop their products/services within this framework. The start-ups that developed over 50% of their products/services outside of the incubators refer to how this took place in networks reaching out to other countries such as Britain or France. The networked incubator deploys mechanisms for stimulating partnerships between start-up teams and other successful companies, thus facilitating flows of knowledge and talent among companies and as well as establishing marketing and technology relationships among them (Hansen et al., 2000). Thus, as regards outsourcing, 50% of these start-ups report not outsourcing to their host incubator. Some of them report subcontracting to higher education institutions. Only 7.1% of these firms report the practice of always outsourcing to other businesses inside their respective host incubator.

Scientific research provides the basic source of the knowledge incorporated into the development of products/services and scientists-entrepreneurs make a correspondingly sizeable input through the founding of spin-offs (Judice & Baêta, 2005). Furthermore, only 4% of start-ups responded negatively to the prospect of launching new spin-off companies from those already under incubation. The start-ups were also unanimous in affirming that no employee had left in order to set up another company.

Start-ups, through collaborative networks, are also able to obtain other levels of resources that ensure the capacity for a swifter market launch, for example, and placing them ahead of potential competitors (Hansen et al., 2000).

The study results furthermore reveal how start-ups normally establish R&D partnerships with regional academic entities, with 14 companies affirming their having engaged in their activities in conjunction with other companies in their respective host incubator. Despite some start-ups having academic members of staff (8) and employees working part-time in HEIs (6), only two firms stated they had paid for the development of basic and applied research undertaken by HEIs for their company. Within the context of business and cooperation networks, 17 start-ups affirm their participation in national and international cooperation networks whether run by business associations, sectoral associations or professional organisations.

According to Barney (1991), financial capital incorporates a varied set of monetary resources potentially available to the discovery and exploration of the initial idea underpinning a particular start-up. As regards their financing, our study results point to 53.6% of start-ups that state never having benefitted from any public aid or funding (structural funds, fiscal benefits, awards, local incentives or others). However, 46.4% of the start-ups have already benefitted from innovation, entrepreneurship and internationalisation support vouchers (Program Portugal 2020), support from the Portuguese Institute of Employment and Professional Training (IEFP), support from municipalities, fiscal benefits, support for hiring and European Union funding.

Finally, the start-ups ranked by order of importance some of the factors that led them to set up in an incubator. Among the most representative factors to this decision were: (1) the infrastructures available in an incubator; (2) the facilitated access to universities and research centres; and (3) the presence of other high technology companies.

Mayer (2005) identified four factors leading to companies locating in a particular region: (1) community of operational companies in the same sector and that relate to the region; (2) the region has to gain the critical mass of company support services over the course of time (potentially associated with the setting up of an incubator in a region); (3) regional policies; and (4) quality of life in a region that ensures entrepreneurs opt to remain in the region. In our research, we find that the motives for entrepreneurs selecting an incubator or a region include: (1) infrastructures available in the incubator; (2) quality of life; and (3) location/privileged access to communication. After comparing with the results obtained by Mayer (2005), we may conclude that they are indeed similar.

5.1.4.3. Academia-industry research project

The economic growth and employment rates of a country are proportional to the number of small companies and the entrepreneurial activities ongoing in a country (Audretsch, 2002). Entrepreneurship is thus fundamental to national economic development (Belso-Martinez, Molina-Morales, & Mas-Verdu, 2013). The European Commission Entrepreneurship Action Plan rests upon three premises: (1) promoting the spirit of entrepreneurship in schools and universities; (2) 'women, seniors – untapped pools of entrepreneurial potential'; and (3) 'migrant, minority or other specific groups of potential entrepreneurs' (EC, 2013). Furthermore, in Portugal, there is a national entrepreneurship strategy enacted through the 'Startup Portugal' program (ME, 2016).

The objective of better understanding the operational mechanisms of UITTs explains the relevance of studying a technological project that took the incubated start-up root. The project title is 'WIFI-Dense: Experimental assessment of WiFi coordination strategies in dense wireless scenarios' and developed by Allbesmart, a company headquartered in the Centro de Empresas Inovadoras in the city of Castelo Branco, Portugal. Operationally, the project underwent implementation between March 2016 and October 2016. This is a European project under

Horizon 2020, Open call 2 of WHISFUL – Wireless Software and Hardware Platforms for Flexible and Unified Radio and Network Control (H2020-ICT-11-2014 Project number: 645274).

The project is justified by how the rapidly increasing popularity of WiFi has created unprecedented levels of congestion in the unlicensed frequency bands, especially in densely populated urban areas. This results mainly because of the uncoordinated operation and unmanaged interference between WiFi access points. Recently, Radio Environment Maps (REM) got suggested as the means for supporting coordination strategies able to optimize the overall WiFi network performance. Radio Environment Maps are computed based on real time spectrum sensing information provided by a network of spectrum sensors. In spite of some theoretical work done in this area, there is no clear experimental evidence of the benefits brought about by WiFi coordination. In this context, the main objective of this experiment involved assessing the benefits of coordinating the management of radio resources in dense WiFi Experiments using REM.

The WIFI-Dense led by Allbesmart, Lda (an academic spin-off incubated at CEI) experienced an almost eight month period of development and received total investment of €40.000. WiSHFUL drew upon the support of IPCB – the Polytechnic Institute of Castelo Branco, as a partner representing an HEI in support of the UITT process through the attribution of some grants and the part-time allocation of two members of staff.

As regards the main difficulties and limitations encountered in terms of the commercialisation of the technology, there was the following: “the fact that the majority of brand/manufacturers of equipment do not allow for open access to their software and equipment (routers) commercialised for WiFi networks. This aspect hinders the implementation of a project of this type in real scenarios”. Representing the operational implementation of a real technological project, this thus confirms the findings of the literature as regards the obstacles in effect for the progress of science and technology (Jung & Lee, 2014).

When questioned about the opportunities and strategies identified/developed for commercialising the technology, the Allbesmart manager affirmed that: “the proliferation of mobile phones (smartphones) has brought along a set of applications that require a constant connection to the Internet. The segments of younger users do not always have mobile data plans and hence very often make recourse to the public and free to access WiFi networks”.

The company representative also added: “in Castelo Branco, in partnership with Castelo Branco Municipal Council, we installed two public WiFi networks that make use of the technology tested by the project: at Castelo Branco river beach and in Violetas Park”.

Despite the project described lasting only for a period of eight months, this did nevertheless confirm the importance of Academia-Industry political decision making collaborative networks within the framework of UITT processes (Chen, Wu, & Yang, 2016; Papagiannidis et al., 2009). Despite the barriers encountered to the transfer and commercialisation of technology, the

cooperative networks enabled the project to discover new opportunities and in this case impacting on the development of a disadvantaged region with a low population density level (Minguillo et al., 2015).

5.1.5. Conclusion

The processes of transferring and commercialising knowledge and technology acquired in universities provide an important source of economic growth to regions. The main objective of this study involved clarifying the different frameworks and processes for the transfer and commercialisation of knowledge and technology applicable to HEIs. Hence, we analysed the perceptions of incubator managers, entrepreneurs and managers of incubated companies, as well as a European project developed by an incubated academic spin-off in cooperation with an HEI in Portugal.

According to Jonsson et al. (2015), the transfer and commercialisation of knowledge and technology processes need to reach beyond the signing of agreement to license patents filed away by the universities in order to foster new entrepreneurial projects (spin-outs). In this sense, these transfer and commercialisation processes should extend deeper through academic commitments to different interactive processes, whether involving conferences, collaborations or publications.

As regards the cooperation networks run by the incubators subject to analysis, they undertake multiple activities in order to stimulate bonds and connections between the companies they host, university students and other businesses and firms. These diverse activities include, for example, promoting and staging workshops for university students and companies in order to present their products/services or experiences, as well as pitches for new and innovative products/services that the students might develop and the companies commercialise. However, the majority of these incubators ranked the cooperation ongoing between higher education institutions and incubated companies as insufficient. To this end, they might encourage and develop workshops for university students and companies so that each may present their products/services or experiences, as well as innovative, new products/services susceptible to mutual development and commercialisation. The incubators able to bring about the launching and development of networks may move onto the organisation of international conferences with a scale to invite influential speakers on the sectors targeted by the incubator and the respective region's strategy. Students and start-ups would thus also gain the opportunity to present their works and projects while learning from specialists. These international conferences may also contribute towards attracting investment to the region. The incubators would themselves generate a greater number of companies for incubation as well as boosting their own revenues. The municipalities, in turn, would gain both more companies and more employment and thus see an expansion in their taxation bases. We would here emphasise that

over 50% of incubators state having R&D connections with other incubators or research institutions or to some other national or international organism (TIE Manchester, Madrid Emprende, Skolkovo Technopark (Moscow, Russia), 3IE (Valparaíso, Chile), SVG (California), ESTGOH and Microsoft). However, within this field, the incubators also convey their awareness that they still need to build further and improve on their collaborative networks.

Within the theme of the transfer of knowledge and technology, the study verified that some incubators did not deploy any mechanisms in support of the transfer of knowledge and technology, indicating that they only engage in promotion and dissemination, which proves in keeping with the broader literature (Van Weele et al., 2017). Others declare providing legal support services, such as partnerships with lawyers specialising in company law and industrial property as well as maintaining strong connections with municipal entities. In these terms, all incubators should necessarily engage in the provision of consultancy services for the management and transfer of technology as well as running regular clarification sessions for entrepreneurs and reputable investors. There are already incubators engaged in such practices in Portugal, for example Startup Braga.

In relation to the commercialisation of technology, the incubators generally reported a lack of any support for this goal. Correspondingly, the recommendation would be for incubators to invest in this area and perhaps set up an office in partnership with municipal councils and higher education institutions in order to improve in this field. Development and support in this area may potentially lead to the emergence of new companies. The study also reports that the majority of incubators maintain connections with business angel networks in order to facilitate access to new sources of financing for their entrepreneurs, which again coincides with that referenced in the literature (Aernoudt, 2004). The incubators might also advance with other actions such as, for example, verifying which products or services their incubated companies purchase and their framework within the strategies at the regional and incubator levels, developing business ideas that they then propose to universities for development and thereby fostering the launch of university founded spin-off companies. Aernoudt (2004) refers to how incubators require the development of combined actions, promoted through networks with other companies, incubators and other European and international organisms in order to provide incentives for the appearance of more technologically based companies.

In terms of the study's limitations, they are those inherent to all case studies, meaning that the results consolidated in this research are not subject to generalisation. The study was also confined to the region of Portugal. Thus, in terms of future lines of research, we would suggest carrying out quantitative studies on this theme to ascertain whether the results returned here do prove susceptible to generalisation. This study might also expand to focus on other countries as well as verifying any differences in the commercialisation of knowledge and technology among countries.

5.2. Study 2 - Value Creation and Commercialization in Insular Ecosystems

Abstract

This article aims to evaluate the resources and capabilities in insular regions, and also to understand how value creation and commercialization take place in the existing ecosystems. A qualitative research methodology was followed through a case study, incorporating interviews with incubators managers of the insular regions of Portugal (Azores and Madeira). The results show some difficulties as a result of the ecosystem's insularity. To shorten the insular regions dissymmetry compared to other non-insular regions, a new model is proposed to help these regions overcome their economic and social problems.

Keywords

Commercialization, Ecosystems, Island, Quadruple Helix, RIS3, Value Creation

5.2.1. Introduction

In recent years, studies on innovation ecosystems have intensified. An innovation ecosystem aims to create a network of actors with a common strategy (Adner, 2017). These actors have the function of creating, providing and valuing the ecosystem (Adner, 2012).

All ecosystems have strengths and weaknesses. However, the difficulties in implementing a successful ecosystem are becoming more pronounced in insular regions. These regions have common characteristics and are confronted with similar economic, environmental and social problems, most of them are structural in nature, over which they have no control. Generally, the common characteristics of insular regions are: i) insularity; ii) strong exposure to natural disasters and the effects of climate change; iii) limited institutional capacity; iv) open and poorly diversified economies; and v) difficulties to access to external capital (Meneses, Ribeiro, & Cristóvão, 2012). Since resources are limited, the sustainable use of these resources is

extremely important. As a rule, there are a limited number of qualified and available human resources in insular regions to work with specialists in sustainable development. In this sense, regional approaches that reinforce the sharing of experiences and knowledge, i.e., innovation ecosystems are extremely important.

Insular regions usually rely heavily on tourism and agriculture as a source of income from work and exchange. Coastal areas are considered of great importance for economic activity (Buhalis, 1999). These regions are still the productive areas of a wide variety of living marine resources and a high degree of biological diversity (Johannes, 1998). However, these resources need to be increasingly enhanced in order to have a positive economic and social impact in those regions.

In this sense, the European Union (EU) has recently defined regional research and innovation strategies for Smart Specialization (RIS3). For the implementation of RIS3 to be effective, it is important that regions analyze different indicators in order to help regions in their economic and innovative diversity, as well as to distinguish the territorial differentiating characteristics (Foray, Goddard, & Beldarrain, 2012).

According to Biggs, Westley, and Carpenter (2010), the integrated and collaborative ecosystem management is not appropriate in all contexts and will certainly generate its own set of problems over time. In this way, new research is suggested to improve ecosystem management models so that they remain innovative and adapt to the difficulties they will find (Berkes, Colding, & Folke, 2008; Chapin III, Kofinas, Folke, & Chapin, 2009; Gunderson, 2001)

According to the research gap identified, this study aims to evaluate the resources and capabilities to be exploited by stakeholders of Portuguese insular regions (Madeira and Azores), in the context of their smart specialization strategies. In addition, this research also aims to understand how value creation and commercialization is carried out in these insular ecosystems contributing to our knowledge in this topic. This research is relevant because it aims to shorten the asymmetries of insular regions compared to other regions. Furthermore, it can help these regions and communities to develop territorial policies and practices management.

The article is structured as follows: this introduction that presented the framework and the importance of this research. The second section presents the literature review, addressing the innovation ecosystems. The third section sets out the used method, detailing it in order to be replicated in future investigations. The fourth section analyzes the results. The next one proposes a model for a successful ecosystem in an insular region. Finally, the conclusions, study limitations and future research lines are presented.

5.2.2. Insular Innovation Ecosystems

The globalization of innovation networks is a recent trend that significantly influences local innovation clusters and regional innovation systems (Komninos, 2009). Social and economic relations intensified by linking remote regions (Giddens, 2013). These relationships were also beneficial in R&D and innovation, where the ability to coordinate networks and transactions in real time on a global scale was achieved (Castells, 2000).

In general, innovation is done primarily in technological and economic terms, by looking for new products based on the latest technological developments or private sector entrepreneurs, that may come to fill a niche market (Kelman, Burns, & Johansson, 2015). These innovations are important and should be investigated and incorporated into regions' governance and culture to create sustainable value (Fagerberg, Mowery, & Nelson, 2005). Innovations in governance concern new public, private and hybrid regulatory regimes and related institutional arrangements. Cultural innovations refer to the creation and development of new conceptions, paradigms and value systems. As a rule, technological and economic innovations can rarely be successful without government adaptation and cultural innovations (Kelman et al., 2015).

The insular regions need to innovate. Innovation in these regions typically results from unique crafts, food and beverage products and remote services for information and communication technologies (Baldacchino, 2005). In insular regions, entrepreneurship is dominated by small and medium-sized enterprises and the geo-economic circumstances of these regions are often mercantilist: imports are more pronounced, deferred exports, and trade and consumption are higher than industrial production. These are some of the circumstances that attract the interest of local trading community. Politically, the importing elite usually has advantages and tend to acquire imported products (possibly cheaper and better) in deferment of local products (Baldacchino, 2005). Locally, consumers prefer to sponsor high-level foreign goods from the mainland or the core, even when they are more expensive or of inferior quality (Worsley, 1968).

The isolation, marginalization and smallness of insular regions must be seen as a momentum and an opportunity to generate innovation, not as difficulties to overcome. To overcome these difficulties (policies and practices), these regions tend to create multicultural groups and alliances that group resources.

Question 1: In what resources and capabilities should stakeholders focus to create value in an insular ecosystem?

A couple of equipment and expertise in a centralized organization can be managed by human resources from various countries, often complemented by employees living in an insular region (Kelman et al., 2015). Thus, with the interaction of several stakeholders, values can be created in these regions and in their ecosystems.

Question 2: Who encourages, initiates and develops an insular ecosystem?

Today, higher education institutions (HEI) are considered key players in regional innovation systems, through their "third mission" rooted in the knowledge and technology transfer to business and society (Jaeger & Kopper, 2014). There are several mechanisms for knowledge and technology transfer (Table 5.2.1).

Table 5.2.1 – Transfer Channels of Technological Knowledge

Transfer channel	**Description**
Temporary employment of an academic	A company employs an academic temporarily.
Research consortium	A company participates in a research consortium of more than one HEI or research institute, individually or with other companies.
Minority capital of a spin-off company	A company buys part of an academic spin-off but does not have majority control.
Consulting and advisory	A company consults an academic about a specific issue.
Joint venture research	A company establishes a joint venture research with an HEI or research institute and, together, creates an independent research entity.
R&D contract	The company pays for a required work from the HEI or research institute.
Research fund	The company funds exploratory research from HEI or research institute.
Purchase a license/patent	The company purchases a license or patent from a HEI or research institute.

Source: Adapted from Gils, Vissers, and Wit (2009)

Regional innovation and entrepreneurship systems play a key role in the regions' competitiveness, stimulating interaction between HEIs, companies and financing and political decision-making mechanisms, including institutions providing a support system for technology transfer and marketing (Markkula & Kune, 2015; McCann & Ortega-Argilés, 2015; Miller, McAdam, Moffett, Alexander, & Puthusserry, 2016; Pugh, 2017; Yoon & Park, 2017).

Question 3: How to market the created value in an insular ecosystem?

This area includes the Technology Transfer Officers (TTO), business incubators, science and technology parks, whose mission is to support economic activity, and in particular academic economic activity (students, doctoral candidates, staff), helping to fight against unemployment and increased commercialization of intellectual property (Siemieniuk, 2016). TTOs are organizations specialized in transferring technology or knowledge of information and communication technology (ICT), with which they are linked internally or externally to other organizations. TTOs have a central mission to increase the likelihood of HEI and research

institutes discovering to become products and services that society can benefit from (Dias & Porto, 2013).

The innovation and business ecosystems can be grouped in geographic, economic, industrial or business terms. Thus, insular ecosystems fall into the geographical type. These groups seek to explain the industrial dynamism and corresponding economic success or failure, in regions through a variety of conceptual lenses, including "entrepreneurship support networks" (Kenny & Burg, 1999), "incubator regions" (Schoonhoven & Eisenhardt, 1989), "social innovation structure" (Florida & Kenney, 1988), or an innovation or entrepreneurial "ecosystem" (Bahrami & Evans, 1995).

Insular regional governments have jurisdictions to create innovative supranational structures to help addressing sustainability challenges (Kelman et al., 2015). A regional business ecosystem can take several strategies towards success: defining the composition of different actors in the ecosystem (Nambisan & Sawhney, 2011); coordinating value creation activities with all stakeholders (Williamson & Meyer, 2012); establishing technological standards (Koenig, 2012) and creating fair value mechanisms (Iansiti & Levien, 2004).

5.2.3. Methodology

The approach used in this qualitative and exploratory study will enable us to develop, clarify and modify concepts and ideas. This approach is especially appropriate to understand the actors' perceptions, making it possible to conceive and deepen new perspectives of knowledge, also contributing to the enrichment of the theory on value creation and commercialization in insular ecosystems. From another perspective, a singular application of quantitative methods fails in capture the essence of phenomena in certain areas of increased complexity (Jonsson, Baraldi, & Larsson, 2015).

The use of case study allows us to verify a peculiar reality, helping to better understand the facts through an in-depth investigation about the operations, assuming itself as an alternative research methodology, in increasing use (Yin, 2015).

As regards the analysis unit, Azores and Madeira business incubators were considered. Business incubators were selected as the unit of analysis because they are the organizations that most easily interact with different stakeholders in insular ecosystems of innovation. Globally, the Azores have four business incubators and Madeira has a business incubator. The five incubators were invited to participate in this study. However, only four incubators accepted to participate (three business incubators in Azores and one incubator in Madeira), thus managing to gather an important representation of the reality of these island regions. A survey which was largely structured from open questions was administered to four Portuguese incubator managers based on the studies of Colombo and Delmastro (2002) and Vedovello (1998).

5.2.4. Business Incubators in Azores and Madeira Islands

The concept of "business ecosystem" was developed by Moore (1993) Moore to refer to coevolution of capacities among various companies working cooperatively to support new products, meet customer needs and incorporate future innovations. However, the concept has evolved and the concept "innovation ecosystem" has emerged. Innovation ecosystems are people, companies and organizations that interact with each other in order to develop projects, forming a learning environment and innovative creation. Technology parks, innovation centers and incubators are some illustrations of innovation ecosystem.

Business incubators positively support local development, boosting entrepreneurship (Siemieniuk, 2016). Incubators of academic startups and spin-offs play an important role in technology transfer and commercialization, offering space and services at a low cost price to incubated companies (Boh, De-Haan, & Strom, 2016; Cesaroni & Piccaluga, 2016). Most incubators provide a physical space, as well as the opportunity to establish Knowledge Transfer Networks and support innovative projects or ideas in its initial phase. In general, incubators are allied and close to universities, laboratories and research institutes, to take advantage of the knowledge that is conceived in these organizations (Hansen, Chesbrough, Nohria, & Sull, 2000).

Business incubators are organizations whose main objective is helping create successful companies that will leave the incubator financially stable and independent, within a previously established period (Aernoudt, 2004). In this study, four incubators distributed by Portugal Islands (Table 5.2.2) answered the questionnaire.

Table 5.2.2 – List of Incubators

Incubator Name	Date of Founding	Legal Status	University Incubator	Incubator integrated and located in a Science and Technology Park infrastructure	Centres of Business Innovation	Independent Incubator	Sector based focus	No. of Companies Incubated
Incubadora GO-ON	2015	Non-profit private institution	No	Nonagon - São Miguel Science and Technology Park	Yes	No	Technology	7
Praia Links - Incubadora Local da Praia da Vitória	2016	Municipal Incubator	No	No	No	Yes	Agro-commercial, sea, local, tourism and technology	22
Startup Angra	2016	Municipal Incubator	No	No	No	No	No	5
Startup Madeira	2006	Quota held company	No	Yes	Yes	Yes	Incubation of technology and service companies	11

Business incubation is defined as a model that seeks to link skills, technology, capital and know-how to leverage business talent and accelerate the company's development (Smilor, 1987). To achieve success incubated companies need to interact to promote the value and increase performance (Hughes, Ireland, & Morgan, 2007).

According to Berry and Taggart (1998), the business incubators must have a strategic plan and an annual management plan of their activities, which was verified in the four insular incubators.

The funding sources for insular incubators are diversified, with four business incubators indicating that they are funded largely by municipalities as well as by community funds. However, they indicate other income sources such as rent (lease and service contract).

The four analyzed business incubators support about 45 companies, which demonstrate their importance for insular regions (Minguillo, Tijssen, & Thelwall, 2015). As far as the formalized universities spin-off is concerned, only the GO-ON incubator has one. The other three business incubators have no university spin-off. However, all insular incubators, with the exception of Startup Madeira, report having at least one Spin-off Company from another company.

Regarding the selection of companies that are intended to incubate, the criteria are based on: (1) the business idea in line with the region's strategic sector and incubator; (2) market size/trend; (3) a business idea that is financially sustainable, competitive and with growth potential; (4) ability to create networks.

In the case of cooperation networks (Papagiannidis, Li, Etzkowitz, & Clouser, 2009), the analyzed business incubators perform some activities to encourage cooperation and value creation between incubator companies with university students and companies. The activities are based on the organization of workshops, visits, co-working, multisector meetings, and event organization.

About legal support to companies and universities, regarding the knowledge/technology transfer, insular incubators only report to have legal and technical support or partnership from the legal department of the Chamber of Commerce. And 2 of the insular incubators do not mention any legal support. Weele, Rijnsoever, and Nauta (2017) argue that sometimes the poor incubators performance in terms of knowledge transfer is due to the fact that incubated companies cannot take full advantage of the resources offered by the incubator.

Regarding the technology commercialization, the incubators only indicated that they organize meetings with potential stakeholders, and Startup Angra indicates that they have support in this area through a partnership with SBDA (Society for the Business Development of the Azores). Aernoudt (2004) states that combined actions, promoted through networks with other European and international companies, incubators and other bodies, should be developed in order to stimulate the emergence of more technology-based companies, fostering entrepreneurship and the technology transfer and marketing, which can also result in an increase in the number of projects for incubators.

With regard to R&D connections with other incubators or research institutions, all incubators in the Azores stated that they have some link type (BICs, Tecparks, EBN and Azores Incubators Network, SVG California), with Startup Madeira being part of the European network of business and innovation centers. This network is supported by EBN (also mentioned in the Azores incubator) and has more than 160 BICs distributed by 28 countries of the European Union.

Incubators evaluate the current cooperation between higher education institutions and incubated companies as insufficient, with the exception of Praia Links, which is positive. Still within the cooperation, all incubators consider the cooperation networks among incubated companies to be of the utmost importance, with the exception of the Praia Links that it considers reasonably important. The main incubators' activity is promoting relations between industry and universities for a mutual exchange of resources as a result of joint R&D projects, as well as public and private research (Westhead & Storey, 1995).

5.2.5. Building a Successful Model for Insular Innovation Ecosystem

As has been seen previously, the insular Portugal regions still have a long way to go in order to overcome the difficulties resulting from insularity. Although incubators have adequate infrastructure for the implementation of enterprises, there are a number of difficulties resulting from the inability of these ecosystems to build synergies so that they can create more value for their regions.

One of these difficulties may be related to the difficulty in recruiting qualified human resources for these regions (Kelman et al., 2015). In this sense, it is important to share knowledge of insular ecosystem. It is recommended that these ecosystems be managed by human resources from a number of countries, or hire employees outside the insular region (Kelman et al., 2015). In general, all incubators recognized the importance of establishing and strengthening networks. However, none of the insular incubators indicated having networks with local or other universities. In this subject the insular incubators are still in an embryonic stage, recommending that they focus on improving the current situation. This should be the next step towards creating a sustainable insular ecosystem. The Quadruple Helix should be incorporate into Insular Innovation Ecosystems (Carayannis & Campbell, 2009), providing the creation of more value in these ecosystems and regions, consequently.

For value creation and commercialization in an ecosystem, the actors and their intermediaries are fundamental (Wieland, Koskela-Huotari, & Vargo, 2016). The definition of knowledge intermediates allows the inclusion of numerous academic entrepreneurship organizations, TTOs (Bradley, Hayter, & Link, 2013), incubators (Mian, 2011), science parks (Mian, Fayolle, & Lamine, 2012) and the proof-of-concept centers (Bradley et al., 2013). Intermediaries

specializing in research, such as cooperative research centers (Gray & Boardman, 2010) and industrial consulting vehicles (O'Gorman, Byrne, & Pandya, 2008) can guide teachers and students to the market. Although these new marketing intermediaries are introduced, the tasks or intermediaries that incubators already use must be maintained, for example, by the Society for Business Development (SBD).

In order for insular ecosystems to succeed, it will be important to gradually introduce the channels of technology transfer (temporary employment of an academic, research consortium, minority capital of a spin-off company, consulting and advisory, joint venture research, R&D contract, research fund, purchase a license/patent).

From the data collected in insular incubators and literature review, the "Insular Innovation Ecosystem" model (Figure 5.2.1) is proposed.

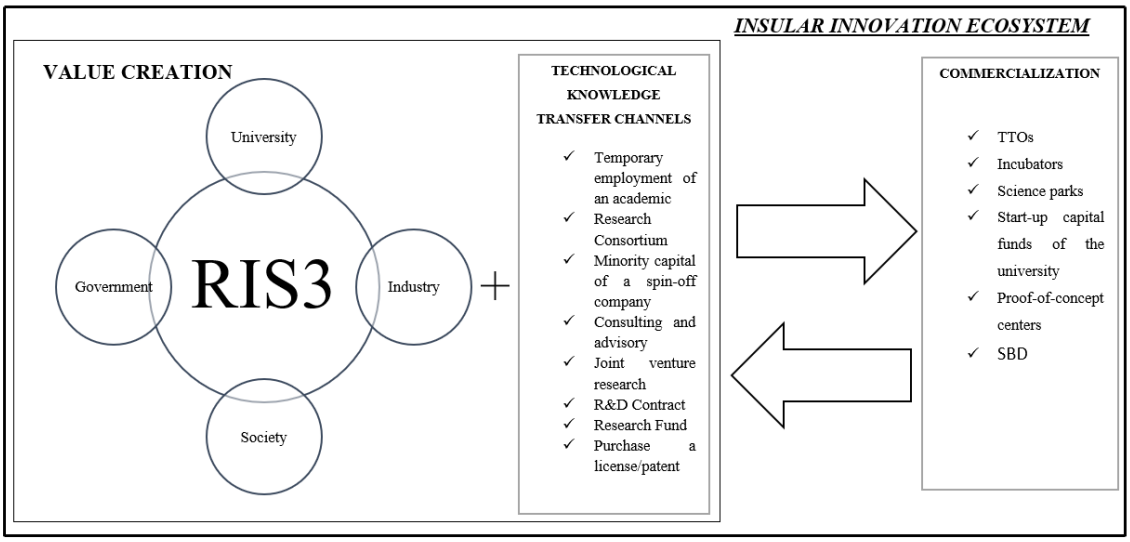

Figure 5.2.1 – Insular Innovation Ecosystem

The Insular Innovation Ecosystem has been developed for insular regions to solve their problems, as well as to improve their economic and social performance in a sustainable way. The model is based on value creation and commercialization and it must start from the resources and capabilities (strategic sectors) defined in RIS3, for each particular region. It is through RIS3 that ecosystems can be financed in large part.

In order to implement and develop the expertise areas defined on RIS3 for each region, it is important for Quadruple Helix actors to interact, so the network connections will be stronger. To accelerate the value creation, it is essential to incorporate the transfer channels of technological knowledge.

Once the value is created, it is necessary to have mechanisms that allow its commercialization. In this sense, intermediaries are important to bridge the gap between value creation and the commercialization of this value by different markets.

The Insular Innovation Ecosystem is a model geared towards international markets. The reason is that these regions have relatively small populations and limited resources and this is a possible way for problems of insular regions can be minimized.

5.2.6. Final Results

This research aimed to evaluate how insular ecosystems create and commercialize value. The results show some difficulties that insular regions face (economic, environmental and social). It was evident that the two insular ecosystems (Azores and Madeira) still have a long way in order to reduce the asymmetries to other regions.

It was found that one of the main problems of insular ecosystems is the creation of networks, both internally and externally. At the internal level, there were only networks created between government and companies, with incubators being a mere link vehicle. For example, no incubator has networks created with universities (local or not), which clearly is a disadvantage for all the actors. At the external level, although they are part of an international network, the idea is that there is no knowledge transfer among the actors that make up this network. A potential solution could be having a human resources interchange between different partners, thus they can learn from each other and improve sectors that are under-income in their region.

It is also verified that the RIS3 defined for each insular region must be taken into great consideration. It is from RIS3 that insular ecosystems of innovation can capture a good part of capital for the ecosystem to succeed. Thus, it will allow the innovation ecosystem to first create the value, and later market it, thus obtaining economic benefits.

In order to insular innovation ecosystems create value more frequently and sustainably, it is crucial that technological knowledge transfer channels (temporary employment of an academic, research consortium, minority capital of a spin-off company, consulting and advisory, joint venture research, R&D contract, research fund, purchase a license or patent) are well implemented and developed. Intermediaries were also identified (TTOs, business incubators, science parks, university start-up funds, proof-of-concept centers, SBD) that can help insular regions and their innovation ecosystems overcome the commercializing problems of the value created.

The two research questions conducted to our proposed model: Insular Innovation Ecosystem model. This model intent to help insular regions to create innovative and sustainable ecosystems. The key concept in the Insular Innovation Ecosystem is the strong interaction between quadruple helix, as well as the creation of internal and external networks for the

insular region where the ecosystem is implanted. It is through the creation of these networks that insular ecosystems will be able to create more value, spreading knowledge among the various partners. In this way, they will accelerate the value creation and with higher profit margins. The focus of these ecosystems must be international markets.

This research is exploratory and innovative in nature, since there are few studies on ecosystems in insular regions. It is believed that the Insular Innovation Ecosystem model can have a significant impact on governments, companies, universities and society in these regions. From this model, new political measures can be developed to boost and improve insular economies and the creation of networks, as well as the society life quality. This model is expected to mitigate the disparities between insular regions and other regions.

As limitations of this study, it should be noted that the Insular Innovation Ecosystem model is theoretical, which is why it still needs to be deeply tested. For this study only the incubators' responses have been taken into account.

Therefore, it recommends for future research lines, quantitative and qualitative studies in which the visions of government, companies, universities and society are considered. In this way, it is possible to compare the vision of all the intervening actors, and the Insular Innovation Ecosystem model can be confirmed, rejected or adjusted. It will be interesting to implement the Insular Innovation Ecosystem model and to test if predictions left in this research are confirmed or not.

Part III

CHAPTER 6 - Conclusions, Regional and Managerial Implications

In the introduction, we formulated the overall research objective of this study: “to analyse the relationship between innovation, entrepreneurship and competitiveness in the context of Research and Innovation Smart Specialisation Strategies” (RIS3), following the quadruple helix network approach to regional economies, in economic and social development ". Thus, the following six specific research objectives were formulated: 1) Identify the main trends of the literature in RIS3 and academic entrepreneurship; 2) Assess the impact of innovation performance in European regions; 3) Analyse the perception of regional stakeholders in the different domains of research and innovation strategies for smart specialization (RIS3) in the creation of regional competitive advantages; 4) Analyse the processes of transfer and commercialization of knowledge and technology; (5) Assess resources and capacities in island regions in the area of value creation and marketing; 6) Find a support model for measuring the perception of regional stakeholders in the different domains of RIS3 in the context of innovative regional ecosystems.

Out of these six general objectives there have been six chapters that make up the present PhD thesis. Chapters 2, 3, 4, 5 are composed of six articles. The articles follow the idea that a good theory needs to be simple, sober and realistic (Pearl, 2009; Popper, 2005).

This final chapter summarises the main conclusions derived from the chapters, after which some general observations and insights learned from the empirical studies are discussed at the end of this chapter. This chapter also considers the main constraints identified during the development of the chapters and identifies possible avenues for future research.

6.1.Main Research Findings and Model Creation

The sustainability and socio-economic development of countries and regions depend on their competitive advantages, including their positioning in global markets, their ability to attract investment (internal or external investment), their ability to attract and retain skills, which together they dictate their overall ability to create wealth, job creation, and social well-being (Buesa, Heijs, & Baumert, 2010; Dudek & Wrzochalska, 2017; Farinha & Ferreira, 2016).

In this context, smart specialisation and RIS3 are the European Union's main growth approach for the period 2014-2020. These strategies must be formulated by a process of discovery and innovation for which academic entrepreneurship is crucial (Panori, Komninos, Kakderi, & Fellnhofer, 2017).

Chapter 2 considered two articles that identified the main tendencies and gaps in the literature in RIS3 and in the "regional academic entrepreneurship".

RIS3 are the new regional policies for the EU, which are based on a smart specialisation strategy. This smart specialisation strategy aims to create competitive advantage (Radosevic & Stancova, 2018). The regions, through regional governments when they implemented RIS3, had to select smart specialisation domains. It is through these smart specialisation domains that the regions have access to the 2014-2020 Structural Funds (Foray et al., 2012; Gemma & Bulderberga, 2017a; Paliokaite, Martinaitis, & Reimeris, 2015).

The "regional academic entrepreneurship" was a new concept developed and proposed by us, which consists of the creation of regional economic value through the commercialisation of intellectual property created by university resources, or through the creation of spin-offs academic or academic startups (Lopes, Ferreira, et al., 2018).

As these two investigations realised the need for additional diagnostic support in relation to the ecosystems of entrepreneurship and innovation in general. More specifically, with the analysis of the clusters the relevance of investigating innovation, smart specialisation, RIS3 and knowledge transfer and technology commercialisation in the regional context was verified. Thus, Chapters 3, 4 and 5 have appeared where these themes are addressed.

To assess the impact of innovation performance in European regions, Chapter 3 was developed. In this context, the most appropriate regional policy for the European 2020 agenda required further reflection on how to direct and guide these policies to achieve the goal of intelligent growth. These policies revealed problems in adapting to the industrial dimension (excellence in knowledge, R&D support, technological innovation) at the regional level (Camagni & Capello, 2013). Having said this, the following research question was formulated: which variables generate impacts on the innovation performance of European regions considered moderate innovator regions?

In order to answer the research question, we arrived at the explanatory model regarding innovation performance in the moderate innovator regions. It was verified that the variable SMEs with product or process innovations positively affects the innovation performance of the moderate innovator regions. In contrast, the variable SMEs innovating in house and innovative SMEs collaborating with others negatively affect innovation performance. Thus, the R&D investment made by the companies and governments of moderate innovator regions has been found to be insufficient. SMEs in moderate innovator regions need to invest more in R&D.

In relation to regional and national policies there was a need to increase networking and interaction among different actors. Support for the mobility of workers within networks should be encouraged so that know-how is more easily disseminated, learned and implemented. The strengthening of networks between universities, research centres, companies and regional governments should be increasingly encouraged. With the creation of networks, companies will be able to adapt more easily to the rapid and uncertain changes in increasingly competitive markets.

Innovation has become increasingly important in the smart specialisation and therefore in RIS3 (Gemma & Bulderberga, 2017b). Regions and their actors should pay more attention to the resources and capacities they have available, so that regional development is increasing. Innovation policy must be seen as a means of mobilising, renewing, building and acquiring new resources and capabilities in a region rather than a cost. Regions should build and stimulate regional capacity at the network level for economic renewal (Laasonen & Kolehmainen, 2017). In this context, in Chapter 4 we analysed the perception of regional stakeholders in the different domains of RIS3 in the creation of regional competitive advantages and find a support model for measuring the perception of regional stakeholders in the different domains of RIS3 in the context of innovative regional ecosystems.

When RIS3 emerged, regions had to select smart specialisation domains as well as their priorities in areas where the region has a relative advantage (Foray, 2014), which can give rise to a competitive advantage. RIS3 highlights the role of knowledge, technology and innovation for economic development and social well-being (Radosevic & Stancova, 2018; Tiits et al., 2015). RIS3 consists of investing in knowledge, human capital, industrial and technological capital and territorial competencies (Camagni & Capello, 2013; Muller et al., 2017).

With respect to territorial competences, the resource-based view (RBV) theory emerged from the objective of assisting strategic decisions, developing tools to study the positioning of companies with respect to their resources and capacities (Grant, 1991; Wernerfelt, 1984).

The model “Value, Rarity, Imitability and implemented in the Organization” (VRIO) serves as a means of applying the RBV. The VRIO model is composed of four dimensions relevant to the resources that achieve real and sustainable advantages: "Value, Rarity, Imitation and Implementation in the Organization" (Barney, 1991; Barney & Wright, 1998). This posed the following research questions: Are the RIS3 domains selected creators of sustainable competitive advantage for regions? Are there significant differences in stakeholder perceptions about RIS3 domains, between insular regions and continental regions? How to apply the VRIO model to regions?

To answer these questions, the VRIO model was adapted and tested in each of the 7 Portuguese regions (North region, Lisbon region, Central region, Alentejo region, Algarve region, Madeira region, Azores region). It was concluded with Chapter 4 that, in general, all Portuguese regions reveal problems in the identification of smart specialisation domains for RIS3. The smart

specialisation domains, before being selected, require a detailed and complete diagnosis of territorial innovation capabilities. A poor diagnosis can lead to the expected results for the regions not being achieved. In order to avoid this situation, the characteristics and traditions of the regions have to be taken into account when selecting the smart specialisation domains (Camagni & Capello, 2013). The results suggest that regions should re-evaluate the selected smart specialisation domains. Searching for new smart specialisation domains to replace those who are not delivering the expected results may be the solution. There are regions with a large number of selected smart specialisation domains (e.g. the North region and Central region), where reducing the number of selected smart specialisation domains may be a good alternative.

The results also confirm the existence of asymmetries in the Gross Domestic Product (GDP) per capita between the regions of the continent and the archipelago. These asymmetries result from the peculiar characteristics and problems resulting from insularity (Lopes, Farinha, et al., 2018). The region of the Azores has the lowest GDP per capita at national level and it is necessary to rethink the policies implemented based on the one indicated previously.

Also in Chapter 4, it was possible to adapt and apply the VRIO model to regions. It should be noted that the VRIO model was originally developed and applied in organisations (Barney, 1991). The model outlined in Chapter 4 is therefore unique to regions. In the new model presented, RIS3 of the respective regions is used as resources and capabilities.

Regarding political agendas, technology transfer and commercialisation processes are currently the main topics of discussion (Debackere & Veugelers, 2005; Peng, Ferreira, & Zheng, 2017). It is crucial that the transfer and commercialisation of knowledge and technology processes need to go beyond the signing of patent licensing contracts deposited by universities in order to foster new entrepreneurial projects. Thus, it is important to understand the process of supporting academic innovation provided by specialised entities, as well as to better clarify the capacity of society to absorb knowledge and technology (Jonsson et al., 2015).

In this context, Chapter 5 deals with 2 articles analysing the processes of transfer and commercialisation of knowledge and technology, as well as evaluating resources and capacities in island regions in the areas of creation and marketing values.

We conclude with Chapter 5 that processes of transferring and commercialising knowledge and technology acquired in universities provide an important source of economic growth for the regions. For this to happen, the transfer and marketing processes must be deepened through academic commitments to different interactive processes, be they conferences, collaborations or publications.

It was also verified that the cooperation networks operated by the incubators subject to analysis, carry out multiple activities with the purpose of stimulating links and connections between the companies that shelter, university students, companies and other diversified activities. These diverse activities include promoting and organizing workshops for college

students and businesses to present their products/services or experiences as well as publicise through campaigns of new and innovative products and services that students can develop and market. However, most incubators rated cooperation between higher education institutions and incubated enterprises as insufficient. Several other activities have been suggested that can be developed to improve cooperation between incubators, enterprises and higher education institutions.

Concerning the cooperation networks, more than 50% of the incubators claimed to have R&D connections with other incubators or research institutions or with some other national or international organisation. However, incubators say they still need to build more and improve collaborative networks.

About the transfer of knowledge and technology, it was found that some incubators did not implement any mechanism to support the transfer of knowledge and technology. Some measures have been suggested that can be implemented to improve this deficit.

In the last article of the thesis and within Chapter 5 we gave special emphasis to the Portuguese island regions. The island regions present similar economic, environmental and social problems, most of them are of a structural nature, over which they have no control (Lopes, Farinha, et al., 2018; Meneses et al., 2012). As resources are limited, the sustainable use of these resources still has a more relevant importunity.

In this context, the isolation, marginalisation and small size of island regions should be seen as an opportunity to develop innovation. To generate innovation, island regions tend to create multicultural clusters and alliances that pool resources. Therefore, the following research questions were formulated: In what resources and capabilities should stakeholders focus on creating value in an insular ecosystem? Who encourages, initiates and develops an insular ecosystem? How to market the created value in an insular ecosystem?

We conclude that the island regions of Portugal still have a long way to go to overcome the difficulties resulting from insularity. The difficulties in recruiting skilled human resources for island regions is a reality. Knowledge sharing in island ecosystems assumes even more as a factor that has to be implemented and encouraged increasingly (Kelman, Burns, & Johansson, 2015).

It was also noted that none of the island incubators indicated having networks with local or other universities. In this regard the island incubators are still at an embryonic stage, recommending that they focus on improving the current situation. This should be the next step towards creating a sustainable island ecosystem. Some suggestions have been made to improve the current situation of island ecosystems.

The “Insular Innovation Ecosystem” model was also developed to help island regions solve their problems, as well as to improve their economic and social performance in a sustainable way. The model is based on the creation and commercialisation of value and must start from the

resources and capacities (strategic sectors) defined in RIS3, for each particular region. It is through RIS3 that island ecosystems can be financed to a large extent. The "Insular Innovation Ecosystem" model is based on a strong interaction between quadruple helix actors, as well as the creation of internal and external networks in the insular region where the ecosystem is implemented. It is through the creation of these networks that island ecosystems can create more value, disseminating knowledge among the various partners. In this way, they will accelerate the creation of value and with greater economic returns.

To facilitate the reader's comprehension of all the literature review and the results of the empirical research carried out in this doctoral thesis, we developed the following model titled "Regional Helix Assessment Model" (Figure 6.1).

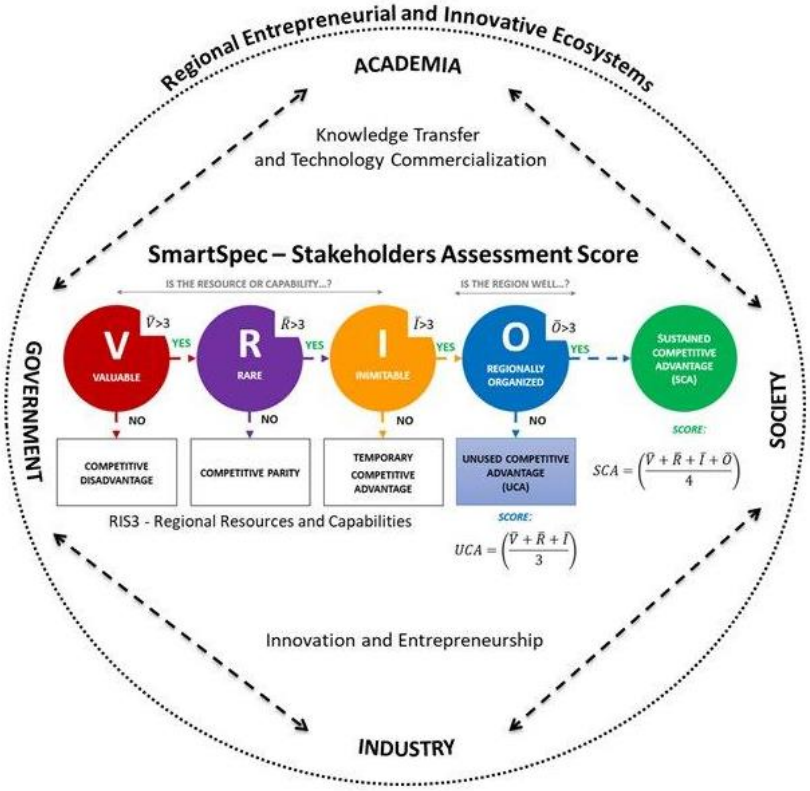

Figure 6.1 - Regional Helix Assessment Model

The "Regional Helix Assessment Model" meets the objective 6 of this thesis, "find a support model for measuring the perception of regional stakeholders in the different domains of RIS3 in the context of entrepreneurial innovative regional ecosystems". These ecosystems supported by the collaborative interfaces of quadruple or more helices (Carayannis et al., 2018; Leydesdorff, 2012; Peris-Ortiz, Ferreira, Farinha, & Fernandes, 2016) need to be associated with other performance measurement tools, including measuring the perception of regional stakeholders in the different domains of Smart Specialisation.

In the framework of the quadruple or more helices, focused on the dynamics of smart specialisation of territories and the valorisation of their resources and capabilities (Barney, 1991) with emphasis on regional entrepreneurial and innovative ecosystems, through knowledge transfer and technology commercialisation (Lopes, Farinha, & Ferreira, 2018; Lopes, Farinha, Ferreira, & Ferreira, 2018), it becomes urgent to evaluate the ecosystems' performance (Lopes & Farinha, 2018), including the perception of its stakeholders.

The original VRIO model studies the performance of resources and capabilities at the internal level of an organisation, from the perspectives of "valuable", "rarity", "expensive to imitate" and "exploited in the organisation". The adaptation of the model to the territories (regions, countries or groups of countries), allows to analyse the stakeholders perceptions, in the perspective of the different dimensions of smart specialisation policies (Barney, 1991; Wernerfelt, 1984).

The operation of the model is based on the application of a stakeholder questionnaire, based on a panel of resources and capabilities, through the application of a 5-point Likert scale agreement (Croasmun & Ostrom, 2011). The validation of each resource or capacity is achieved when it reaches an average above three, reaching the Unused Competitive Advantage (UCA) or Sustained Competitive Advantage (SCA) position when this resource or capability is already implemented in the region.

The model aims to help the regions achieve sustainable competitive advantages, facilitating the comparison of performance between regions.

6.2. Limitations and Future Lines of Research

Any scientific investigation inevitably incurs its own limitations. For an adequate interpretation of the results it is imperative that the limitations detected in the investigations become explicit. Limitations vary according to the deliberate and subconscious choices made.

In the context of Chapter 2, only articles published in the Web of Science or SCOPUS database were considered, thus excluding studies that might be of interest. The key search terms used limit the results achieved, as well as the areas underlying the selected themes. As future lines of research, articles can be approached according to their methodologies (conceptual, quantitative, qualitative and mixed) and therefore be quantified. These quantifications can then be treated by SPSS to arrive at more conclusions. Other types of publications may be included in addition to articles. Publications present in other databases may also be taken into account.

With regard to the variables that best explain the performances of EU innovative regions as verified in Chapter 3, the data collected was restricted to that available in the Regional Innovation Scoreboard 2016. Only EU regions classified as moderate innovators were considered

for the study. Therefore, innovation leaders, strong innovators and modest innovators regions were excluded from the study. Consequently, we suggest that in future lines of research, the other excluded typologies should be included and comparative analyses performed.

With regard to evaluating stakeholders' perceptions about the adequacy of the Smart Specialisation strategies defined in RIS3 for their regions, discussed in Chapter 4, the model developed was only tested in the 7 regions of Portugal. Thus, in future investigations the model can be applied in other regions or countries that have implemented RIS3.

In the context of the dynamics underlying the mechanisms of transfer and commercialisation of university technology in Portugal, discussed in Chapter 5, the limitations of the study are inherent to all case studies, i.e. the results achieved in these investigations cannot be generalised. The study was also restricted to Portugal. Regarding the "Insular Innovation Ecosystem" model, it should be noted that it is theoretical and still needs to be tested. In terms of future lines of research, we suggest quantitative studies on this topic to validate if the results verified here can be generalised. This study can also be expanded to other countries, as well as examining the differences in the commercialisation of knowledge and technology between countries. Regarding the "Insular Innovation Ecosystem" model, it is pertinent to implement and test, thus verifying if the predictions left in this investigation are confirmed.

6.3. Published Studies

The part II of this PhD thesis has four chapters. From the four chapters resulted six scientific. The six scientific research are published in journals indexed to the database Web of Science or Scopus as can be seen in Table 6.1.

Table 6.1 - Published chapters

Chapters	Articles	Journals	ISI/WoS - Impact Factor (2017)	Scopus - Quartile (2017)
Chapter 2	Innovation Strategies for Smart Specialisation (RIS3): Past, Present and Future Research	Growth and Change	1.192	Q3
	Emerging Perspectives on Regional Academic Entrepreneurship	Higher Education Policy	0.821	Q2
Chapter 3	Reflecting on Innovative Performance of European Regions in the age of smart specialization	Global Business and Economics Review	-	Q3
Chapter 4	Does Regional VRIO model help policy-makers to assess the resources of a region? A Stakeholder perception approach	Land Use Policy	3.194	Q1
Chapter 5	Peeking beyond the wall: Analysing university technology transfer and commercialisation processes	International Journal of Technology Management	0.869	Q2
	Value creation and commercialization in insular ecosystems	International Journal of Social Ecology and Sustainable Development	-	Q4

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List of Annexes

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Annex II – (Chapter 5)

Questionnaire-based surveys of Portuguese incubator managers

Annex III – (Chapter 5)

Questionnaire-based surveys of Portuguese incubated company managers

Annex IV – (Chapter 5)

Semi – structured interview guide R&D project

Annex I – (Chapter 4)

Questionnaires applied in the 7 regions of Portugal (North region, Lisbon region, Central region, Alentejo region, Algarve region, Madeira region, Azores region)

North region

O presente questionário está a ser desenvolvido no âmbito da tese de doutoramento "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems" da Universidade da Beira Interior (UBI) em Portugal. Está a realizar-se um estudo internacional sobre recursos e capacidades nas regiões de Portugal. Este questionário é dirigido a empresas, incubadoras, câmaras municipais, universidades e institutos politécnicos sediados na região Norte de Portugal. Abaixo estão algumas perguntas que nos ajudarão a perceber a sua perceção acerca das Capacidades e Recursos da região.

Na escala de valores do questionário abaixo (1 a 5), responda aos itens, marcando o que considera ser a resposta apropriada. Escolha apenas uma resposta. Muito obrigado pela sua cooperação!

1.Classifique os Recursos do Mar e Economia quanto a:

		1	2	3	4	5	
1.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
1.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
1.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
1.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

2.Classifique o Capital Humano e Serviços Especializados quanto a:

		1	2	3	4	5	

2.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
2.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
2.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
2.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

3.Classifique a Cultura, Criação e Moda quanto a:

		1	2	3	4	5	
3.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
3.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
3.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
3.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

4.Classifique as Indústrias da Mobilidade e Ambiente quanto a:

		1	2	3	4	5	
4.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
4.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
4.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
4.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

5. Classifique os Sistemas Agro-ambientais e Alimentação quanto a:

		1	2	3	4	5	
5.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
5.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
5.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
5.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

6. Classifique as Ciências da Vida e Saúde quanto a:

		1	2	3	4	5	
6.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
6.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
6.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
6.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

7. Classifique o Capital Simbólico Tecnologias e Serviços do Turismo quanto a:

		1	2	3	4	5	
7.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
7.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
7.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
7.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

8. Classifique os Sistemas Avançados de Produção quanto a:

		1	2	3	4	5	
8.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
8.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
8.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
8.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

9.Dados da organização

9.1. Nome da organização (facultativo):_____

9.2. Classificação da organização (selecione somente 1):

Empresa ☐

Incubadora/Parque tecnológico ☐

Câmara municipal ☐

Universidade ☐

Instituto Politécnico ☐

9.3. Sector de atividade (selecione somente 1):

Agricultura, produção animal, caça e silvicultura ☐

Pesca, aquacultura e atividades dos serviços relacionados ☐

Indústrias alimentares e das bebidas ☐

Fabricação de têxteis ☐

Indústria do couro e de produtos do couro ☐

Indústria do calçado ☐

Indústrias da madeira e da cortiça e suas obras ☐

Indústria da cortiça ☐

Fabricação de pasta, de papel e cartão e seus artigos ☐

Fabricação de moldes metálicos ☐

Construção ☐

Alojamento e restauração (restaurantes e similares) ☐

Caminhos de ferro, transportes marítimos e aéreos ☐

Tecnologias de Informação, Comunicações e Eletrónica (TICE) ☐

Publicidade ☐

Seleção e colocação de pessoal ☐

Serviços às empresas ☐

Investigação e Desenvolvimento	☐
Ensino	☐
Organizações económicas, patronais e profissionais	☐
Administração Pública	☐
Outra opção	Qual?_____

Lisbon region

O presente questionário está a ser desenvolvido no âmbito da tese de doutoramento "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems" da Universidade da Beira Interior (UBI) em Portugal. Está a realizar-se um estudo internacional sobre recursos e capacidades nas regiões de Portugal. Este questionário é dirigido a empresas, incubadoras, câmaras municipais, universidades e institutos politécnicos situados na região de Lisboa. Abaixo estão algumas perguntas que nos ajudarão a perceber a sua perceção acerca das Capacidades e Recursos da região.

Na escala de valores do questionário abaixo (1 a 5), responda aos itens, marcando o que considera ser a resposta apropriada. Escolha apenas uma resposta. Muito obrigado pela sua cooperação.

1.Classifique o Turismo e Hospitalidade quanto a:

		1	2	3	4	5	
1.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
1.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
1.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
1.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

2.Classifique a Mobilidade e Transportes quanto a:

		1	2	3	4	5	
2.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
2.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
2.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
2.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

3.Classifique os Meios criativos e Indústrias culturais quanto a:

		1	2	3	4	5	
3.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)

3.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
3.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
3.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

4.Classifique a Investigação, Tecnologias e Serviços Saúde quanto a:

		1	2	3	4	5	
4.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
4.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
4.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
4.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

5.Classifique a Prospeção e Valorização de Recursos Marinhos quanto a:

		1	2	3	4	5	
5.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
5.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
5.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
5.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

6.Classifique os Serviços Avançados às Empresas quanto a:

		1	2	3	4	5	
6.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
6.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
6.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
6.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

7.Dados da organização

7.1. Nome da organização (facultativo):_____

7.2. Classificação da organização (selecione somente 1):

Empresa	☐
Incubadora/Parque tecnológico	☐
Câmara municipal	☐
Universidade	☐
Instituto Politécnico	☐

7.3. Sector de atividade (selecione somente 1):

Agricultura, produção animal, caça e silvicultura	☐
Pesca, aquacultura e atividades dos serviços relacionados	☐
Indústrias alimentares e das bebidas	☐
Fabricação de têxteis	☐
Indústria do couro e de produtos do couro	☐
Indústria do calçado	☐
Indústrias da madeira e da cortiça e suas obras	☐
Indústria da cortiça	☐
Fabricação de pasta, de papel e cartão e seus artigos	☐
Fabricação de moldes metálicos	☐
Construção	☐
Alojamento e restauração (restaurantes e similares)	☐
Caminhos de ferro, transportes marítimos e aéreos	☐

Tecnologias de Informação, Comunicações e Eletrónica (TICE)	☐
Publicidade	☐
Seleção e colocação de pessoal	☐
Serviços às empresas	☐
Investigação e Desenvolvimento	☐
Ensino	☐
Organizações económicas, patronais e profissionais	☐
Administração Pública	☐
Outra opção	Qual?_____

Central region

O presente questionário está a ser desenvolvido no âmbito da tese de doutoramento "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems" da Universidade da Beira Interior (UBI) em Portugal. Está a realizar-se um estudo internacional sobre recursos e capacidades nas regiões de Portugal. Este questionário é dirigido a empresas, incubadoras, câmaras municipais, universidades e institutos politécnicos situados na região Centro. Abaixo estão algumas perguntas que nos ajudarão a perceber a sua perceção acerca das Capacidades e Recursos da região.

Na escala de valores do questionário abaixo (1 a 5), responda aos itens, marcando o que considera ser a resposta apropriada. Escolha apenas uma resposta. Muito obrigado pela sua cooperação.

1.Classifique a Agricultura quanto a:

		1	2	3	4	5	
1.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
1.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
1.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
1.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

2.Classifique a Floresta quanto a:

		1	2	3	4	5	
2.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
2.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
2.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
2.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

3.Classifique o Mar quanto a:

		1	2	3	4	5	
3.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)

3.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
3.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
3.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

4.Classifique o Turismo quanto a:

		1	2	3	4	5	
4.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
4.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
4.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
4.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

5.Classifique na área das tecnologias de informação, comunicação e eletrónica (TICE) quanto a:

		1	2	3	4	5	
5.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
5.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
5.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
5.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

6.Classifique os Materiais quanto a:

		1	2	3	4	5	
6.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
6.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
6.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
6.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

7.Classifique a Biotecnologia quanto a:

		1	2	3	4	5	
7.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
7.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
7.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
7.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

8.Classifique a Saúde e Bem-estar quanto a:

		1	2	3	4	5	
8.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
8.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
8.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
8.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

9.Dados da organização

9.1. Nome da organização (facultativo):_____

9.2. Classificação da organização (selecione somente 1):

Empresa	☐
Incubadora/Parque tecnológico	☐
Câmara municipal	☐
Universidade	☐
Instituto Politécnico	☐

9.3. Sector de atividade (selecione somente 1):

Agricultura, produção animal, caça e silvicultura	☐

Pesca, aquacultura e atividades dos serviços relacionados ☐

Indústrias alimentares e das bebidas ☐

Fabricação de têxteis ☐

Indústria do couro e de produtos do couro ☐

Indústria do calçado ☐

Indústrias da madeira e da cortiça e suas obras ☐

Indústria da cortiça ☐

Fabricação de pasta, de papel e cartão e seus artigos ☐

Fabricação de moldes metálicos ☐

Construção ☐

Alojamento e restauração (restaurantes e similares) ☐

Caminhos de ferro, transportes marítimos e aéreos ☐

Tecnologias de Informação, Comunicações e Eletrónica (TICE) ☐

Publicidade ☐

Seleção e colocação de pessoal ☐

Serviços às empresas ☐

Investigação e Desenvolvimento ☐

Ensino ☐

Organizações económicas, patronais e profissionais ☐

Administração Pública ☐

Outra opção Qual?_____

Alentejo region

O presente questionário está a ser desenvolvido no âmbito da tese de doutoramento "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems" da Universidade da Beira Interior (UBI) em Portugal. Está a realizar-se um estudo internacional sobre recursos e capacidades nas regiões de Portugal. Este questionário é dirigido a empresas, incubadoras, câmaras municipais, universidades e institutos politécnicos situados no Alentejo. Abaixo estão algumas perguntas que nos ajudarão a perceber a sua perceção acerca das Capacidades e Recursos da região.

Na escala de valores do questionário abaixo (1 a 5), responda aos itens, marcando o que considera ser a resposta apropriada. Escolha apenas uma resposta. Muito obrigado pela sua cooperação.

1.Classifique a Alimentação e Floresta quanto a:

		1	2	3	4	5	
1.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
1.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
1.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
1.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

2. Classifique a Economia dos Recursos Minerais, Naturais e Ambientais quanto a:

		1	2	3	4	5	
2.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
2.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
2.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
2.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

3. Classifique o Património, Indústrias Culturais e Criativas e Serviços de Turismo quanto a:

		1	2	3	4	5	
3.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)

3.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
3.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
3.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

4. Classifique as Tecnologias Críticas, Energia e Mobilidade Inteligente quanto a:

		1	2	3	4	5	
4.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
4.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
4.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
4.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

5. Classifique as Tecnologias e Serviços Especializados da Economia Social quanto a:

		1	2	3	4	5	
5.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
5.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
5.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
5.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

6.Dados da organização

6.1. Nome da organização (facultativo):_____

6.2. Classificação da organização (selecione somente 1):

Empresa	☐
Incubadora/Parque tecnológico	☐
Câmara municipal	☐
Universidade	☐

Instituto Politécnico ☐

6.3. Sector de atividade (selecione somente 1):

Agricultura, produção animal, caça e silvicultura ☐

Pesca, aquacultura e atividades dos serviços relacionados ☐

Indústrias alimentares e das bebidas ☐

Fabricação de têxteis ☐

Indústria do couro e de produtos do couro ☐

Indústria do calçado ☐

Indústrias da madeira e da cortiça e suas obras ☐

Indústria da cortiça ☐

Fabricação de pasta, de papel e cartão e seus artigos ☐

Fabricação de moldes metálicos ☐

Construção ☐

Alojamento e restauração (restaurantes e similares) ☐

Caminhos de ferro, transportes marítimos e aéreos ☐

Tecnologias de Informação, Comunicações e Eletrónica (TICE) ☐

Publicidade ☐

Seleção e colocação de pessoal ☐

Serviços às empresas ☐

Investigação e Desenvolvimento ☐

Ensino ☐

Organizações económicas, patronais e profissionais	☐
Administração Pública	☐
Outra opção	Qual?_____

Algarve region

O presente questionário está a ser desenvolvido no âmbito da tese de doutoramento "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems" da Universidade da Beira Interior (UBI) em Portugal. Está a realizar-se um estudo internacional sobre recursos e capacidades nas regiões de Portugal. Este questionário é dirigido a empresas, incubadoras, câmaras municipais, universidades e institutos politécnicos situados na região do Algarve. Abaixo estão algumas perguntas que nos ajudarão a perceber a sua perceção acerca das Capacidades e Recursos da região.

Na escala de valores do questionário abaixo (1 a 5), responda aos itens, marcando o que considera ser a resposta apropriada. Escolha apenas uma resposta. Muito obrigado pela sua cooperação.

1.Classifique o Turismo quanto a:

		1	2	3	4	5	
1.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
1.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
1.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
1.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

2.Classifique o Mar quanto a:

		1	2	3	4	5	
2.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
2.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
2.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
2.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

3.Classifique o sector Agro-alimentar / Agro-industrial quanto a:

		1	2	3	4	5	
3.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)

3.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
3.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
3.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

4.Classifique a TIC (Tecnologia da informação e comunicação) e Atividades Criativas quanto a:

		1	2	3	4	5	
4.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
4.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
4.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
4.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

5.Classifique as Energias Renováveis quanto a:

		1	2	3	4	5	
5.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
5.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
5.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
5.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

6.Classifique as Atividades de Saúde e Ciências da Vida quanto a:

		1	2	3	4	5	
6.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
6.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
6.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
6.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

7.Dados da organização

7.1. Nome da organização (facultativo):_____

7.2. Classificação da organização (selecione somente 1):

Empresa	☐
Incubadora/Parque tecnológico	☐
Câmara municipal	☐
Universidade	☐
Instituto Politécnico	☐

7.3. Sector de atividade (selecione somente 1):

Agricultura, produção animal, caça e silvicultura	☐
Pesca, aquacultura e atividades dos serviços relacionados	☐
Indústrias alimentares e das bebidas	☐
Fabricação de têxteis	☐
Indústria do couro e de produtos do couro	☐
Indústria do calçado	☐
Indústrias da madeira e da cortiça e suas obras	☐
Indústria da cortiça	☐
Fabricação de pasta, de papel e cartão e seus artigos	☐
Fabricação de moldes metálicos	☐
Construção	☐
Alojamento e restauração (restaurantes e similares)	☐
Caminhos de ferro, transportes marítimos e aéreos	☐

Tecnologias de Informação, Comunicações e Eletrónica (TICE)	☐
Publicidade	☐
Seleção e colocação de pessoal	☐
Serviços às empresas	☐
Investigação e Desenvolvimento	☐
Ensino	☐
Organizações económicas, patronais e profissionais	☐
Administração Pública	☐
Outra opção	Qual?_____

Madeira region

O presente questionário está a ser desenvolvido no âmbito da tese de doutoramento "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems" da Universidade da Beira Interior (UBI) em Portugal. Está a realizar-se um estudo internacional sobre recursos e capacidades nas regiões de Portugal. Este questionário é dirigido a empresas, incubadoras, câmaras municipais, universidades e institutos politécnicos situados na Madeira. Abaixo estão algumas perguntas que nos ajudarão a perceber a sua perceção acerca das Capacidades e Recursos da região.

Na escala de valores do questionário abaixo (1 a 5), responda aos itens, marcando o que considera ser a resposta apropriada. Escolha apenas uma resposta. Muito obrigado pela sua cooperação.

1.Classifique o Turismo quanto a:

		1	2	3	4	5	
1.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
1.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
1.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
1.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

2. Classifique os Recursos e Tecnologias do Mar quanto a:

		1	2	3	4	5	
2.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
2.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
2.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
2.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

3. Classifique a Saúde e Bem-estar quanto a:

		1	2	3	4	5	
3.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)

3.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
3.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
3.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

4. Classifique a Qualidade Agro-alimentar quanto a:

		1	2	3	4	5	
4.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
4.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
4.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
4.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

5. Classifique a Sustentabilidade, Gestão e Manutenção de Infraestruturas quanto a:

		1	2	3	4	5	
5.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
5.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
5.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
5.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

6. Classifique a Bio-sustentabilidade quanto a:

		1	2	3	4	5	
6.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
6.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
6.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
6.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

7. Classifique a Energia, Mobilidade e Alterações Climáticas quanto a:

		1	2	3	4	5	
7.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
7.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
7.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
7.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

8.Dados da organização

8.1. Nome da organização (facultativo):_____

8.2. Classificação da organização (selecione somente 1):

Empresa	☐
Incubadora/Parque tecnológico	☐
Câmara municipal	☐
Universidade	☐
Instituto Politécnico	☐

8.3. Sector de atividade (selecione somente 1):

Agricultura, produção animal, caça e silvicultura	☐
Pesca, aquacultura e atividades dos serviços relacionados	☐
Indústrias alimentares e das bebidas	☐
Fabricação de têxteis	☐
Indústria do couro e de produtos do couro	☐
Indústria do calçado	☐
Indústrias da madeira e da cortiça e suas obras	☐
Indústria da cortiça	☐

Fabricação de pasta, de papel e cartão e seus artigos	☐
Fabricação de moldes metálicos	☐
Construção	☐
Alojamento e restauração (restaurantes e similares)	☐
Caminhos de ferro, transportes marítimos e aéreos	☐
Tecnologias de Informação, Comunicações e Eletrónica (TICE)	☐
Publicidade	☐
Seleção e colocação de pessoal	☐
Serviços às empresas	☐
Investigação e Desenvolvimento	☐
Ensino	☐
Organizações económicas, patronais e profissionais	☐
Administração Pública	☐
Outra opção	Qual?_____

Azores region

O presente questionário está a ser desenvolvido no âmbito da tese de doutoramento "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems" da Universidade da Beira Interior (UBI) em Portugal. Está a realizar-se um estudo internacional sobre recursos e capacidades nas regiões de Portugal. Este questionário é dirigido a empresas, incubadoras, câmaras municipais, universidades e institutos politécnicos situados nos Açores. Abaixo estão algumas perguntas que nos ajudarão a perceber a sua perceção acerca das Capacidades e Recursos da região.

Na escala de valores do questionário abaixo (1 a 5), responda aos itens, marcando o que considera ser a resposta apropriada. Escolha apenas uma resposta. Muito obrigado pela sua cooperação.

1.Classifique a Agricultura, Pecuária e Agro-indústria quanto a:

		1	2	3	4	5	
1.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
1.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
1.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
1.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

2. Classifique as Pescas e Mar quanto a:

		1	2	3	4	5	
2.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)
2.2. Raridade	(Nenhuma raridade)	☐	☐	☐	☐	☐	(Total raridade)
2.3. Difícil de imitar	(Fácil de imitar)	☐	☐	☐	☐	☐	(Difícil de imitar)
2.4. Explorado pela região	(Nada explorado pela região)	☐	☐	☐	☐	☐	(Totalmente explorado pela região)

3. Classifique o Turismo quanto a:

		1	2	3	4	5	
3.1. Valor	(Nenhum valor)	☐	☐	☐	☐	☐	(Total valor)

3.2. Raridade	(Nenhuma raridade)	☐ ☐ ☐ ☐ ☐	(Total raridade)
3.3. Difícil de imitar	(Fácil de imitar)	☐ ☐ ☐ ☐ ☐	(Difícil de imitar)
3.4. Explorado pela região	(Nada explorado pela região)	☐ ☐ ☐ ☐ ☐	(Totalmente explorado pela região)

4.Dados da organização

4.1. Nome da organização (facultativo):_____

4.2. Classificação da organização (selecione somente 1):

Empresa	☐
Incubadora/Parque tecnológico	☐
Câmara municipal	☐
Universidade	☐
Instituto Politécnico	☐

4.3. Sector de atividade (selecione somente 1):

Agricultura, produção animal, caça e silvicultura	☐
Pesca, aquacultura e atividades dos serviços relacionados	☐
Indústrias alimentares e das bebidas	☐
Fabricação de têxteis	☐
Indústria do couro e de produtos do couro	☐
Indústria do calçado	☐
Indústrias da madeira e da cortiça e suas obras	☐
Indústria da cortiça	☐
Fabricação de pasta, de papel e cartão e seus artigos	☐

Fabricação de moldes metálicos	☐
Construção	☐
Alojamento e restauração (restaurantes e similares)	☐
Caminhos de ferro, transportes marítimos e aéreos	☐
Tecnologias de Informação, Comunicações e Eletrónica (TICE)	☐
Publicidade	☐
Seleção e colocação de pessoal	☐
Serviços às empresas	☐
Investigação e Desenvolvimento	☐
Ensino	☐
Organizações económicas, patronais e profissionais	☐
Administração Pública	☐
Outra opção	Qual?_____

Annex II – (Chapter 5)

Questionnaire-based surveys of Portuguese incubator managers

O presente questionário destina-se a servir de base ao trabalho de investigação conducente à elaboração de uma tese de doutoramento com o tema: "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems".

I. IDENTIFICAÇÃO E CARACTERIZAÇÃO DA INCUBADORA

1. Qual é o nome da Incubadora? Qual a sua data de fundação (e/ou início de atividade)?

2. Qual é a forma jurídica da incubadora?

3. Situação estatutária/dependência da Incubadora:

    a. Incubadora de uma universidade? Se sim, qual?

    b. Incubadora integrada na estrutura de um Parque de Ciência e Tecnologia? Se sim, qual?

    c. Incubadora integrada na estrutura de um Parque Tecnológico? Se sim, qual?

    d. Incubadora sediada num Parque Tecnológico? Se sim, qual?

    e. Centros de inovação de negócios (BIC)?

    f. Incubadora independente?

    g. Outra situação? Se sim qual?

4- Quais são os principais associados/sócios/acionistas participantes no capital da incubadora e respetiva percentagem de participação?

5- A sua incubadora tem alguma orientação sectorial definida estatutariamente? Se sim, qual? (exemplo: Incubação de empresas da área dos serviços, Incubação de empresas da área comercial, Incubação de empresas de base tecnológica)

6- Qual o número de empresa incubadas presentemente? Quais os sectores de atividade abrangidos?

II - GESTÃO DA INCUBADORA

7- Quais são os órgãos de gestão da incubadora?

8- A direção elabora algum Plano anual de atividade? É elaborado algum plano estratégico ou outro de natureza idêntica?

9- Quais são as fontes de financiamento da incubadora? (exemplo: Rendas dos alugueres; Receitas de serviços prestados; Investimentos de "business angels"; Capital de risco; Fundos comunitários; Fundos da universidade; Subsídios dos governos local, regional e central)

10- Quais os serviços que a Incubadora disponibiliza às empresas sediadas?

11- Qual é a origem das empresas sediadas na sua incubadora? (indique o número de empresas em cada origem)

a. Empresa Spin-off de Universidades.

b. Empresa Spin-off de outra empresa.

c. Empresa nova, iniciativa individual ou dos sócios.

d. Empresa ou filial já existente

e. Outras? Se sim, quais?

12- Quais são os critérios de seleção das empresas candidatas à instalação na Incubadora? Existe alguma restrição à admissão de empresas originadas fora do âmbito da Universidade?

13- Que ações desenvolvem para fomentar as ligações de cooperação entre as empresas sediadas na incubadora e a universidade?

14- Que ações desenvolvem para fomentar as ligações de cooperação entre as diversas empresas sediadas na incubadora?

15- Que ações desenvolvem em termos do apoio legal às empresas e universidade no que se refere à transferência do conhecimento / tecnologia (registo marcas, pedidos de patentes, licenciamentos etc...)?

16- Quais os mecanismos de apoio à comercialização de tecnologia disponibilizados pela incubadora?

IV - AVALIAÇÃO DA COOPERAÇÃO UNIVERSIDADE-EMPRESA

17- A sua incubadora está filiada em algum organismo nacional, estrangeiro ou internacional?

a. Se sim, qual?

18- No plano internacional, a sua incubadora estabeleceu alguma ligação de I&D com outras incubadoras ou instituições de investigação?

a. Se sim, qual?

19- Como avalia o estado atual da cooperação existente entre as instituições de ensino superior e as empresas sediadas?

20- Como avalia a importância das redes de cooperação entre as empresas incubadas no contexto nacional e internacional?

21 - Seria possível fornecerem os Estatutos e Regulamento da Incubadora, assim como o último Relatório de gestão e atividades?

Annex III – (Chapter 5)

Questionnaire-based surveys of Portuguese incubated company managers

O presente questionário destina-se a servir de base ao trabalho de investigação conducente à elaboração de uma tese de doutoramento com o tema: "Smart Specialization Strategies as Booster of Regional Entrepreneurial and Innovative Ecosystems".

I. INFORMAÇÃO DE CONTACTO

1. Nome da Empresa?

2. Ano de fundação?

3. Pessoa de contacto? (Nome; Posição / cargo; E@mail; Telefone:)

II. SETOR DE ATIVIDADE DA EMPRESA E PORTFÓLIO DE PRODUTOS

4. Código de atividade económica (CAE)?

5. [Aplicável a empresas da Indústria de alta tecnologia] Em que setor(es) de atividade operam?

6. [Aplicável a empresas prestadoras de serviços de alta tecnologia] Em que setor(es) de atividade operam?

7. Quais os principais produtos (bens ou serviços) da empresa?

8. Qual o mercado onde são comercializados os produtos? - exemplo: hospitais, construção, indústria nuclear, automóvel...

9. Quantos colaboradores a vossa empresa emprega?

    a. Homens?

    b. Mulheres?

III. RECURSOS HUMANOS

10. Quantos colaboradores da empresa têm as seguintes qualificações?

    a. Doutoramento

    b. Mestrado

    c. Pós-graduação

    d. Licenciatura

e. Qualificação profissional

f. Sem qualificação

g. Outra? Se sim, indique qual e o número de colaboradores.

11. Existem políticas de incentivo à formação académica na empresa?

12. Existem motivos específicos (facilitadores e / ou barreiras) para o perfil do emprego, por exemplo facilidade /dificuldade de recrutamento?

a. Se sim, Quais?

IV. LOCALIZAÇÃO

13. O produto (bem ou serviço) é concebido e desenvolvido no Parque de Ciência e Tecnologia/Incubadora?

1 2 3 4 5

(Não é concebido) ☐ ☐ ☐ ☐ ☐ (É totalmente concebido)

14. Qual a percentagem de fabricação / desenvolvimento localizada no Parque de Ciência e Tecnologia/Incubadora?

a) No caso da maior parte do produto ser realizada noutro sítio, por favor indicar local.

15. A sua empresa subcontrata no Parque de Ciência e Tecnologia/ Incubadora?

1 2 3 4 5

(Não subcontrata) ☐ ☐ ☐ ☐ ☐ (Subcontrata sempre)

15. a. Se na maior parte da subcontratação ocorre noutro lugar, por favor indique qual.

16. A sua empresa já deu lugar à criação de novas empresas spin-off? [Empresa nascente de um grupo de pesquisa, normalmente com o objetivo de explorar um novo produto (bem ou serviço) de alta tecnologia]

16.a. Se sim, qual o nome da(s) empresa(s)?

17. A sua empresa teve colaboradores que deixaram a organização para criar uma nova empresa?

17.a. Se sim qual o nome da(s) nova(s) empresa(s) criada(s)?

V. REDES DE COLABORAÇÃO E DE NEGÓCIO

18. A empresa ... (assinale somente as respostas positivas (sim))

a) Possui académicos no quadro? ☐

b) Possui colaboradores como docentes a tempo parcial em Instituições de Ensino Superior (IES)? ☐

c) Desenvolve investigação básica e aplicada em IES paga pela empresa? ☐

d) Estabelece parcerias ao nível de I&D com a Academia regional (Universidade / Instituto Politécnico)? ☐

e) Colabora no âmbito das suas atividades, com outras empresas do Parque de Ciência e Tecnologia? ☐

f) Outras? Quais?

19. Que redes de negócio e cooperação a sua empresa integra (exemplo: associações empresariais, associações sectoriais, clusters, ...)

19.1. Considera que o estabelecimento de redes cria valor para a sua empresa? Se sim, quais as mais valias que as redes proporcionam ou podem vir a proporcionar à sua empresa à sua empresa?

19.2. Consideraria fazer parte de um ecossistema de inovação regional? Porque motivo?

20. Que redes de negócio e cooperação você ou a sua empresa gostariam de integrar (caso existam)?

21. A sua empresa já beneficiou de ajuda ou de apoios públicos? (Fundos estruturais, benefícios fiscais, prémios, incentivos locais ...)

21.a. Se sim, quais?

22. A sua empresa já beneficiou de prémios de mérito ou de estímulo ao empreendedorismo e à inovação?

22.a. Se sim, especifique.

Annex IV – (Chapter 5)

Semi – structured interview guide R&D project

1. Designação do projeto:
2. Programa/apoio (Ex. QREN – I&D em Copromoção):
3. Síntese do projeto:
4. Ano de início/Fim (ou em curso):
5. Investimento total:
6. Total de incentivo:
7. Promotor Líder:
8. Parceiro(s) da Academia:
9. Qual o papel da Academia (Universidade) no apoio à comercialização da tecnologia no contexto do projeto?
10. Quais as principais dificuldades e limitações encontradas ao nível da comercialização da tecnologia?
11. Quais as oportunidades e estratégias identificadas/desenvolvidas para a comercialização da tecnologia?