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Examining the Role of Entrepreneurial Universities in Regional Development

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Examining the Role of Entrepreneurial Universities in Regional Development

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The chapter addresses the main challenges that higher education institutions face in the 21st century as key actors for regional development. The chapter emphasizes their entrepreneurial dimension, as well as new approaches about this subject as it rethinks the scope of the studies about the role of universities in regional development and research on academic entrepreneurship, resulting from the finding that there have been huge expectations on the role of higher education institutions in development, while evidence suggests that the benefits of third mission approaches on society are not as successful as anticipated. In sum, the chapter tackles simultaneously the role of universities in regional development, human capital formation, knowledge formation and diffusion and activation for citizenship, in other words, this chapter contributes to a better understanding of the role of higher education institutions, especially given its relationship with society and the need for a more effective contribution to socioeconomic development.

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The chapter focuses on measures and indicators of universities activities through a bibliometric and a critical review of the existing literature. It aims to provide not only an overall picture of the state-of-art of literature on universities’ missions and roles in regional development, but also a systematisation of the contributions on performance measures and indicators of universities activities. The authors highlight that the empirical assessment of social and cultural impact of the university in a community has been largely overlooked.

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The chapter intends to provide a conceptual framework of the strategic role of entrepreneurial universities which has been viewed as an operational approach of promoting innovation – driven regional growth. Entrepreneurial universities' strategic role and research institutions' innovative capabilities are distinguished as a significant knowledge facilitator for regional economic development, due to their adding value through knowledge creation and the entrepreneurial discovery process. This chapter intends to exemplify entrepreneurial universities strategic perspectives and its impact on regional innovation systems that enables a region to be more creative and innovative, especially new European Union member states territories in order to create their pioneering business opportunity with worldwide competency.

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The chapter concentrates on the concept of 'entrepreneurial universities' in the sense of those universities which assume the mission. In other words, universities have gone beyond their traditional missions—teaching and researching—and have assumed technology transfer, entrepreneurship, and economic-social impact as their third and fourth mission. This chapter presents an in-depth critical overview of the theoretical and empirical research done on the topic, highlighting the limitations of each approach. The authors give special attention to the potential impacts of universities' technology transfer and entrepreneurship activities on regional competitiveness, considering the ongoing transformation process of universities towards the 'entrepreneurial university' model.

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The chapter seeks to understand the processes that comprise entrepreneurial universities by adopting an organizational learning perspective. Drawing upon insights from 4I - Intuiting, Interpreting, Integrating, and Institutionalizing - organizational learning framework, the author indicates how each of the four processes delineated in the framework yields insights about the processes that comprise the life cycle of the entrepreneurial university construct. Using the 4I framework as a theoretical lens, the research recognizes the dynamic nature of opportunities unfolding as entrepreneurial university engage with them. The chapter also contributes and responds to the call by entrepreneurship researchers to identify specific antecedents of entrepreneurial university that go beyond the individual entrepreneur and to incorporate context into our understanding.

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The chapter analyses the background of the entrepreneurial ecosystems in the literature, how they are connected to the entrepreneurial university, and their importance for regional development. Based on this discussion, the authors analyse and create a framework for entrepreneurial micro-ecosystems at a university setting. There are tangible and intangible boundaries and connections between the micro-ecosystem and the regional ecosystem, that create a specific environment for the actors and participants of the micro-ecosystem and can either foster or inhibit creation and growth of businesses. To illustrate the structure and functionality of this entity, it is provided an empirical example of an entrepreneurial micro-ecosystem at Tecnológico de Monterrey, Querétaro, México. The authors propose a theoretical model that describes how the micro-ecosystems interact and potentialize the impact in congruence with the regional entrepreneurial ecosystem, and functions as a growth engine if managed properly and with intent.

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The chapter provides an analytical framework for understanding the influence of universities on institutional conditions that foster regional innovation. The authors integrate theories of the institutional entrepreneurship and institutional logics to provide an analytical framework for understand how universities can support institutional change in regional innovation systems. The framework will be applied to an empirical analysis of the role of Tongji University in transforming the institutional context of a regional innovation system in Yangpu District, Shanghai, China. The authors selected this case because it demonstrates a unique and successful model of regional innovation system development.

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Irina A. Pavlova, National Research Tomsk Polytechnic University, Russia

The chapter engages the reader in the discussion of using the functional approach for the analysis of the entrepreneurial universities in social and economic systems. The chapter studies innovation systems on both national and regional levels distinguishing the entrepreneurial university's social and economic roles on micro and macro levels. Based on empirical data, the functional analysis empowers to draw conclusions on certain characteristics of entrepreneurial universities overcoming the limitations embedded in the national settings.

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Rachel Granger, Leicester Castle Business School, De Montfort University, UK

Bruno F. Abrantes, Niels Brock Copenhagen Business College, Denmark

Charlotte Forsberg, Niels Brock Copenhagen Business College, Denmark

The chapter looks to transnational education which is a growing trend in higher education that decouples learning from the location of the awarding institution. Few studies of entrepreneurial universities have considered entrepreneurial universities in the context of the changing geographic landscape of education. This chapter examines the entrepreneurial dimensions of transnational education using empirical evidence from a transnational partnership between De Montfort University and Niels Brock Copenhagen Business College. The authors conclude that the commercialization of knowledge through transnational education requires processes and interactions that foster regional development and thus have implications for social and economic development.

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Celeste Varum, University of Aveiro, Portugal & GOVCOPP, Portugal

Ana Dias Daniel, Departamento de Economia, Gestão, Eng.ª Industrial e Turismo, Universidade Aveiro, Portugal

The chapter provides evidences regarding the role of universities as determinants of regional economic growth in Portugal. Covering the period 2004-2017 for Portuguese NUTS III regions across, this chapter not only considers universities as a determinant of regional growth, but it also employs an innovative methodological approach. First, the study is applied to a thirteen-year time period. Second, the generalized method of moments estimator is applied, which allows to surpass debilities associated with static panel data models. Moreover, the magnitude of effects is transversely stronger in the long run, which requires the need to avoid structural breaks in public actions previously initiated in the past.

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Celeste Varum, Universidade Aveiro, Portugal

Carmen Guimarães, Universidade Aveiro, Portugal

Mariasole Bannò, University of Brescia, Italy

The chapter explores the role of universities as determinant of firms' growth at regional level, in Portugal. The authors explore a special type of firm growth, high growth, providing new evidence about the influence of universities through their impact upon human capital in the region, on the probability of firms obtaining high-growth rates and, therefore, being high growth firms. The impact of universities as determinants for high growth does not appear significant for the sample analysed composed by Portuguese companies covering the period 2006-2014. The results for concentration also signal the effects of competition for scarce resources. Results on the importance of location attributes for firm performance are rather important from the economic policy perspective. Knowing the regional factors that drive innovation success at the firm level would help to implement effective innovation policies.

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Isabel Román-Martínez, University of Granada, Spain

María Elena Gómez-Miranda, University of Granada, Spain

Teresa García-Muñoz, University of Granada, Spain

The chapter aims to obtain empirical evidence of the economic contribution of Spanish university spinoffs under a regional perspective. To do so, some key variables to local economic development, such as jobs and creation of wealth have been analysed. After detecting an unequal distribution of university spinoffs impact, the authors attempt to identify which factors are associated to a university spinoff achieve a greater figure of employment than others, and the possible influence of the own features of regions where they are located. Applying a logistic regression data panel for the 2012 to 2015 period, empirical findings show that some traits of university spinoffs and their parent universities determine a greater number of employees, but the particularities of the environment in which they operate, only affect to university spinoffs belonging to the information and communication technology sector. The results obtained will contribute to bridge the gap in the research and allow owners and institutions to take the appropriate measures and to propose policies that improving the performance of university spinoff which leads to a greater impact contribution of these companies to the regional economy.

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Lisa Nieth, University of Twente, The Netherlands & Regio Twente, The Netherlands

Paul Benneworth, Høgskulen på Vestlandet, Norway & University of Twente, The Netherlands

The chapter addresses the question of how universities respond to regional policy, and the ways in which academics are motivated and encouraged by regional development policies. The chapter specifically asks whether entrepreneurial universities create frameworks which allow university actors to positively contribute to collective development activities (such as clusters or technology transfer networks) by

building new kinds of regional institutions. Based in examples from three universities that all seek to be actively regionally engaged, this chapter identifies the factors that both encourage but also discourage these individual actors and notes that ongoing connections between individual academics and regional partners are critical to ensuring this constructive collaboration. The chapter contends that regional innovation policy should devote more resources to building these critical links.

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Liliana Fonseca, University of Aveiro, Portugal
Maria Salomaa, University of Lincoln, UK

The chapter reflects on an entrepreneurial university’s potential to contribute towards regional development through its involvement in the research and innovation smart specialisation strategies (RIS3) process and resulting projects funded through structural funds. The chapter presents an in-depth case study of a university in the less-developed NUTS II region of Portugal aimed to address the relationship between the regional government authority, the RIS3 process and the university in responding to regional needs and in fomenting the innovation and entrepreneurial ecosystem. The study strives to contribute to the debate on the implementation issues of regional policies driven by smart specialisation, focusing particularly on the role of academia.

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Katja Lahikainen, LUT University, Finland
Timo Pihkala, LUT University, Finland
Elena Ruskovaara, LUT University, Finland

The chapter examines the expectations of the regional policy institutions toward the university and the influence of the university for the regional policies, in particular, how the regions define the different roles and expectations for the university, as well as how the university itself influences these definitions and expectations. These questions are addressed through a case region located in Southeast Finland that represents a peripheral region and is dominated by a single university that has a strong technological and entrepreneurial focus. The results of the study show that the existence of a single university in a peripheral region easily leads to a university-dominant policy and thus to a possible regional policy lock-in. Consequently, the implementation of the regional policies can be in the hands of the university, leaving other regional stakeholders with a minor role. In order to fully utilize the potential of the university to address the specific regional challenges, the university should not only be seen as a locus of new spin-offs and start-ups, but rather as a producer of qualified graduates and future entrepreneurs.

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Preface

The last decades witnessed a rising interest by policymakers and academics in the contribution of ‘Universities’, and more generally Higher Education Institutions (HEIs), for regional growth and competitiveness (Kempton 2019).

Alongside the teaching and research activities (first and second missions of Universities, respectively), a considerable amount of studies exist that assesses the impact of Universities based on ‘hard’ activities related to the commercialization of research (the ‘third mission’), namely patents, licenses and spin-offs (Teixeira & Mota, 2012; Sánchez-Barrioluengo & Benneworth, 2019).

Although the traditional ‘entrepreneurial university’ (Etzkowitz, 1983) model lack an explicitly regional focus (Kempton, 2019), ignoring the wide-ranging systemic settings (Pinheiro, Benneworth, & Jones, 2012), more recent and nuanced versions of the entrepreneurial model attribute central place to regional engagement ‘soft’ activities such as collaborative research, contract research or consulting (Perkmann et al., 2013). Indeed, as referred by Pugh et al. (2018, p. 1836), “the role of universities stretches beyond generating technology transfer (through, for example, patents, spin-offs, and start-ups) encompassing wider roles such as contributing and providing leadership for creating entrepreneurial thinking, actions, institutions and entrepreneurial capital.”. They play “multi-faceted roles” contributing to regions’ performance by “helping to build regional absorptive capacity for knowledge and human capital as well as contributing to regional leadership and collaborative capacity in the innovation ecosystem (Kempton, 2019, p. 12).

Notwithstanding the expectations regarding the (positive) role of (entrepreneurial) Universities to regional growth and development, in this domain empirics lags far behind the theory. Indeed, besides a few renowned, non-replicable, case studies of success, the university regional engaged approach lacks verified empirical evidence that Universities make a positive impact on regional innovation (Kempton 2019). Additionally, company based available information from the Community Innovation Survey evidence that Universities are one of the least used sources of innovation among innovating companies.¹ Despite this evidence, policymakers all over the world see Universities as central actors in or as a ‘silver bullet’ for regional innovation and development (Harrison & Leitch, 2010). In this context, and especially after the world economic crisis of 2008, Universities have been increasingly pressured to generate regional impact and justify their public funding, by being more engaged in supporting their local and regional economies (Sánchez-Barrioluengo & Benneworth, 2019).

Several authors (e.g., Veugelers et al., 2012; Brown, 2016; Bonaccorsi, 2017; Motoyama & Mayer, 2017; Kempton, 2019) suggest that the regional impact of Universities might be overstated and call for special cautious when devising ‘one-size-fits-all’ policy measures which blindly assume that Universities can and are willing to make significant contributions to regional development and that no structural obstacles/ difficulties exist in this regard.

It is already reasonably recognized that the distinct geographical and strategic scopes of ‘hard’ (more national and internationally bounded) and ‘soft’ (more regionally bounded) activities posit some conflicts and difficulties to Universities (Sánchez-Barrioluengo & Benneworth, 2019). Additionally, high cognitive distance or mismatches between Universities (research and teaching) specialisms and regions’ industrial base may constitute a serious obstacle to the deployment of knowledge from academic research (Noteboom et al., 2007). Finally, the traits and idiosyncrasies of regions and companies there located, as well as the stage of innovation ecosystem, play a critical role on the likelihood and extent of Universities’ impact (Heaton, Siegel & Teece, 2019). Indeed, in some peripheral regions the low level of infrastructure and industrialization may substantially weaken the capacity of universities to establish productive relations (Bonaccorsi, 2017)

The set of 15 original contributions gathered in the present book has three main objectives: 1) to contribute for widening and deepening the debate on the regional impact of Universities; 2) to present new and diversified evidence of the role of Universities in regional competitiveness; and 3) to extend the discussion on the policy implications and expectations of the regional engaged entrepreneurial University.

The chapters of the book are organized into four parts/ key themes related to entrepreneurial university (EU) and regional development and competitiveness (see Figure 1).

Part I conceptualizes the entrepreneurial dimension of Universities and other Higher Education Institutions (HEIs), presenting an overview of their main challenges (Chapter 1, by Olo, Correia & Rego), missions and roles in general (Chapter 2, by Riviezzo, Napolitano & Fusco), and roles in a regional context (Chapter 3, by Saha, Sáha & Sáha).

Part II synthesizes the main methodologies for assessing universities (regional) impact (Chapter 4, by Teixeira et al.) and puts forward some frameworks of analysis applied to emerging economies (Chapter 5, by Baporikar), and, within emerging economies, to Mexico (Chapter 06, by Rehak, Diegoli & Montes) and China (Chapter 07, by Cai & Liu).

Part III presents the empirical evidence addressing the functions/ activities of Entrepreneurial Universities and their impact on regional development/ competitiveness (Chapter 8, by Pavlova), focusing several levels of analysis, most notably: university (Chapter 9, by Eatmon et al.), regional (Chapter 10, by Ribeiro, Varum & Daniel), and company (Chapter 11, by Varum, Guimarães & Bannò, and Chapter 12, by Román-Martínez, Gómez-Miranda & García-Muñoz).

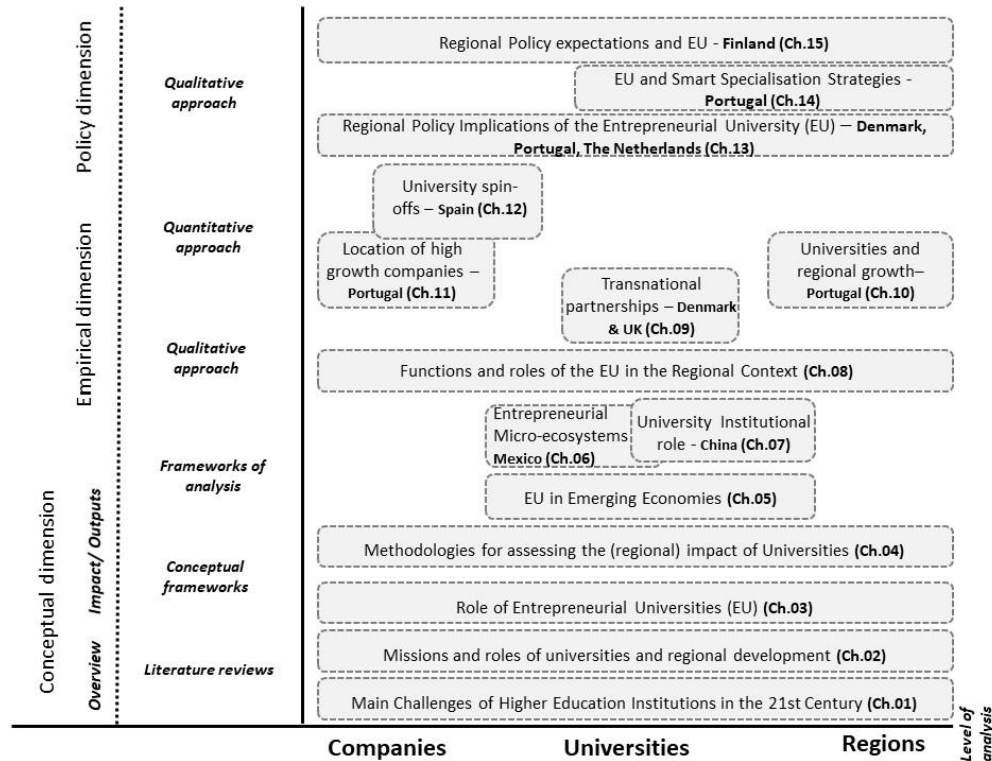
Part IV discusses the regional policy of the entrepreneurial University, its implications (Chapter 13, by Nieth & Benneworth), strategies (Chapter 14, by Fonseca & Salomaa), and expectations (Chapter 15, by Lahikainen, Pihkala & Ruskovaara).

Detailing a bit further each contribution, in Chapter 1 (“The main challenges of higher education institutions in the 21st century: A focus on entrepreneurship”), Daniela Olo, Leonida Correia and Maria da Conceição Rego address the main challenges faced by HEIs in the 21st century as key actors for regional development, emphasising their entrepreneurial dimension. The authors undertake a detailed analysis and discussion of the relevant literature, contending that extant pressures exerted on HEIs to become more effective, efficient, and autonomous require a reflection regarding the present and future of higher education and underline the need for considering Universities’ contribution in a holistic sense, to socioeconomic development.

Such a holistic view is complementarily addressed in Chapter 2 by Angelo Riviezzo, Maria Napolitano and Floriana Fusco (“Along the pathway of university’s missions: A systematic literature review of performance indicators”), who asserts that in the last decades new missions have been recognized to universities, new theoretical frameworks have been developed, and new university models have been

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Figure 1. An overview of the structure of the book
 Source: Own elaboration



proposed - the “entrepreneurial university”, the “civic university”, the “community-engaged university”, the “transformative university” or the “interconnected university” – which called for a wide range of performance metrics and indicators to assess the impact of university activities.

Providing a conceptual framework of entrepreneurial universities strategic role in driving regional growth, Nibedita Saha, Tomáš Sáha, and Petr Sáha, in Chapter 3 (“Entrepreneurial universities strategic role in accelerated innovation for regional growth”), underline the importance of academic spin-offs and the value they add through knowledge creation and entrepreneurial discovery process.

The most often used demand and supply-side theoretical perspectives, and corresponding methods, to assess the regional impact of universities are described in Chapter 4 (“The impact of Universities on regional competitiveness: A review of the main theoretical and methodological approaches”) by Aurora Teixeira and her co-authors, who also synthesize the main dimensions of impact Universities potentially have on regions.

Adopting a qualitative approach, Neeta Baporikar develops, in Chapter 5 (“Understanding Entrepreneurial University: A Framework for Emerging Economies”), a framework to rationalize the development of the Entrepreneurial University in a yet overlooked context, the Emerging Economies, usually identified as rapidly growing and volatile economies of certain Asian and Latin American countries, which entail huge potential for growth but also pose significant political, monetary, and social risks (Saccone, 2017; IMF, 2019).

Based on a specific case of Tecnológico de Monterrey located in an Emergent Economy, Mexico, Jan Rehak, Rafaela Diegoli and Miguel Montes construct a three-layer framework for a better understanding of the entrepreneurial micro-ecosystems and its internal and external interactions (Chapter 6, “Entrepreneurship Micro-ecosystems in practice”). The authors argue that the entrepreneurial micro-ecosystems are likely to generate an exponential effect both for entrepreneurs at the campus as well as for the regional entrepreneurial ecosystem and development.

Focusing on another Emerging Economy, China, Yuzhuo Cai and Cui Liu combine, in Chapter 7 (“The Role of University as Institutional Entrepreneur in Regional Innovation System: Towards an Analytical Framework”), the theories of institutional entrepreneurship and institutional logics to provide an analytical framework for understanding how universities can support institutional change in regional innovation system. Such a framework is used then applied to the case of Tongji University located in Shanghai regional innovation system.

Embracing also an institutional perspective, Irina Pavlova (Chapter 8, “Revisiting functions and roles of the entrepreneurial university in social and economic systems in the regional context”) recognizes that different national settings require the use of diverse approaches for the university performance evaluation. Nonetheless, she argues that it is possible to describe an entrepreneurial university as an institution through the combination of characteristics and university functions on the practice-oriented, systemic and methodological levels.

Thomas Eatmon and colleagues address a rather unexplored issue, (Chapter 9, “The entrepreneurial dimensions of transnational education”), using empirical evidence from a transnational partnership between De Montfort University (UK) and Niels Brock Copenhagen Business College (Denmark). The authors conclude that the commercialization of knowledge through transnational education requires processes and interactions that foster regional development and thus have implications for social and economic development.

Resorting to quantitative econometric methods, most specifically dynamic panel data, Vitor Ribeiro, Celeste Varum, and Ana Daniel, (Chapter 10, “Role of universities on the level of regional growth in Portugal”) demonstrate, for the set of Portuguese NUTS III regions over the period 2004-2017, that Universities impact positive and significantly on regional growth, being the magnitude of effects transversely stronger in the long run.

The role of Universities in the location decision of high growth firms is investigated in Chapter 11 (“Universities and human capital as regional determinants for high-growth firms”) by Celeste Varum, Carmen Guimarães and Mariasole Bannò using data for more than 25 thousand continuing incumbent manufacturing firms between 2006 and 2014. According to the estimation results the presence of Universities, measured by the number of graduates by high education institutions in the district in the proportion of the number of persons employed all sectors in the district, does not seem to influence the location of high-growth firms. At least in part, migration of university graduates is likely to explain the nonsignificant results. Notwithstanding, further research is needed to disentangle such non-linear, complex relations.

Such firm-level complex relations are also dealt with by Isabel Román-Martínez, María Gómez-Miranda and Teresa García-Muñoz (Chapter 12, “Economic contribution of university spin-off: A regional study of the Spanish case”). For the 2012-2015 period, the authors analyse the impact of university-related variables (number of University spin-offs and the assignment of physical spaces by the university) on the region’s job creation. Based on a sample of 192 University spin-offs (USOs), the results show that some traits of USOs and their parent universities determine a greater number of employees, but the particularities of the environment in which they operate, only affect to USOs belonging to the ITC sector.

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The regional policy implications of the entrepreneurial university are the focus of Lisa Nieth and Paul Benneworth's contribution to the present book (Chapter 13, "Regional policy implications of the entrepreneurial university: Lessons from the ECIU"). Resorting to case study methodology, the authors selected cases from universities in regions where there was a long history of the universities engaging with regional partners to improve their regional environments. Specifically, they selected three universities that were members of the European Consortium of Innovative Universities (ECIU), and that constitute examples of researcher-led engagement projects that had some kind of visible effect on the engagement, namely the Fraunhofer Project Center at the University of Twente (the Netherlands), the Creative Science Park around the University of Aveiro (Portugal) and the Matchmaking Scheme around Aalborg University (Denmark). They conclude that these projects drove wider institutional changes and increased the entrepreneurial orientation of their universities as a whole. They nevertheless highlight that policy interventions can create tensions for institutional entrepreneurs by making it harder for them to construct these activities in ways that meet both university and regional needs. As such, the authors recommend that policy-makers develop more nuanced instruments and tools to empower institutional entrepreneurship by individual academics rather than focusing on high-level contracts with the university steering centre.

Based on the in-depth case-study of the University of Aveiro (Portugal), Liliana Fonseca and Maria Salomaa (Chapter 14, "Entrepreneurial universities and regional innovation: Matching smart specialisation strategies to regional needs?"), evaluates the contribution of entrepreneurial universities to the 'Research and Innovation Strategy for Smart Specialization' (RIS3) goals. The authors conclude that the S3 framework and the funding therein provided seems to have contributed to more directly link the University of Aveiro's research to regional needs. In turn, the university's strong local partnerships enabled it to more effectively leverage the received funding, and advanced and diversified its action throughout the region, ensuring the promotion of a more dynamic entrepreneurial ecosystem and collective learning. Nevertheless, some observed difficulties included the promotion of an effective link between regional domains defined within the regional policy to the academic community, as university's institutional strategic and engagement mission is not always communicated and operationalised successfully.

The final chapter ("High hopes: Regional policy expectations for the entrepreneurial university"), by Katja Lahikainen, Timo Pihkala, and Elena Ruskovaara, addresses a yet disregarded topic, the expectations of the regional policy institutes toward the university. Based on a case study of a technological university located in a peripheral region in Finland, the authors show that the existence of a single university leads easily to a university-dominant policy and thus to a regional policy lock-in. Consequently, the implementation of the regional policies can be in the hands of the university, leaving other regional stakeholders with a minor role. Thus, the authors contend that in order to fully utilize the potential of the university to address the specific regional challenges, the university should not only be seen as a locus of new spin-offs and start-ups, but rather as a producer of qualified graduates and future entrepreneurs.

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ENDNOTE

- ¹ Universities are highly important as a source of innovation for only 6.3% (average for 24 European countries) of innovating companies, the lowest figure among 12 distinct sources considered, after Government or public research institutes (3.6%) and Private research institutes (2.6%) – information gathered from <https://ec.europa.eu/eurostat/web/science-technology-innovation/data/database>.

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Section 1

Chapter 1

The Main Challenges of Higher Education Institutions in the 21st Century: A Focus on Entrepreneurship

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ABSTRACT

Interest in higher education institutions (HEIs) as instruments for development has increased in recent years. The main objective of this chapter is to address the main challenges HEIs face in the 21st century as key actors for regional development, emphasising their entrepreneurial dimension. The pressures exerted on HEIs to become more effective, efficient, and autonomous require a reflection regarding the present and future of higher education. Through a detailed analysis and discussion of the relevant literature, this chapter contributes to a better understanding of the role of HEIs, especially given its relationship with society and the need for a more effective contribution to socioeconomic development.

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INTRODUCTION

Interest in higher education institutions (HEIs) as instruments for development has increased since the mid-1980s, influenced by phenomena such as the globalisation of trade and the growth of intensive knowledge production (Drucker, 2016; Drucker & Goldstein, 2007; Schubert & Kroll, 2016). Many countries have answered positively to this challenge through a social transformation process, with an emphasis on higher education development, research, and innovative capacities (Azman, Sirat, & Ahmad, 2014). The study of this subject remains pertinent because, among other factors, long-term reduction of government financing causes pressure to demonstrate positive economic returns of public funding in HEIs, with a direct contribution to the economy (Etzkowitz, Webster, Gebhardt, & Terra, 2000). Namely, these investments generate questions about the magnitude and distribution of their impacts, as well as their effectiveness in achieving goals (Blackwell, Cobb, & Weinberg, 2002).

The literature points out that HEIs contribute to development through the economic effects and the knowledge spillovers related to their missions of teaching, research, and public service (Goldstein & Drucker, 2006; Lendel & Qian, 2017; Uyarra, 2010). Other contributions include disseminating entrepreneurial behaviors and attitudes in human capital through participation in entrepreneurship studies and education (Finkle, Soper, Fox, Reece, & Messing, 2009; Katz, 2003; Secundo, Del Vecchio, & Passiante, 2015; Solomon, Duffy, & Tarabishy, 2002).

In trying to answer a variety of requests from society, HEIs are undergoing a significant transformation process in structure, organization, and the redefinition of its social purposes. HEIs all over the world face problems and challenges, leading to a reflection on the current position of the university. This is deeply influenced by globalisation, government interference, and financial constraints. HEIs aim to meet the needs and requirements of the 21st century society, which is a society of knowledge, information, and education technologies. As a result, the mission of HEIs and its redefinition are issues of current debate to meet these challenges as it balances academic tradition with social change.

Therefore, the main objective of this chapter is to address the main challenges that HEIs face in the 21st century as key actors for regional development. It emphasises their entrepreneurial dimension, as well as new approaches about this subject as it rethinks the scope of the studies about the role of universities in regional development and research on academic entrepreneurship, resulting from the finding that there have been huge expectations on the role of HEIs in development, while evidence suggests that the benefits of third mission approaches on society are not as successful as anticipated.

Although several authors address the role of universities in regional development, human capital formation, knowledge formation and diffusion and activation for citizenship, it is difficult to find a document that encompasses all these issues simultaneously and that allows the new researchers to be comprehensively integrated into the theme. Thus, this chapter intends to present the “big picture” to readers who may be new to these issues and trends.

Using a detailed analysis and discussion of the relevant literature, this chapter contributes to a better understanding of the role of HEIs, especially given its relationship with society and the need for a more effective contribution to socioeconomic development.

HEIs and Development

Development can be understood as the ability of society to meet the needs of its population, allowing it to achieve an adequate level of well-being. Combining a development perspective from Seers (1969) and Sen (1999), the authors can define it as access to goods, services, and opportunities. This access enables people to meet their basic needs, including employment and training, in addition to the satisfaction of other goods and essential services like basic healthcare, better working conditions, food, and housing. In this way, it appears that the concept of development is multidimensional and presupposes improvements at both the economic and social level for all members of society (Nafziger, 2007).

According to OECD (2011), money is not enough to measure well-being. Indeed, the well-being concept is composed by: (1) current material living conditions (or economic well-being) that determine consumption possibilities and command over resources; (2) quality of life defined as the set of non-monetary attributes of individuals, shaping opportunities and life chances; and (3) sustainability of the socioeconomic and natural systems, which depends on how current human activities impact different capital (natural, economic, human, and social).

The role of HEIs in development has received great attention from governments, regional development agencies, and funding agencies through national, regional, and institutional policies directed at strengthening development (Fongwa & Wangenge-Ouma, 2015). Their impact on economic well-being and innovative potential of regions has also been the object of intense scholarly and policy interest (Uyarra, 2010).

Some clues allow HEIs to be associated with development. For instance, it will be necessary to improve the quality of education and research, as well as promote innovation and knowledge transfer, in which universities play a major role (Azman et al., 2014). They work as a knowledge spillover channel through their missions and transmit growth impulses to the economic and social context by their training of human resources and dissemination of knowledge, information, and innovation. They are key actors on which the new development process should be based (Drucker & Goldstein, 2007; Goldstein & Drucker, 2006; Lendel & Qian, 2017). The strategy set for Europe in Agenda 2020 focused on economic competitiveness through intensive knowledge activities. This shows the importance of higher education in economic growth and sustainable development.

The contribution of HEIs for development can be felt in a direct way (demand effects) because the institution's existence implies the permanence of income in the local economy. This income is reinvested rather than spent elsewhere. It contributes to both an increase in the volume of firms in the region and the volume of available employment. Thus, the presence of HEIs creates employment, generates revenue, and leads to expenditure. It results in an increase in local gross domestic product (GDP) in the payment of wages, creation of jobs associated with the institution, and the increase of tax revenue (Schubert & Kroll, 2016). In this context, it is especially important to carry out studies that evaluate the economic impact of these institutions in the community to perceive the supplementary creation of wealth (i.e., product, income, and employment) arising directly and indirectly from the activity of HEIs (Pastor, Pérez, & De Guevara, 2013). In addition to these possibilities, an HEI is also a source of attraction for visitors and tourists due its activities or to visit students from outside the region. HEIs can be considered "poles of development" through the increased economic and social impacts caused by a multiplier effect in the economic activity of the regions where they are inserted (Gluckler, Panitz, & Wuttke, 2015; Pastor et al., 2013).

The effect can also be felt in an indirect way (supply effects) as HEIs interact with the region beyond simple income creation. Knowledge-based activities, as well as teaching and research, are embodied in technology transfer programs, university-business partnerships, and curricula adapted to local needs in terms of the knowledge industry. These measures contribute to local development (Drucker & Goldstein, 2007; Goldstein & Drucker 2006; Lendel & Qian, 2017). These spillovers result in a better qualification of human capital, leading to an increase in productivity, lifetime income, and research and development (R&D) and registration of patents. Thus, HEIs are recognized as regional development tools due to their financial and social importance through guaranteeing educational, economic, social, and cultural opportunities that may not exist in the region (Kroll, Schricke, & Stahlecker, 2013). They are, therefore, a powerful source of employment with opportunities for highly skilled labor and technical specialists for local businesses. In turn, they attract and retain investments (Bonander, Jakobsson, Podestà, & Svensson, 2016).

Universities generate spillovers through a growing variety of economic development activities, including technology marketing, consulting, innovation support and entrepreneurship, and traditional research and teaching missions. Due to the difficulty of empirically distinguish the outputs of HEIs, as well as the scarcity of data, most studies have focused on only three of these outputs: (1) human capital; (2) knowledge creation; and (3) technology transfer (Drucker, 2016). At this level, Lendel and Quian (2017) identified three university outputs that can be clearly defined in a supply-demand framework and are explicitly related to regional development: (1) education services; (2) knowledge transfer services; and (3) business services. These outputs are closely related to the three missions assigned to universities: (1) teaching; (2) research; and (3) public service.

Teaching

Education and training are key factors in the development of any country as it enhances economic growth (Hanushek, 2013; Sarid, 2017). By investing in education, individuals are equipped with a range of skills to improve their position in the labour market, as well as their income through a higher salary associated with higher education (Bowen & Qian, 2017; Harris-Reeves & Mahoney, 2017).

The development of a country is strongly related to levels of education and R&D. In other words, developed countries usually have a higher level of education or spend relatively more on education and research. Conversely, any weakness in this area represents an obstacle to development (Cinnirella & Streb, 2017; Haapanen & Tervo, 2012).

HEIs contribute to a valorisation of regional human capital through university graduates who serve as a predictor of regional productivity growth (Bhadury & Troy, 2014; Pink-Harper, 2015; Qian, 2013; Sezonova, Galchenko, & Khodirevskaya, 2016; Yirdaw, 2016). The effect that human capital exerts on economic growth involves, on the one hand, a direct increase in a qualified workforce. On the other hand, it is an important contribution to research, increasing labour productivity indirectly and accelerating technological change (Cinnirella & Streb, 2017; Sánchez-Barrioluengo & Consoli, 2016). Graduates can also create businesses that boost the dynamics of the local economic environment, as well as contribute to the innovation, creativity, and productivity of local companies (Agasisti, Barra, & Zotti, 2017).

Human resources will always be the richest and most promising part of endogenous potential. Therefore, education and training play a strategic and structuring role in the development process (Kroll et al., 2013). There is a growing recognition that a population with a level of higher education may be more

The Main Challenges of Higher Education Institutions in the 21st Century

innovative and able to face technological change and a successful entry into the labour market (Guichard & Larre, 2006). Consequently, regions that raise the average level of education of their employees tend to introduce novelties and innovation into the existing industrial context (Agasisti et al., 2017).

Research

Research can be defined as the ability to transform knowledge into economically relevant products, services, and processes (Bornmann, 2013). Indeed, society can only reap the benefits of research if the results are converted into marketable products or services. Scientific research, along with education, is an important factor for economic and social development (Aranguren, Guibert, Valdaliso, & Wilson, 2016). At the highest levels of knowledge, research and teaching are inextricably linked and mutually reinforce each other in different ways (Adshead & Quillinan, 2017).

HEIs can contribute to an increase in local economic development through the creation of knowledge and regional innovation through research in scientific publications (Drucker & Goldstein, 2007). They generate new knowledge, as well as maintain the chain of knowledge. Scientific research results can foster innovative activities in companies or create knowledge spillovers within the regional environment, leading to an improvement of local economies (Agasisti et al., 2017).

Chatterton and Goddard (2000) emphasized that HEIs should focus on research and financing activities to answer regional needs and contribute to local economic development. This is achieved through the conception of new products, formation of industry, job creation, and access to advanced management and professional services. The authors also considered that universities often have an explicit regional motivation on a multidisciplinary and collaborative basis. They are seen as key actors in promoting the establishment and development of new clusters of economic activity.

Universities should establish strategic alliances with external research partners to explore networks of wider knowledge, such as research centers and science parks. To meet the needs of society, universities began to intensify their research activity, making the production of knowledge a priority (Ion & Ceacero, 2017).

Public Service (Third Mission)

HEIs are involved in a growing diversity of tasks that go beyond teaching and research, including cooperation with industry, technology transfer, and creation of new enterprises (Čorejová & Rostášová, 2016). In this way, they try to achieve high interaction with society by building a link between research and business through the “third mission,” including patents, business incubators, and collaboration agreements (Agasisti et al., 2017).

The third mission of universities is related to the traditional missions of teaching and research. It entails the establishment of close links between universities and institutions for which knowledge and technology are transferred (Kroll et al., 2013).

Universities have long depended on the success of knowledge and technology transference (O’Shea, Allen, Chevalier, & Roche, 2005; O’Shea, Allen, Morse, O’Gorman, & Roche, 2007). This effect can be understood as the process of capturing and sharing explicit and tacit knowledge, including skills and competences, through commercial and noncommercial activities. These include research collaborations, consulting, licensing, spin-off creation, mobility of researchers, and publication (Fongwa & Marais, 2016; Serbanica, Constantin, & Dragan, 2015).

Universities increasingly attach importance to the creation of new enterprises as an instrument for the commercialization of intellectual property. This increase in university business activity has social implications (Lazzeretti & Tavoletti, 2007; Siegel, Wright, & Lockett, 2007). It is consensual in the literature that regional competitiveness and university spillovers are strong complements of the innovation activity of start-ups (Audretsch, Hülsbeck, & Lehmann, 2012; Berggren & Lindholm, 2009; Bonaccorsi, Colombo, Guerini, & Rossi-Lamastra, 2014; Ghio, Guerini, & Rossi-Lamastra, 2016).

Universities can contribute to regional economic development by engaging in local business-creation assistance. For example, hundreds of universities are home to business and small business incubators and development centres that provide basic and professional services for new small and medium enterprises (e.g., Oxford University, Stanford University, UNC-Chapel Hill, Massachusetts Institute of Technology). On a larger scale, several universities create or support science and technology parks, contributing to the improvement of technology infrastructures that are attractive to high-tech companies (Lendel & Qian, 2017).

Thus, universities cease to be isolated islands of knowledge. They become ever more involved with several external partners through business activities (Zhang, MacKenzie, Jones-Evans, & Huggins, 2016). At this level, there are growing opportunities for universities to establish links with the industry sector, particularly by setting up university spin-offs, conducting licensing and research activities, providing consultancy services, and mobility of graduates and researchers. As higher education is increasingly associated with social and economic evolution, R&D activities at universities can no longer be considered purely academic activities. Therefore, it is strongly related to the business environment and society (Lawton Smith & Leydesdorff, 2014; Miller, McAdam, Moffett, Alexander, & Puthusserry, 2016; Sperrer, Mueller, & Soos, 2016).

The importance of a more effective interaction between academics and other actors in society, especially companies, in making university teaching and research more relevant to societal challenges is widely recognized (Aranguren et al., 2016). HEIs should be the lead actors in new partnerships leading to the production of cooperation and networking (Pugh, Hamilton, Jack, & Gibbons, 2016).

To play their regional role, HEIs must do more than simply educate and investigate. They should engage with other stakeholders in their regions, provide opportunities for lifelong learning, and contribute to the development of knowledge-intensive jobs that enable graduates to find local employment and remain in their communities (Albulescu & Albulescu, 2014).

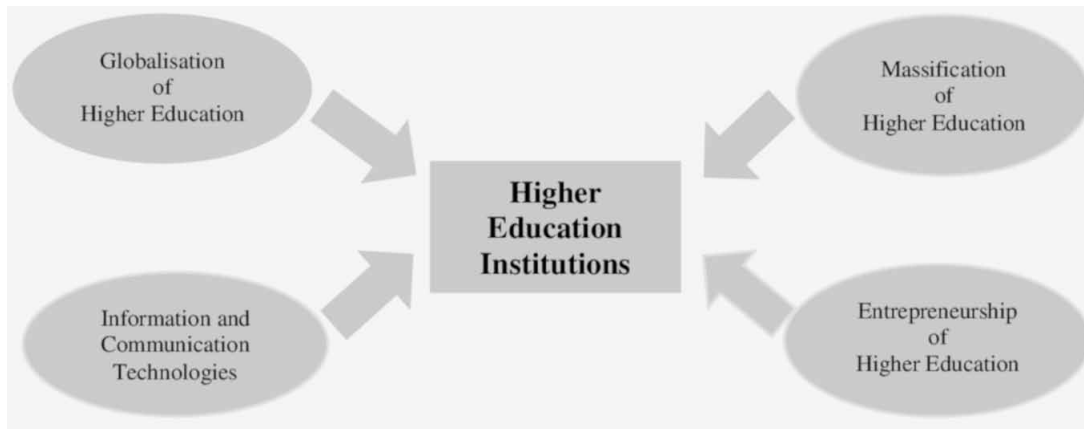
The initiatives undertaken by HEIs must demonstrate their “added value” for the region. It must examine whether it leads, for example, to a net increase in innovation, employment, wealth creation, and networking among the various players in the region (Chatterton & Goddard, 2000).

MAIN CHALLENGES OF HEIS IN THE 21ST CENTURY

Higher education has become a global marketplace. Therefore, it is not immune to changes in the 21st century. Today, HEIs intends to answer to several challenges due the diverse demands of society (see Figure 1). University missions must be worked and refined to meet challenges in an increasingly global, digital, and dynamic context.

The Main Challenges of Higher Education Institutions in the 21st Century

Figure 1. Challenges of higher education in the 21st century



Globalisation of Higher Education

This subject has been approached by many authors (e.g., Pucciarelli & Kaplan, 2016; Varnava-Marouchou, 2004). Most analyses converge on several conclusions. One such conclusion is that globalisation is a current challenge to attend (e.g., Knight, 2013; Pucciarelli & Kaplan, 2016; Scott, 2000, 2006). In this context, the university has defied to incorporate modernity, as well as to transcend more actively its spatial bounds. Thus, the postmodern university tends to internationalize its teaching, research, and public service in the global information age. In fact, in a globalized world, knowledge, research, and innovation are becoming increasingly important resources, influencing the societal role of universities.

It raises seemingly contradictory positions to the globalization of the educational offer versus regional economic development leveraged by HEIs. In fact, under the globalization, HEIs are encouraged to prepare students for the world, but according to Sánchez-Barrionuengo and Consoli (2016), the contribution of HEIs to their local environment is often confused with their ability to provide skilled workers to local labour markets. In this context, the qualification of human resources oriented to the needs of the companies is fundamental (Pang, Wong, Leung, & Coombes, 2019). HEIs should establish links with public, central, or local bodies and with companies to ensure that their programs and content lead to higher levels of employability (Rae, 2007).

According to Chatterton and Goddard (2000), the creation of specialized courses locally oriented to the characteristics of the region, especially those closely linked to the growing industries in the region, may offer greater possibilities for success and mobility in the regional labour market. This teaching often attracts representatives from local industry to add practical experience to the teaching process. In addition, the courses can be collaboratively undertaken with regional partners and addressed to regional issues. There is, however, the reverse of the medal, since education programs that are very focused on the economic base of the region may lead to courses being more susceptible to cycles of growth and contraction in the regional economy. In addition, courses geared to regional needs may be of little attraction to non-local students and may also adversely affect student performance in national labour markets. Summing up, this dichotomy can be seen as the essence of the University, or HEIs, in the sense that being global institutions, they are able to absorb the innovative knowledge that is produced and are present, by their

actions, globally. However, they may also be the institutions that transfer this knowledge and connect with the local, through the various modes of collaboration with the local. HEIs are like “institutional hinges” that associate the global with the local, through the various functions they perform.

Despite the virtues associated with internationalization, their lesser points cannot be neglected. Indeed, on the one hand, such internationalization provides universities with access to a diversity of talents, bringing several benefits as it contributes to the development of individuals, institutions, nations, and the world in general. It presents an opportunity to expand and diversify education and its transmission, as well as increase the mobility of students, teachers, and programmes. However, on the other hand, it exposes universities to competitors who seek to capture the same resources. In a global market in which national economies compete, HEIs are key players in enhancing the positions and reputations of their respective countries by fostering innovation. Thus, internationalization forces universities to compete both in a national field and a global field. This trend suggests that there will be an increase in competition at institutional, national, and international levels.

Massification of Higher Education

Another phenomenon that challenges HEIs is the massification of higher education (Geuna, 1998; Pucciarelli & Kaplan, 2016; Trow, 2000; Varnava-Marouchou, 2004). The university was no longer considered an elite institution with a minority of high-class students. The university is open to all kinds of people. Due to the phenomena of mass education, the features of today’s students include diversity in terms of age, socioeconomic status, gender, and ethnicity. Today, students in higher education include second career students and a growing number of individuals from diverse backgrounds. This also includes a growth in the number of women attending higher education institutions. Therefore, HEIs must deal with a more diverse population, marked by a new generation of multicultural students. These students, who promote mobility in the context of globalisation and dominance of new technologies, have expectations regarding university education, teaching, and learning in the classroom. These expectations differ from those of traditional pupils. The current HEIs should define strategies for teaching, research, and public service to respond to these challenges. In fact, a bigger competition between universities and the massification of education have encouraged HEIs to increase their market share by expanding and diversifying their educational levels offerings and curricula to attract new students.

Information and Communication Technologies

Issues that defy HEIs remain unfinished. Given that 21st century economies in most countries are based on knowledge, information and communication technology (ICT) is another significant challenge to consider (Amirault, 2012; Andresen, 2006; Byrd, 2001; Chernikova & Chernikova, 2018; Goosen, 2016; Pucciarelli & Kaplan, 2016; Varnava-Marouchou, 2004). Traditional universities and colleges must address these changes to remain competitive. Indeed, information technology is a new opportunity as it provides new access to different approaches to the dissemination and application of knowledge.

The evolution to a knowledge society has become a challenge not only for science but also for education. Traditionally, the university was a place to produce and transfer knowledge. Today, in a knowledge society, special attention is given to the relationship between knowledge and action. Thus, the mechanisms to obtain and translate knowledge have changed. They are now conditioned by the digitalization of education and the fourth industrial revolution. ICT developments have enhanced the potential of

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universities for knowledge creation and dissemination. In this context, HEIs are strongly committed to adapt their products to the new reality, taking advantage of new technologies and adjusting them to academic needs. According to Andresen (2006), in the current labour market more and more people need to acquire new skills. Thus, the pressures of information technologies demand that higher education be rethought, in order to also meet the need for lifelong learning, which implies that people of active age need to return to the education system to acquire new skills required by their employer. Higher education is becoming more accessible, with a tendency to move away from buildings and campuses. Distance learning (e-learning systems) and the leaders of educational technology are in an excellent position to leverage this change and improve higher education, promoting the self-apprenticeship. ICT has also facilitated the creation of a network society, contributing to an expansion of collaboration inside institutions and among organizations, overcoming the limits of traditional forms of cooperation. The network society encourages HEIs to strengthen relationships with core stakeholders and engage in interactions with partners, including other universities and industry partners.

Entrepreneurship of Higher Education

This fact leads to another challenge: the entrepreneurship of higher education (Amirault, 2012; Clark, 1998; Culkin 2016; Etzkowitz & Leydesdorff, 2000; Guenther & Wagner, 2008; Hansmann, 2012; Hassan, 2017; Siegel & Wright, 2015; Urbano & Guerrero, 2013; Uyarra, 2010). Due to tighter budgets, institutions are pressured to do more with less while diversifying their funding sources. The need for HEIs to become more effective, efficient, and financially autonomous requires serious consideration of the present and future of higher education. The emphasis must change from capitalizing knowledge assets to better connecting higher education sectors with the rest of the economy, which highlights its “third mission.”

In this sense, all universities should adapt and become more entrepreneurial, meaning that universities should be more financially independent. Thus, universities are encouraged to act entrepreneurially by finding new sources of income through their activities. The underlying fundamental idea is the need for greater organizational and financial autonomy, better quality, better strategic vision, greater connection to society, and greater entrepreneurial dynamism. These factors aim to make teaching a commercial product, like any other.

Since the 1980s, the neoliberal ideology of free markets has generated the idea that an alternative to the reduction of state funding is the creation of the university market. As a result of such marketization of the higher education sector, management approaches, which are typical to private sectors, are increasingly being applied to universities. In this context, the entrepreneurial university emerges as a multifaceted institution with direct mechanisms to support the transfer of technology from academia to industry. It is seen as a promoter of regional economic and social development, exploring knowledge as business opportunities.

The Entrepreneurial University

The first reference to the term “entrepreneurial university” appears in Etzkowitz (1983), in which a change of academic mentality is emphasized in the face of rising research costs and scarce state or business support. This causes researchers and administrators to seek new forms of financing and opening business research. The university, once considered by companies as a source of people training and specialized

consulting, came to be a production factor to transfer research to companies, creating value at a lower cost than if it were done within an individual company. Universities, on the other hand, receive funds from companies to support the continuity of research (Etzkowitz & Klofsten, 2005; Svensson, Klofsten, & Etzkowitz, 2012). This new way of thinking and acting on the part of the universities opened doors to society, as well as diversified sources of income. This made universities independent from the state financing (De Zilwa, 2005).

An entrepreneurial university is a university that offers opportunities, practices, cultures, and hopeful environments to actively encourage and embrace the entrepreneurship of students and graduates. It is a place where entrepreneurship integrates the institution. This concept often appears related to the term “academic entrepreneurship,” which refers to efforts undertaken by universities to promote commercialization on campus and in surrounding regions of the university with activities like university licensing, patenting, and start-up creation.

According Siegel and Wright (2015), academic entrepreneurship has undergone transformations since universities first established technology transfer offices (TTOs) in the 1980s and 1990s. When these activities were developed on campuses, there was a robust emphasis on two key dimensions of university technology transfer: patenting and licensing. Little attention was paid to the start-up dimension. Today, universities increasingly attach importance to the creation of new companies as a mechanism for commercialization of intellectual property.

Universities and higher education systems play a relevant role in the innovation chain because they disseminate behaviours and entrepreneurial attitudes in human capital. In fact, universities have been participating in studies on entrepreneurship and their education as they have contributed to regional development. They have been embracing the goal of economic development as a complement to their traditional teaching and research missions. Thus, entrepreneurship became a growing importance in the development of countries by introducing innovation and increasing competitiveness and competition. Effectively, the entrepreneurial university is characterized by more mixed forms of public-private involvement by engaging different stakeholders.

Universities have had a gradual commercial strategy building relationship with industry and government, which has contributed to innovation. The relationship between the three entities (i.e., university, industry, government) is explained by Etzkowitz and Leydesdorff (1997) through the triple helix model. The model emerged in the mid-1990s as universities and industry were encouraged by policymakers to work more closely together for the benefit of society as a result of commercialization knowledge (Lawton Smith & Leydesdorff, 2014). This model, created by Etzkowitz and Leydesdorff (1995), explains the relationship between university, government, and industry, as well as the internal transformation within each of these stakeholders. Industry acts as a source of production. Government provides regulations, stability, and rules. Universities provide technology and new knowledge.

Etzkowitz (2003) stated that the triple helix is increasingly responsible for innovation. According to some authors, the long-term growth of innovation and the importance of integrating citizens’ perspective on media and culture created the quadruple helix model (e.g., Khan & Al-Ansari, 2005; Liljemark, 2004; Van Horne & Dutot, 2016). This adds another stakeholder to the original model. The structure is based in an economy divided into four stakeholders: (1) university; (2) business; (3) government; and (4) civil society. The relationship generates innovation and economic development. More recently, some authors (Carayannis & Campbell, 2011; Carayannis & Rakhmatullin, 2014; Kolehmainen et al., 2016) already refer to the quintuple helix, which is based on the triple helix model and quadruple helix model and adds as fifth helix the “natural environment”. The quintuple helix can be proposed as a framework

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for transdisciplinary analysis of sustainable development and social ecology. It stresses the socioecological perspective of the natural environments of society. According to Lilles & Rõigas (2017), the Nordic experience has proved that HEIs may be important drivers pushing forward regional innovation and development in general. In fact, many successful regional economies seem to have one important thing in common—they put innovation at the heart of their regions' economic sustainability and growth. Finland and the Nordic region are great examples to consider (Carayannis & Rakhmatullin, 2014).

Weak economic perspectives and an increase in unemployed youth have led many governments, the European Commission, and the Organisation for Economic Cooperation and Development to highlight the need for higher education. It responds to economic and social needs, improves the employability of graduates through a stronger focus on entrepreneurship and innovation, and strengthens partnerships between universities and businesses (Sursock, 2015). It is expected that a greater focus on education—reinforcing knowledge and innovation associated with entrepreneurship—will lead to higher levels of employment and, consequently, to better development.

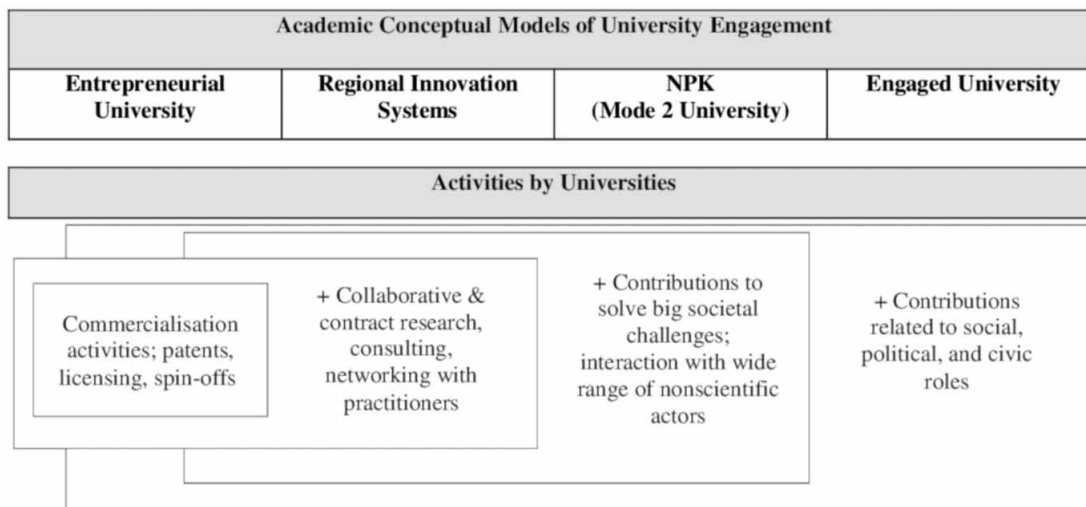
In this sense, Uyarra (2010) argued that HEIs are complex organizations which undertake a variety of activities that can have an economic impact on the regional economy. The author identified five roles related to regional innovation. Each role advocates for a set of features of universities, spatial aspects of interactions, and mechanisms for university engagement. First, universities are considered producers of scientific knowledge (or knowledge factories). Their local economic impact is seen in the form of spillovers, which contribute to increased levels of R&D. Second, university-industry links assume a “relational” or collaborative role of universities. These links acknowledge a variety of bidirectional links between firms and universities, constituting an opportunity to raise extra funding and complement academic research activities. Third, the university is seen under its entrepreneurial role. It is encouraged via dedicated organizational arrangements in universities, such as TTOs and science parks, as well as legal changes and incentive structures. Fourth, universities, as institutional actors in regional systems of innovation, are seen as boundary-spanning institutional “nodes.” Their influence is shaped by the specific regional innovation systems in which they are embedded. Fifth, universities are recognised as having a predominantly “developmental” role as actors. They are actively engaged in the economic development of the local and regional areas in which they are located.

These roles are closely linked to four academic conceptual models of university engagement. They capture and explain activities by which universities can support regional development (see Figure 2).

Entrepreneurial University Model: This is based on the idea that HEIs complement their traditional missions (research and teaching) by the third mission as related to economic development (Clark, 1998; Etzkowitz, 1983; Etzkowitz et al., 2000). HEIs make a regional contribution by taking an active role in commercialising their knowledge through spin-offs, patents, and licensing. Regions profit from the entrepreneurial activities of HEIs through job creation, spin-offs, knowledge spillovers, attraction of new talent, research that may be translated into products and services, and maintaining regional specialization (Grimaldi, Kenney, Siegel, & Wright, 2011).

Regional Innovation System (RIS) Model: This gives a fundamental role to HEIs in interactive innovation processes as key actors of a region's knowledge infrastructure (Asheim, Smith & Oughton, 2011; Cooke, 1992). This model emphasizes knowledge exchange between HEIs and the industrial world. It considers a much wider set of knowledge transfer mechanisms beyond commercialization. These include contract research, formal R&D cooperation, and forms of knowledge spillovers and informal contacts with firms.

Figure 2. University models: Activities by universities
 Source: Adapted from Tripl, Sinozic, and Smith (2015)



Mode 2 University Model: This model is based on the new production of knowledge (NPK) theory (Gibbons, 2013; Nowotny, Scott, & Gibbons, 2013). It discusses the role of universities in relation to new forms of knowledge production (referred to as mode 2). Traditional forms of university research are complemented by knowledge from different disciplines (transdisciplinarity). It is directly applicable to current societal challenges, in collaborative research with other organizations, producing knowledge that is relevant and connected to its environment.

Engaged University Model: This model shows the adaptation of university functions to regional needs (Boyer, 1990; Uyarra, 2010). For example, HEIs can adjust their teaching programmes to local needs (local student recruitment and retaining of graduates) and direct involvement with local firms. This provides assistance and research support (Arbo & Benneworth, 2007).

These university activities contribute to regional economic and societal development in different national contexts as “third mission” activities. Some find an answer to the challenge of HEIs financial constraints, especially through academic entrepreneurship.

Since the early 1990s, there have been major expectations regarding the role that universities play for regional development. In recent years, several authors have called for a deep rethinking (e.g., Bonaccorsi, 2017; Siegel & Wright, 2015). There is a serious risk of exaggerated expectations on the role of universities for regional development. In fact, it is time to rethink academic entrepreneurship in a juncture characterized by the changing role and purpose of universities. The debate regarding universities and academic entrepreneurship has relied too much on the research-third mission nexus. It’s narrow focus on the university-industry links has ignored the previous roles of universities. Evidence suggests that the benefits to society from third mission approaches have not been as great as anticipated (Grimaldi et al., 2011).

We are in the middle of a disenchantment period (Bonaccorsi, 2017). Thus, theoretical research and empirical academic entrepreneurship must consider these changes to improve the rigor and relevance of future studies on this topic.

SOLUTIONS AND RECOMMENDATIONS

As a result of the previous analysis and discussion, it is possible to verify that the literature has emphasised a positive contribution of HEIs to development. Indeed, research since the 1990s has focused expectations on the role that universities play for regional development. It highlights university-technology transfer and university-based start-ups, the production and dissemination of knowledge in a variety of formal and informal ways, establishes network relationships, and participation of regional governance and policy processes (Arbo & Benneworth 2007). However, evidence suggests that the benefits to society from third mission approaches have not been as great as anticipated (Grimaldi et al., 2011).

The majority of studies on university-led regional innovation systems include renowned cases, including Oxford and Cambridge in the UK, California's Silicon Valley, the Research Triangle in North Carolina, and Route 128 in Boston. These have evolved, respectively, around the universities of Stanford, UNC-Chapel Hill, and MIT (Uyarra, 2010). This focus has become something of the holy grail for regional policymakers who are intent on replicating the unique case of Silicon Valley's prodigious start-up culture. However, it would be misleading to generalize these cases. Indeed, universities play a different role in each regional economy. In this sense, it is recommended to be careful with this generalization and attend to the philosophy of: One size does not fit all. In each circumstance, region, and country, the relationship between the universities and the surrounding environment must take into account specific characteristics, potentialities, and limitations. We cannot apply the same model to each region as we wait for positive solutions.

The literature shows that regional competitiveness and university spillovers are strong complements to promoting start-up innovation activity. However, regional differences play a role in the intentions to create start-ups. The valorisation of entrepreneurship in each region helps to explain regional differences in entrepreneurial intentions (Liñán, Urbano, & Guerrero, 2011). Indeed, the commercialization of knowledge is a slow process. It is shaped by contextual influences with infrastructural and cultural changes. Thus, it creates a degree of uncertainty regarding the role of the HEIs in development (Kacperczyk, 2013).

FUTURE RESEARCH DIRECTIONS

This chapter intends to make a theoretical contribution to the subject under study, however, to strengthen the analysis of the main challenges of HEIs in the 21st century, further research will require an enlargement to an empirical approach, with secondary data focused on the target population of HEIs and Entrepreneurial universities, which allows to support the reflection about the dichotomy, post-modernism reality of internationalized universities and retention of human capital, knowledge spillovers and regional economic development.

Regarding the contribution of HEIs to development as presented in this chapter, there is a belief that the debate on universities and academic entrepreneurship has relied on the research-third-mission nexus and insufficient focus on teaching and/or education. Several authors suggested that the scope of the studies about the role of universities in regional development and research on academic entrepreneurship needs reconsideration. Rethinking academic entrepreneurship has several implications for entrepreneurship research. This may shape future research lines and open new studies at multiple levels of

analysis, namely the roles of property rights and incentives, entrepreneurial mobility, and international entrepreneurship. This will allow for the development of theories and empirical analysis to improve the understanding of entrepreneurship.

This reconsideration points to the fact that future studies can benefit from adopting a perspective beyond the third mission policies. Indeed, several institutions under various policy domains (e.g., research funding, education policy, industrial policy) have influenced the regional impact of universities. Thus, understanding the effect of a larger set of policies on university activities is an important line of future research. Furthermore, academic research must clarify the relationship between policy institutions at various spatial scales, that is, to what extent and in which ways they complement, reinforce, or contradict each other, and how this affects universities' engagement in regions.

The university cannot forget its fundamental mission to qualify people and produce knowledge. It needs to accomplish this task more efficiently and quickly, in a context of constant change and challenges. Thus, the university of the future must connect with the speed advancement of knowledge and demands of society through its cultural, economic, and political missions. It should be a privileged institution of dialogue, debate, acquisition, preservation, and transmission of knowledge, thus assuming its strategic importance for the future of the country and people. In this context, it should form individuals for the knowledge society with the ability to think in a holistic, systemic way with a commitment to reality. Mobility and flexibility should also be the hallmarks of higher education in the future. These issues open new areas of research in organisational behaviour, organisational theory, human resource management, ethics, and social responsibility. It should also suggest the greater importance of research on social networking in academic entrepreneurship.

CONCLUSION

HEIs can contribute to both local and regional economies. Regarding demand, it can purchase local goods and services through teachers, staff, and students. Regarding supply as sellers, it can create and sell products in economies. In economic growth theories, supply-side improvements often lead to long-term growth. Changes in demand only reflect short-term dynamics. Knowledge spillovers are a central ingredient in all supply-side productivity improvement processes.

HEIs, through their first mission (learning) are central players in the promotion of development. They can improve human capital and attract highly qualified people in the form of graduate students. Their second mission (research) focus on education and R&D. Developed countries usually present a higher level of education or spend relatively more on education and research. Their third mission (public service), via a link between research and business, includes patents, business incubators, and collaboration agreements.

The current challenges of higher education can be summarized in four aspects: (1) the globalization of higher education, with the internationalization of teaching, research, and public service missions to increase the mobility of students, teachers, and programmes; (2) massification of universities as they open to all kinds of people, diversifying their offerings of educational levels and curricula to attract new students; (3) new technologies based on knowledge of the 21st century economy; and (4) the entrepreneurship of higher education, showing the importance of the university-industry relationship to better serve the community and provide measures to deal with funding constraints.

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Since the early 1990s, there have been huge expectations on the role of HEIs in development. This is seen in several ways, including the creation of human capital, production and dissemination of knowledge, establishment of network relationships, and participation in regional governance and policy processes. However, evidence suggests that the benefits of third mission approaches on society are not as successful as anticipated. In recent years, several authors have suggested a need to rethink the scope of studies regarding the role of universities in regional development and research on academic entrepreneurship.

Specifically, theoretical research and empirical academic entrepreneurship need consider these changes to improve the rigor and relevance of future work on this topic. They must provide examples of key research questions to address and understand academic entrepreneurship.

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KEY TERMS AND DEFINITIONS

Entrepreneurial Universities: Higher education institutions that define strategies and tools to promote entrepreneurship and innovation. These constantly adjust to learning and knowledge transfer opportunities at regional, national, and international levels.

Globalisation: The integration of economies, industries, markets, cultures, and policies around the world.

Innovation: The introduction of something new. The process of translating an idea or invention into a good or service that creates value or for which customers will pay.

Knowledge: Facts, information, and skills acquired through experience or education.

Research: A detailed study of a subject to discover original information or reach a new understanding.

Spillovers: The impact that seemingly unrelated events in one part of the world can have on economies elsewhere.

Teaching: In education, teaching is the concerted sharing of knowledge and experience. This is usually organised within a discipline and, more generally, the provision of stimulus to the psychological and intellectual growth of a person by another person or artefact.

Technology Transfer: The process of transferring (disseminating) technology from the places and in-groups of its origination to wider distribution among more people and places.

Third Mission: An additional function of universities in the context of knowledge society. The university is not only responsible for qualifying human capital (education – the first mission) and producing new knowledge (research – the second mission). Universities must engage with societal needs and market demands by linking the university's activity with its own socioeconomic context.

Triple Helix Model: Universities, government, and companies relationships to establish the transfer of research and technology.

Chapter 2

Along the Pathway of University Missions: A Systematic Literature Review of Performance Indicators

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ABSTRACT

Over the last decades, the pressure on the university to facilitate direct application and exploitation of its knowledge and capabilities to contribute to social, cultural, and economic development has steadily increased. As a result, new missions have been recognized to universities, new theoretical frameworks have been developed, and new university models have been proposed, including the “entrepreneurial university”, the “civic university”, the “community-engaged university”, the “transformative university” or the “interconnected university”. Thus, a corresponding advancement of performance metrics and indicators used to assess the impact of university activities is required. Through a bibliometric and then a critical review of the extant literature, this study provides: i) an overall picture of the state-of-art of literature on universities’ missions and roles in regional development; ii) a systematisation of the contributions on performance measures and indicators of universities’ activities.

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INTRODUCTION

Over the last decades, research on the relationship between universities and local development has steadily increased (Harrison and Turok, 2017). Several theoretical frameworks have been developed, including the “triple helix”, the “quadruple helix” and the “quintuple helix” models of innovation (Etzkowitz & Leydesdorff, 2000; Carayannis and Campbell, 2010; Carayannis and Rakhmatullin, 2014), the “learning region” (Shaw and Allison, 1999), the “regional innovation systems” (Benneworth et al., 2017), or the “smart specialization strategy” (Kempton et al., 2013). As a result of such conceptual and theoretical pathway, the pressure on the university to facilitate the direct application and exploitation of its knowledge and capabilities in order to contribute to the social, cultural and economic development is nowadays higher and higher (e.g., Etzkowitz, 2002, 2004, 2013; Napolitano and Riviezzo, 2008; Riviezzo and Napolitano, 2010, 2014; Urbano and Guerrero, 2013; Leih and Teece, 2016; Schmitz et al., 2017; Riviezzo et al., 2017; Riviezzo et al., 2019a).

In this regard, it is possible to maintain that universities are “overloaded” with new missions (Enders and Boer, 2009; Benneworth et al., 2017). For instance, to the third mission of contributing to the economic development, a fourth mission has been recognized to the university, that is a renewed civic engagement or civic responsibility within the community, the city and region of which it is part and on which it forms its identity (e.g., Goddard, 1999; Chatterton and Goddard, 2000; Thornton and Jaeger, 2008; Goddard and Vallance, 2013; Riviezzo et al., 2019b). Therefore, the university plays a key role as an “anchor” institution, which works with and in its community to create shared value (Goddard and Kempton, 2016). Part of the literature refers to this as the “third role” of the university (e.g., Goddard, 1999; Chatterton and Goddard, 2000) to indicate the need of an “increasing embeddedness of higher education institutions in their regions and their duty as responsible local, as well as national and international agents” (Chatterton and Goddard, 2000; p. 490). Thus, these theoretical developments have served “to strengthen regional ties and reinforce an awareness of a responsibility of universities to be partners in the economic health and wealth of their region” (Allison and Keane, 2001; p. 127), putting the “third role” not only “alongside, but fully integrated with mainstream teaching and research” (Chatterton and Goddard, 2000; p. 475).

As a consequence of this progressive “enlargement” of the role of the university in the dynamics of local development, a corresponding evolution of performance metrics and indicators used to assess the impact of university activities is required. However, the theme of measures and indicators of universities activities is, to a large extent, not yet sufficiently explored (e.g., Urbano and Guerrero, 2013; Mazdeh et al., 2013; Schmitz et al., 2017). Through a bibliometric and then a critical review of the extant literature, the present chapter aims precisely to provide: *i*) an overall picture of the state-of-art of literature on universities’ missions and roles in regional development; *ii*) a systematisation of the contributions on performance measures and indicators of universities activities. We finally draw useful insights for future research, highlighting that the empirical assessment of social and cultural impact of the university in a community has been, to date, largely overlooked.

METHODOLOGY

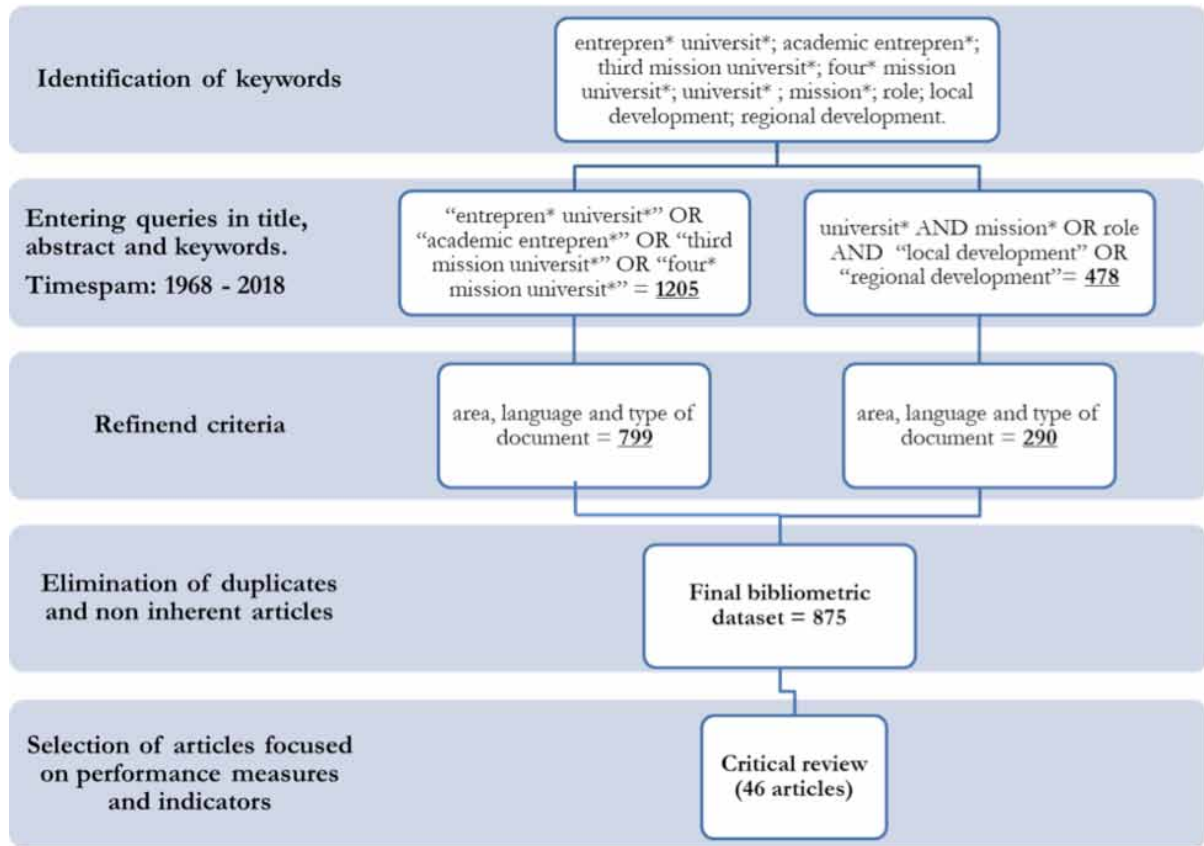
In order to reach the aims of this study, we used both quantitative and qualitative methods (Figure 1). Firstly, we employed a bibliometric analysis to draw a picture of the extant literature on the topic. Since it is based on the statistical measurement of science, scientists or scientific activity, bibliometric analysis is an objective and reproducible method to develop a review process (Verbeek et al., 2002; Diodato and Gellatly, 2013), and it is increasingly used in social sciences (e.g., Teixeira et al., 2012; Riviezzo et al., 2015; Schmitz et al., 2017; Mascarenhas et al., 2017; Fusco and Ricci, 2019). There are two main approaches in conducting a bibliometric analysis: performance analysis and science mapping (Noyons et al., 1999; van Raan, 2003; Cobo et al., 2011; Zupic and Čater, 2015). The performance analysis aims to quantify the research field, through the measurement of performances and impacts of the scientific actors (i.e., countries, universities, departments, authors), such as the number of published documents or the number of citations (Nederhof and van Raan, 1993; van Raan, 2003; Cobo et al., 2011). Indeed, the citation analysis also falls in this technique; it is based on the hypothesis that frequently cited studies have a greater influence on the development of the research field than those less frequently cited (Culnan, 1987; Tahai and Meyer, 1999). On the other hand, the science mapping, including co-citation (Small, 1973) and co-word analysis (Callon et al., 1983), aims to determine the cognitive structure of the field and its evolution.

In the present study, we carried out a performance analysis by using Bibliometrix, a free software supported by R environment, that provides a set of tools for quantitative research in bibliometrics and scientometrics (Aria and Cuccurullo, 2017). We used Scopus as database for our review.

The first step was the definition of the best keywords set to be used in order to better map the evolution of the research field. Then, considering our specific aims and as a result of the previous step, we entered in Scopus the following queries: “entrepren* universit*” OR “academic entrepren*” OR “third mission universit*” OR “four* mission universit*”; universit* AND mission* OR role AND “local development” OR “regional development”. The searching was refined by time (1968 – 2018), language (English) and type of document (article, review and article in press). Moreover, we restricted the area of interest to “business, management and accounting”; “social sciences”; “economics, econometrics and finance”. These queries, launched on 5 March 2019, resulted in the retrieval of 1089 documents. After the exclusion of duplicates and articles not really related to the topic, the collection has been cleaned up through a screening of titles and abstracts. The final dataset is made up by 875 articles, used for our bibliometric quantitative analysis.

The following step in our research process consisted of a critical review on 46 articles. The selection of the articles for the critical review was done by reading the title and the abstract of the articles included in our dataset. Thus, we chose for the critical analysis those articles that best fitted our aims (i.e., those explicitly focused on the topic of university missions’ performance measures). Furthermore, by using the snow-ball technique, we integrated the articles retrieved from our dataset with some others not originally included. Thus, this represents the qualitative part of our review.

Figure 1. Research flow



KEY FINDINGS OF THE BIBLIOMETRIC ANALYSIS

The sample used for our bibliometric analysis consists of 875 articles, sourced by 280 Journals, and published in a period of 46 years (1972 – 2018). Our data show a collaboration index of 2.1, with an average of 1.74 authors for each document (0.58 documents per author), while the single-authored articles are 246 (Table 1).

Scientific productivity is heavily concentrated in the last decade, with over 85% (n. 744) of the articles published since 2008 and over 14% (n. 124) only in 2018 (Figure 2).

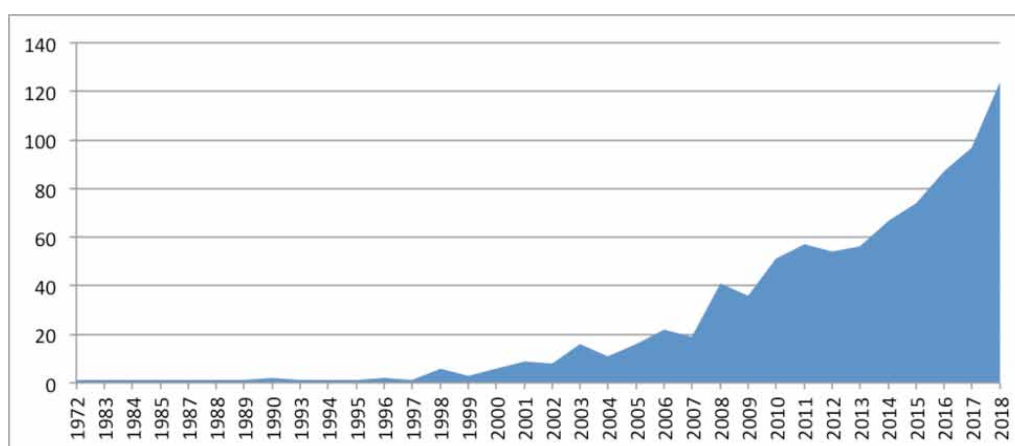
The research field is strongly localised in Anglo-Saxon countries (USA, UK and Canada) and Europe (especially Italy, Germany and Spain), even if scholars from the emerging countries are increasingly contributing to the field (Figure 3).

The ten most productive authors are reported in Figure 4. They are all academics, with similar seniority (full or associate professor), correlated background (Management, Economics, Engineering), and research interests mainly focused on Innovation, Entrepreneurship, and Technology Management. The first author in this list, with 23 articles, is Henry Etzkowitz, who theorized seminal concepts such as the “entrepreneurial university” model and the “Triple Helix” model. Then, we find some other pioneers of the field, such as Mike Wright (18 articles) or Magnus Klofsten (8 articles), but also authors who have

Table 1. Sample characteristics

Main information	
Document	875
Sources (Journals, Books, etc.)	280
Keywords Plus (ID)	1226
Author's Keywords (DE)	1797
Period	1972 - 2018
Average citations per documents	24,51
Authors	1520
Single-authored documents	246
Documents per Author	0.58
Authors per Document	1.74
Collaboration Index	2.1

Figure 2. Distribution of the articles in the sample per year



a more recent presence in this field of research, but a very high productivity, such as David Urbano (17 articles) or Maribel Guerrero (16 articles). Such high productivity is also confirmed by the temporal distribution of their publications (Figure 5).

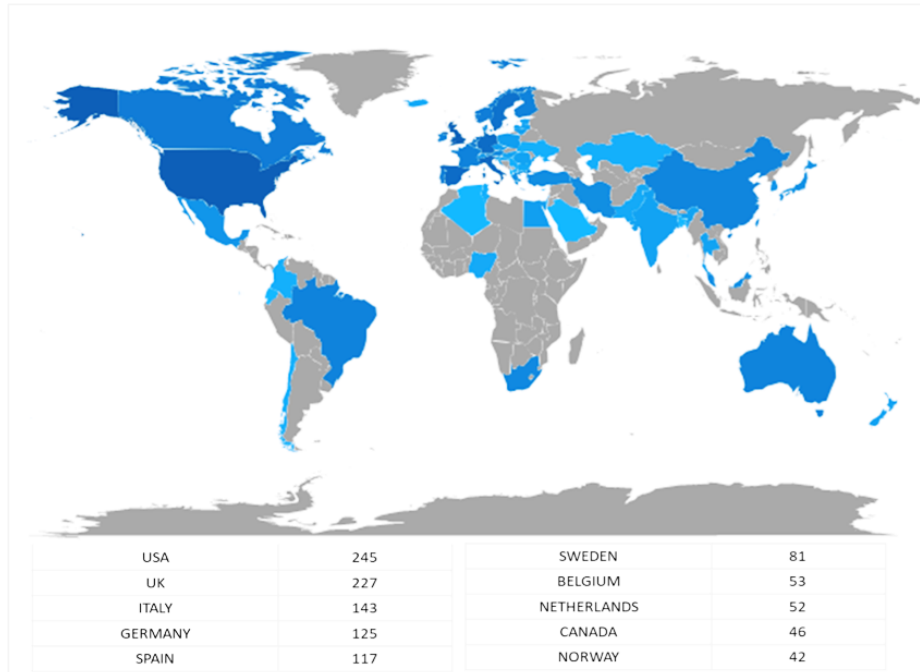
Among the 280 sources, the top 10 per publications (Table 2) are mainly journals dedicated to Technology, Innovation and Entrepreneurship or Higher Education, with the only exception of *European Planning Studies*, an outlet focused on development processes and policies in Europe.

It's worth observing the citation pattern in the field, considering both the citation of the papers in the sample, and the citation of the references within them, thus identifying the most influential articles. We can use this as a first, even if basic, indicator of the intellectual structure of this literature.

Firstly, focusing the attention on the average citations per year of the articles in our sample (Figure 6), we can observe that the citational peaks correspond with the years of publication of prominent contributions, that is 1983, 1998, 2000, 2003, 2004. Table 3 shows the top ten documents in our sample per number of global citations, that is the number of citations received from the documents to the date of our

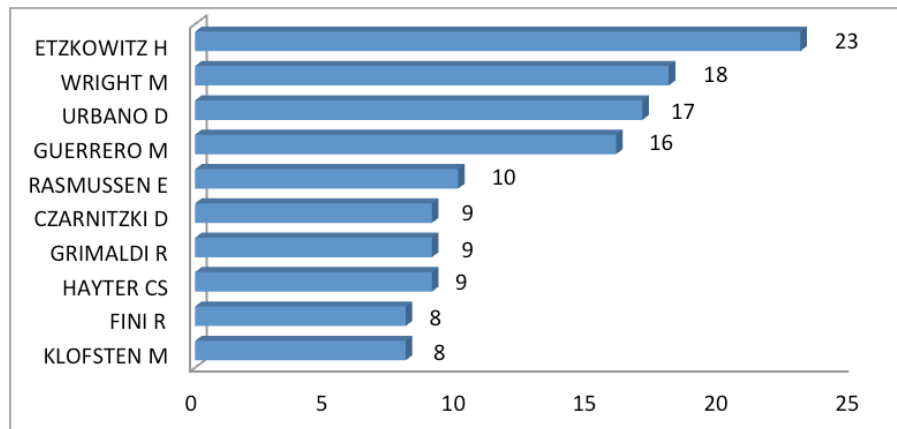
Along the Pathway of University Missions

Figure 3. Distribution of the articles in the sample per country of the authors*



*Different shades of blue indicate different levels of productivity. The countries with more articles are in darker blue, while the areas with no articles are in grey.

Figure 4. Top 10 authors in the sample



extraction. The most cited article among those in our sample is “Etzkowitz, H., Webster, A., Gebhardt, C., & Terra, B. R. C. (2000), The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm, *Research policy*, 29(2), 313-330”. Then, we can find other contributions that conceptualized or empirically tested the Triple Helix model (n. 1), the industry-university relations (n. 2), the entrepreneurial university model (n. 2), and the academic engagement (n. 4).

Figure 5. Top authors' production over the time

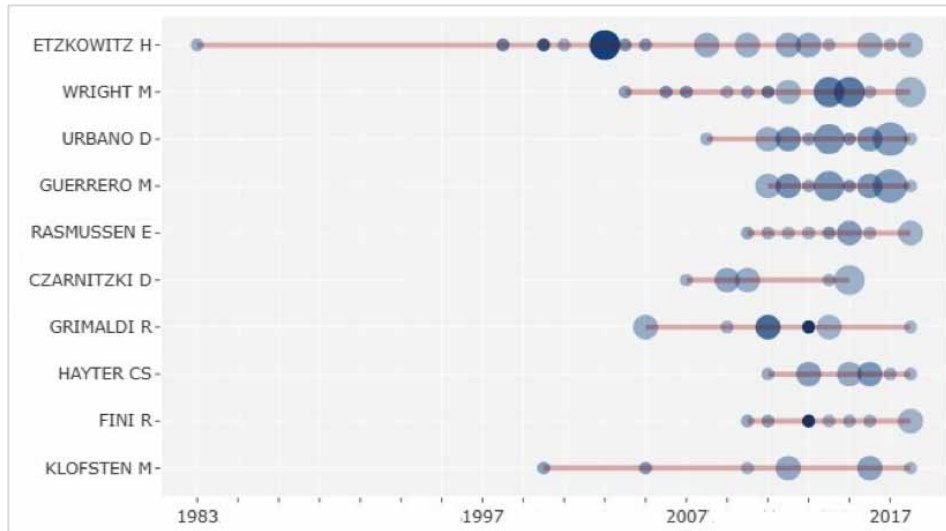


Table 2. Top 10 sources in the sample

Journals	N. Papers
Journal of Technology Transfer	82
Industry and Higher Education	62
Research Policy	45
Science and Public Policy	18
Technovation	18
European Planning Studies	17
Higher Education	15
Small Business Economics	15
Higher Education Policy	14
International Entrepreneurship and Management Journal	12
International Journal of Technology Management	12

The most cited references are shown in Table 4. They refer to the most cited references within the articles in our sample. They are all scientific papers, mainly empirical (n. 8), and adopting different theoretical frameworks, sometimes not explicitly explained. We can find in this list some of the most influential contributions in the field, such as, for instance, the ones theorizing the “entrepreneurial university” or the “Triple Helix” models (Etzkowitz et al., 2000; Etzkowitz, 1983, 1998, 2003). Among the most recurring theoretical frameworks used in these studies, it’s worth citing the institutional theory (e.g., Bercovitz and Feldman, 2008; Etzkowitz et al., 2000), the resource-based view (e.g., Lockett and Wright, 2005) and the entrepreneurial opportunities (e.g., Shane and Stuart, 2002).

Along the Pathway of University Missions

Figure 6. Average citations of the articles in the sample per year

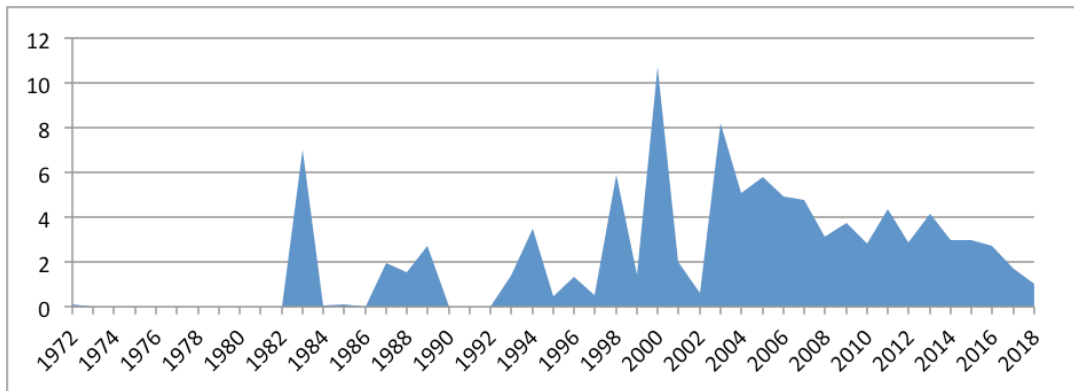


Table 3. Top 10 articles per number of citations

Documents	Citations
Etzkowitz, H., Webster, A., Gebhardt, C., & Terra, B. R. C. (2000). The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. <i>Research policy</i> , 29(2), 313-330.	943
Etzkowitz, H. (2003). Research groups as 'quasi-firms': the invention of the entrepreneurial university. <i>Research policy</i> , 32(1), 109-121.	612
Etzkowitz, H. (1998). The norms of entrepreneurial science: cognitive effects of the new university–industry linkages. <i>Research policy</i> , 27(8), 823-833.	539
Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., ... & Krabel, S. (2013). Academic engagement and commercialisation: A review of the literature on university–industry relations. <i>Research policy</i> , 42(2), 423-442.	485
Walter, A., Auer, M., & Ritter, T. (2006). The impact of network capabilities and entrepreneurial orientation on university spin-off performance. <i>Journal of business venturing</i> , 21(4), 541-567.	439
Etzkowitz, H. (2003). Innovation in innovation: The triple helix of university-industry-government relations. <i>Social science information</i> , 42(3), 293-337.	425
Bercovitz, J., & Feldman, M. (2008). Academic entrepreneurs: Organizational change at the individual level. <i>Organization science</i> , 19(1), 69-89.	332
Gulbrandsen, M., & Smeby, J. C. (2005). Industry funding and university professors' research performance. <i>Research policy</i> , 34(6), 932-950.	314
Powers, J. B., & McDougall, P. P. (2005). University start-up formation and technology licensing with firms that go public: a resource-based view of academic entrepreneurship. <i>Journal of business venturing</i> , 20(3), 291-311.	306
Goldfarb, B., & Henrekson, M. (2003). Bottom-up versus top-down policies towards the commercialization of university intellectual property. <i>Research policy</i> , 32(4), 639-658.	270

Looking at the keywords (Figure 7), “academic entrepreneurship” has been the most used keyword in the field until a few years ago, when “entrepreneurial university” reached it. Although there is no agreement on what exactly the two theoretical constructs really mean and what are the differences between the two, it is possible to ascribe to the former a more individual connotation. In this view, “academic entrepreneurship” is the entrepreneurial activity fielded by an academic/researcher or students in order to exploit and commercialise knowledge and technology (e.g., Klofsten and Jones-Evans, 2000; Urbano and Guerrero, 2013). The construct is, therefore, strictly related to the “academic entrepreneurs”; for instance, Urbano and Guerrero (2013, p. 41) defined an “academic entrepreneur” as “both an academic, affiliated at a higher academic organization categorized as an entrepreneurial university, and an entrepreneur

Table 4. Top cited references

References	Citations	Theoretical Framework	Methodology	Findings
Di Gregorio, D., Shane, S., (2003). Why Do Some Universities Generate More Start-Ups Than Others?. <i>Research Policy</i> , 32, Pp. 209-227	99	Academic engagement	Empirical	The intellectual eminence of the university, and the policies of making equity investments in TLO start-ups and maintaining a low inventor share of royalties increase new firm formation activity.
Bercovitz, J., Feldman, M., (2008). Academic Entrepreneurs: Organizational Change At The Individual Level. <i>Organization Science</i> , 19 (1), Pp. 69-89	79	Academic entrepreneurship/ Technology transfer/ Institutional theory	Empirical	Individual attributes are conditioned by the local working environment. In terms of personal attributes, individuals are more likely to participate if they trained at institutions that had accepted the new initiative and been active in technology transfer. The longer the time that had elapsed since graduate training, the less likely the individual was to actively embrace the new commercialization norm. Considering the localized social environment, when the chair of the department is active in technology transfer, other members of the department are also likely to participate, if only for symbolic reasons.
Eizkowitz, H., (2003). Research Groups As 'Quasi-Firms': The Invention Of The Entrepreneurial University. <i>Research Policy</i> , 32 (1), Pp. 109-121	78	Entrepreneurial university/ Academic entrepreneurship/ Triple Helix	Conceptual with example	Academic entrepreneurship is both endogenous and exogenous. Endogeneity and exogeneity may be defined in terms of what is developed within an institutional sphere versus what is imported into it. It is endogenous in the sense that it is an internal development within academia that emanates from the way that the research university grew up. On the other hand, university-based innovation is in part the result of external influences including military research funding.
Lockett, A., Wright, M., (2005). Resources, Capabilities, Risk Capital And The Creation Of University Spin-Out Companies. <i>Research Policy</i> , 34 (7), Pp. 1043-1057	52	Technology transfer/ Resource-based view	Empirical	Both the number of spin-out companies created and the number of spin-out companies created with equity investment are significantly positively associated with expenditure on intellectual property protection, the business development capabilities of technology transfer offices and the royalty regime of the university. The results highlight the importance not just of resource stocks, but also of developing appropriate capabilities of technology transfer officers in spinning-out companies.
Eizkowitz, H., (1998). The Norms Of Entrepreneurial Science: Cognitive Effects Of The New University-Industry Linkages. <i>Research Policy</i> , 27 (8), Pp. 823-833	45	Academic entrepreneurship/ Technology transfer	Empirical	A 'second revolution' interested the universities, supposed to incorporate economic and social development as part of their mission. The heart of this new mission is the 'capitalisation of knowledge', that could have different approaches such as: 1) hands off, leave the matter entirely to the transfer office; 2) knowledgeable participant, aware of the potential commercial value of research and willing to play a significant role in arranging its transfer to industry; and 3) seamless web, integration of campus research group and research program of a firm.
Eizkowitz, H., (1983). Entrepreneurial Scientists And Entrepreneurial Universities In American Academic Science. <i>Minerva</i> , 21, Pp. 198-233	42	Entrepreneurial university/ Academic entrepreneurship	Theoretical	Entrepreneurial science has not arisen as a result of demand by existing industries. It came about as university scientists, at times through interaction with venture capitalists, decided to exploit the industrial applications of their research. The university is evolving from an institution dependent for its support on income from endowment, gifts, fees paid by students and grants from governments, into an enterprise capable of obtaining income from its research activities.

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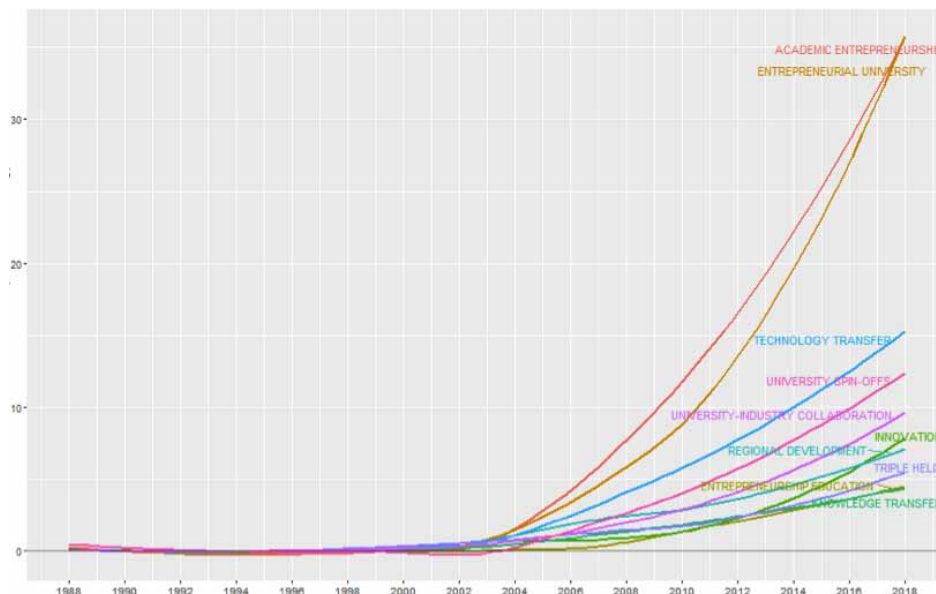
Table 4. Continued

References	Citations	Theoretical Framework	Methodology	Findings
Etzkowitz, H., Webster, A., Gebhardt, C., Terra, B.R.C., (2000). The Future Of The University And The University Of The Future: Evolution Of Ivory Tower To Entrepreneurial Paradigm. <i>Research Policy</i> , 29 (2), Pp. 313-330	38	Triple helix/Entrepreneurial university/ Institutional theory	Conceptual with example	A pattern of transformation toward an entrepreneurial university is emerging, from different bases, in the US, Latin America, Europe and Asia. At least two major trends can be identified that affect the future role of the entrepreneurial university: one is the shift to ever greater dependence of the economy on knowledge production and, the second, the attempt to identify and guide future trends in knowledge production and their implications for society.
Yohora, A., Wright, M., Lockett, A., (2004). Critical Junctures In The Development Of University High-Tech Spinout Companies. <i>Research Policy</i> , 33 (1), Pp. 147-175	28	Academic entrepreneurship	Empirical	University spinout companies go through various stages: (1) research phase; (2) opportunity framing phase; (3) pre-organization phase; (4) re-orientation stage; and finally (5) sustainable returns phase. At the interstices between the different phases there are some "critical junctures" that ventures face in terms of the resources and capabilities they need to acquire to progress to the next phase of development. These are: (1) opportunity recognition; (2) entrepreneurial commitment (3) venture credibility; and (4) venture sustainability.
Shane, S., Stuart, T., (2002). Organizational Endowments And The Performance Of University Start-Ups. <i>Management Science</i> , 48 (1), Pp. 154-170	28	Entrepreneurial opportunities / Resource-based view	Empirical	Two measures of founders' social capital - the presence of direct and indirect ties to venture investors prior to firm founding - sharply decrease the hazard of mortality and increase the likelihood that start-ups obtain external funding. The social capital endowments, through their impact on the fund-raising process, have long-term, positive influences on the performance of new ventures.
Shane, S., Venkataraman, S., (2000). The Promise Of Entrepreneurship As A Field Of Research. <i>Academy Of Management Review</i> , 25 (1), Pp. 217-226	26	Entrepreneurial opportunities	Theoretical	Entrepreneurship is the process through which new economic activities and organizations come into existence. Opportunities are central to this process. Micro-level explanations of entrepreneurial action and outcomes should look beyond the individuals involved. Equally important is the quality of the opportunities they pursue, and the fit between individual and opportunity. Within this framework, a central task for entrepreneurship research is to develop and test theory about how characteristics of opportunities, directly and in interaction with individuals' characteristics, give shape to entrepreneurial processes.
Jacob, M., Lundqvist, M., Hellsmark, H., (2003). Entrepreneurial Transformations In The Swedish University System: The Case Of Chalmers University Of Technology. <i>Research Policy</i> , 32 (9), Pp. 1555-1568	24	Entrepreneurial university	Empirical	Creating an entrepreneurial university takes several years, as both infrastructural and cultural changes are necessary to achieve success. Moreover, innovation policy at macro level and flexibility at micro level are required.
Clarysse, B., Wright, M., Lockett, A., Van De Velde, E., Vohora, A., (2005). Spinning Out New Ventures: A Typology Of Incubation Strategies From European Research Institutions. <i>Journal Of Business Venturing</i> , 20 (2), Pp. 183-216	23	Entrepreneurship	Empirical	It is possible to identify three distinct incubation models of managing the spin-out process: Low Selective, Supportive, and Incubator. The different incubation models have very different resource implications in managing the process. In particular, the resource and competence differences relate to finance, organization, human resources, technology, network, and infrastructure. The growing body of accounts of successful technology-transfer models in the academic literature may be misspecified for three main reasons: initial goals, organizational culture and regional environment, that should be considered.

involved in a new venture start up founded to exploit intellectual property created in this organization”. On the other hand, “entrepreneurial university” seems to refer to the organizational level of analysis, and it “includes developmental mechanisms and emergent structures” within universities (Etzkowitz et al., 2000, p. 316). In this perspective, Kirby et al. (2011, p. 304) defined the “entrepreneurial university” as “a university oriented towards innovation and the development of an entrepreneurial culture which has a new managerial ethos in governance, leadership, and planning, including greater faculty responsibility for accessing external sources of funding”; Guerrero et al. (2014, p. 415) defined it as “a university that tries to provide a supportive environment, in which the university community can explore, evaluate and exploit ideas that could be transformed into social and economic entrepreneurial initiatives”. Therefore, the entrepreneurial university is the cradle in which the academic entrepreneurship is fed. However, it must be emphasized that this distinction is not widely accepted and the two theoretical constructs have been often used as synonymous. For instance, the eight specific types of academic entrepreneurship identified by Klofsten and Jones-Evans (2000) – that are *i*) large scale science projects; *ii*) contracted research; *iii*) consulting; *iv*) patenting/licensing; *v*) spin-off firms; *vi*) external teaching; *vii*) sales; *viii*) testing – represent also commonly used indicators of performance of the entrepreneurial university, as it will be highlighted in the following paragraph.

Coming back to the most recurrent keywords, “technology transfer”, “knowledge transfer” and “university-industry collaboration” were frequently used in the early development stage of the field, being largely outdated in recent years by the two above mentioned “academic entrepreneurship” and “entrepreneurial university”. Looking at the fast-growing keywords in the most recent years, it is possible to observe how research in this field has expanded to various interconnected topics, such as “entrepreneurship education” and “regional development”. The presence of the first keyword must be interpreted as a sign of scholars’ large interest towards the educational activities carried out by the universities that have the purpose of stimulating the entrepreneurial culture and skills among the students (e.g., Jesselyn

Figure 7. The keywords temporal dynamics



Co and Mitchell, 2006; Blenker et al., 2008; Galvão et al., 2018). On the other hand, the occurrence of “regional development” among the frequently used keywords refers to the growing attention posed on the specific role that universities may play in regional development, that is precisely the focus of the critical analysis presented below.

A CRITICAL REVIEW: THE EVOLUTION OF UNIVERSITIES’ FEATURES AND PERFORMANCE INDICATORS

As stated above, the specific aim of this chapter is to provide a picture of the performance metrics and indicators proposed in the literature in order to assess the impact of universities activities on local development. Thus, a further step in our research process was the selection and critical analysis of a set of articles best fitting our objectives among those included in the bibliometric analysis, following an approach largely used in systematic literature reviews (e.g., Schmitz et al., 2017). Furthermore, we also included in such critical review some relevant articles caught using the snowball technique and not originally entered in our bibliometric dataset. On the whole, we analysed 46 articles focused on the performance measures and indicators of universities’ role in regional development. The full list of these articles is available on request to the authors.

Our critical review confirmed the progressive emergence of new missions for universities, with new theoretical frameworks proposed to describe this transformation and heterogeneous indicators adopted to assess its effect on the dynamics of economic and social development. Since Etzkowitz (1983) theorised the so called “second academic revolution” and the born of the third mission of contributing to local development, besides the traditional missions of education and research of the Humboldtian model, additional missions and models have been identified for universities. For instance, Goldstein (2010) proposed three different university models: the Humboldtian model, the land-grant or engaged university model, and the triple helix or the entrepreneurial university model. Trippel et al. (2015) proposed four models: the entrepreneurial university model, the regional innovation system university model, the mode 2 university model, and the engaged university model.

Despite the heterogeneity of the models proposed, the theoretical frameworks developed, and the empirical methods adopted, moving from our critical review and focusing specifically on the differences in terms of performance metrics and indicators, three relevant groups of articles can be defined: *i*) the first group is based on the entrepreneurial university model (third mission); *ii*) the second group embraces those studies based on the regional engaged university model (third role); *iii*) the third group combines those contributions based on the civic engaged university or broader engaged university model (fourth mission). As already noted (Schmitz et al., 2017), these models very often share some components and variables and the boundaries between them are not always very clear. In this regard, the first and the second groups of articles seem to have many similarities, also in terms of performance metrics, but they clearly originated from different disciplines and research areas. And this is reflected also in the outlets used for their publication. The first group, aggregated around the entrepreneurial university model, is more rooted in the strategic, innovation and technology management areas (and it is mainly published in journals like: *The Journal of Technology Transfer*, *Research Policy*, *Technological Forecasting and Social Change*, and so on). The second group, built around the regional engaged university model, is more linked with the territorial development and regional studies (and mostly published in journals like: *Local economy*, *European Planning Studies*, *Regional Study*, and so on). The third group turns out to be

a convergent but non-linear evolution of the previous two, as a result of the progressive expansion of the role assigned to the university towards the territory and the community it belongs to. This is manifested also in the nature of measures and indicators used to assess the different missions recognized to the university, as we will discuss in depth below.

Table 5 presents a sample of empirical papers falling into the three groups.

The Entrepreneurial University: The Third Mission

The entrepreneurial university is the result of the so-called “second academic revolution”, through which the university has been transformed into a “teaching, research and economic development enterprise” (Etzkowitz, 2003, p. 110). Thus, it is no more considered an “isolated island” (Klofsten and Jones-Evans, 2000) or an “ivory tower” and becomes an economic actor, with the ability to create “new sources of funds like patents, research under contracts and entry into a partnership with a private enterprise” (Etzkowitz, 1983, p. 198). Although a shared definition is still lacking and there is yet no agreement around a comprehensive model of what exactly it is, we can state that it is characterised, on the one hand, by a strong emphasis on closer relationships with industry and the dissemination and commercialisation of its knowledge; on the other hand, by a strategic and organizational change, that is needed to encourage individuals and groups towards entrepreneurship (e.g., Etzkowitz, 1983; Clark, 1998, 2004; Subotzky, 1999; Riviezzo and Napolitano, 2010, 2014; Urbano and Guerrero, 2013; Riviezzo et al., 2019a). However, while the focus of these studies was initially on the creation of economic development through the protection and commercialization of university’s knowledge, thus responding to an internal logic (University Entrepreneur Two), the emphasis has been gradually translated into a broader concept of contributing to regional development (University Entrepreneur Three), with a growing attention posed on the impact of universities activities on the territory (Etzkowitz, 2013).

Regarding the performance metrics and indicators, it’s possible to observe that the contributions included in this first group are characterised by an assessment of universities entrepreneurial activities that is mainly economic in nature. Even though many authors, from the conceptual point of view, maintain that the entrepreneurial university should create economic and social utility, then most of the empirical studies make use of just economic and quantitative parameters. A largely used indicator is the number of *spin-off*, both as the sole parameter (e.g., Vincett, 2010) and, more often, in combination with others (e.g., Perkmann et al., 2015; Guerrero et al., 2016; Riviezzo et al., 2019a). For instance, Fini et al. (2017) distinguish the quantity of spin-offs, that is the number of university spin-offs from a given university in a given year, and the quality of spin-offs, operationalised as the number of university spin-offs from a given university in a given year, which have received a first round of venture capital financing in that year. Other frequently used metrics are: *patents* (e.g., Urbano and Guerrero, 2013; Secundo and Elia, 2014; Guerrero et al., 2015; Perkmann et al. 2015; Riviezzo et al., 2019a); *consulting or professional contracts* (e.g., Perkmann et al., 2015; Guerrero et al., 2015; Trequattrini et al., 2018); *publications* (e.g., Urbano and Guerrero, 2013; Secundo and Elia, 2014); *entrepreneurial education* (e.g., Secundo and Elia, 2014; Trequattrini et al., 2018); *student or researcher exchange* (e.g., Urbano and Guerrero, 2013); *facilities* (Guerrero et al., 2015); *networking and collaboration with industry* (e.g., Secundo and Elia, 2014; Guerrero et al., 2015). With regard to regional impact, the metrics most frequently used are: *GDP* (e.g., Vincett, 2010; Urbano and Guerrero, 2013; Guerrero et al., 2016); *Gross Value Added – GVA* (Guerrero et al., 2015; Trequattrini et al., 2018); *employment rate* (e.g., Guerrero et al., 2016; Trequat-

Along the Pathway of University Missions

Table 5. Key performance measures

Group of articles	References	Methodology	University performance and impact measures	
			Soft	Hard
The entrepreneurial university: the third mission	Perkmann, M., Fini, R., Ross, J. M., Salter, A., Silvestri, C., & Tartari, V. (2015). Accounting for universities' impact: Using augmented data to measure academic engagement and commercialization by academic scientists. <i>Research Evaluation</i> , 24(4), 380-391.	Empirical/ Quantitative		<ul style="list-style-type: none"> • Consulting contracts • Patenting activities • Entrepreneurial activities (spin-outs)
	Guerrero, M., Urbano, D., & Fayolle, A. (2016). Entrepreneurial activity and regional competitiveness: evidence from European entrepreneurial universities. <i>The Journal of Technology Transfer</i> , 41(1), 105-131.	Empirical/ Quantitative		<ul style="list-style-type: none"> • number of start-ups • GDP per capita; • GDP change; • Employment rate by highest level of education;
	Trequatrin, R., Lombardi, R., Lardo, A., & Cuzzo, B. (2018). The impact of entrepreneurial universities on regional growth: a local intellectual capital perspective. <i>Journal of the Knowledge Economy</i> , 9(1), 199-211.	Empirical/ Quantitative		<ul style="list-style-type: none"> • Entrepreneurial curricula; • Academic spin-offs; • Supply of professional services • Percentage of regional added value on the total • Regional return on assets (ROA) values • Regional employment rate • Regional exports value
	Riviezzo, A., Santos, S. C., Liñán, F., Napolitano, M. R., & Fusco, F. (2019). European universities seeking entrepreneurial paths: the moderating effect of contextual variables on the entrepreneurial orientation-performance relationship. <i>Technological Forecasting and Social Change</i> , 141, 232-248.	Empirical/ Quantitative		<ul style="list-style-type: none"> • Patents • Spin-offs
The regional engaged university: the third role	Allison, J., & Keane, J. (2001). Evaluating the role of the Sunshine Coast University (USC) in the regional economy. <i>Local Economy</i> , 16(2), 123-141.	Empirical/ Qualitative	<ul style="list-style-type: none"> • support for industry and sponsorship of enterprise development • Skills transfer (courses offer with local focus) • Local sourcing; • Collaboration with local firms and knowledge exchange • Partnerships and networks with local organisations (high schools, businesses, regional public institutions) • Cultural and sports facilities; • Promotion of sport and health 	
	Glasson, J. (2003). The widening local and regional development impacts of the modern universities-a tale of two cities (and north-south perspectives). <i>Local Economy</i> , 18(1), 21-37.	Empirical/ Qualitative	<ul style="list-style-type: none"> • Initiatives to encourage student and graduate placements • University-Industry collaborations • Activities to reduce physical environmental impacts • Lifelong learning activities • Public access to university facilities and events • Support to local voluntary and community organisations 	<ul style="list-style-type: none"> • Direct and indirect employment and expenditure impacts • Consultancy, training and business support activity • Spin-outs
	Benneworth, P., Coenen, L., Moodysson, J., & Asheim, B. (2009). Exploring the multiple roles of Lund University in strengthening Scania's regional innovation system: Towards institutional learning?. <i>European Planning Studies</i> , 17(11), 1645-1664.	Empirical/ Qualitative	<ul style="list-style-type: none"> • Responding to firm-based knowledge demands • Collective research and learning activities • Infrastructure sharing • Networking 	<ul style="list-style-type: none"> • Spin-off companies • Patenting/ Licensing • Consultancy support

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Table 5. Continued

Group of articles	References	Methodology	University performance and impact measures	
			Soft	Hard
The broader university or civic engaged university: the fourth mission	Trencher, G., Yarime, M., McCormick, K. B., Doll, C. N., & Kraines, S. B. (2013). Beyond the third mission: Exploring the emerging university function of co-creation for sustainability. <i>Science and Public Policy</i> , 41(2), 151-179.	Empirical/ Qualitative	<ul style="list-style-type: none"> • Knowledge management (e.g. collaborative research and publications, consulting, training for key stakeholders and decision makers) • Technical demonstration projects and experiments (e.g. innovation or pilot project) • Reform of built and natural environment (e.g. university administration-led real-estate development, neighbourhood reform or infrastructure improvements) • Socio-technical experiments (building or reconfiguration of a food or consumption network, the re-organising of technological artefacts or the introduction of an experimental incentive or policy tool designed to change the behaviour of citizens or the private sector) 	<ul style="list-style-type: none"> • Technology transfer and economic development (e.g. patenting and licensing to industry, or the creation of spinoff firms technology parks and cluster zones)
	Mbah, M. F. (2016). Towards the idea of the interconnected university for sustainable community development. <i>Higher Education Research & Development</i> , 35(6), 1228-1241.	Empirical/ Qualitative	<ul style="list-style-type: none"> • Embracing a collaborative form; • Broadening participation; • Adopting relevant channels to ascertain community ideas and needs; • Operating accessible community centres; • Researching local concerns • Customising educational programmes and service learning 	
	Rinaldi, C., Cavicchi, A., Spigarelli, F., Lacchè, L., & Rubens, A. (2018). Universities and smart specialisation strategy: From third mission to sustainable development co-creation. <i>International Journal of Sustainability in Higher Education</i> , 19(1), 67-84.	Empirical/ Qualitative	<ul style="list-style-type: none"> • Initiatives to support the development of creative and cultural industries (cultural incubators) • Initiatives to support local culture, products and firms • Initiatives to promote entrepreneurship (scholarship program and training) 	

trini et al., 2018); *regional exports value* and *regional return on assets (ROA) values* (e.g., Trequattrini et al., 2018). Urbano and Guerrero (2013) also report indirect *social impacts*, such as *attracting business* or *producing social mobility*.

Despite the academic consensus received and the great empirical echo, the model of entrepreneurial university has been questioned for different reasons. Audretsch (2014) stresses the lack of effective integration between the traditional Humboldt core and the “third mission” areas that should be exceeded through the transition towards the university in the entrepreneurial society, whose mission “is not just to promote technology transfer and increase the number of startups but to ensure that people thrive in the emerging entrepreneurial society” (p. 320). Czarnitzki et al. (2014) underline that the push towards the commercial opportunities or commercialising knowledge could restrict public disclosure, so the decrease in the production of academic research should be considered as a potential social cost and taken into account to calculate net social benefit. Other scholars held the effectiveness of this model and its ability to produce expected results (Harrison and Leitch, 2010), as its limited attention on the non-economic and non-financial aspect of development (e.g., McAdams and Debackere, 2018; Riviezzo et al., 2019b).

The Regional Engaged University: The Third Role

Articles clustered in this group assign to the university a key role in regional development, first as a “spending multiplier”, then as a “stimulator” of economic development through specific activities (Goldstein, 2010). The advancement of knowledge society pushed policymakers to leave the idea of the industrialization as the only way of promoting local development, thus putting emphasis on a knowledge-based endogenous growth, where the learning and the innovation are the driving forces (Charles, 2003). At the same time, the region (that is an area larger than a city, but smaller than a country) has been increasingly seen as an important basis of economic coordination at the meso-level. The result is the development of theoretical frameworks such as “regional innovation systems” (RIS) and “learning regions”, where the focus is on the collaborative interaction between regional actors (firms and institutional entities) to assure continuous learning and innovative processes (e.g., Florida, 1995; Morgan, 1997; Cooke et al., 1998; Cooke, 2001; Asheim and Isaksen, 2002; Gunasekara, 2006). Cooke et al. (1998; p. 1581) define RIS as a system “in which firms and other organizations are systematically engaged in interactive learning through an institutional milieu characterized by embeddedness”. In this context, the university, as the knowledge infrastructure par excellence (Tripl et al., 2015), becomes the core of this innovative growth process (e.g., Allison and Keane, 2001; Charles, 2003; Benneworth et al., 2009). The new and strengthened role of university in regional development has been defined “third role”, widely understood as the responsibility of higher education institutions to be partners in the economic health and wealth of their region (Goddard, 1999; Chatterton and Goddard, 2000; Allison and Keane, 2001). Such conceptualization of the third role, compared to the third mission and the triple helix model, put more emphasis on adaptive responses and stronger focus on regional needs in defining the university missions (Gunasekara, 2006). Moreover, it also paid much attention to the first and second missions and their links with context (Tripl et al., 2015). Thus, these theoretical developments have served to out the “third role” not only “alongside, but fully integrated with mainstream teaching and research” (Chatterton and Goddard, 2000; p. 475).

Concerning the metrics used to assess this new role, there are some similarities with “entrepreneurial university”, mainly in term of knowledge commercialisation (spin-offs) and knowledge exchange. However, in this group of studies much more emphasis is posed on networking, even informal, and collaboration, and also the engagement with local community is more underlined. It’s worth noting, that the empirical studies in this group are mainly qualitative (above all, case studies), thus the indicators are more descriptive. For instance, Allison and Keane (2001) analyse the role of the university in the region on the basis of six dimensions: *i) enterprise development*, understood as the support for industry and sponsorship of enterprise development (e.g., staff support to local industry, management education, etc.); *ii) skills transfer*, that is the design of an educational offer with a local focus; *iii) sourcing and supply chains*, that is supplies from local firms; *iv) technology and research development*, that arises from an exchange of technology and ideas between universities and local firms; *v) partnerships and networks*, with local firms and other institutions; *vi) civic engagement*, that leads providing facilities (i.e. library) and potential opportunities for the promotion of sports/health. Benneworth et al. (2009) focused on *spin-off companies, responding to firm-based knowledge demands; collective research; infrastructure sharing; networking and consultancy support*. The formation of human capital and knowledge that respond to local needs and strong business support is also found in Glasson (2003), that points out also the role in terms of employment and GDP. In sum, we can say that in this model *i)* the contribution of university is strongly dependent of context, because it should respond to local specific needs; *ii)* this

contribution is largely translated into knowledge support to local firms; *iii*) although evident differences between entrepreneurial model and some references to community development, there is still a strong prevalence of economic concerns. Furthermore, the excessively local and restricted territorial vision has been criticized (e.g., Trippel et al., 2015).

The Broader University or Civic Engaged University: The Fourth Mission

In the last years, the need to consider more broadly the role and the consequent impacts of the university gave birth to a flourishing but still fragmented literature. The labels assigned to universities are several, but they all share the emphasis on non-economic and therefore social, environmental and cultural impacts (Goddard et al., 2011). “The quest for an ‘ethical university’ is more important today than ever before, a quest in which ethical values, practices and responsibility will be the dominant factors in terms of the university’s vision, targeted objectives, strategic planning and management, while the commercial values, practices and profitability will only be of secondary importance. This points to an interdependence of citizenship and education” (Chan, 2011; p. 275). Thus, the engaged university appears to be entrepreneurial, but also closely linked to the territory and widely responsible for the overall community development and well-being. For example, a broader regional impact is recognised in “smart specialization strategy” (S3) literature, based on the key concept underlying the European innovation strategy in 2014-2020 programming period (Kempton et al., 2013; Kempton, 2015). In addition to stretch the role of university in regional innovation as active player in defining the territorial strategy, S3 is also variously linked with other concepts. Carayannis and Rakhmatullin (2014) investigate the growth based on regional innovation smart specialisation strategies via the ‘multi-focal lens’ of the Quadruple and Quintuple Innovation Helixes perspective. They argue that “Quadruple Helix models place a stronger focus on cooperation in innovation and, in particular, the dynamically intertwined processes of co-opetition, co-evolution and co-specialisation within and across regional and sectorial innovation ecosystems that could serve as the foundation for diverse smart specialisation strategies” (Carayannis and Rakhmatullin, 2014; p. 218). Quadruple and Quintuple helices expanded the “triple helix model” adding the “civil society” and the “environment” with the specific aim of ensuring a more democratic, socially and ecological approach to innovation, driving policies and practices towards a triple-bottom baseline (Carayannis and Rakhmatullin, 2014; Carayannis et al., 2018). In this more complete and complex dynamic, “Mode 3” university emerge to integrate and combine the “Mode 2” and “Mode 1”. It represents a type of open and non-linear knowledge production, emphasizing and engendering creative and innovative organizational contexts for research, education, and innovation (Carayannis and Campbell, 2010; Carayannis et al., 2018). The link with sustainability is also present in Trencher et al. (2013a, 2013b), that coin the “transformative university” and “the co-creation for sustainability” mission. They argue that the sustainability crisis has led organisations and civil society to collaborate in order to create concrete and effective solutions. Therefore, to the three missions of the university, another one is added, that is “collaborate with diverse social actors to create societal transformations with the goal of materialising sustainable development in a specific location, region or societal sub-sector” (Trencher et al., 2013a; p. 152).

The focus on local area (city or regions) and the host community is found in Goddard et al. (2011), who point out the potential ability of universities of providing not only economic innovation but also social inclusion, emphasizing also the barriers and the poor recognition of this aspect in public policy or governance. In others works (Goddard, 2009; Goddard and Kempton, 2016), the strong responsibility toward host communities and areas were declined in terms of a renewed civic engagement (or civic

responsibility) of the university within the community, the city and the region of which it is part and on which it forms its identity. In this view, university is “a civic institution, mobilising its resources to meet quintessentially multi-disciplinary challenges, like urban sustainability, health and culture” (Goddard and Vallance, 2013, p. 151). Other authors (e.g., Mbah, 2016; Shiel et al., 2016) encourage the university-community cooperation with the aim of a sustainable development. The idea of the “interconnected university” emphasises the role of the university as an institution able to establish strong cords of relationships within itself, as well as with different segments of the community to determine shared ideas, and galvanise collective participation/action towards a common mission of addressing community but also university (sustainable) aspirations. In this “interconnected university” model, “the community provides the context of the learning environment and may play a central role in the learning process. [...] Furthermore, community sites provide ideal locations for class projects, applied and service learning, and internships, whereas academic institutions, as members of the community, are core to educating citizens, professionals, innovators, and problem-solvers” (Shiel et al., 2016, p.124). Thus, community development includes not only the community involvement and the faculty work in communities, but an “extended working together across organisational, institutional, political, cultural, economic, social and personal divides to realise the holistic transformation of a residential community, with each member experiencing an improvement in wellbeing” (Mbah, 2016, p. 1230).

Concerning the commonly used performance metrics, Trencher et al. (2013) propose the following parameters: *i) knowledge management* (e.g., collaborative research and publications, consulting, training for key stakeholders and decision-makers); *ii) technical demonstration projects and experiments* (e.g., innovation or pilot project); *iii) technology transfer and economic development* (e.g., patenting and licensing to industry, or the creation of spinoff firms, technology parks, and cluster zones); *iv) reform of built and natural environment* (e.g., university administration-led real-estate development, neighbourhood reform or infrastructure improvements); *v) socio-technical experiments* (e.g., building or reconfiguration of a food or consumption network, the re-organising of technological artefacts or the introduction of an experimental incentive or policy tool designed to change the behaviour of citizens or the private sector). Therefore, besides some entrepreneurial metrics, Trencher et al. (2013) introduce responsibility measures towards the environment and society. Rinaldi et al. (2018), analysing an Italian university by the lens of co-creation for sustainability and S3 strategy, recur to Kempton et al. (2013) classification to capture the activities through which universities can be able to contribute to regional smart specialization strategy. In fact, they stress in their case-study the presence of: *i) initiatives to support the development of creative and cultural industries; ii) initiatives to support food and tourism culture; iii) initiatives to promote entrepreneurship*. Similarly, Shiel et al. (2016) and Mbah (2016) identify the *democratic value*, the adoption of relevant channels to ascertain *community ideas and needs*, and the participation and involvement of *community in research*, the focus on *local sustainability* and the creation of *customised learning courses* and the *voluntary community service*. Goddard and Vallance (2013) propose activities like *health improvement, physical regeneration and place making, student housing, and cultural production and consumption*.

As noted above, the specific mean of “fourth mission” is still not uniform, although the general, common reference is to the promotion of social, cultural and economic development of the host community, that, in a very broad sense, leads to argue that university should contribute also to the quality of life perceived by the community itself (Riviezzo et al., 2019b). This new focus and the concept of societal impact is now a recurring theme for academics as well as for policymakers and practitioners. Fini et al. (2018) defines it as “the effect on or change or benefit to the economy, society, culture, public policy or services, health, the environment, or quality of life from new or improved products or services based on

scientific knowledge. These impacts can be both positive and negative” (Fini et al., 2018, p. 8). However, the impact measures are mostly qualitative, that is an enumeration of activities and behaviours. The development of less relative and appropriate indicator of these complex and long-term relations between university and community/territory is therefore a key challenge (Kempton, 2015).

CONCLUSION

The multiplicity of conceptual and theoretical advances on the relationship between universities and local development has been paralleled by the need of new performance metrics and indicators in order to assess the missions progressively recognized to the university. Indeed, the use of a few and very specific indicators may prevent a consistent assessment of the economic, social and cultural externalities created by universities and associated with their impact on “demography, economy, infrastructure, culture, mobility, education, and society” (Guerrero et al., 2015, p. 752). Thus, the investigation of universities activities’ measures and indicators represents an emerging theme in this stream of literature (e.g., Urbano and Guerrero, 2013; Mazdeh et al., 2013; Schmitz et al., 2017). However, to date, it seems to be not yet sufficiently explored. Through a bibliometric and then a critical review of the extant literature, this study aimed precisely to provide a systematisation of the contributions on performance measures and indicators of universities activities.

Our bibliometric analysis confirmed the growing importance of the literature on the relationship between university and local development. The analysis of bibliographical production shows an accelerated growth in the number of publications on the topic, driven primarily by Anglo-Saxon countries (USA, UK and Canada) and Europe (especially Italy, Germany and Spain), even if scholars from the emerging countries are increasingly contributing to the field. Furthermore, the profile of the publications confirms the interdisciplinarity of the field, with journals of academic relevance in the areas of management, technology, innovation, entrepreneurship, higher education, and regional studies.

The conceptual approaches identified in the literature are really fragmented, such as the methods and the findings, thus generating multiple perspectives on the topic.

Our critical review of selected articles was focused on the measures and indicators developed to assess outputs, outcomes and impacts of universities activities. We identified three relevant groups of articles: i) the first group is based on the entrepreneurial university model (third mission); ii) the second group embraces those studies based on the regional engaged university model (third role); iii) the third group combines those contributions based on the civic engaged university or broader engaged university model (fourth mission). What clearly emerged from our critical review is that, while contributions on the entrepreneurial university and, to certain extent, those on the regional engaged university make large use of very focused (i.e., mainly economic) and mostly hard (i.e., identifiable, measurable, quantifiable) indicators, the contributions aggregated around the civic engaged university model propose multi-dimensional (i.e., economic, social, cultural) indicators that are, very often, soft (i.e., descriptive, qualitative) indicators. This is mainly due to the research methods adopted, that are qualitative in most of the selected articles falling in the third group (i.e., mostly single case-study researches).

Such approach, on the one hand, allowed a deeper analysis of the multifaceted nature of the relationship between the university and the region where it is located; but, on the other side, it prevented the accumulation of knowledge around specific topics (e.g., the performance measures and indicators), thus favouring a fragmentation of the literature. Thus, the richness of the theoretical frameworks developed

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and university models proposed, including the “civic university” (e.g., Goddard, 2009; Goddard and Kempton, 2016), the “community-engaged university” (e.g., Shiel et al., 2016), the “transformative university” (e.g., Trencher et al., 2013a, 2013b; Rinaldi et al., 2018) or the “interconnected university” (e.g., Mbah, 2016), has not been adequately paralleled on the empirical level by the elaboration of corresponding measures, both “hard” (i.e., built around quantifiable indicators) and “soft” (i.e., which deal with less tangible community impacts and values).

Therefore, our study provides arguments to sustain that the empirical assessment of social and cultural impacts of the university in a community has been largely overlooked. Indeed, the impact measures are mostly qualitative, that is an enumeration of activities and behaviours. Given the new role of university in the knowledge based society, there is the need to assess holistically and systematically the impact of teaching, research and entrepreneurial activities that universities carry on in order to increase economic, social and cultural development and preserving autonomy and sustainability of the universities themselves (Schmitz et al. 2017). University is now intended as “a civic institution, mobilising its resources to meet quintessentially multi-disciplinary challenges, like urban sustainability, health and culture” (Goddard and Vallance, 2013; p. 151). Hence, even activities such as health improvement, physical regeneration and place making, student housing and cultural production and consumption (Goddard and Vallance, 2013) should be included in the evaluation of the impact of universities activities.

Thus, assessment indicators should present a balanced picture of university’s performance across all its missions (Kapetaniou and Lee, 2017), by adopting a more “holistic approach that examines the main channels that bind universities to the rest of society” (Molas-Gallart et al., 2002; p. IV). Such plurality of metrics and indicators did not emerge from our critical analysis of the extant literature. In this perspective, we can maintain that the development of less relative and more appropriate indicators of these complex and long-term relations between university and community/territory still represents a key challenge for future research (Kempton, 2015; Riviezzo et al., 2019b).

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Chapter 3

Entrepreneurial Universities' Strategic Role in Accelerated Innovation for Regional Growth

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ABSTRACT

This chapter provides a conceptual framework of entrepreneurial universities' strategic role which has been viewed as an operational approach of promoting innovation-driven regional growth. Nowadays, entrepreneurial universities' strategic role and research institutions' innovative capabilities are distinguished as significant knowledge facilitators for regional economic development, due to their spin-off that adds value through knowledge creation and entrepreneurial discovery process. This chapter exemplifies entrepreneurial universities' strategic perspectives and their impact on a regional innovation system that enables a region to be more creative and innovative, especially new EU member states' territories in order to create their pioneering business opportunity with worldwide competency.

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INTRODUCTION

In the period of contemporary knowledge-based economy, the appearance of 'Entrepreneurial Universities' strategic role has been observed as an operational approach that act as a means of promoting innovation – driven regional economic development. On the other hand, while discussing about the process of knowledge development within the region, it is to be noted that generally significant knowledge is developed within universities and government research and development institutions. In addition, they are considered as significant facilitator for regional economic and socio-economic development, due to the spin-off of new, innovative initiatives that add value through knowledge creation and entrepreneurial discovery process (EDP). The current discussion on innovation-driven regional growth, regional economic development strategy represents one of the most common policies and practices to address the stresses between globalization and internationalization. This chapter discusses about the importance and challenges of entrepreneurial universities strategic perspectives as well as its impact on regional innovation system or regional innovation strategy (RIS) that enables a region to be more creative and innovative. As, nations and territories are economically divergent from each other, due to their distinct modification. Divergent regions are unique and they compete in diverse products, services and topographical places. Consequently, different regions expose their diverse strengths and weaknesses, and as a result they provide exceptional potentials and prospects for their regional economic growth and development. Now the question rises, how regions can speed up their innovative capabilities through the distinctive features of entrepreneurial universities strategic approach? How entrepreneurial development process can foster growth in one region may be under a blockage effect on another. Therefore, this sub-chapter from a conceptual insight point of view, considers that regional innovation strategies key components and entrepreneurial universities key enabling features can enable regions to strengthen, promote and foster their particular circumstances that deliberate innovation –driven regional growth.

To illustrate the conception of entrepreneurial universities strategic role and its distinctive features this chapter, demonstrated that entrepreneurial universities play a great role in order to accelerate the innovative capabilities of the metropolises and provinces. More specifically, it can be stated that currently universities are progressively perceived as promoters or facilitators for overall growth and development of a nation as well as a regional economic development. Research shows that entrepreneurial universities substantial contribution not only acts as service providers of education and research, but they also play an active role in the development of their economic, social and cultural surroundings where, successful entrepreneurial university ecosystem automatically leads to the emergence of business ecosystems with subsequent benefits to the region as well as tacit knowledge utilization, knowledge retention in small and medium-sized enterprises (SMEs), and knowledge dynamics (Fuster et. al., 2019); (Baporikar, 2018). Continuing with the discussion, authors premeditated to epitomize a unique purposeful framework that takes into account economically as well as socially valued network relations between places of divergence regions. Where, it is reinforced with detailed theoretical analysis and systematic approach, the framework of competing economically valued relations between regions in order to enhance regional development strategies that are crucial to the place-based policy initiatives of the new European regions interconnection policy. Furthermore, this emerging concept of entrepreneurial universities strategic approach has now become a crucial issue that provides an enthusiastic provision for academics, researchers, students and policy-makers to address and facilitate the development effect of an entrepreneurial universities strategic perspectives that consequently enable new firms to boost innovative skills and creativity at the university level.

Concerning this ground-breaking concept and policy debate on entrepreneurial universities strategic initiatives, Caseiro and Santos, (2019); Saha et. al. (2018) emphasized that the current academic discussion on regional innovation system and entrepreneurial university's impression has now become a gateway of innovation –driven regional growth. Related to this burning issue it is essential to highlight that since late 80's universities specifically in Europe they started to induce the new organizational model in order to meet the global challenges as well as to develop the entrepreneurial attitude. Since then, universities were viewed as an accelerator to meet the following emergent needs of the society such as: *to develop new knowledge and to transfer this new knowledge to the businesses environment* and prepare the existing industrial system competitive so that they could be considered as an important instrument for the economic development of a country. Referring to this Gibb (2012) addressed that the concept of the entrepreneurial university is not a new approach to regional economic development. Conversely, it can be said that the notion of entrepreneurial university emerged in order to face the challenges and consequences, which boost the urge of internal development of the university and external influences on the university. More explicitly, it is understood that 'entrepreneurial university' notion has a combined effect of developing knowledge, improving knowledge, adopting new knowledge in the society in order to encapsulate knowledge-based innovation system, through regional innovation strategy. Therefore, from the business development and commercialization point of view, it apprehends that the appearance of entrepreneurial universities strategic role turns into innovation-driven in order to achieve the prerequisites of its specific environmental impact and contribution that influence on regional and national economic development.

Although, Hannon (2013) also stated that nowadays the perception of entrepreneurship in higher education institutes (HEI) has been considered as an important key driver that reinforces innovation within the society and in regions too. Regarding this matter, several researchers such as Tripl et. al. (2015) have pointed out that entrepreneurial university approach empowers firms and higher education institutes (HEIs) to tackle as well as to face the economic, social, and industrial turbulence. Furthermore, this chapter has focused on how regional innovation strategies can generate the necessary conditions (social, cultural, institutional and territorial economic growth) in order to achieve the highest competitiveness and innovation levels possible. Though there are certain loopholes in regional innovation systems to be shielded, especially when referring to the strategic role of entrepreneurial universities. The aim of this sub-chapter is to explore and investigate the notion of regional innovation strategy and its a twin perspective on entrepreneurial universities role in regional knowledge creation and innovation that conceptually mainly focused on innovation-driven regional growth and regional economic development.

This chapter contains six additional sections. Section one emphasized on illustrating the theoretical background of entrepreneurial universities strategic role, the regional development strategy, i.e. smart specialization strategies influence on regional growth and regional economic development. Section two summaries about entrepreneurial universities positive effect on regional competitiveness along with the subsection of regional innovation strategies (RIS) key components influence. Subsection three offers new roles and challenges for regional development connected to the distinguishing features of smart specialization mentioned above. Accordingly, subsection four extends the discussion by addressing the challenges of entrepreneurial universities strategic role and regional innovation strategies combined effort that accelerate innovation –driven regional growth. Later, section five proposed solutions and recommendations with the issues, influences and difficulties. Finally, section six and seven comprehends the conclusion, and highlights the compulsion for further studies in detail on the said topic carried onward by the chapter as the consequence of entrepreneurial universities strategic approach on regional economic growth that continues to move forward for further development.

THEORETICAL FRAMEWORK ABOUT THE EMERGENCE OF ENTREPRENEURIAL UNIVERSITY AND ITS ROLE IN REGIONAL INNOVATION SYSTEM

Currently, entrepreneurial universities innovative and strategic approaches play a vital role on regional innovation and entrepreneurship that are crucial processes for the economic growth. Entrepreneurial university conception has increasingly been recognized as a leading provincial competence development strategy. The conceptual perception of entrepreneurial universities innovative and strategic capability has been seen as an excellent regional development approach due to its value in realizing the entrepreneurial mindset creation process for managing regional growth. Research shows, that the creation of such business mindset in people with a science or engineer background is a relevant recent challenge for those universities that are willing to create as well as to activate a deepen reconfiguration of their organizational and regional structures their programs and learning processes. The authors' purpose is to discuss the relative approaches of entrepreneurial ecosystems that confer regional and organizational essence, competence. The role of entrepreneurial universities strategic perspective is the corner-stone of creating unique entrepreneurship and the knowledge-driven innovation center in the region associated with the regional growth strategy. This chapter deliberates about the responsiveness and imitativeness of regional innovation strategies effective approach that leverage on regional entrepreneurship and create awareness and novelty inside the provincial economic value. Finally, this chapter proposed some research assumptions that the added value of this knowledge development process that will lead the regions and organizations to achieve their competitive advantages through the transfer of explicit distinct knowledge of the community awareness, and vice versa.

Accentuating the above mentioned discussion, Sperrer, Müller, and Soos (2016) also highlighted that the perception of "entrepreneurial university" currently acknowledged as a main driving force for enhancing self-development strategy and regional development strategy, i.e. smart specialization strategy that support regions and societies to develop an appropriate strategy to keep pace with the dynamic environment and response to ensuing the highly turbulent and unpredictable market conditions. Moreover, it is noteworthy to underline that entrepreneurial university enables institutional leaders to be responsive to the ever-changing milieu. Precisely, entrepreneurial universities strategic role as well regional development strategies innovation policy is a strongly interconnected area that facilitates them to understand where they can strategically fit within the organization due to their entrepreneurial mindsets and behaviors that have been developed. Accordingly, Pugh et. al. (2018) has stressed on entrepreneurial universities strategic role that has gained prominence as a knowledge and innovation actor, key factor for enhancing competitiveness, key components for boosting regional economic growth and wealth creation in today's globalized world (Fayolle and Redford, 2014; Mian, 2011).

Conversely, from the regional growth perspective point of view, numerous researchers like Gordonet et. al. (2012); Guerrero et. al. (2015); Johnstone and Huggins, (2016); Larty et. al. (2016) have recognized that recently universities are willing to place themselves as 'entrepreneurial' due to its intrinsic key enabling features that enable them to develop network as well as to increase their impact within the regions through knowledge spillovers, innovation and growth. Respectively, it is required to mention that regional innovation system or regional development strategy (RIS) concept has been realized as the leading concept for formulating strategic goals and measures related to entrepreneurial universities formal factors, i.e. capitalization of knowledge, interdependence with the industry and government, independence with another institutional spheres, hybrid organizational forms and renovation. Thus, it can be assumed

that entrepreneurial universities play a vital role especially that targeted to higher educational institutes (HEIs) initiatives and regional organizations (ROs) in order to stimulate the innovative spirit of their staff members and students, by offering guidance and services in a coherent manner with business requisites. Correspondingly, Saha et. al. (2018) denoted that entrepreneurial universities deliberated role and smart specialization strategies policy perspectives show a dynamic effect to foster knowledge-driven societies competitiveness, institutional innovativeness and regional growth due to their inherent capability.

Furthermore, to indicate the relative approach of entrepreneurial universities strategic role within the framework of Smart Specialization Strategies (S3), Santos and Caseiro (2015) mentioned that the challenging perspectives of entrepreneurial university can be regarded as a significant approach for its successful implementation within the region due to their effective contribution both as a partner institution, policy actor and producer of knowledge and social capital. Though the concept of entrepreneurial ecosystem has been represented as a significant instrument for future development of smart specialization strategy S3 and entrepreneurial universities interactions.

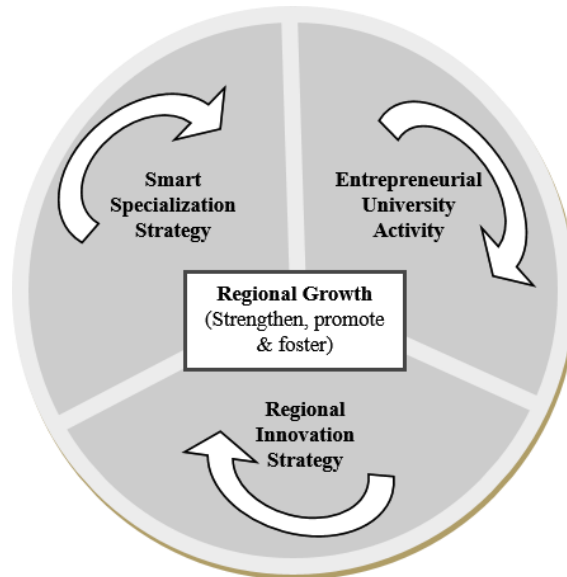
SMART SPECIALIZATION STRATEGY AND ENTREPRENEURIAL UNIVERSITIES STRATEGIC ROLE ON REGIONAL GROWTH

Relationship Between Entrepreneurial University and Regional Growth

To explore and investigate the influence of both smart specialization strategy and entrepreneurial universities strategic role of regional growth, this sub-chapter also highlighted the significance of regional innovation strategies (RIS) policy perspectives. It is necessary to contemplate that regional innovation system and strategic approach also plays a great role on accelerating knowledge & innovation-driven regional growth. The role of regional innovation system in smart specialization strategy is the cornerstone of creating distinctive entrepreneurship and the knowledge-driven innovation centre in the region associated with the regional development strategy. Both regional innovation strategy and smart specialization have accomplished its prominence in the EU's regional policy dialogue, owing to its starring role in the upcoming new program period of the EU structural policy from 2014 to 2020 (EUA, 2014). It is noteworthy, to mention that both approaches have been acclaimed by the policy makers, researchers, scientists, technocrats, industrialists and students' nationally and internationally as the basic unit for implementing different policies such as research & innovation, industrial and regional policies. Denoting the above mentioned discussion, Marinelli and Elena-Perez (2017) also emphasized the importance of smart specialization strategies and entrepreneurial universities strategic role on regional growth as well as their connection in research and innovation strategies part, is a crucial component of the existing European Cohesion Policy.

To comprehend the association between the distinctive features of smart specialization strategy and entrepreneurial development process it is compulsory to focus on the strategic role as well as impact and prominence of regional innovation strategy, which is comprehensive with the and strived for increasing the competence of knowledge and innovation-driven territorial growth. Linking to this issue, the above mentioned Fig.1 demonstrate that if the smart specialization strategies distinguishing characteristics and regional innovation strategies key components along with the entrepreneurial universities' strategic role amalgamate together, then it elevates the regional effectiveness and competitiveness, i.e. regional growth. In order to justify, Caseiro and Santos, (2019); Saha et. al. (2019) mentioned that smart specialization

Figure 1. Smart specialization strategy, regional innovation strategy and entrepreneurial universities role on regional growth



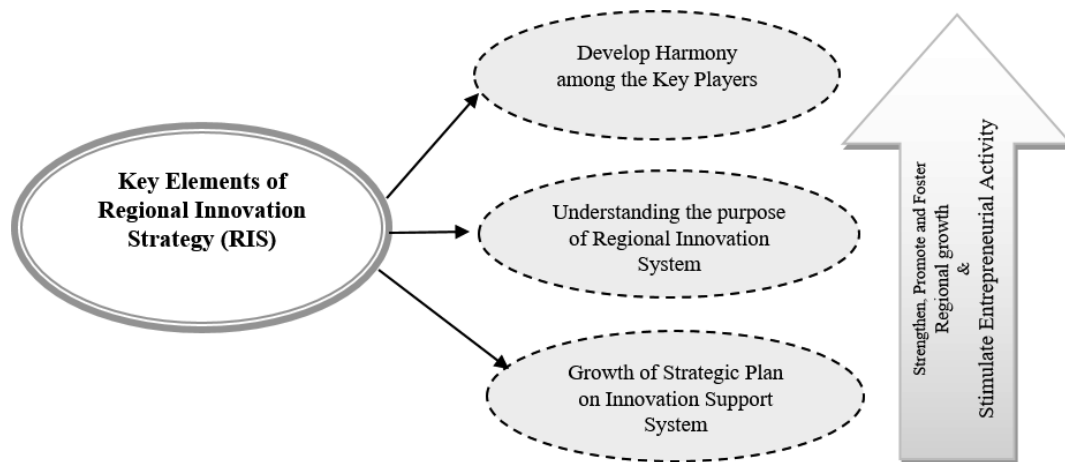
strategies priorities and entrepreneurial universities strategic role is a crucial reference that inspects a new competitive paradigm where, universities can act as a partner institution and affect the potential for economic growth and development of regions. Henceforth, Markkula and Kune (2015) pointed out that regional knowledge can be expanded by the regional players due to the regional innovation system and entrepreneurial ecosystem that ranging from business, government, universities, and civil society. Therefore, concerning regions important potentiality and their application of knowledge can most powerfully be exploited when effective collaboration of both the policy approaches determines the way a region can be smart, and the way it influences its potentiality, i.e. the efficiency of the regional innovation ecosystem.

Influence of Regional Innovation Strategy Stimulate Entrepreneurial Activity within the Region

In pursuit of classifying the key enabling factors of regional innovation strategy that stimulate entrepreneurial activity within the region this sub-chapter discusses the best possible use of available local and regional resources, i.e. the main driving forces and components of regional innovation strategy that strengthen, promote and foster regional growth and enable to achieve the highest value added for the region. On the other hand, to discourse the motivational factors of entrepreneurial activity, i.e. the way of starting a new business or start-ups that facilitates regions to be technologically innovative. Simultaneously, through this process of technological up gradation regions become more effective and efficient to enter in to the global market and capable to raise overall productivity. In order to justify the consequences, the below mentioned Fig.2 exhibit that regional innovations strategies crucial elements enable regions to *develop a harmony between the main actors, i.e. public sector research and development public universities, and government support of private research institutes; determine the role of*

Entrepreneurial Universities' Strategic Role in Accelerated Innovation for Regional Growth

Figure 2. Influence of regional innovation strategy stimulate entrepreneurial university activity



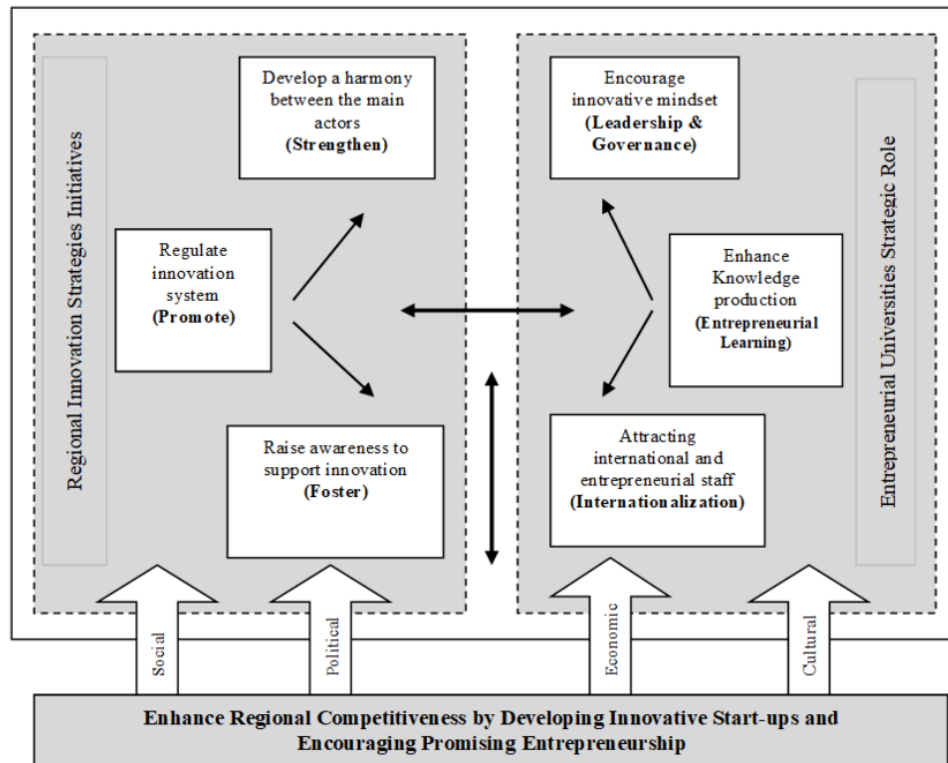
regional growth; raise the awareness of supporting regional innovation system that directly and indirectly encourage entrepreneurial activity within the region. Consequently, regions develop a foremost source of job growth, i.e. employability enhancement capability within the region that attracts innovation through encouraging young people to work and keeping the workforce fully engaged.

Relating entrepreneurial universities strategic initiatives, Guerrero, et. al. (2015), exposed that universities can be considered as the key enabling factors for strengthening, promoting and fostering regional, economic and social development. Since, developing countries have adopted this perception that existence of smart specialization strategies, i.e. regional innovation strategy stimulates the entrepreneurial activity of universities in the society as well as in the regions. Similarly, Audretsch et. al. (2018) also emphasized the way entrepreneurial university activity within a region that supports the development and growth of innovative start-up, scale-up to enter in to a global market and provide prospective opportunity to promote enhance and elevate regional growth.

Entrepreneurial Universities and Regional Innovation Strategies Synergistic Effect on Regional Competitiveness

While justifying the relation with regional innovation strategies initiatives and entrepreneurial universities strategic role it is required to remark that though the successful implementation of smart specialization strategies changing aspects are embedded in an entrepreneurial discovery process, but there is some constraint on the main process of regional innovation strategy especially for generating information that identify the restricted set of research and innovation priorities. The below mentioned Fig.3 tries to exemplify that regional innovation strategies components contain some powerful mechanisms in order to *encourage innovative mindset through leadership and governance*, i.e. fostering industrial competitiveness, *enhancing knowledge production within the region, through teaching and learning* i.e. boosting institutional innovation and attracting entrepreneurial spirit and ecosystem through internationalization of SMEs, i.e. regional growth due to their existence of quality human capital (intrinsic competence).

Figure 3. Thematic diagram of entrepreneurial universities and regional innovation strategies synergistic effect on regional competitiveness



Described Fig.3 combines both the placed as well as resource-based and positioning views of regional innovation strategy, i.e. the perception of competitiveness in association with entrepreneurial university activity and smart specialization strategy. Accordingly, the consequence of this study shows regional innovation strategies inventiveness is influential instruments to strengthen, promote and foster knowledge-development society's competitiveness, regional innovation and provincial growth due to their intrinsic competence (Schmitz et. al. .2017). Henceforth, to discourse the importance of entrepreneurial universities strategic impact on regional competitiveness Guerrero, et. al. (2014) highlighted that during recession period, academics, governments and policy-makers around the world stirred for creating entrepreneurial universities within the region in order to facilitate and expedite the knowledge driven economic growth specially in the convergence region. Furthermore, Baporikar (2016) emphasized that entrepreneurship concept in today's global market is intertwining the connectivity and communication, enhance environmental sustainability, that influence on government policy approaches for regional growth. In addition, Rothaermel et. al., (2007) and Secondo et. al., (2017) also revealed the way of entrepreneurial universities and regional innovation strategies synergistic effect on regional growth that enables regions by innovation, technology and knowledge transfer, continuing education and life-long learning education and broadening its social engagement.

Entrepreneurial Universities' Strategic Role in Accelerated Innovation for Regional Growth

Hence, this chapter leads to classify the succeeding two important research assumption and or proposed elucidation, i.e. hypothesis that has been made on the basis of limited evidence on entrepreneurial universities strategic role, prominence of smart specialization strategy and regional innovation strategy as a starting point for further investigation. Wherever, this research assumption assists authors contribution to support and comprehend the rational thinking of this research purposes such as:

Proposition One: It states that entrepreneurial universities' synergistic effect on regional development is considered as one of the major policies and processes of building regions, organizations, and institutions more innovative and competitive. So, there is a vibrant role aimed *entrepreneurial universities initiatives and regional organizations (ROs) for sustainable development as well as to stimulate the regions entrepreneurial spirit* of their staff members, by contributing guidance and services in a coherent manner with business requisites.

Proposition Two: Concerning potential contribution of regional innovation strategies initiatives the second proposition highlighted that though entrepreneurial universities strategic role and regional innovation strategies combined effort has a synergistic effect on regional economic development, but the design and implementation of smart specialization strategies dynamism, i.e. priorities, elements, basic aspects also play a vital role. Thus, both the concepts, i.e. *entrepreneurial universities positive impact and smart specialization strategies promising priorities* plays a vital role on entrepreneurial ecosystems development and growth-oriented entrepreneurship spirit in the region.

To substantiate the considered strategic role of entrepreneurial universities to accelerate regional economic development Baporikar (2019) mentioned that nowadays universities in emerging economies are stirring towards developing entrepreneurial university mind set up in order to meet the ever-changing global challenges as well as to intensify the critical success factors of regional economies. Hence, territorial, industrial, and technological policies tend to be predominantly initiated on entrepreneurial universities strategies, which provide the idea for achieving competitiveness, attractiveness, and economic and technological performance at a national and international level. Similarly, researcher Budyldina (2018) also highlighted the significant starring role of entrepreneurial university within the region where, human resources development and their attraction for creation of entrepreneurship capital, informal networks, innovative ideas have influenced on rationalized knowledge-generating institutions through localized knowledge spillovers.

On other hand, from the regional development point of view Kroll (2017), pointed out that the impression of smart specialization strategies priorities along with entrepreneurial universities distinctive approach basically promised for better connecting regions through the distributed development and application of technologies that substantially leverage on territorial growth. In order to justify the importance of entrepreneurial universities dynamic activities universities' universities' contributions to regional development is broad and diverse. Correspondingly, Blazek and Csank (2016), emphasized that the regional, institutional environment under smart specialization strategy, plays a fundamental role in determining positive linkages and collaborations between various actors within the knowledge and innovation-driven development process where entrepreneurial universities positive impact should be exemplified as one of its main achievement. In a nutshell, concerning regional knowledge development process it is necessary to mention that entrepreneurial universities strategies are interlinked by nature through complementary activity.

SOLUTIONS AND RECOMMENDATIONS

Finally, in order to identify the clarification and recommendations concerning the debated issue of entrepreneurial universities strategic impact on regions knowledge spill over and competitiveness, it has been viewed that the insight of entrepreneurial universities innovative and strategic approaches enhance region's competitive capability. Although presenting the challenging perspectives of entrepreneurial universities strategic initiatives which is outlined in the above mentioned discussion, state that entrepreneurial mindset creation is an integrated process based model that combines together with the technology intensive entrepreneurial venture creation, the entrepreneurial learning strategies, and the collaboration with the stakeholders' network. To designate the significance of associating regional, inter-regional, national and global interfaces at a regional level for common understanding. Since, the empirical evidence shows that the key dimensions of the present business environment are concentrating on proper access to knowledge, skills and technology, where the presence of an entrepreneurial university within the region is considered to be a key player. Thus, smart specialization notion is the mainstay of any regional implementation and monitoring of the new regional innovation strategies that empowering business, institutions to enhance its core competencies through interaction and pooling of information between individuals within an organization or a university. Consequently, this chapter has intended to articulate the way of enriching provincial economic development. Based on the aforesaid research investigation, this study has outlined some scheme as suggestion for fostering the competitiveness of regions. Preliminary explanations of these recommendations have been represented below:

Recommendation 1: It is assumed that the added value of this knowledge development process will lead the regions to achieve their competitive advantages through the transfer of specific individual knowledge to the collective knowledge, and vice versa, i.e. through entrepreneurial universities role in strategic activities. The directed research emphasizes the importance of a high level of implementation of activities in the area of linking different firms, people, and knowledge at a regional level where the education of HR and cooperation with educational institutions appear as critical factors for the successful regional economic development.

Recommendation 2: In order to enhance regional economic development regions should put emphasis on important priorities of smart specialization, when delivered by entrepreneurial university activity. Though there remain some gap in the new regional innovation strategies as: lack of engagement with private sector actors (public sector lead); insufficient analysis of regional assets and possibilities leading to unrealistic expectations; inappropriate transfer of ideas and models from prototype regions into others; tendency for regional strategies to chase the same sectors and technologies; lack of attention given to trans-regional aspects. Since, it can support the development of human resources within the universities and in an organization that facilitates them to enhance their institutional as well as regional performance and to achieve the competitive advantage.

FUTURE RESEARCH DIRECTIONS

From the regional economic development point of view, innovative regional development strategy will try to cover economically- important regions from different countries nationally and internationally. Whether it might be the least developed countries (LCD), or developed countries (DC) and under developed coun-

tries (UDC). Consequently, it can be anticipated that a more well balanced situation will lead regional policymakers to put more emphasis on regional economic geography, regional economic sociology, and international business that will eliminate the barriers of internationalization through entrepreneurial spirit. Therefore, this regional innovation strategies initiative and entrepreneurial universities activities key issues for sustainable regional economic development of regions having difficulties will have the potential to benefit the economic stability, especially through innovation –driven knowledge society.

Alternatively, from the academic point of view, it can be anticipated that this research will motivate the young generation to go for higher education, due to the significance of entrepreneurial ecosystems and entrepreneurial spirit, entrepreneurial start-ups, spin-offs that has a great influence on regional development strategy, regional science, keeping in mind how, they can add value. Such as, Organization for Economic Co-operation and Development (OECD) promotes policies for higher Education in Regional and City Development.

CONCLUSION

To conclude, this chapter mainly discusses about the significance of entrepreneurial universities groundbreaking strategic approaches that foster firm's competitiveness through regional economic development.

Finally, this chapter proposed some research assumptions that the added value of this knowledge development process that will lead the regions and organizations to achieve their competitive advantages through the transfer of explicit distinct knowledge of the community awareness, and inversely. Therefore, this study suggested that entrepreneurial universities strategic approach could be very stimulating and sophisticated approach for the new EU member states territories their research institutions, universities, small and medium enterprises in order to create new business opportunity with global competency.

On the other hand, regional development strategy could be supportive for the universities and business to provide assistance in prospectuses to ensure that graduates have the right skills and transversal competences. Moreover, it is to be noted that the emerging conception of the entrepreneurial universities strategic approach is the process of entrepreneurial mindset development and the organizational model. Where, entrepreneurial education means the activation of innovative processes and approaches that allow individuals to learn not only about entrepreneurship. It enables to human resources within the region to develop an entrepreneurial mindset, entrepreneurial capabilities, and essential skills for managing the growth of the new entrepreneurial ventures.

In another way, it can be said that the regional innovation system or regional development strategy (RIS) concept has been realized as the leading concept for formulating strategic goals and measures related to entrepreneurial universities formal factors, i.e. capitalization of knowledge, interdependence with the industry and government, independence with another institutional spheres, hybrid organizational forms and renovation. Furthermore, this chapter has mainly focused on how regional innovation strategies can generate the necessary conditions (social, cultural, institutional and territorial economic growth) in order to achieve the highest competitiveness and innovation levels possible. Though there are certain ambiguities in regional innovation systems to be shielded, especially when referring to the strategic role of entrepreneurial universities. Basically, the most important role of entrepreneurial universities strategic perspective is the corner-stone of creating unique entrepreneurship and the knowledge-driven innovation centre in the region associated with the regional growth strategy and emerging economies.

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KEY TERMS AND DEFINITIONS

Competitiveness: In this chapter competitiveness, relates to the regional abilities, competences and performance of a region.

Entrepreneurial Learning: In this chapter, entrepreneurial learning indicates ground-breaking ideas and innovative skills and knowledge development process that facilitate individuals within the regional members to be creative.

Entrepreneurial University: It resembles a commercially-important academic organization, that encourage and empowers prevailing human resources to cooperate and strengthens regional economic growth.

Globalization: It indicates a crucial period of business development nationally and internationally within the region.

Regional Economic Development: In this chapter, regional economic development has been considered as the process of regions commercial development that facilitate to enhance and expand regional growth.

Regional Innovation System: Regional innovation system is considered as one of the most eminent policy approaches in this chapter that encompasses regional knowledge development process.

Smart Specialization strategy: In this chapter, smart specialization strategy has been considered as an important policy approach of regional growth that facilitate regions to enhance its competitive capability.

Section 2

Chapter 4

The Impact of Universities on Regional Competitiveness: A Review of the Main Theoretical and Methodological Approaches

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ABSTRACT

This chapter presents an in-depth critical overview of the theoretical and methodological approaches that have been used to assess the impact of Universities on regional competitiveness and development, including short-term/demand-side (economic) perspective and long-term/supply side (endogenous growth, technological transfer and commercialization, and institutional) perspective. It gives special attention to the potential impacts of universities' technology transfer and entrepreneurship activities on regional competitiveness, considering the ongoing transformation process of universities towards a 'regional engaged entrepreneurial university' model.

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INTRODUCTION

Universities are considered nowadays crucial actors in the knowledge-based economy, not just as a hub of new knowledge generation, but also as a booster of entrepreneurship and regional economic development. In fact, the emergence of the entrepreneurial university is a fairly universal, albeit controversial (see Jessop 2017), phenomenon reflected in a new type of institution integrating economic development as an academic function alongside teaching and research (Rodrigues 2011; Sá, Dias & Sá 2018).

Entrepreneurial universities may contribute to social and economic development through the generation, attraction, and retention of job seekers and entrepreneurs, as well as the retention of prestigious researchers (Bramwell & Wolfe 2008). They could attract or generate new enterprises that promote competition and diversity (Urbano & Guerrero 2013) and provide leadership for the creation of entrepreneurial thinking and the development of the ‘entrepreneurial capital’ (Audretsch 2014; Audretsch & Pena-Legazkue 2012; Guerrero, Urbano & Fayolle 2016). Their role is especially important in structurally weak and peripheral regions where universities tend to have a monopoly over the production of intellectual capital (Baptista, Lima & Mendonça 2011).

Some critics have argued that the process of transforming traditional university into an entrepreneurial one is more complicated than it might have been assumed (Kirby 2006; Jessop 2017), and that there are “limits of entrepreneurialism” (Vestergaard 2007: 43). In fact, some authors have argued that technology transfer has only a modest potential for creating new jobs or businesses, and it has just a modest impact on regional development (Bozeman 2000; Harrison & Leitch 2010).

The transformation process mentioned above has motivated new research on the impact of Higher Education Institutions (HEIs) at the regional level (Valero & van Reenen 2019), and we find a broad spectrum of approaches, theoretical frameworks and methodologies within the literature. As we will see in detail in the next sections, most of the empirical studies present limitations, either because of their geographical scope (e.g., empirical macro literature assesses the impact of education at a country level, raising issues concerning omitted variables) (Valero & van Reenen 2019), or because they use proxies instead of economic output (e.g. technology transfer and commercialization literature) (Valero & van Reenen 2019), or because the methodology used leaves apart some sources of impact (e.g., methodologies under a direct approach) (Drucker & Goldstein 2007).

The aim of the present chapter is to provide an in-depth overview of the literature on the theoretical and methodologic approaches for assessing the impact of universities on regional development and competitiveness, embracing not only the demand-side/ economic approach and related methodologies but also those more recent approaches/ methodologies, related to knowledge spillovers – endogenous growth, technology transfer and institutional - which reflect the impact of activities associated with universities’ third and fourth missions (commercialization of technology and social-local development).

Such updated literature on the theoretical and methodologic approaches used for assessing the impact of Universities, most notably, Entrepreneurial Universities contributes to fill in a gap in the extant literature as, to the best of our knowledge, no comprehensive literature review exists on this topic.

This chapter is organized as follows. Section 2 starts by providing an overview of the definition of ‘entrepreneurial university’. Section 3 details and discusses the types of activities, by main mission, Universities potentially develop which are likely to contribute to local and regional competitiveness and growth. The distinct theoretical and methodological approaches used to assess the impact of Universities are described in Section 4. Finally, Section 5 provides some concluding remarks and avenues for future research.

The Concept of Entrepreneurial University

Universities have been embracing new missions and relations in order to contribute to economic and social development, both at national and regional levels, while trying to preserve their own economic and financial sustainability (Etzkowitz, Webster, Gebhardt & Terra 2000; Pugh, Lamine, Jack & Hamilton 2018).

In the academic context, the ‘ivory tower’ label is associated with the traditional view of higher education institutions which emphasize research, teaching and other scholarly activities’ international orientation being rather disconnected and isolated from their local and regional contexts (Sánchez-Barrioluengo & Benneworth 2019). In recent years, such label has been gradually replaced by other labels, which emphasize Universities’ third mission activities, most notably the ‘entrepreneurial university’ (Etzkowitz et al. 2000), the ‘(regional) engaged university’ (Perkmann et al. 2013) or the ‘civic university’ (Goddard, Hazelkorn, Kempton, & Vallance 2016).

The definition of entrepreneurial university is way far of being unique or consensual. We divide the several existent definitions of ‘entrepreneurial university’ into two groups: one that defines entrepreneurial university according to its relationship with the non-academic world, and another that defines entrepreneurial university according to its inner features. Regarding the former group, we find that entrepreneurial mission is the capacity the university has of creating new businesses by exploiting the intellectual property engendered within the university or to assume that economic development is one of academia’s goals, together with teaching and researching (Daniel, Ferreira, Preto & Quaresma 2015). Therefore, an entrepreneurial university is an organization whose activities transcended their traditional mission by transferring technologies and commercializing science (Secundo, Perez, Martinaitis & Leitner 2017), creating economic and social value to the society in exchange for academic funding (Etzkowitz 2013). The second group is more associated to the so-called ‘academic entrepreneurship’ reflecting the capacity universities may have to provide the adequate environment to researchers enabling them to generate, transform and commercialize their knowledge and technology (Urbano & Guerrero 2013). In this context, entrepreneurial universities are those able to adapt to environmental changes, oriented to an entrepreneurial culture, assume the risk of participate in new, innovative ventures, without leaving behind their traditional missions of teaching and researching (Guerrero, Cunningham & Urbano 2015).

The ‘(regional) engaged university’ can be seen as a nuanced, but broader, version of the ‘entrepreneurial university’ moving the role of the university beyond teaching and generation of knowledge to a much wider, developmental one which sees the university collaborating with the society as well as industry by emphasizing reciprocated partnership, sharing knowledge and resources for common benefit (Kempton 2019).

Impacts of Universities by Main Missions and Activities

Universities have evolved in terms of functions, mission and outputs, and it is possible to define four different generations (Kotosz, Lukovics Molnár & Zuti 2016). The first generation of universities has as the only mission to provide education, whereas the second generation of universities adds research as second main goal. The third-generation universities include education, research and the utilization of knowledge in their core missions, whereas the last / fourth generation universities assume as goals all the former but seeking economic and social impact.

Accordingly, in today’s world policymakers expect universities embrace all the above-mentioned missions, most notably teaching, research and social and economic development, with the latter covering third and fourth mission activities such as technology transfer (or knowledge commercialization) (Sam & Sijde 2014; Rolfo & Finardi 2014), entrepreneurship (Schmitz, Urbano, Dandolini, Souza & Guerrero 2017), and related activities associated with the development of science parks, incubators, university spin-offs, as well as formal and informal collaboration with the industry (Kretz & Sá 2013; Secundo et al. 2017).

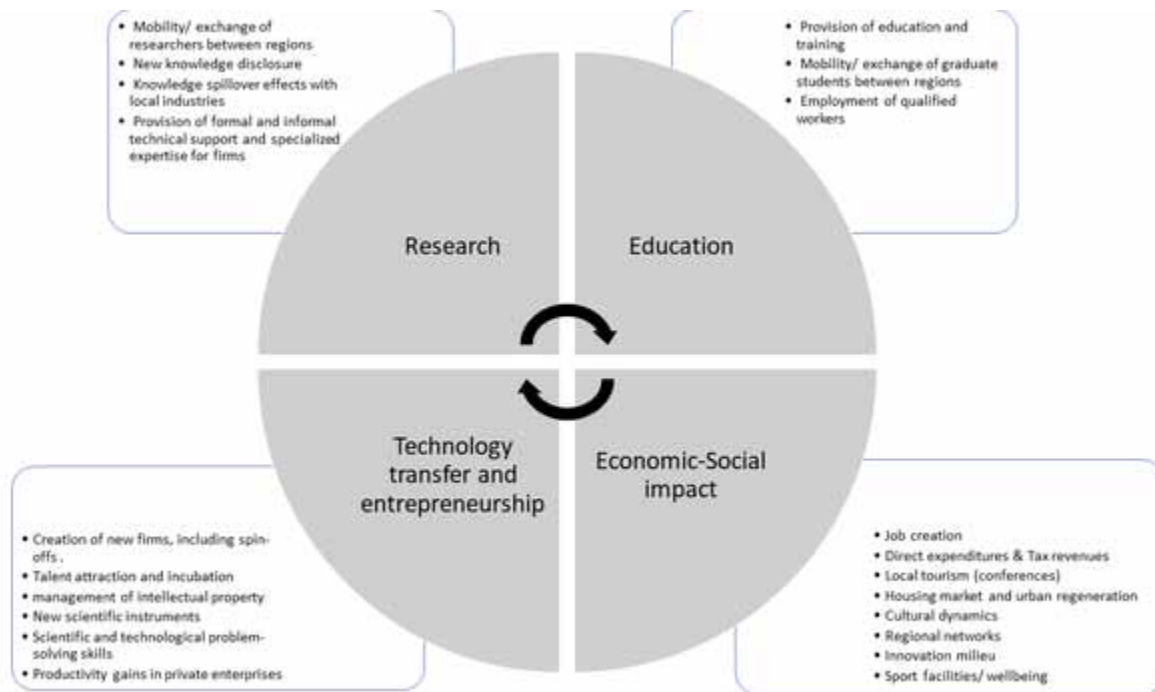
By carrying their missions and activities, universities may impact at distinct levels on the regions where they are located (see Figure 1).

Source: Own elaboration based on Arionesei, Ichim & Vransiu (2015); Bluestone (1993); Boucher, Conway & Meer (2003); Bramwell & Wolfe (2008); Drucker & Goldstein (2007); Glasson (2003); Guerrero et al. (2015); Kotosz, Lukovics & Anderson (2016); Locket et al. (2005); Puukka & Marmolejo (2008); Salter & Martin (2001); Secundo et al. (2017); Urbano & Guerrero (2013); Veugelers & del Rey (2014)

Theoretical and Methodological Approaches for Assessing the Impact of Universities on Regional Competitiveness

The economic impact of universities on regional economy can be measured from demand and supply-side perspectives (see Garrido-Yserte & Gallo-Rivera 2010). Demand-side perspective is focused on the university’s demand for inputs, goods, services and labor provided by local economic agents and it analyzes the impact of such demand within the region where the university is located. Supply-side

Figure 1. Universities impact on regions by main missions and activities



The Impact of Universities on Regional Competitiveness

perspective is focused on the impacts that the different university' outputs/ activities have in terms of knowledge creation, human resources education and training, and technology transfer (Saúde, Borralho, Féria & Lopes 2014).

Within the supply-side perspective, Porter (2007) underlined the influence of universities at the level of a region as advisors and network builders, by running programs that put students and researchers closer to firms, whereas Pastor, Pérez & Guévara (2013) referred to the contribution of higher education institutions in providing intangible assets, such as cultural assets, and in enhancing regional reputation.

The demand-side/ economic perspective is more associated to the traditional view of Universities whereas the supply-side perspective by considering a broader scope of University activities and functions convey the view related to regional engaged entrepreneurial Universities (see Figure 2).

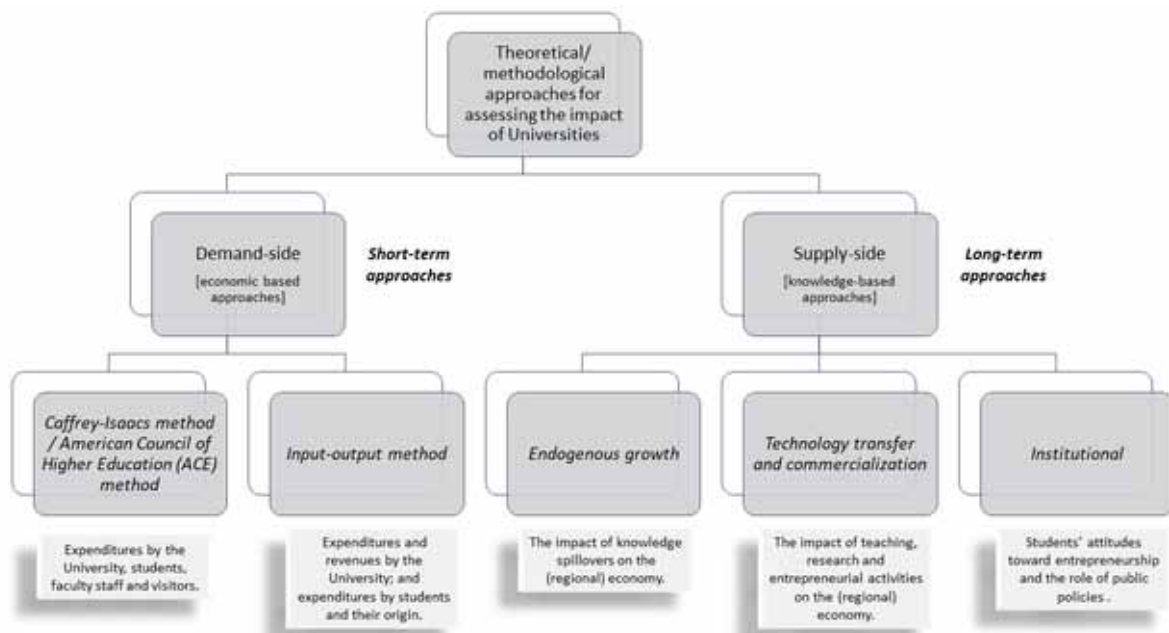
Demand-Side Perspective

Overview

Among the demand side approaches are included methodologies that aim to assess the university expenditure and its multiplier effects on local economy (Garrido-Yserte & Gallo-Rivera 2010). Such methodologies exclude medium and long-term effects (Pastor et al. 2013) and the empirical results derived constitute a static image of the total impact of universities in the region where they are located (Martin 1998).

Figure 2. Main theoretical and methodological approaches for assessing the impact of Universities on regions competitiveness

Source: Own elaboration.



The demand-side perspective rests on the fact that the university demands inputs (human, physical, and financial resources) to generate outputs related to its missions - education, training, research, knowledge transfer -, and focus on the expenditures these institutions have to incur to acquire goods and services and to hire employees (Garrido-Yserte & Gallo-Rivera 2010).

The total impact of universities from a demand-side perspective can then be split into direct, indirect, and induced effects (Kotosz, Lukovics & Anderson 2016). The direct effects are concerned the local expenses done by the university, its employees and students (Garrido-Yserte & Gallo-Rivera 2010). The indirect effects are net payments to factors employed not by the higher education institution, but by firms and businesses affected by the presence of the institution (Beck, Elliott, Meisel & Wagner 1995). The indirect effects are estimated as income Keynesian multipliers per each euro of university and its community direct expenditure it generates on some other amount of transactions among firms that are not linked directly to the university. These can increase total economic impact by 50% to 100% of the direct impact levels in the case of US universities (Blackwell, Cobb & Weinberg 2002). The induced effects include the expenditures of university visitors, the effects on banking and real state sectors and eventual effects on firm reallocation that cause an increase in households' income, spent on regional final consumption (Carrol & Smith 2006; Garrido-Yserte & Gallo-Rivera 2010).

More recently, Lukovics & Dusek (2014) added a fourth level of impact, the 'catalytic impact', which measure, among others, the effects of a greater attractiveness of investment or an increase on workforce qualification, the impact on "local image" or attraction of visitors. Such impacts nevertheless are strongly related with the definition of induced impacts suggested by Garrido-Yserte & Gallo-Rivera (2010).

Most empirical works address only the first two levels of impact, direct and indirect, being the remain two are almost ignored, mostly because the induced effects are assumed to be indirect effects, and the catalytic effects are hard to quantify (Lukovics & Dusek 2014).

Methodological Approaches

The most common methods for the estimation of impacts under the demand-sided approach are the Caffrey-Isaacs method (a direct estimation method, since it uses primary information), and the input-output analysis (an indirect estimation method).

Caffrey-Isaacs Method

Caffrey and Isaacs (1971) proposed a methodology to assess the regional economic impacts of universities, based on their backward linkages, i.e., their net effects on business volume (impact on local businesses), government revenues and municipal services' costs (impact on local governments), and on employment, income, and consumption behavior (impact on local individuals). This method, often called the American Council of Higher Education (ACE) method, aims to quantify in the first place, the expenses with the university operation that arise both from nonlocal sources and local sources which would have occurred in some other region if the university did not exist (Blackwell, Cob & Weinberg 2002). These are called the direct incremental impacts of universities in a region. Besides the institutions' own expenses, also consider spending done by students, faculty staff and visitors.

The first-stage, or direct, effects are quantified mainly through the information obtained from administrative records of the universities, local businesses and local governments, although in some cases and for some dimensions - such as students' origin and personal expenses - a survey can be carried out.

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In a second stage, the ACE's method aims to estimate how much additional spending by local firms results from each currency-unit of universities purchases, assuming that most income generated from the direct impacts is spent within the community or region of the university (Steinacker 2005). These effects are calculated from the information on the local purchases done by providers of the university and other local purchases done by economic agents that are not members of the university (staff and students) but whose income is related to the university (for example, visitors). A regional job multiplier should be available so to be possible to access job creation besides locally hired member of university staff.

The first criticisms to the original (from 1971) ACE model are related to the fact that it does not distinguish the expenses done by students and staff who would live and consume within the region even if there was no university (Vyrostová & Vyrost 2007). To reply to such critique, Elliot, Levin & Meisel (1988) adapted the ACE model to restrict the expenses to those made by students, staff and visitors who live and consume in the region just because the university is located there (either they are originally from the region or not), and synthesize a six-step procedure to more accurately assess the economic impact of the universities. Such procedure includes (Brown & Heaney 1997): (1) to identify and delimit the region of analysis; (2) to survey students and faculty staff to obtain information on expenses behavior and identify students that are not originally from that region; (3) to quantify non regionally-based funds; (4) to sum the expenditures obtain in the previous two steps; (5) to select proper input-output multiplies to apply into step (4) to get the final economic impact; and (6) to estimate additional tax revenues. Other criticisms concern the inability of the method to estimate mid and long-term impacts (Elliot et al., 1988), and the fact that the collection of data on students and staff consumption pattern through surveys may take too much time and conduct to non-representative results (Drucker & Goldstein 2007).

Input-Output Method

In a similar way to the Caffrey-Isaacs method, the input-output method is also a short-term procedure. It is the most used indirect estimation method, being relevant whenever we have regional data on resources' transfers between sectors (Saúde et al. 2014). Its initial premise is that any change in an economic agent's activity - like the provision of higher education services - affects other economic agents (firms, Government, etc.) (Ambargis, Mead & Rzeznik, 2014). It requires a high-level disaggregation of data, not always available, and information on the spending habits of students, their origin and their hypothetic behavior in the case the university did not exist in that region, as well as information on the institution's budget, revenues and expenditures (Kotosz, Lukovics & Anderson 2015).

The total economic impact using an input-output approach can be decomposed into direct effects, indirect effects, and induced effects, both on output and employment. Then, an output and employment multipliers are calculated, usually Keynesian-type multipliers (see Kotosz et al. 2015). Two types of regional multipliers are calculated, the "inter-industry" multiplier effects, and the "household-spending" multiplier effects (Ambargis et al. 2014).

Although it requires a lot of information, the input-output analysis is considered a relatively simple approach (Ambargis, McComb & Robbins, 2011), once a couple of assumptions are made. These latter include: (1) there is a common production pattern for all the output related to a specific multiplier; (2) the models that produce these multipliers are linear, and (3) input-output relationships imply there are no binding constrains from the supply side. Other assumptions are required concerning consumption patterns (namely that employees' expenditures are made where they live rather where they work), and location quotients for production (Ambargis et al. 2011).

Empirical Evidence

Caffrey-Isaacs Method

Despite criticisms, the ACE method (or its simplified version by Leslie & Lewis (2001)) has been chosen by most of the extant impact studies. Using this method, Ohme (2004) found a multiplier effect of 1.80 of the direct expenditures by the University of Delaware. Carroll & Smith (2006) studied the Bowling Green State University, and estimated a total impact of 704.9 million dollars, 64% of which from direct expenditure done by the university, students and staff. Garrido-Yserte & Gallo-Rivera (2010) estimated that the University of Alcala had a total effect of 127 million euros in Madrid Region (Spain) in 2005, and, like Carroll & Smith (2006) found that most of that amount is caused by the expenditures done by the university (direct effects) and only 11% is due to the indirect effects. The University of Alcala is, direct and indirectly responsible by more than six thousand jobs in the regions. Siegfried, Sanderson & McHenry (2007) summarizes the results obtain by some US universities: 1.04 billion dollars and fifteen thousand jobs is the impact of Loyola University Chicago on Chicago area in 1994; the University of Georgia System is responsible for 106 thousand jobs in Georgia and adds 9.7 billion dollars to Georgia's GDP. In Bragança (Portugal), the Polytechnic Institute's activity represented between 9.7% and 11.02% of regional GDP in 2007 (Fernandes, Cunha & Oliveira 2013).

Input-Output Method

Using an input-output methodology, Garrido-Yserte & Gallo-Rivera (2010) estimated a total effect of the University of Alcala on Madrid region's GDP of more than 225 million euros, which implies a multiplier effect of 1.84 (the total impact measured by the input-output method is 1.77 higher than when measured by the ACE method). Regarding the impact of UK universities in the national GDP, Kelly (2014) found a multiplier effect of 2.03. Pastor et al. (2013) found a multiplier effect between 2.16 and 2.38 of Valencian public universities on the Valencian Community region when uncertainty was included (through the introduction of stochastic factors).

Supply-Side Perspective

Overview

Demand-sided approaches are likely to underestimate the full impact of universities on regional economic development due to three main factors (Martin, 1998; Drucker & Goldstein 2007): 1) the methodologies used present limitations; 2) they do not take into considerations all types of impacts universities may have; and 3) they neglect the dynamic impacts of universities, i.e., the impacts that universities generate in terms of productivity and GDP over time.

Instead of focusing on the direct and indirect impacts of universities expenditures, the supply-side perspective assess the regional impacts that universities have considering a myriad of activities and outputs (Goldstein & Drucker 2006; Lendel 2010; Winters 2011): (1) creation of knowledge; (2) human-capital creation; (3) transfer of existing know-how; (4) technological innovation; (5) capital investment; (6) regional leadership (role on local committees and boards); (7) knowledge infrastructure production

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(stock of knowledge and the institutional features of the university that allows that knowledge to grow); and (8) influence on regional milieu (unintended externalities, namely in terms of cultural and social enhancement of the region, that rise due to the concentration of highly educated people.

We can consider three main approaches under the supply side perspective: 1) the endogenous growth approach; 2) the technology transfer and commercialization approach; and 3) the institutional approach.

The endogenous growth approach highlight impact of knowledge spillovers on the economy; the technology transfer and commercialization approach tackles the impact of teaching, researching and entrepreneurial activities carried by higher education institutions; and the institutional approach is focused on the institutional context under which universities develop their entrepreneurial mission, namely students' attitudes toward entrepreneurship and public policies relevance (Veciana & Urbano 2008).

Several methodologies for analysing data are used under such approaches, namely case studies, econometric estimations, and quasi-experimental designs. The most common methodologies used in empirical studies developed under these approaches are case studies and econometric models estimations.

Case studies allow to access primary data (surveys, interviews, reports, administrative data), to have information on the university's internal organization (useful to asses if those internal culture is entrepreneurship-friendly, for example), and to capture university characteristics that are not easily quantified (Goldstein & Drucker 2006). On the down side, case studies make difficult to control all factors that may interfere with the causal relation between the presence of the institution and the regional economic performance (Goldstein & Renault, 2004).

Considering the specific impact of knowledge production in the universities, the econometric models have contributed to a better understanding of knowledge spillovers and the universities' contribution on rising the regional innovation level. The most common dependent variables to measure economic competitiveness are "average annual earnings", "employment change", "GDP per capita", "change in GDP per capita", and "establishment birth" (Drucker 2016; Guerrero et al. 2015). The output for university's entrepreneurial activity and technology transfer is less consensual, although the most common proxies are the expenditures on R&D activities (Huggins & Johnston 2009) and the number of patent applications registered (Huggins & Johnston 2009). Measurement and data issues have been raised, namely concerning the use such proxies (Goldstein & Renault 2004), and some alternatives have been suggested (Vinig & Lips 2005), for example, to use as proxy the revenues from patenting and licensing processes.

Quasi-experimental designs are far less common than the previous two methodologies, Such methodology aims to reduce the risk of having bias from omitted-variables by controlling the study population, the sample (to have control groups rather than a random sample) and the period, before applying statistical inference methods (that include covariance and variance analysis using gain scores, and regular multiple regression models) (Goldstein & Renault 2004; Goldstein 2010)

Despite the efforts to list and synthesize the different activities/ outputs that universities might have, extant literature provides partial pictures at the most, often leading to overestimation of the overall impacts of Universities on regional economies (Lendel 2010). Moreover, limitations on identifying appropriate proxies and collecting accurate data related with third and fourth mission activities remain, mainly due to (1) the dependence of this activities on a multi-level context (from the individual to national level) and (2) the subjectivity implied in many of the indicators needed to measure the outputs (e.g. personal perception) (Secundo et al., 2017).

Methodological Approaches

Endogenous Growth Approach

Initial endogenous growth models put focus on the crucial role of human capital, following the works of Lucas (1988) and Romer (1990), and on the importance of R&D investment made by firms (Jones 1995). New endogenous growth models go further on the role of human-capital in the production of new inventions (Okada 2012; Vandenbussche, Aghion & Meghir 2006; Aghion, Boston, Hobby & Vandenbussche 2009) and in boosting R&D investment (Acemoglu 1997), creating a close relationship between R&D expenditure and economic growth (Guerrero et al. 2015). Under this approach we include studies that frame their theoretical findings according to classical or new endogenous growth models.

Audretsch & Keilbach (2004a) add entrepreneurial activity as a new production factor to the neoclassical aggregate production function, arguing that such activity is the source of knowledge spillovers. Audretsch, Bönte & Keilbach (2008) assume instead these spillovers as exogenous, and although they recognize spillovers' significant impact on regional performance, the authors argue that they only generate economic growth if the region owns entrepreneurship capital, i.e., the means to support entrepreneurs and help them to implement those new processes or to produce those inventions that result from innovative knowledge. Therefore, Audretsch et al.'s (2008) work tests whether regional innovation efforts have a positive impact on regional knowledge driven entrepreneurial activity or whether it is the entrepreneurial activity that fosters knowledge spillovers, boosting regional economic performance in consequence. These authors do that by considering "technical knowledge", "innovation efforts", "entrepreneurship capital" and "economic performance" as latent variables and by using a structural equation model to estimate the relationship between those variables. The measurement of "entrepreneurship capital" is proposed in Audretsch & Keilbach (2004b) as the number of star-ups in the region relative to its population. Besides this latter variable (entrepreneurship capital), the production function includes labour, physical capital, knowledge capital, and it is estimated resorting to an OLS model.

In general, the previous contributions do not clearly identify the contributions of universities, although it is assumed that they are sources of new knowledge. Nevertheless, some studies, under the same endogenous growth framework, explicitly mention the role of government and university R&D to enhance national productivity (Guellec & de la Porterie 2004). Guellec & de la Porterie (2004) tackle the difficulties in measuring the magnitude of Universities impact decomposing R&D stock into private R&D, foreign R&D and public R&D (government and higher education institutions) capital stocks, estimating their impacts on total productivity through an error correction model. Using case study analysis, Cohen, Nelson & Walsh (2002) assessed the impact of public research on industrial R&D, considering that the impact is heterogenous according to scientific fields, being stronger in engineering and applied science, and across industries, within which the pharmaceutical industry is an outlier. Aghion et al. (2009) built a model to study the relationship between different levels of technology and the impact on economic growth of an increase in the supply of higher education. According to their model, the impact of higher education is not the same across regions and it is expected that regions with higher shares of highly educated workers (i.e., regions closer to the technology frontier) would benefit more from an investment in higher education than those with lower shares of highly skilled workers. This result is reinforced with the introduction of migration flows. The theoretical model of Vandenbussche, Aghion & Meghir (2006) reached the same conclusions, although the authors had not taken into account the impact of migration flows.

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Econometric analysis is the most common methodology used under endogenous economic growth approach to empirically quantify the impacts of higher education's outcomes. Total factor productivity is often the outcome of the regression (Gellec & de la Potterie 2004; Vandenbussche et al. 2006; Ang, Madsen & Islam 2011), but we also find the estimation of growth equations (Aghion et al. 2009; Audretsch et al. 2008). As dependent variables we find proxies to measure the proximity to the technological frontier (Vandenbussche et al. 2006; Aghion et al. 2009), or the level of entrepreneurial activity embodied in the economy (Audretsch & Keilbach 2004b; Audretsch et al. 2008).

Technology Transfer and Commercialization

Universities have been increasingly concerned about the commercialization of their research (Rolfo & Finardi 2014). In this context, they have developed activities such as patenting and licensing, encouraged start-ups creation and potentiated university-industry partnerships (Bozeman 2000). This set of activities that seeks technology transfer and knowledge commercialization by universities are often labelled 'academic entrepreneurship' (Giuri, Grimaldi & Villani 2014).

Although the focus of such approach is mostly on the impacts of third-mission activities on (regions) economic development, in the empirical literature is common to find studies under this approach that assess the impact of universities' main missions besides technology transfer and commercialization, namely teaching and research.

The channel through which teaching activities impact regional economies is widely accepted and tested empirically - highly educated population has a positive effect on employment, since university graduates have lower rates of unemployment and face shorter periods of unemployment, present better levels of productivity (Pastor, Peraita & Pérez 2015), and lead to an increase in regional earnings (Pastor et al. 2015; Drucker 2015; Winters 2011). Some studies (e.g., Bonander, Jakonsson, Podestà & Svensson 2016; Winters 2011) took into account the indirect impacts of higher education institutions on regional stock of human capital in the long-run - universities increase the access to higher education for locals but also attract students from outside the region which may be regionally employed.

Moving to the university technology transfer activities, it is first needed to address the channels through which the process occurs. Caro, Tomás, Schachter & Tur (2017) mentioned the existence of formal and informal channels, being the formal channels related with patent licensing, university incubators and labs where start-ups and companies can build and test prototypes, and the informal channels related with either the mobility that researchers have from the universities to the industry or the regional labor and knowledge networks (e.g., conferences and researchers platforms). Boh, De-Haan & Strom (2015) focused on the role of students' entrepreneurship on the technology transfer process, referring that most common pathway for university spinoff development is based on partnerships between faculty researchers and PhD/Post-Doc students or between faculty researchers and experienced entrepreneurs. The authors also focused on the role of Technology Transfer Offices (TTOs) in evaluating inventions and ensure the procedures to patent them.

The effects of university technology transfer themselves can be analyzed from several different lenses. At the start, we may consider that technology transfer has an impact on regional employment in the sense that start-ups, created and raised in strict connection to the university and using university-patented technologies are a source of new employment. This employment can be created by the university within the institution itself, whenever new jobs are need at the TTOs (Lowe & Quick 2005), or by innovative firms tightly related with the university (Hobbs, Link & Scott 2017).

A research question broadly asked within the empirical literature that deals with universities' entrepreneurial mission regards whether the proximity to Higher Education institutions plays a significant role on the technology flow process. Audretsch & Caiazza (2015) refer the existence of knowledge geographical clusters as a result of firms' choice of settle next to universities or public research institutions so they can benefit from the knowledge spillovers. Additionally, Calcagnini, Favaretto, Giombini, Peruhini & Rombaldoni (2016) found that innovative start-ups choose to locate close to highly reputed research universities, recognized by their high-quality academic research, number of graduates, and commitment to carry third mission activities, namely by investing in spin-offs, business incubators and Technology Transfer Offices. In the same line, Giunta, Pericoli & Pierucci (2016) found that proximity between universities and firms enhances their cooperation, namely by increasing the probability of co-publishing, in a sector in which research and scientific publications are particularly important as the biopharmaceutical industry. In another complementary perspective, Hobbs et al. (2017) found that the closer the science park from the university, the higher the rate of employment growth of firms within the park. The importance of being closer to a university so the firms integrated in a science park have access to scientific knowledge and research innovations is also referred by Colombo & Del-Mastro (2002).

All the above-mentioned contributions result from empirical research based on econometric estimations, although involving different dependent variables, namely: distance to the closest university (Calcagnini et al. 2016); number of research articles co-authored by academic authors and scientists employed by private biopharmaceutical firms (Giunta et al. 2016); and employment growth rate (Hobbs et al. 2017).

It is nevertheless predicted that not all firms benefit with the same intensity from the external knowledge produced at the university level: younger and larger firms are more open to innovative processes – albeit some authors argue that small firms are more efficient in R&D cooperation (Bellucci & Penacchio 2016) – as well as firms operating in high-tech industries (Rodríguez-Gulías, Rodeiro-Pazos & Fernández-López 2015).

Although the most commonly referred process of knowledge commercialization is based on the licensing public research-based innovations (Siegel, Westhead & Wright 2003), other structures, such as university spin-offs, science and technology parks, and university incubators have an important role as well.

Licensing and patenting are the main tasks of the university Technology Transfer Offices (TTOs), together with the protection of university intellectual property (Secundo, De Beer & Passiante 2016). University TTOs play an important role on the technology transfer process, as they are critical in at three main levels: 1) to identifying the commercialization potential of an idea and a market for it (Lockett, Siegel, Wright & Ensley 2005; Weckowska 2015); 2) managing the university intellectual property (Weckoska 2015), assessing whether it is better to licensing the innovation or to create a spin-off (Lockett et al. 2005), and helping to select potential investors (Weckoska 2015); and 3) providing enough support to university spin-offs (Lockett et al. 2005) and serving as intermediaries between industry and researchers/ inventors (Weckoska 2015).

TTOs may approach the commercialization of research from different angles, based on their different perspectives on the innovation process: while some TTOs are more relation-focused, i.e., TTOs that set as a goal to create a strong network among academics and researchers, and follow the research in progress in order to identify potential commercial opportunities at an early stage, other TTOs are transactions-focused, i.e., TTOs that set as a goal to sell research outputs as finished innovation products (Weckowska 2015). It is important to note that TTOs capabilities and expenditures on licensing and patenting are strongly related with the number of university spin-offs (Lockett et al. 2005).

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University spin-offs are new companies created to commercialize the university-produced knowledge and innovative technologies (Corsi & Prencipe 2018) and allow for the direct dissemination of new knowledge (Rodríguez-Gulías et al. 2016). The success of spin-off companies, i.e. the effect of these companies on regional competitiveness, depends on the support provided by the parent university, namely by ensuring the relation with experience professionals and entrepreneurs and some degree of resource allocation (Corsi & Prencipe 2018; Teixeira 2017). It further depends on the level of innovation incorporated in each spin-off (Teixeira & Ferreira 2019). Indeed, these constraints are not negligible, with some authors (e.g., Fini, Fu, Mathisen, Rasmussen & Wright 2016; Harrison & Leitch 2010) noticing that most of university spin-offs have limited economic impacts, and the proliferation of spin-offs - due to university institutional changes centered in the promotion of spin-offs creation - decreases their quality, namely by decreasing their available funding (Fini et al. 2017).

The same doubts apply to the impact of Science Parks (or Technology Parks or Business Innovation Centers) (Löfsten & Lindelöf 2002) and incubators, namely in terms of firms' probability of survival, job creation, number of patents and licenses and creation of new products (Siegel et al. 2003). Science Parks and incubators are focused on the mission of business acceleration through knowledge agglomeration and resource sharing (Phan, Siegle & Wright 2005). Science Parks have as main goal to stimulate the creation and growth of R&D-intensive companies and promote stronger relations between larger firms and research institutions, namely Universities (Siegel et al. 2003). To fulfill this goal, universities around the world have created at an increasing rate (Link et al. 2003) these infrastructures to promote and support start-up firms based on university patents or licenses (Phan et al. 2005), and thus to enhance the university-industry linkages and push up firms' productivity (Link & Scott 2003).

From the firm's point of view, to be integrated in a university incubator or science park may be profitable in the sense that firms get better access to the most recent developments in research done by the universities, to high-skilled professionals and students, to business and managerial advise services and to administrative services and facilities - at a lower cost than firms not integrated in an incubator (McAdam & McAdam 2008). The institutional reputation stands also as a relevant factor in favor of firms integrated in university-owned incubators (Jamil, Ismil & Mahmood 2015).

Although the number of science parks and incubators linked to universities have substantially rise in the last decades (Link et al. 2003; Phan et al. 2005), the literature on their regional impacts is far from being abundant, and those positive contributes predicted by the theory lack empirical evidence (McAdam & McAdam 2008). Whenever impact evaluations on university science parks or incubators are carried, they mostly use new firms created or new jobs as an outcome measure, but such evaluations often fail in assessing the regional effects, the accomplishment of the missions science parks or incubators aim and the problems these organizations face (McAdam, Galbraith, McAdam & Humphreys 2006).

Institutional Approach

The institutional approach involves the analysis of the institutional framework which is likely to promote (or not) entrepreneurship activities, firm creation and innovative development (Veciana & Urbano 2008). It also deals with the study of the institutional elements (namely, family and education) that turn university students more prone to start up a firm (Raposo, Ferreira, Paço & Rodrigues 2010).

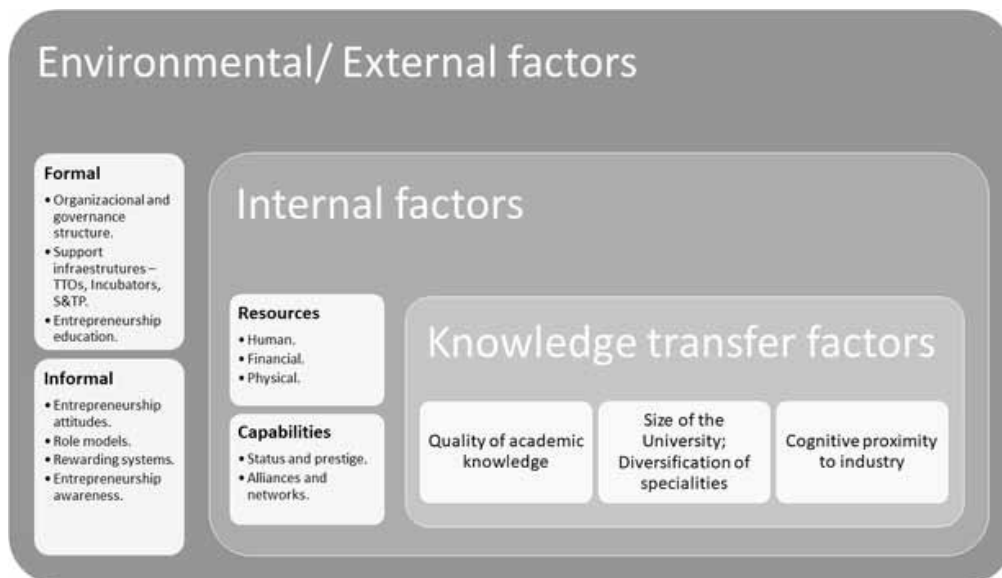
Applied to the context of Higher Education Institutions (HEIs), the institutional approach analyzes the external and internal factors that distinct entrepreneurial universities from more traditional teaching and researching-oriented institutions (Urbano & Guerrero 2013). Those internal and external factors that shape entrepreneurial HEIs are depicted in Figure 3.

A branch of the literature on technology transfer is closely related with the institutional perspective, underlying the macro environmental context under which universities operate their entrepreneurial mission and also the universities' own characteristics (Urbano & Guerrero 2013; Guerrero et al. 2006, 2014). Bellucci & Pennachio (2016) stress the importance of firms' structural and governance characteristics (including size), namely those operating in knowledge-intensive sectors and already investing in R&D which present a closer relationship with universities. The importance of entrepreneurship-friendly policies to build a strong national innovation system, such as the creation of legal framework to foster R&D cooperation needs also to be accounted for (Bellucci & Pennachio 2016). Finally, Government deserves special attention by the institutional approach given its possible active role as knowledge producer (through public R&D labs), as well as an intermediary between universities and firms (Bozeman 2000).

Several theoretical models/ frameworks within the institutional approach – see Clark (1998), Etzkowitz et al. (2000), Etzkowitz (2004), Kirby (2006), Guerrero & Urbano (2012) - recall the relevance of formal and informal factors (cf. Figure 3) and establish the needed institutional changes for universities to become more entrepreneurial led. Notwithstanding these frameworks' contribution in highlighting the environmental factors needed to an entrepreneurial university (Pugh 2017), the impact of these universities on the (regional) economy has not yet been adequately captured.

Figure 3. Institutional approach: external and internal factors considered in Universities impact assessments

Source: Own elaboration based on Urban & Guerrero (2013); Guerrero et al. (2006, 2014) and Bellucci & Pennacchio (2016).



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The Triple Helix Model can be seen as a neo-institutional approach as it accounts for a new configuration of institutional forces rising within the innovation processes (Etzkowitz, Webster, Gebhardt & Terra 2000), by formalizing the dynamic interactions among three ecosystem actors - University, Government and Businesses – which are needed to be developed, promoted and integrated in order to foster innovation at a sectorial, regional or national levels (Ivanova & Leydesforff 2014). In the context of the Triple Helix model, the evolution towards a knowledge-based economy, in which the third-generation universities play a central role, is explained by four processes (Etzkowitz et al. 2000; Etzkowitz 2002): 1) the internal transformation in all the three actors (e.g., the adoption of economic development as a university' mission); 2) the increasing influence each actor has over the other two; 3) the creation of new forums where all the three are represented, to encourage and promote new forms of cooperation; and 4) the recursive effect of such networks inside each institutional sphere.

Under the institutional approach, most of the empirical work is based on case studies methodologies, which focuses on the identification of the factors and parameters that turn HEIs into entrepreneurial Universities (Guerrero, Kirby & Urbano 2006). Most frequently used methodologies resort to surveys or personnel interviews to academics, students and graduates, in order to assess their personal perception on the performance of their institution according to those factors/ parameters. Surveys can also be used to follow students' career path after graduation and convey conclusions on the impact of the university as a regional supplier of human capital (Urbano et al. 2013). Information on knowledge transfer is obtained through administrative databases, internal documentation or by using the Science Citation Indexes to measure the impact of science-industry relationship on knowledge production (Ranga, Debackere & von Tunzelmann 2003). Likewise, interviews and surveys to firms located in the region are used to assess their perception on the suitability of educational programs to enterprises' needs, or their perception on the success of knowledge transfer programs (Bramwell & Wolfe 2008).

Empirical Evidence

Endogenous Growth Approach

Based on regional data for German regions, Audretsch & Keilbach (2004b) estimate that 'entrepreneurship capital' has a positive impact on regions' economic performance, being a key factor in explaining output differences across German regions. Specifically, the authors evidence that an increase of 1% in regional's entrepreneurship capital implies an increase of output of 0.12%. Using a structural equation model instead of OLS models, Audretsch et al. (2008) estimated that in West-German regions an increase in innovation efforts by 1% increase economic performance by 0.05%, whereas the same increase in entrepreneurial capital increases economic performance by 0.07%. These results validate the hypotheses under test: regional innovation efforts play a role in regional level of knowledge-based entrepreneurship, and the latter leads to better economic performance through fostering knowledge spillovers at the regional level.

Focusing on a sample of 15 OECD countries, Guellec & de la Potterie (2004) found a positive long-term elasticity of total productivity with respect to public research (0.17), higher than the elasticity with respect to private R&D, 0.13, and a negative effect of government funding on the elasticity of total productivity with respect to private R&D. Moreover, the authors found evidence of scale effects, with higher levels of private R&D enhancing the impact of public research on total productivity.

In Aghion et al. (2009) the authors combined case study and panel data econometric analysis for assessing the impact of HEIs on US states growth. In concrete, resorting to three case studies, using two US states with lower levels of technology (Alabama and West Virginia) and one state with high level of technology (Massachusetts), it was shown that all the three states had a one-off boost in investment in high education, but only in the state with higher levels of technology, Massachusetts, it was observed an increase in economic growth. The more comprehensive exercise involving 48 continental US states and panel data econometric analysis, suggest that states at the technological frontier evidenced an increase in growth of 0.04 p.p. and 0.07 p.p. for a thousand dollars per person investment, respectively in research education-type and in four-year college. The corresponding impacts for the states far from the technology frontier were 0.07 p.p and 0.03 p.p., respectively. Investment in two-year college did not produce any statistically significant impact in any class of states. Vandesbussche et al. (2004) reached similar conclusions from panel data that included 19 OECD countries over the period 1960- 2000: countries closer to the technological frontier reap higher growth outcomes from increases in skilled human capital.

Technology Transfer and Commercialization

Most of the empirical literature associated with technology transfer and commercialization approaches uses econometric analysis to measure the impact of Universities entrepreneurial activities on regional competitiveness. The range of dependent variables proxies is wide, including regional GDP (Corsi & Prencipe 2018; Huggins & Johnston 2009; Goldstein & Drucker 2006; Bonander et al. 2016), patent activity (Corsi & Prencipe 2018; Rodríguez-Gulías et al. 2016; Bonander et al. 2016), R&D spending (Corsi & Prencipe 2018; Bonander et al. 2016), and employment (Lendel 2010).

The general impact of universities on US metropolitan regions is studied by Goldstein and Drucker (2006), who established a relation between the size of the region and the magnitude of the positive effect that universities' research, teaching activities, R&D expenditures and patents have with medium and small-sized regions benefiting more than large regions.

Focusing on UK regions, Huggins & Johnston (2009) found that the economic impact of universities in more competitive regions is higher than in less competitive regions. The authors further added that the latter are nevertheless more dependent on universities to achieve higher levels of income and innovation, even when they are less competitive than their counterparts in more competitive regions. Also analyzing the UK case, Lendel (2010) compared the performance of different UK universities, ranked in terms of R&D expenditures, in different periods of the business cycles, and concluded that only high-quality universities experience positive impacts during recessions.

Evidence gathered by Bonander et al. (2016) based on two Swedish regions cast doubts on the effectiveness of research universities in fostering regional growth and development. The authors analyzed the value-added of publicly research granted universities (which host master and PhD. programs) over university colleges, and found no impact on the number of students, patents or start-ups. Likewise, those universities do not seem to contribute more to regional GDP than college universities.

The limited impacts of University technology transfer activities are also observed by Drucker (2016), who found that teaching and researching activities have a much stronger impact on US economic performance. The same happens in Vining & Lips (2015), who found poor performances from Dutch university transfer activities in terms of revenue from patents, licenses and spin-offs, even in universities with highly recognized academic research.

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Focusing on more specific types of impacts related to entrepreneurship related activities, most notably University Spin-Offs (USOs) and Science Park infrastructures support, Corsi & Prencipe (2018) found an overall positive impact from Italian university spin-offs (USOs) on regional GDP per capita, but rather weak impacts on regional competitiveness (measured in terms of the number of patent applications). The authors explain the latter results by the low levels of innovation embodied in Italian USOs and the weak capacity of the regions themselves to fully exploit the spillovers provided by the USOs. Corsi and Prencipe (2018) conclude that the impact of Italian USOs is quite dependent on pre-existent regional development and competitive advantages. Regarding the Spanish case, Rodríguez-Gulías et al. (2016) put emphasis on the size of the USOs - the larger USOs are the greater the access to funding - and industry in which they operate as main determinants of patent activity. As Corsi and Prencipe (2018) for Italy, Rodríguez-Gulías et al. (2016) found that the regional context impacts on the probability of USOs having patent activity in Spain. For Hong-Kong, Chan & Lau (2005) underrated the impact of science parks on start-ups' performance and found that a strong link between the university and the technology start-up is more valuable through ensuring higher support in terms of equipment provision and consulting advices.

Fini et al. (2017) gathered evidence for a multiplicity of countries around the globe on the relevance of USOs and found that these companies have only small effects on economic performance of countries-regions of Italy, Norway and the UK.

Institutional Approach

Urbano & Guerrero (2013) suggest that all the seven universities in Catalonia can be considered as entrepreneurial universities, providing some insights on their contribution for the stock of human capital in the region. The authors show that universities produce important impacts on regions through the provision of adequate educational programs which foster linkages between universities and firms.

Studying the case of the University of Waterloo (Canada), Bramwell & Worlfe (2008) considered it an entrepreneurial university due to its spin-off activity, the important role of R&D activity and dynamic entrepreneurial activities, being closely linked to the local firms and playing an important role as an intermediary between students, researchers and firms. They further evidence that together with the recognition of high-quality educational programs, the University of Waterloo is critical for the development of a local high-tech based economy.

Resorting also to case study analysis, this time involving the University of Twente (The Netherlands), Lazzaretti & Taboletti (2007) studied the factors that enabled this university to reach top standards. They found that higher quality research center, public laboratories together with private research organizations were part of the success, namely in terms of the boost that the University of Twente gave to the economic development of a peripheral and once economically poor region.

CONCLUSION

The present chapter provided a novel and comprehensive overview of the main theoretical and methodological approaches for assessing the impact of Universities on regional economic development and competitiveness. It described in a detailed manner both short (economic based) and long (knowledge based) term perspectives to shed light on the impacts that universities have on the development of the

region where they are located, underlying relevant contingent factors that can inhibited/enhance university impacts at the regional level involving all of its main missions (education, research and socio-economic impact activities).

The main scientific contribution of the undertaken literature review was to organize a hitherto scattered and wide range theoretical and methodological contributions in this domain. Such exercise helped to re-position the current debate on the relevance of Universities, or Higher Educations Institutions in general, for regions' development and competitiveness.

Demand-side/ short-term perspectives tend, in general, to convey a positive economic impact of Universities in regions through the estimation of multiplier effects of universities' expenditures. Such methodologies, however underestimate the potential impact Universities can have on regions as they neglect knowledge and cultural related spillovers which may occur over a longer time span. Supply-side theoretical and methodological approaches, including endogenous growth, technology transfer and commercialization and institutional approaches, underline the difficulty of gathering clear-cut, linear results. Instead, evidence based on such approaches underlined that the direct link between university research and innovation is often weak and lacks scale, with external / institutional factors limiting the potential of universities playing a dominant and valuable role in driving and stimulating regional competitiveness.

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Chapter 5

Understanding Entrepreneurial University: A Framework for Emerging Economies

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ABSTRACT

Universities globally are facing new challenges and rapid changes like the increased pace of technological progress, demographic shifts, reduced funding, new skills requirement, competition, etc. These challenges and changes call for academic revolution in universities. This implies a need to make these organizations more entrepreneurial in their thinking and approaches, hence the term entrepreneurial universities. Further, they are expected to create the future by educating those to whom the future belongs and by generating the ideas and discoveries that can transform the present and build a better world. In the current context, educating those to whom the future belongs means providing them with solid knowledge and entrepreneurial skills for coping with future challenges, generating ideas and innovations and transferring them to build a better world. Adopting a qualitative approach with an in-depth literature review, the aim is to understand the entrepreneurial university and its role, and to provide a framework for their development in emerging economies.

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INTRODUCTION

Most universities are operating in the public sector and traditionally they are not suited for an entrepreneurial role (Kirby, 2006). However, over the past two decades, world over, universities are facing new challenges and rapid changes like increased pace of technological progress, negative demographic shifts, decreasing public funding, new skills required in the marketplace, fierce competition for attracting students and research funds. Thus, universities as organisation, which were dominating and stable for more than 2500 years, are on verge of collapse (Abeles, 2001). Reasons are many. Among them, the most important could be inability to adjust to the development of technology, especially the convergence of ICT, which had led to the creation of alternative forms for knowledge acquisition, learning and higher education. Even the dominating role they enjoyed as a source of enlightening the society is turning to now just a place for knowledge communication (Delanty, 2001). These changes and challenges ask for a new academic revolution in order for universities to survive and develop, and this implies making these organizations more entrepreneurial. Whitehead the philosopher said, “Universities create the future”; and Faust, Harvard University president explained how they do “in two fundamental ways”: by educating those to whom the future belongs, and by generating the ideas and discoveries that can transform the present and build a better world” (as cited in Thorp and Goldstein, 2010; p. 151). In the current context, educating those to whom the future belongs means providing them with solid knowledge and entrepreneurial skills for coping with the future challenges and generation of ideas and innovations and transfer to build a better world. This again requires an entrepreneurial approach. Thus, for university to remain relevant and useful as a form of organization need to respond and adapt. This requires change in the mindset and change in the tenets of managing and governing the universities. This calls for restructuring of universities. Therefore, the question for higher education and university system is not whether but how to cope with these changes, which characterize the modern and emerging economies of today (Baporikar, 2019). Therefore, adopting a qualitative approach with in depth literature review the main objective of this chapter is to discuss the concept, key characteristics of entrepreneurial university and provide a framework for entrepreneurial university, in emerging economies with focus on Namibia. The primary purpose being extension of our cumulative understanding of entrepreneurial opportunities as an enduring phenomenon of interest. Given the importance of the opportunity construct in the field of entrepreneurship as well as the current difficulties associated with respect to its adequate understanding, we believe that knowledge about the phenomenon stands to gain substantially if researchers import appropriate frameworks, perspectives, and theoretical paradigms from allied fields to suitably inform and enhance their overall understanding of the phenomenon.

Thus, this chapter seeks to understand the processes that comprise entrepreneurial universities by adopting an organizational learning perspective. We believe that in engaging with opportunities, universities like entrepreneurs essentially follow a path of self and organizational learning. Barnett and Sorenson (2002) find that the processes of organizational creation and growth emerge from ecologies of learning organizations. To develop our arguments, we draw upon insights from Crossan, Lane, and White’s (1999) 4I (Intuiting, Interpreting, Integrating, and Institutionalizing) organizational learning framework. By doing so, we indicate how each of the four processes delineated in the framework yields insights about the processes that comprise the life cycle of the entrepreneurial university construct. The foremost strength of the 4I framework is that it adopts a process orientation to learning. It recognizes that learning has both a positivist/realist (or cognitive) side to it as well as an interpretive (or situated) side. Therefore, in using the 4I framework as a theoretical lens, we are able to recognize the dynamic nature of

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opportunities unfolding as entrepreneurial university engage with them. The chapter also contributes and responds to the call by entrepreneurship researchers to identify specific antecedents of entrepreneurial university that go beyond the individual entrepreneur (Busenitz, West, Shepherd, Nelson, Chandler & Zacharis, 2003; Venkataraman, 1997) and to incorporate context into our understanding.

The chapter is structured as follows: we begin with background of university as form of organization, types of universities, genesis of entrepreneurial university, characteristics of university, both ontological positions Schumpeterian and Kirznerian on which entrepreneurial opportunities research has been based. This discussion allows us to compare and summarize the often-divergent insights that they reveal about the phenomenon. Next, we introduce the 4I organizational learning framework by highlighting its process nature, levels of analysis, as well as cognition-action backbone. Having established this background, we then use the 4I framework to study entrepreneurial university as a process, thus developing conceptual insights for its many attributes noted in practice. Then we move on to implications, recommendations, future areas of research and end with a conclusion.

LITERATURE REVIEW

University as Form of Organization

The original Latin word “*universitas*” refers in general to a number of persons associated into one body, a society, company, community, guild, corporation, etc. (Lewis & Short, 1966). Like many organisations and other guilds, they were self-regulating and determined the qualifications of their members (Colish, 1997). Today, university has come to mean an institution of higher learning where faculty and students engage in teaching - learning process for acquiring degrees in various disciplines. University also has the acknowledged power to confer degrees. Although universities in general have been, slow to accept new sciences and methodologies as they emerged, when they did accept new ideas it facilitated to convey legitimacy and respectability. There are many examples, which belie the commonly perceived inflexibility of universities (Gascoigne, 1990). Aristotelian epistemology delivered a rational framework for knowledge construction and training of scholars. The creation of new scientific constructs and the epistemological challenges integral to creation opened the idea of autonomy of science and the hierarchy of the disciplines. Thus, the aim of higher education from being to create general scholarship shifted to discipline detailed. This divergence between those focused on science and those still entrenched in the idea of a general scholar exacerbated the epistemological tensions that were already beginning to emerge (Feingold, 1991).

Claes (2005) describes the birth of the university as a very “complex historical process in which its structure, identity and mission have been appropriated and re-appropriated to the different needs, structures and aspirations of different times and settings” (p39). For countries of Africa for instance, and the many nations that share the heritage of colonization, the university became something of a post-independence symbol, as much a symbol of sovereignty as a tool for early nation building. A principal purpose according to Atuahene (2011) was the training of civil and public servants to fill roles of public administrators during the decolonization period as well as quickly create mass of educated class of employable graduates. Nevertheless, if universities are mostly categorization systems to separate smart and hard-working pupils from their less able so that employers can easily find them then the importance and esteem in which society holds them is not justifiable by their function. If universities are factories for

the dissemination of job skills then too the universities are not fulfilling the role expected from them by the society. Then the question is what role universities played in the past and whether that is sufficient in the present scenario. Ideally speaking an answer would be that universities are places where individuals should acquire two types of knowledge, technical and practical knowledge. Technical knowledge is the knowledge that is ample through lectures, notes points and maybe memorized by rote methods. However, practical knowledge delivery by traditional university has been an issue (Baporikar, 2017a).

In developed economies, many of the universities have faced these challenging times by becoming more corporate and entrepreneurial in approach. Stanford University is one of the first examples of entrepreneurial universities (Lenoir et al. 2003, cited by Blenker et al. 2006). Accordingly, universities in emerging economies are now also moving towards becoming 'entrepreneurial university' to meet the changing demand and the challenges faced due to the factors of globalization, ICT convergence and knowledge explosion. Further, the importance and potential benefits of entrepreneurship are widely cited (Drucker, 1985; Gartner, 2001; Shane, 2003). Yet entrepreneurship's dynamic and volatile nature continues to pose obstacles for organisations seeking these benefits without wanting to assume the associated risks. Wealth creation (Hitt et al., 2001), competitive advantage (Ireland et al., 2001), product leadership (Porter, 1980), and financial and economic gain (OECD, 1998) are some of the many benefits referred to in the context of entrepreneurship. Entrepreneurship has also been associated with seizing opportunity (Kirzner, 1979), swift action (Bhide, 1994), and rapid economic change (Barth, 1969). However, not all firms are able to transform entrepreneurial activity into financial gain (Lumpkin and Dess, 1996).

University Types

Before we delve, further let us briefly look at the types of universities that exist today. Broadly, universities are of the following types (Baporikar, 2019):

1. **Traditional Universities:** Focused on teaching and producing graduates into various disciplines of arts, science and commerce.
2. **Liberal Universities:** Are those, which focus more on humanities, art and liberal education and are generally are not into science education.
3. **Corporate University:** Who are involved in teaching and learning but more the focus is on research training and consultancy.
4. **Private University:** A private university is one where the ownership and operations rests with the private sector.
5. **Research Focused Universities:** Are those focusing on postgraduate level of teaching and research to create knowledge and disseminate it for the good of society.
6. **Corporate Universities:** Are those universities, established by corporates and focus more creating the skilled personnel, which may be industry specific or so.
7. **Entrepreneurial Universities:** Are of the recent kind where either of the above type of universities are resetting their agenda to become entrepreneurial university. The aim is to transform themselves more internally and externally to meet the altering needs of the knowledge economy and accelerate entrepreneurship, innovate and become more sustainable.

GENESIS OF ENTREPRENEURIAL UNIVERSITY

Subotzky (1999) argues that two major tendencies affect universities. One they are under pressure to become more market-oriented and to respond to rapid changes in the environment and secondly universities should work for the benefit of the society, promoting social equity and responding to the community needs.

However, reduction in the public funding of universities, on one hand, and the emergence of a more competitive market for education and research, on the other hand, necessitate universities to become innovation agents and also entrepreneurial. If not, they “*will hamper regional and national development as well as international competitiveness*” (Arnaut, 2010, p. 135).

According to Thorp and Goldstein (2010), five trends endorse the idea that an entrepreneurial mind set for universities is critical in the 21st century. They are:

- To solve the big and complex problems of the 21st century huge resources and non-traditional approaches are needed,
- Information-based tools are at the disposal of individuals undermining large bureaucratic institutions and empowering the ones with an entrepreneurial mind set,
- Students are now the Millennials generation and have a different mind-set pushing universities towards innovative approaches,
- Traditional sources of funds are decreasing and funders have performance-based expectations that can be best addressed by an entrepreneurial approach,
- To address the world’s great problems new ways of problem solving that combine traditional rationality with creative solutions – entrepreneurial thinking - are needed.

Considering the challenges of the 21st century that universities have to face, a comprehensive definition of the Entrepreneurial University is suitable. The entrepreneurial mind-set should be present at the organizational level in redesigning the way universities operate internally and in relation with all its stakeholders. However, more important is the inculcation of entrepreneurial mind-set within students so that they will be capable to bring solutions for the challenges they will have to face. How universities approach, this transformation is different as each university has different talents, resources and leadership. This defines also a bottom-up process in transforming the universities. Nevertheless, at the government level, policies developed in order to support universities in their endeavour (Atkinson and Pelfrey, 2010).

However, things are much different in the context of Africa especially a small country like Namibia with only two universities. Yet due to globalization, technology boom and digital explosion there has been a convergence of information, technology and communication. This sharing of information lead to creation of knowledge society usually referred to knowledge economy. Thus, the issue in Namibia is also, whether universities are only capable to foster job seekers and professionals or whether they can transform and become entrepreneurial in their approach. This can then lead to creation of entrepreneurs who are capable of innovation to meet the challenges of development and contribute to the overall development process of the economy, society and humanity at large. Technology after has the ability to connect, bend and break societies.

Further, a university can play a fundamental role in establishing and developing an entrepreneurial-oriented economy (Huq, Huque & Rana, 2016). In addition, the economic advancement of a country largely depends upon the availability or development of the group of people with entrepreneurial skills. Universities being one of the important actors of regional development, especially, development of

entrepreneurial sustainable universities is the need of the hour to enhance and affect entrepreneurship on regional development. Universities are important for societal and regional development as they have critical influence on society (Celikdemir & Katrinli, 2016). With increasing pressure on universities to play a role in the national innovation process, the concept of the entrepreneurial university (Etzkowitz, Webster, Gebhardt & Terra, 2000) is manifesting itself within the context of a comprehensive university setting. For a university to transform and become entrepreneurial Burgelman's (1983) understanding of the entrepreneurial process is necessary. University has to become entrepreneurial to address the needs not only of its own environment, contribute to regional and national economic development (Gibb, 2012), but also to survive, grow and be sustainable.

Entrepreneurial university refers to the university, which is able to survive and adapt in highly complex and uncertain environment (Clark, 2001). However, researchers oppose to the entrepreneurial model, as they perceive it to be a threat to the traditional integrity. Nevertheless, the need of the hour is the creation of entrepreneurial university. This does not mean that research focus is lost, on the other hand, research and educational activities get more value since the view is that research and knowledge creation is intellectual capital for university to generate revenues and better serve community. Experts currently recognize "Entrepreneurial University" as a major driver for self-development and innovation and as an appropriate response to succeeding in highly turbulent and unpredictable markets (Hannon, 2013). The entrepreneurial university is a multifaceted process of continuous improvement; therefore, it is also difficult to define strict guidelines for its implementation (OECD, 2012). Given that the diversity of entrepreneurial approaches taken by universities is one of the concept's most important features (Fayolle & Redford, 2015), a clear definition would be likely unachievable.

For our chapter we simply define entrepreneurial university *'as an organization involved in higher education that is creative, innovative and inclusive so as to foster the creation of new knowledge both applied and theoretical and also which is capable of transferring knowledge through research and technology to meet the market needs and address societal issues'*.

CHARACTERISTICS OF ENTREPRENERUIAL UNIVERSITY

Some of the salient characteristics of the entrepreneurial university are:

- Strengthened legitimacy through enhancing employability skills, entrepreneurial thinking and market-oriented student behavior (Baporikar, 2017b).
- A changed mindset of the university (Hagen, 2002).
- All members of the university - faculty, students, and employees – become more entrepreneurial in their approach.
- Interaction of the university with the environment, the "structural coupling" between university and region, follows entrepreneurial patterns (Röpke, 2014).
- Ability and capacity to educate people from different backgrounds who can utilize strengths and resources at hand to creatively solve problems, adapt to change at the right timing of opportunity (Etzkowitz & Zhou, 2008).

Understanding Entrepreneurial University

Within an entrepreneurial university, there are two important actions: the academic entrepreneur and the entrepreneurial academic (Alexander, Miller, & Fielding, 2015). Academic entrepreneurs engage in formal commercialization activities leading to patents, licenses and even creation of new ventures. In contrast, entrepreneurial academics participate in a wide range of activities to link the university with industry and other organizations. This has to do more with the attitude. It also opens new possibilities for students as well as faculty members. Certainly, these are not the only groups who benefit from this model; there are many different stakeholders (Baporikar, 2016).

ONTOLOGICAL POSITIONS

Schumpeter's Position: In Schumpeter's view, opportunities emerge as a process of "creative destruction." Entrepreneurs do not discover opportunities; rather, they create them by taking advantage of technological change, of an innovation occurring in the economy. Entrepreneurial opportunities arise in the economy as an outcome of ". . . a self-transformation process, the driving element of which is an innovating 'entrepreneur-hero' . . . Consequently, Schumpeter elaborates upon the psychology of his 'entrepreneur-hero'" (Witt, 1995, pp. 84–85). In other words, by attributing to the entrepreneur the role of a "heroic" change initiator in the economy, Schumpeter gives cognizance to the importance of the personal traits and motivation of the entrepreneur. He suggests that entrepreneurs are the rare breed of individuals motivated intrinsically to utilize the benefits of technological, demographic, and social changes to create upheavals in the current state of equilibrium and to usher new products and services or new ways of working (Schumpeter, 1934). Thus, even though he does not state this explicitly, Schumpeter believes that the entrepreneur is high in terms of intuition, creativity, and the power to overcome skepticism and hostility—intrinsic personal qualities that are difficult to imitate. In taking this view further, Lumpkin and Dess (1996) indicate that these attributes lead to the development of an entrepreneurial orientation, which incorporates within itself characteristics such as autonomy, innovativeness, risk taking, pro-activeness, and competitive aggressiveness. At the same time, Schumpeter is silent on the role of information or the knowledge that the entrepreneur must have access to in order to initiate a specific change outcome. To summarize, the Schumpeterian view on entrepreneurial opportunities suggests that there is creation of opportunities rather than they being discoveries. In addition, in the overall process of the emergence of entrepreneurial opportunities, entrepreneurs' personal attributes, rather than their personal knowledge resources, play the most critical role.

Kirzner's Position: In contrast to the Schumpeterian view, Kirzner's (1979, 1997, 2000) theory of entrepreneurial alertness and discovery is concerned with understanding how certain individuals secure profits on the basis of knowledge and information gaps that arise between people in the market. Drawing upon the early work of Austrian economists Mises (1966) and Hayek (1945, 1948), Kirzner suggests that the entrepreneur discovers opportunities by acting as an arbitrageur or a price adjuster in the marketplace, capitalizing on knowledge or on information asymmetries. By taking recourse to asymmetries associated with individual level "day-to-day" knowledge (Hayek, 1945, 1948), certain individuals are able to engage in ". . . discovery of particular 'facts' that are useful for achieving specific, transitory purposes . . . [allowing] entrepreneurs [to] perceive changes in economic circumstances, discover imperfect coordination between individual decisions and adjust prices to new market conditions" (Harper, 2003, pp. 20–21). According to Kirzner, the price-adjusting process capitalizing on information disparities or on ignorance in the marketplace engaged in by the entrepreneur allows entrepreneurial alertness to flourish.

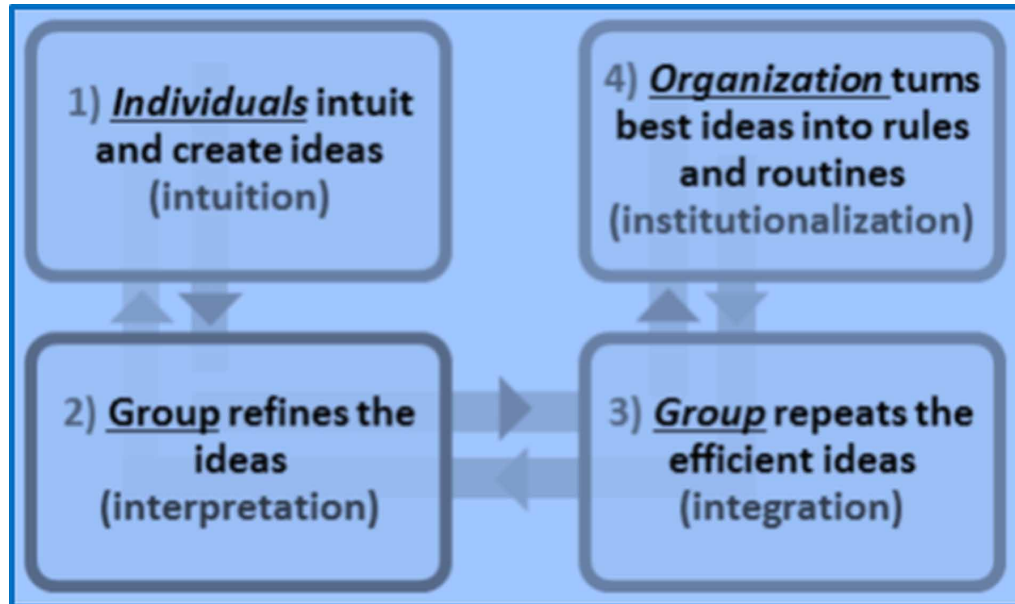
In fact, alertness and day-to-day knowledge go hand-in-hand, in order for opportunities discovery by the entrepreneur. Moreover, the process of opportunity recognition is more complex than simply identifying knowledge gaps in a particular market by the entrepreneur. It can take the form of a complex web of information discontinuities and knowledge gaps across markets, technologies, and substitutes over timeframes. Therefore, idiosyncratic knowledge pools that are available with individual entrepreneurs assume critical importance in recognizing entrepreneurial opportunities. Entrepreneurship emerges when certain individuals capitalize on their unique day-to-day knowledge and are able to discern unique opportunities in the marketplace, on the basis of “. . . discovery of previously unsatisfied wishes and desires of the consumers, including the goods and services which they demand and the prices they are willing to pay” (Hayek, 1948, p. 96). Thus, entrepreneurial opportunities are associated more strongly with the idiosyncratic knowledge base of entrepreneurs rather than with their intrinsic personal traits. Entrepreneurial alertness becomes an idiosyncratic resource with the following characteristics: it is not simply superior knowledge about market opportunities. Rather, “. . . the abstract, very general and rarefied kind of knowledge which we must ultimately credit with discovering and exploiting the opportunities unearthed . . .” (Kirzner, 1963, p. 69). It is tacit, and decisions to deploy it across multiple opportunities are difficult; no market exists for hiring entrepreneurial services—rather, entrepreneurial resources have to be realized and utilized and entrepreneurship is costless in that it is spontaneously learnt or acquired without deliberately searching for the information gaps that lead to emerging opportunities (Harper, 2003; Kirzner, 2000).

To summarize, it can be said that while the Schumpeterian view of entrepreneurial opportunities faithfully follows the “opportunities discovered” ontological position, the Kirznerian view attempts to go beyond and even leans toward the ontology proposed by the “opportunities enacted” approach by incorporating the idea of subjectivism into the opportunity process. Accordingly, any framework that seeks to offer a reasonably complete explanation of the process of entrepreneurial opportunities needs to be able to reconcile or even to synthesize the apparently conflicting positions of the two ontological approaches into a coherent explanation that recognizes the inherent complexities associated with the process of entrepreneurial opportunities. However, Crossan et al. (1999) 4I organizational learning framework is able to achieve this aim. Hence adopting the 4I organizational learning framework, we propose the entrepreneurial university framework for Namibia

The 4I Organizational Learning Framework

Organizational learning is defined as the capacity or the process within an organization to maintain or to improve performance on the basis of experience (Nevis, DiBella, & Gould, 1995), a capacity to encode inferences from history or from experience into routines that guide future activity and behavior (Levitt & March, 1988), systematic problem solving, and ongoing experimentation (Garvin, 1993). According to the 4I framework, learning occurs at multiple levels within an organization. It arises as an ongoing tension between exploring that is assimilation of new learning versus exploitation that is making use of what has already been learned (March, 1991). Schilling and Kluge (2009) explain that learning has a relatively permanent effect on the skills and knowledge. There are two different perceptions regarding the Universities; firstly, as a social system that shares the same objectives and secondly, as a gestalt of rules and structures, that regulates the behavior of people. According to Huber (1991), the upper level of the concept of organizational learning consists of four constructs, which are knowledge acquisition, information distribution, information interpretation and organizational memory. Operating in a competi-

Figure 1. Modified process of 4I
Source: Self-Developed



tive environment requires from the university as organization also dedication to work with precarious and unknown issues. Crossan et al. (1999) state that the process of organizational learning consists of three levels: individual, group and organization. The four different psychological and social processes (entitled 4I processes), intuiting, interpreting, integrating and institutionalizing, presented in Figure 1 below, combine these three levels.

Out of the 4I processes, presented in Figure 1 above, intuiting, interpreting and integrating are all parts of the exploring the unknown, in other words exploration. The process of institutionalization is part of embedded learning and refinement of the existing competences; that is exploitation. (Crossan et al. 1999; March 1991). Both the keeping and transferring of the existing knowledge and the permissible learning of the new, unknown and uncertain things needed in a university as organization going through a strategic renewal. Thus, the processes are at a focal point in the framework as they form the glue that binds the structure together.

Thus, in this multilevel model of learning, four socio-psychological processes link learning from the individual to that of the university. Figure 2 depicts these intuiting, interpreting, integrating, and institutionalizing the 4I as in a university setting. Learning is a combination of stocks and flows of knowledge: even as individuals, groups, and the organization act as repositories of knowledge, learning flows across these levels through the 4I processes in the form of feedback and feed-forward linkages.

Crossan et al. define the 4I learning processes as follows: *Intuiting* is the preconscious recognition of the pattern and/or possibilities inherent in a personal stream of experience. This process can affect the intuitive individual's behavior, but it only affects others as they attempt to (inter)act with that individual

. . . *Interpreting* is the explaining of an insight, or idea to one's self and to others. This process goes from the preverbal to the verbal and requires the development of a language . . . *Integrating* is the process of developing shared understanding amongst individuals and the taking of coordinated action through mutual adjustment. Dialogue and joint action are crucial to the development of shared understanding.

Figure 2. University setting 4I
 Source: Adopted from Crossan, Lane, and White (1999)



This process will initially be ad hoc and informal, but if the coordinated action is recurring and significant, it is institutionalized . . . *Institutionalizing* is the process of ensuring that routinized actions occur. Tasks are actions specified and organizational mechanisms put in place to ensure that certain actions occur. Institutionalization is the process of embedding learning that has occurred by individuals and groups into institutions of the organization including systems, structures, procedures and strategy. (1999, p. 525)

Crossan et al. (1999) acknowledge that there is an environment, or more accurately, “stimuli” that influence individual and organizational learning. They suggest that the “nature or texture of the domain within which individuals and organizations operate, and from which they extract data, is crucial to understanding the interpretive process. The precision of the language that evolves will reflect the texture of the domain for attempting the tasks. Furthermore, they acknowledge that individuals will interpret the same stimulus differently based on their established cognitive maps, because stimulus can evoke a different or an equivocal meaning for different people.

To summarize, the 4I framework provides a multilevel and dynamic process framework that encompasses the entire cycle of learning—from intuition to institutionalization of insights and ideas. If intuiting, which occurs at a preconscious level within the individual mind, entails a recognition of patterns or possibilities emanating out of the individual’s collective experience, interpreting enables the individual to engage in a process of sense making to bring this understanding to the conscious level. Both these processes, thus, directly focus on the enactment attributes of learning. Integrating and institutionalizing relate to the development of a collective or shared view of that learning. To a certain extent, that which becomes “institutionalized” forms the objective reality or the context within which the entrepreneurial university operates. Therefore, we suggest that the adoption of the 4I framework to explain the process of entrepreneurial university holds the potential to reconcile the currently divergent views on opportunities as discovered versus enacted.

IMPLICATIONS

In this chapter, we have suggested that approaching entrepreneurial university from an organizational learning perspective, and more specifically, the 4I organizational learning framework, offers a useful way of reconciling and building upon some of the apparently conflicting aspects of entrepreneurial opportunities that arise from the two ontological traditions and develops a more coherent explanation of the phenomenon. The application of the 4I framework to the process of entrepreneurial opportunities has also allowed us to perform a “levels-of-analysis” of the phenomenon and to draw its links to the practice. By treating entrepreneurial university as a process that involves intuiting, interpreting, integrating, and institutionalizing at multiple levels, we believe that we have been able to provide a richer theoretical exposition on the phenomenon. In the process, we have responded to a call by Kreuger who said, “. . . if we wish to argue intelligently about whether entrepreneurial opportunities are ‘discovered’ or if they are ‘enacted,’ theory is crucial” (2003, p. 105).

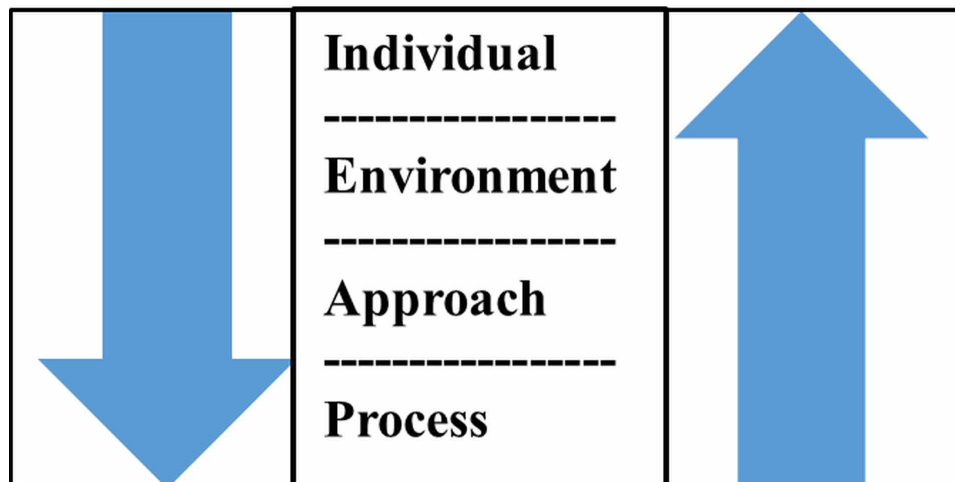
Further, organizing an entrepreneurial university means assembling ongoing interdependent actions into sensible sequences that generate sensible outcomes (Weick). First, it emphasizes that individuals with expertise are a key element and at the same time that it recognizes the entrepreneurial approach as an organizational entity, it stresses that the new approach is not instantaneously produced, but evolves over time (beyond a year). This approach is further within the context of its environment: as it forces to seek out resources and it competes in the market place. All these aspects of the entrepreneurial approach need to be in mind if there has to be adequate description and classification.

Figure 3 presents a basis for describing the creation of an entrepreneurial university across these four dimensions:

- Individual(s)-the person(s) involved in starting a new approach;
- Environment-the situation surrounding and influencing the new approach;
- Approach -the kind that is started; and
- Process-the actions undertaken by the individuals) to start the entrepreneurial approach

Figure 3. Dimensions of Entrepreneurial University

Source: Self-Developed



Further, the propositions we derive from this deliberations of what is entrepreneurial university especially for emerging economies like Namibia include:

Proposition 1: Entrepreneurial universities are associated more strongly with the intrinsic personal traits of their faculty and staff.

Proposition 2: Entrepreneurial universities are further also strongly associated with the idiosyncratic knowledge base of their faculty and staff.

Proposition 3: Expert intuition is associated with the process of discovery.

Proposition 4: Entrepreneurial intuition is associated with the process of enactment.

Proposition 5: Entrepreneurial engagement encompasses both discovery and enactment linked through the 4I learning processes: intuiting, interpreting, integrating, and institutionalizing.

Proposition 6: Entrepreneurial engagement with an opportunity evolves from intuiting to interpreting through conversations that enable faculty and staff to develop a more coherent language to describe the opportunity.

Proposition 7: Opportunities that have progressed from intuiting to interpreting have a higher chance of implementation compared to opportunities that have remained at the intuiting stage.

Proposition 8: Entrepreneurial university engagement with an opportunity evolves from interpreting to integrating through conversations that enable entrepreneurs to generate a shared understanding about the opportunity among critical stakeholders.

Proposition 9: Opportunities that have progressed from intuiting and interpreting to integrating have a higher chance of implementation compared to opportunities that have remained at either the intuiting or the intuiting and interpreting stages.

Proposition 10: Universities that engage in the process of institutionalizing learning with respect to entrepreneurial opportunities demonstrate a culture of corporate entrepreneurship (or intrapreneurship) and demonstrate a stronger record of accomplishment of venture creation and entrepreneurship development compared to universities that do not do so.

RECOMMENDATIONS

No new approach especially when a university decides to adopt entrepreneurial is possible for comprehensive description, nor can its complexity adequately accounted for, unless all of its four dimensions are investigated and an attempt is made to discover how variables from each dimension interact with variables from other dimensions. This “thinking across dimensions” is especially apparent in the work of those theorists and researchers who have developed entrepreneurial classification schemes. Against the backdrop of a changing global macroeconomic setting that boasts of knowledge societies and knowledge-based strategies for development and growth, the entrepreneurial university transforms the knowledge produced within the university into capital. Capital to drive and support the needs and interests of the new and evolving higher education stakeholder base as globalising trends become permanent features of higher education today. Claes (2005) calls it the “innovative model”, where students are consumers, with specific wants: marketable skills and competencies certified by academic credentials. Service providers, in a diversified higher education system, compete, in order to satisfy these consumer wants. In this approach, government and industry are also customers with specific wants, affirming the first of Etzkowitz’ (2004) five “norms” of the entrepreneurial university. These are capitalisation of knowledge,

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interdependence, high degree of independence from the state and industry, hybridisation and reflexivity. Though the modern university concept emphasises an entrepreneurial component, university as higher education institution has to be understood not just as a provider of facilities and an informer of opportunities, but also as a source of inspiration and motivation (Baporikar, 2015). There exists a perception among young Namibians that the university itself needs to become more entrepreneurial in order to change the mind-set of others, both in a sense of strategy and in a very practical way (Baporikar, 2018). The university can prove and practice its entrepreneurial skills for attracting funds and collaborators so that it can support the entrepreneurship initiatives for its stakeholders.

Making an entrepreneurial university is not an easy task. It is also time consuming. It is easy to decide but the difficulty lies in creating a culture and especially changing an existing culture is more complex. This is possible only with systematic planning and mindful work on construction of value awareness through various methods and activities. From the start of the decision to become an entrepreneurial university, it is recommendatory that:

- Ensure and establish proper accountability and autonomy structure.
- Adopt holistic, inclusive and integrated entrepreneurial culture.
- The government can also stimulate entrepreneurial ecosystems, but the challenge for government policy is to develop policies that work, but avoid the temptation to try to effect change via direct intervention. This is in contrast to “traditional” versus “growth-oriented” policy approaches to enterprise development. They need to focus on trying to grow the total number of firms via business start-up programs, venture capital financing and investment in R&D or technology transfer. It can also include business or technology incubators, grants, tax incentives and support programs. Such programs are essentially transactional in nature. It is not that they are of no value, but they cannot guarantee success via such direct intervention.
- Growth oriented approach and a focus on entrepreneurial leadership, which seeks to understand the networks and how to foster the expansion of such networks at the local, national and international level.
- The most important thing is the strategic intent of the team running the university. Universities seeking to grow need help in linking up with all stakeholders and other resource providing actors in the ecosystem who can provide
- Government ministers can play a critical role in fostering enterprise and innovation in universities. Their role is to direct the departments, institutions and agencies to focus on the problem and develop effective policies. A minister who has a good understanding of what entrepreneurial ecosystems are, how they form and the role and limitations of government policy is well-placed to generate more effective outcomes.
- Last but not the least is the ethos, which can mandate commitment of all actors at the university. This is plausible by developing a joint vision and well-integrated entrepreneurial culture.

FUTURE RESEARCH DIRECTIONS

Entrepreneurial universities are at different stages in different parts of the world. In developed countries, they are established and in emerging economies, they are still in transition. This research has several limitations that creates future research lines; for example, an extended investigation comparing Namibian

entrepreneurial universities with African or other universities. In addition, a longitudinal comparison of the entrepreneurial evolution of each university would prove to be useful and interesting information. In addition, other diagnostics with analytical tools applied to universities' strategies in other regions would be a good research opportunity (Wong, Ho, Singh & Wong, 2007). Furthermore, there are other factors that need to be considered in the conceptual model proposed; for example, in-depth analysis needs to be focused on the influence of formal factors such as specific legislation, initiatives, incentives or other strategies developed by the regional governments to foster entrepreneurship and innovation. In addition, there is a need for further research on the informal factors linked with the impact of social dynamics of entrepreneurship in the configuration of entrepreneurial intentions, and the acceptance of academic entrepreneurs (role models) in the region. However, the developing attitudinal divide between disciplines regarding entrepreneurial university ideal needs to be established. For that to happen some of the research studies which need to be done include role of these universities as drivers and/or contributors to innovation and entrepreneurship development, identification of variables, development of performance metrics to measure outcomes. Another area is developing models and frameworks needs for academic leadership and governance for establishing the entrepreneurial culture. Study of contextual factors especially that affects the development of entrepreneurial universities would also be required.

CONCLUSION

Entrepreneurship is a wide concept and is an observation in several scenarios such as real-life cases, scientific projects and new enterprises and in the configuration of societies. Specifically, in this last scenario, the value addition is through generation out of the entrepreneurial opportunities that make the difference between the traditional and new knowledge economies (Audretsch 2007). In this context, the entrepreneurial opportunities are associated with the generation and the exploitation of knowledge considered such a key factor of production in this economy (Romer 1986). Besides, the university has been experimenting with several cultural, educational, institutional and legislative challenges in order to be a survivor inside a global competitive environment. Because of these challenges, the phenomenon of entrepreneurial universities has emerged with a common strategy focused on being entrepreneurial at all university levels (Kirby 2005). This is not surprising because, since its creation, the university is an organization for research and innovation to discover the societies' necessities. However, universities are complex organizations comprising a number of overlapping and nested communities of practice (Finlay 2004) and the economic benefit of universities for the local area is not highly visible. In this respect, Feldman and Desrochers (2003) attribute the lack of incentives and encouragement for commercial activity, which might have potentially benefited the local area.

Thus, the entrepreneurial university is an instrument that not only provides a workforce and value added with the creation or transformation of knowledge but also improves the individual's values and attitudes towards these issues. During the last years, at the academia level, this has represented a profitable research opportunity area in order to bring examples of good practices, strategies, solutions and recommendations to the university authorities and the policy makers. However, most of studies reveal a tendency to use case studies and the lack of a robust theoretical framework to understand the interrelations among the factors that conditioned the development of entrepreneurial university missions (Guerrero et al. 2006; Guerrero 2008). However, an interesting point is that only few studies in the field have analyzed the academics' intentions (Hay, Butt & Kirby, 2002). From this analysis, the stages model of

an entrepreneurial university can be by an application orientation, a product orientation and a business orientation (Tijssen 2006). In this sense, the university would need to develop several strategies, structures and a culture oriented to reinforce better methods of quality education and training based on the personal growth that supports the creativity and entrepreneurial experience; better strategies for incentives and strong collaborative agreements between university and industry. Only when this prevails than truly the universities will become engines for growth, innovation and regional development. Hence, it is the university, which must generate ideas and create qualified human resources while industry must utilise these as economic resources to transform ideas into economically useful products. This is possible when universities transform and become truly entrepreneurial in their approach and strategic intent.

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KEY TERMS AND DEFINITIONS

Emerging Economy: Is a rapidly growing and volatile economy with low to middle per capita income.

Entrepreneurial Ecosystems: Refer to the components – individuals, enterprises, institutions, resource and information availability, culture or legal mechanisms – outside the entrepreneur that are conducive to, or inhibitive of, the choice of an individual to become an entrepreneur, or the probabilities of his or her success following start.

Entrepreneurial Universities: Are those higher education institutions that clearly define strategies and tools to promote entrepreneurship and innovation, constantly adjusting to learning and knowledge transfer opportunities at regional, national and international levels.

Innovation: Is the process of translating ideas into useful – and used – new products, processes and services.

Knowledge Production: Refers to the cluster of related activities in a higher education institution, a research centre or an enterprise that has to do with producing new knowledge.

Knowledge Transfer: Is the means by which transfer of scientific and technological knowledge and expertise from a knowledge-based organization to those in need of that asset takes place.

Private University: A private university is one where the ownership and operations rests with the private sector. The private simply “means” that the university’s funding comes from tuition and investments.

Regional Development: Seeks to understand better the issues and problems facing the regions because of the contemporary economic and social changes, including the formulation of territorial policies accordingly.

Social Capital: Refers to the community value of the social networks and the patterns of reciprocity that come up from these networks to do things for each other that can leverage initiatives or projects.

University-Industry Collaboration: It refers to any type of cooperation between universities (i.e. their researchers) and companies in order to jointly either develop new goods/services or improve existing goods/services.

University Role: The position and purpose that a university possesses. The role of the university may be for example, communication of ideas. It is considerable that universities have a key role to play in augmenting entrepreneurship since educational institutions are the place in shaping entrepreneurial aspirations among students.

Chapter 6

Entrepreneurship Micro– Ecosystems in Practice

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ABSTRACT

This chapter addresses the role of university campuses as potentializer of the impact of entrepreneurship on regional entrepreneurship ecosystem. The authors define the role and structure of entrepreneurial micro-ecosystems at a university level based on the body of knowledge focused on entrepreneurial and university ecosystems. Based on a specific case of Tecnológico de Monterrey in Querétaro, Mexico, authors construct a three-layer framework for a better understanding of the entrepreneurial micro-ecosystems and its internal and external interactions. Specifically, authors argue that the entrepreneurial micro-ecosystems are endemic to university campuses, and evolve at any type of entrepreneurship-focused university. On the other hand, these micro-ecosystems are scarcely recognized and managed. The authors believe that when they are accounted for and fostered, they generate an exponential effect both for entrepreneurs at the campus as well as for the regional entrepreneurial ecosystem and development.

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INTRODUCTION

Well-functioning and growing entrepreneurial ecosystem is beyond any doubt an important issue for local governments, both public and private institutions that focus to foster entrepreneurship, as well as for the entrepreneurs themselves. The creation of functional entrepreneurship ecosystems is believed to foster innovation and growth of new enterprises, and to create agile collaboration between institutions and entrepreneurs. On the other hand, there are many issues with a rapid employment of entrepreneurial ecosystems without a solid base of knowledge on the topic. Entrepreneurial ecosystems represent the social, cultural, political and economic context surrounding, supporting and influencing entrepreneurs (Neck et al., 2004). There is a growing body of knowledge that takes on the challenge of the definition and theorization of the entrepreneurial ecosystems. The creation and implementation, as well as definition of the processes that take place within the entrepreneurial ecosystems, and what separates well-functioning and poorly functioning ecosystems are topics that need to be understood in order to help building and maintaining an entrepreneurial ecosystem at any level.

Universities play an important role as an actor within the entrepreneurial ecosystems on both national and regional level, since they provide knowledge and education, trained labour force (Spiegel & Harrison, 2018), and in many cases also potential entrepreneurs. The interaction and impact of universities in influencing and shaping the context of entrepreneurs both outside and inside the campuses, represents an interesting branch of research, that is growing in importance.

Understanding the role of universities in the entrepreneurial realm in the last decades led institutions all over the world to shift their attention to entrepreneurship with the intention to improve students' chances for a bright future. The number of entrepreneurship education programs have increased exponentially (Katz, 2003; Kuratko, 2005; Solomon, 2007), and the discussion surrounding their impact on both entrepreneurship development and the entrepreneurial ecosystem is of great interest (Duval-Couetil, 2013; Rideout & Gray, 2013; Martin et al., 2013; Bae et al., 2014).

Most researches that address the issue of the impact of entrepreneurship education focus on a few particular programs (Fayolle et al., 2006; Souitaris et al., 2007; Lanero et al., 2011). We argue that university campuses, especially in universities with a strong focus on entrepreneurship, have turned into entrepreneurial ecosystems on a small scale, and need to be understood better. We believe that these university ecosystems play an important role for the companies that are started by the local entrepreneurs (be it students, alumni or employees of these institutions), and foster the local and regional entrepreneurial ecosystem.

Entrepreneurial ecosystems at university campuses are an organic answer for entrepreneurs' needs and contributions and are composed of many elements depending of the environment they are created in, origin of its economy, business culture and history. Overall, the ecosystems are shaped by the complexity of the university's environment and context. Internal and external forces mold the structure, organization, topics and define stakeholders, depending on the region where the campus or university is located, generating different formats of these "micro-ecosystems". It is a task of the micro-ecosystem managers at the university, to identify the internal and external forces that have a direct impact on the development of entrepreneurs and take advantage of the unique mixture of elements that the environment provides.

In this chapter, we will analyse the background of the entrepreneurial ecosystems in the literature, how they are connected to the entrepreneurial university and their importance for regional development. Based on this discussion, we will analyse and create a framework for entrepreneurial *micro-ecosystems* at a university setting. The term *entrepreneurial micro-ecosystem* will be used throughout the chapter, to

refer to the entrepreneurial ecosystem at a university campus, since we believe that the social, cultural and material setting of the university campus constitutes a specific context for the nascent entrepreneurs at the university, and at the same time this context is a small and integral part of the regional entrepreneurial ecosystem. There are tangible and intangible boundaries and connections between the micro-ecosystem and the regional ecosystem, that create a specific environment for the actors and participants of the micro-ecosystem and can either foster or inhibit creation and growth of businesses. To illustrate the structure and functionality of this entity, we provide an empirical example of an entrepreneurial micro-ecosystem at Tecnológico de Monterrey, Querétaro, México. We propose a theoretical model that describes how the micro-ecosystems interact and potentialize the impact in congruence with the regional entrepreneurial ecosystem, and functions as a growth engine if managed properly and with intent.

BACKGROUND

Entrepreneurial Ecosystems in Theory

To properly understand the composition and function of entrepreneurial ecosystems, we need to take a look at the ecosystems in a broader sense of the word. An ecosystem, or an ecological system, is a biotic community that encompasses both its physical environment, as well as the interactions that are possible within this environment, including both living and non-living components (Tansley, 1935). The metaphor of ecosystem is used in business literature to describe and understand the way how different economic agents interact between each other, with and within the environment (Colombo et al., 2017). The term entrepreneurial ecosystem is, thus, much younger. The concept of entrepreneurial ecosystem represents a framework that helps businesses, academics and policy makers understand the context and places where entrepreneurship grows and successfully develops (Audretsch et al., 2018).

There are many definitions of what represents the entrepreneurial ecosystem, what are the most important actors, factors, props of a proper entrepreneurial ecosystem and how they function together. According to Spiegel (2017), the ecosystems are defined as a “combination of social, political, economic and cultural elements within a region, that support the development and growth of innovative start-ups and encourage nascent entrepreneurs and other actors to take risks of starting, funding, and otherwise assisting high-risk ventures.” The elements of this definition are categorized into three broad groups as cultural, social and material elements. The cultural elements represent the general cultural outlook and attitudes towards entrepreneurship and can either foster the creation of ventures or become barriers. The role of culture, and the importance of a well-developed entrepreneurial culture within the ecosystem is to foster and motivate individuals to take risks that are associated with high-growth entrepreneurship (Spiegel & Harrison, 2018). The social elements, or resources of an ecosystem are the ones that are accessed through the social networks of the ecosystem. These are represented by venture capital, well developed and trained labour force, or mentorship and advice of incumbent entrepreneurs with more experience. The better and denser the social networks of an ecosystem, the better the access to these resources. The role of networks within the ecosystem is to connect entrepreneurs with both capital and employees (Spiegel & Harrison, 2018). The material elements of the ecosystem are represented by institutions and organization within the geographical location of the ecosystem, that are focused on fostering innovative or high-growth entrepreneurship (Spiegel & Harrison, 2018). Within the material elements of the ecosystem are not only incubators and accelerators, firms that provide services to start-ups or the

universities and the physical infrastructure (Patton & Kenney, 2005). The material elements also include the intangible elements of the ecosystem, like programs, policies, training and local markets, but also informal institutions such as legal rights (Bathelt & Glucker, 2011).

There is a discussion in the entrepreneurial ecosystems literature, to what extent is the whole research branch connected to the literature focused on clusters and regional innovation systems, and what is the main added value of referring to a complex of interactions and elements as an entrepreneurial ecosystem instead of a cluster or innovation system (Audretsch et al., 2019). There is however a number of differences that define the ecosystems and are not relevant for either clusters or innovation systems. On the other hand, the entrepreneurial ecosystems literature, and this has to be acknowledged, is built on the pillars elevated by the cluster and regional innovation systems literature, which provide frameworks for the ecosystems research (Spiegel & Harrison, 2018). The important extensions of these two frameworks within the entrepreneurial ecosystems' literature is focused on several areas. The role of state of government, that is crucial in Clusters and RIS, is replaced by the entrepreneurs themselves, who at the same time become the key actors of the system, as opposed to large firms and public agencies. The role of technical and market knowledge is supplemented by specific entrepreneurial knowledge. The focus on single industry and its value chain in clusters and innovation systems is less relevant, since the entrepreneurial ecosystems transcend the industry structure, do not have high levels of direct competition and encourage cooperation (Spiegel & Harrison, 2018).

Within the context of entrepreneurial ecosystems, the act of starting a business is considered the output of the interactions within this complex interconnected system. This output (be it entrepreneurship or innovation as such) is then both enabled and constrained by the context that the ecosystem provides (Acs et al., 2017). However, the interaction of the interdependent actors and the environment relies to a certain extent on the entrepreneurs themselves, therefore the entrepreneurial activity is an important input of the whole ecosystem (Stam, 2015). According to Acs et al. (2017), we can identify three approaches to the current understanding of the entrepreneurial ecosystems: strategy approach, regional development approach and entrepreneurial ecosystems approach.

The strategy approach focuses on the role of the ecosystem in the creation of value by the firms that collaborate through the connections with the different actors in the system (Williamson & De Meyer, 2012). The ecosystem represents the collaboration between a set of partners in order to create a differentiated value proposition for the market. The alignment of the actors in the ecosystem is the central topic of this approach, and the output of the ecosystem is dependent on the degree to which the actors are capable of strategic collaboration.

The regional development approach focuses on the regional ecosystems to explain the differences in the economic performance of the geographic entities. The regional development approach is shaped by concepts such as industrial clusters and districts as well as regional innovation systems, which focus on regional performance in terms of innovativeness, productivity or employment (Stam & Spiegel, 2017). The importance in this approach is the interaction between the people and firms in a specific territory in the struggle for international success. The concentration of complex interconnected companies, service providers, suppliers, and other entities both compete but also cooperate in order to create an ecosystem that allows the region to grow. These also create regional innovation systems, formed by networks of institutions, universities and innovative firms that allow for spillover effects generating regions innovativeness (Cooke et al., 1997).

Entrepreneurship Micro-Ecosystems in Practice

The entrepreneurial ecosystems approach focuses on the understanding of the different factors within the boundaries of an ecosystem that affect high-growth or innovative entrepreneurship, in order to take advantage and foster innovation, growth, and employment creation, which are considered to be the outcome of these types of entrepreneurship (Mason & Brown, 2014). This approach describes the role of the social context in fostering or restricting the process of entrepreneurship (Stam, 2015). The difference between the entrepreneurial ecosystems approach and the before mentioned approaches is that instead of the firm, in the center of the entrepreneurial ecosystems approach is the entrepreneur himself. This approach is of special interest for universities, a place that has the potential to concentrate, develop, connect and promote entrepreneurs. Another important difference is that as opposed to other approaches, entrepreneurship is not a mere output of the ecosystem, but entrepreneurs form central players in the process and are considered “feeders” of the ecosystem (Feld, 2012). The government can also play the role of an ecosystem feeder through the adjustment of laws and regulations in favour of innovative and high growth entrepreneurship. Under this approach, the entrepreneurial ecosystem has nine key attributes: leadership, intermediaries, network density, government, talent, support services, engagement, companies and capital (Feld, 2012). They all play a key role in the development of the functional entrepreneurship ecosystem on a regional or national level. A more process-oriented concept of the entrepreneurial ecosystem can be provided by Stam (2015) who defines the entrepreneurial ecosystem as a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship. A constructive synthesis of the literature led Stam (2015) to create a new model of the entrepreneurial ecosystem and its causality.

We also have to acknowledge, that there is not a single ecosystem in a region, but an interconnected network of systems (Cowell et al., 2018). For entrepreneurship to grow in a region, there is a need to identify and support a spectrum of diverse entrepreneurial activities. Healthy ecosystems develop and promote entrepreneurial resources appropriate for different types of entrepreneurs in a variety of development stages, across the spectrum of entrepreneurial activity. The overall strength and functionality of the ecosystem depends on a number of factors and the way they interact within the system. Spiegel and Harrison (2018) propose a model, where the level of strength of an entrepreneurial ecosystem depends on the social networks that define how well interconnected is the ecosystem, and the resources available within the ecosystem. The level of development of social networks also determine the ease of flow of the resources to the actors within the ecosystem. In a well-functioning ecosystem, the entrepreneurs have easy and functional access to the resources through a dense network created between the actors. These relationships are based on long-term trust and fostered by the local entrepreneurial culture (Spiegel & Harrison, 2018). As the ecosystem develops through-out time, beside the focus on the availability of resources within the ecosystem, as would be intuitive to believe based on the literature, the importance of strengthening the social networks is crucial for a proper development and functionality of the ecosystem.

Every entrepreneur faces disparate challenges and uneven access to resources and networks (Cowell et al., 2018). For example, innovation-driven “gazelle” enterprises have numerous growth-related resource needs that must be addressed by the ecosystem in order for them to develop within the region, including angel, venture and scale-up funding; prototyping equipment and facilities; and research transfer by local universities. Small- and medium-sized enterprises require different services and resources, such as entrepreneurial education programming, subsidized office space and clearer pathways through the government regulatory system.

Within the entrepreneurial ecosystem, it is important to understand that different types of entrepreneurs use a variety of ways to access, and utilize key resources, in order to navigate through the development process. Traditionally, the role of universities in this process is, above all, to provide some of the above-mentioned resources. We believe that the university campuses can go a step further, and form an active part in the entrepreneurial ecosystem, facilitating the access to the resources provided by different actors within the ecosystem and become an engine of social networks creation.

Entrepreneurial Universities and Entrepreneurial Micro-Ecosystems in Theory

Within the entrepreneurship ecosystem on a national or a regional level, universities play a role as providers of leadership, talent, knowledge and support services, but also form a part of the formal institutions. The growth of importance of entrepreneurship in the past decades led to the development of entrepreneurial micro-ecosystems within the university campuses, that play a role in fostering the development of innovative and rapidly growing enterprises, as well as the growth of traditional businesses, founded by the student entrepreneurs (or alumni/faculty). These entrepreneurial ecosystems are closely linked to the regional entrepreneurial ecosystems through a number of channels and in a way constitute a subsystem on their own, since they provide local entrepreneurs and founders with the substitutes of both framework and systemic conditions in a particular way.

Within the literature focused on entrepreneurial education and development, there is a scarcity of definitions and analysis of what constitutes a university entrepreneurial micro-ecosystem, however, there have been several attempts to define this phenomenon.

Miller & Acs (2017) define the university entrepreneurial micro-ecosystems through a lens of frontier attributes that function as enablers for the growth of entrepreneurship within the university campuses. These frontier attributes are liberty/freedom, diversity and available assets. Liberty or freedom represent the ability of students to freely choose the courses and extracurricular activities, the freedom of decision-making and options today's students have in terms of international transfers, research, etc. Diversity is represented by a number of demographic factors, but also fields of study, visiting faculty and students, political ideologies, etc. The available assets can be perceived in terms of courses and educational programs, alumni, professors, labs, networks to other institutions and many more. Important part of these assets available to the actors within the micro-ecosystem the offer of entrepreneurship education programs (EEP) offered by the institution (Henry et al., 2007). The programs should, in an ideal world, be connected and aligned with the necessities of several actors, such as government, institutions (universities, economic development agencies), enterprises, as well as, groups of individuals like students and potential entrepreneurs (Fayolle, 2008).

The entrepreneurial ecosystem at the university is deeply connected with the entrepreneurial culture, that the institution fosters and develops within the campus. The understanding of the development of such culture helps understand the level, at which the university campus functions, as well as coin a strategy for the development of the ecosystem itself. Davis (2001) created a theoretical framework of such systematization. Within this framework, the two variables are degree of systematisation of the entrepreneurial activity, and the degree of importance of entrepreneurialism at the university. The degree of importance defines, how well is the entrepreneurship orientation within the university developed, from marginal, scarcely organized activities, to an extensive number of activities and linkage of entrepreneurial development to the everyday life at the campus. On the other hand, the degree of systematisation refers to the way these activities are organized within the campus. From ad hoc, or low degree of systematisation, which

refers to the more localised and primitive initiatives, often individual or on a department (school) level, to high degree of systematization, which is connected to top-down, and leadership supported orientation of entrepreneurial activities and culture within the university structure. This understanding provides us with a framework that allows us to further analyse the entrepreneurial ecosystems at a university level, and their connection to the outside, external entrepreneurial ecosystems.

Universities focused on entrepreneurship are increasingly dedicated to the commercialisation of knowledge in different forms. The analysis of the focus of universities resulted in formulation of three clusters: the “Entrepreneurial Universities” cluster focuses on changes in the university paradigm; the “Academic Entrepreneurship” cluster refers to the commercialisation of knowledge; and the “Creation of Technology-Based Companies” cluster focuses on spin-off creation (Mascarenhas et al., 2017). These three clusters represent different approaches in the development of entrepreneurial university both in theory and practice and are all endemic of some level of entrepreneurial micro-ecosystems. However, we believe that each of the truly entrepreneurial micro-ecosystem needs to create an environment where these three paradigms can co-exist.

Analysing the entrepreneurial ecosystems at the university level we can see a clear parallel between the entrepreneurial ecosystem as defined by Stam (2015) or Spiegel (2017) and the Miller & Acs (2017) model for the campus ecosystems. We argue however, that every university is an entrepreneurial micro-ecosystem of a sort, intentional or unintentional. The more intentional and aligned (in other words “managed”) the actors and context within the micro-ecosystem, the higher potential impact they have on the entrepreneurs that are active within this micro-ecosystem.

Entrepreneurial Universities and Regional Development

Defining the connection between regional development literature and the role of the entrepreneurial university within this context is important to understand the context of entrepreneurial micro-ecosystems and how they have the potential to influence regional context and entrepreneurial ecosystems outside of the university.

The regional development literature focuses on identifying factors influencing the economic growth (in its different forms and understanding, from employment, productivity, innovativeness etc.), analysing the impact of different characteristics on the region, and developing frameworks to understand and foster this development, within specific geographic areas (Stam & Spigel, 2017). As we mentioned above, the importance of the interaction of the different stakeholders within the entrepreneurial ecosystem, including universities, and the effect of the ecosystem on regional development, can be visible through spill over effects in terms of innovation. The relationship between the networks of companies and institutions within a given region, can have a positive influence on innovation, thus fostering the regional development (Cooke et al., 1997)

In this sense, universities play the role as anchor institutions of regional innovation systems and entrepreneurial ecosystems, since they have a clear social purpose and offer formal and informal support for development (Culkin, 2016). The impact of entrepreneurial universities in regional development has been too focused on the creation of students’ enterprises in the past decade (Miller & Acs, 2017). We argue that a more holistic approach is necessary. Universities and their entrepreneurial ecosystems foster the development of entrepreneurial skills and attitudes as well as new venture creation, which is in line with the view of the entrepreneurial ecosystem literature, focusing on the development of the entrepreneurship specific skills and knowledge (Spiegel and Harrison, 2018). As Galvão et al. (2018)

observe, universities use entrepreneurship education programs that develop students' entrepreneurial spirit. They may lead to new venture creation, but they also impact in the development of other career paths (Jones et al., 2017), and the spill over effect of this knowledge can thus find its way to different actors within the ecosystem.

The contribution of entrepreneurial universities to regional entrepreneurship ecosystems and thus to regional development goes further than just enterprise creation. The metrics that could comprehensively and profoundly evaluate the added value of the universities to the ecosystems are yet to be developed and implemented. Traditionally, technology transfer metrics are the primary way that universities demonstrate their contribution to economic development, but it is a rather limited metric if we want to demonstrate the role played by university in talent development, for example. Walshok and Shapiro (2014) propose that entrepreneurial universities contribute as a function of culture, commercialization supports, talent development and connections with a diversity of industries. Finally, we must take into account that different stakeholders within the university micro-ecosystem will have different interests and objectives, and the metrics should reflect that. For example, university management cares for reputation and rankings, while faculty focuses on student recruiting, and research funding; at the same time business incubators and accelerators look at number of start-ups formed and dollars of capital raised (Huang-Saad et al., 2018).

In the literature review we focused on two main topics, the definition and literature that defines and explores the entrepreneurial ecosystems, and the literature that focuses on entrepreneurial university and the micro-ecosystems that the university campuses develop. Further we looked at the role of the universities and their micro-ecosystems in the regional entrepreneurship ecosystems, and how these two entities interact together. As mentioned before, we believe that the university micro-ecosystems form an integral part of the entrepreneurial ecosystem and are clearly interconnected. At the same time, the micro-ecosystems at the campuses function on their own, as a small version of the entrepreneurship ecosystem. Here actors can not only learn and research, but also create and develop businesses, search for funding, interact with different internal and external players through social networks and take advantage of the cultural, social and material elements of the micro-ecosystem within and across its boundaries. University campuses – and their entrepreneurial micro-ecosystems provide the environment – the general context on a small scale– for students, faculty, alumni and other actors, who can interact with and within this environment to accelerate and foster the creation of high-growth and innovative ventures. In the next section of this chapter, we provide an example of such micro-ecosystem, and based on this example we create a framework for a better understanding of the functionality, and management of a university entrepreneurial micro-ecosystem.

THE CASE OF TECNOLÓGICO DE MONTERREY IN QUERÉTARO

Brief Introduction of the Context

The authors selected a single case-study approach since it provides a more in-depth exploration. Tecnológico de Monterrey was chosen for two main reasons. First, it is world-wide recognized for its entrepreneurship program. In 2018, Tecnológico de Monterrey ranked 10th in the Princeton Review Ranking for Undergraduate Entrepreneurship Programs (The Princeton Review, 2019).

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Second, the university has 26 campuses all over Mexico and 18 international offices. Although they all operate under the same regulations, there are some flexibility concerning the entrepreneurship programs offered by each campus (especially, extra-curricular ones). This characteristic allowed the authors to select a campus that best fits the concept of a micro-ecosystem to study: Campus Querétaro. In concrete, the information for this case-study was obtained from interviews with collaborators, professors and students of the campus, documentation of the activities and personal experience from the authors, from 2016 to 2018. The qualitative analysis allowed the authors to describe the micro-ecosystem and draw generalizations that could be used by other universities.

Tecnológico de Monterrey is located in Mexico, a country located in North America that accounts for more than 110 million inhabitants and has the 15th biggest economy of the world with a value of 1.24 thousand billion U.S. dollars (International Monetary Fund, 2019). It is constituted by 31 states and one federal city, that is the capital (Mexico City). Querétaro is the fifth smallest state in Mexico, located in the central geographical region, although it is ranked among the 5 most important economies of the country by the size (INEGI, 2018) and the 2nd most competitive State after Mexico City (IMCO, 2018). The main city, also called Querétaro, has 2 million inhabitants and concentrates most of the industries and services economy. Querétaro's economy has growth above the national average since 1994 and nowadays it is mainly dependent on Automotive, Aerospace and Metal-mechanic industries (INEGI, 2017).

The university of Tecnológico de Monterrey was founded in 1943 in Monterrey, a city in the north of Mexico. It has more than 57,000 undergraduate students in 26 campuses around Mexico and 18 international offices (Tecnológico de Monterrey, 2019). Tecnológico de Monterrey continually received accreditation by the Southern Association of Colleges and Schools (SACS) for the last 30 years. Also, the last QS ranking released, recognized Tecnológico de Monterrey in place 158 in the QS Global Ranking, place 2 in Mexico and place 6 in Latin America (QS Quacquarelli Symonds Limited, 2019). The main campuses of Tecnológico de Monterrey are located in Monterrey, Guadalajara, Mexico City, Puebla, and Querétaro. Campus Querétaro is one of the oldest campuses, with more than 40 years and more than 17,000 undergraduate students.

The entrepreneurship program in Tecnológico de Monterrey started in 1978 with courses for undergraduate students that led to the creation of business incubators, accelerators and several other initiatives (Tecnológico de Monterrey, 2019). This program is recognized internationally. In 2018, Tecnológico de Monterrey ranked 10th in The Princeton Review for Undergraduate Entrepreneurship Programs (The Princeton Review, 2019). All entrepreneurship initiatives are coordinated by Eugenio Garza Lagüera Entrepreneurship Institute (IEEGL), founded in 2013 and hosted in the Business School (Instituto de Emprendimiento Eugenio Garza Lagüera, 2019). The institute serves all students and faculty of the university, and external stakeholders, coordinating programs that promote the development of the entrepreneurial spirit and creation of new enterprises. Although some programs have a unique design that is replicated in each campus, local teams have plenty of freedom to adapt them to the regional context. This is especially true for non-academic programs, which represent a big portion of the services of the institute.

In more than 70 years, Tecnológico de Monterrey, nationwide, had developed 8 high impact business incubators, 24 basic business incubators, 8 business accelerators, 14 technology parks, 13 centers for family business development, which had helped to create more than 208 thousand companies, generating 2.8 million jobs, contributing to 19.4% of national GDP. High impact start-ups of Tecnológico de Monterrey's ecosystem had been recognized and prize-winner by organizations like Forbes, Babson College, Y Combinator, Plug N Play, Hult Prize, Consumer Electronics Show, Masschallenge, Posible, Global Student Entrepreneur Awards, among others (Instituto de Emprendimiento Eugenio Garza Lagüera, 2019).

Campus Querétaro by its own, had developed more than 900 entrepreneurial projects and businesses, has more than 100 mentors into its programs, and more than 60 companies hosted in the campus' technology park (Instituto de Emprendimiento Eugenio Garza Lagüera, 2019).

Entrepreneurial Micro-Ecosystem at Tecnológico de Monterrey in Querétaro

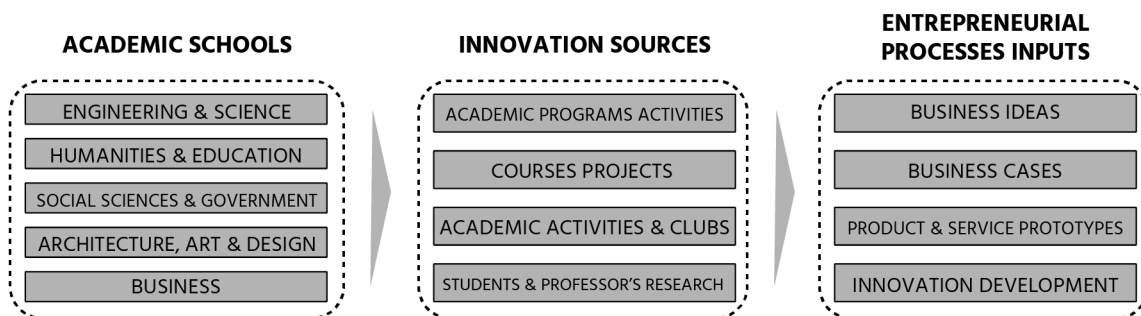
The entrepreneurial micro-ecosystem at Tecnológico de Monterrey in Querétaro has different offers in order to teach the local community about, for and through entrepreneurship (CITA). These offers can be academic and non-academic, and they cover the main three phases of entrepreneurial project development. First, the Inspire and Discover phase: entrepreneurs are at the beginning of their entrepreneurial journey, evaluate opportunities and create business ideas. Second, the Validate and Launch phase: entrepreneurs create and validate business models, start operations, develop a product-market fit. Finally, the Growth and Scale phase: entrepreneurs already operate a company and are focused on scaling the business.

The Entrepreneurial micro-ecosystem of Tecnológico de Monterrey in Querétaro takes advantage of the university environment, recognizing the academic courses and initiatives as one of the most important sources of business ideas and potential start-ups with functional prototypes and validation of research hypothesis. Within this mapping of the entrepreneurial ecosystem of the university, we provide two perspectives. Firstly, we show how the academic schools within Tecnológico de Monterrey interact with the internal ecosystem (Figure 1). Then we provide a global view of the micro-ecosystem, and its interaction with the external stakeholders (Figure 2).

As other universities, Tecnológico de Monterrey is organized by schools that provide different academic programs: Engineering & Science; Architecture, Art & Design; Humanities & Education; Social Sciences & Government; Business; and Health Sciences (not available in Querétaro).

Within the schools there is a high potential for a creation of spin off innovative products and services with functional prototypes based on research and students' academic projects. In Figure 1, we present the process in which students from different schools participate in initiatives that are a source of innovation and therefore, provide the input for the entrepreneurial process. The sources of innovation (such as academic programs activities, projects developed in courses, students' clubs, and research), that are intrinsic within the academic schools structure and process, generate business ideas and cases, prototypes and innovation development that serve as inputs for the entrepreneurial process within the entrepreneurial

Figure 1. Generation of entrepreneurial process inputs within the university
 Source: authors



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micro-ecosystem. The level of Entrepreneurial Processes' Inputs from each academic school, depending on the level of development of entrepreneurial culture; and entrepreneurial potential and performance (Davies, 2001), that influences the school's innovation sources.

In the particular case of campus Querétaro, we could identify the following innovation sources for this process:

- Major in entrepreneurship (Business Creation and Development).
- Basic courses of entrepreneurial leadership and social entrepreneurship (mandatory course for all undergraduate students).
- Courses that use Project Oriented Learning and culminate with a prototype.
- Complete immersion programs for entrepreneurial competencies development through business project development.
- Complete immersion activities for entrepreneurial competencies development through full week activities.
- "Freshmen Entrepreneurship Challenge": one week-long challenge for first year undergraduate students focused on product or service design and sales.

Once the process is in place, mostly detonated by academic innovation sources, several other initiatives constitute the entrepreneurial micro-ecosystem of Tecnológico de Monterrey, in Querétaro.

- Events
 - Talks and peer-mentoring sessions with successful entrepreneurs. Linkage of Business Creation and Development major with other majors' entrepreneurs ("Starters Sessions").
 - Online live podcast with successful entrepreneurs of the ecosystem ("El Drive").
 - Online reading club on business and start-up topics ("BizR").
 - Networking sessions at Technology Park with all entrepreneurial ecosystem groups and external communities.
 - Massive fast mentorship event ("Mentor Hub").
 - Talks and mentorship sessions with family businesses owners, with students that have a participation in a family business ("Family Board Club").
 - Talks and mentorship sessions between businesses owners or high-level companies' managers, and students that manage their own companies ("CEO Skills Club").
 - Hosting of external communities networking events at the Technology Park.
 - Entrepreneurship and innovation festival in Monterrey ("INCmty").
- Competitions
 - National innovative business idea competition for undergraduate and high school students ("La Cueva de Los Lobos").
 - Social innovation businesses competition, in the ideation and launch phases ("Social entrepreneurship contest").
 - Best entrepreneurship projects and businesses are tracked for national and international contests and calls.
- Entrepreneurial Space
 - Free coworking Space at Technology Park for students that are part of academic or non-academic incubation processes.

- Private offices for growing incubated projects at Technology Park.
- Landing spaces for innovative national or international companies at Technology Park, that collaborate with entrepreneurial ecosystem and academic initiatives.
- Entrepreneurs support services
 - Groups of entrepreneurial students in different phases of development, who receive mentoring through weekly session, generate peer mentoring, and look for growth opportunities as a cluster. They are divided into 6 groups by topic/industry: Engineering, Bioengineering, Information Technology, Creative and Cultural Industries, Public Entrepreneurship & Innovative Services, and Highschool Entrepreneurs (“Crowds”).
 - Incubation programs “Tec Lean”: Tec Lean Discovery for customer discovery, value proposition and MVP generation; Tec Lean Launch for go-to-market strategy and sales plan generation; and Tec Lean Growth for company building, operation and organization scaling.
 - Incubation program for social entrepreneurship projects to design innovative social business model in order to generate and measure impact (“Social Entrepreneurship Hub”).
 - Specific workshops on business development topics, and mentorship sessions (“Tec Lean Workshops”).
 - Mentorship program for companies in the phase of growth and scaling process. Campus advisors (expert and successful entrepreneurs) become the board of advisors for the selected high growth companies for a period of two years (“Enlace+ Program”).
 - Business Accelerator: consulting services for companies in growth and scaling phase, focused on solving specific problems.
- High-impact activities
 - Idea innovation boot camp for undergraduate students, through creativity and innovation techniques (“Valuable solutions”).
 - Business model and financial strategies focused on firm creation for undergraduate students in architecture, design, civil engineering, digital animation and public accountants, among others (“Launching my own firm”).
 - Idea innovation boot camp for undergraduate entrepreneurs, focused on incorporating technology, trends and innovative business models into their business ideas (“Alt Impact”).
 - Business idea hackathon aboard a bus on the way to INCmty entrepreneurial and innovation festival (“Bus Challenge”).
 - Workshop focused on business opportunity detection, value proposition design and action steps plan for professors looking for an entrepreneurial career on the campus (“Professors in business”).

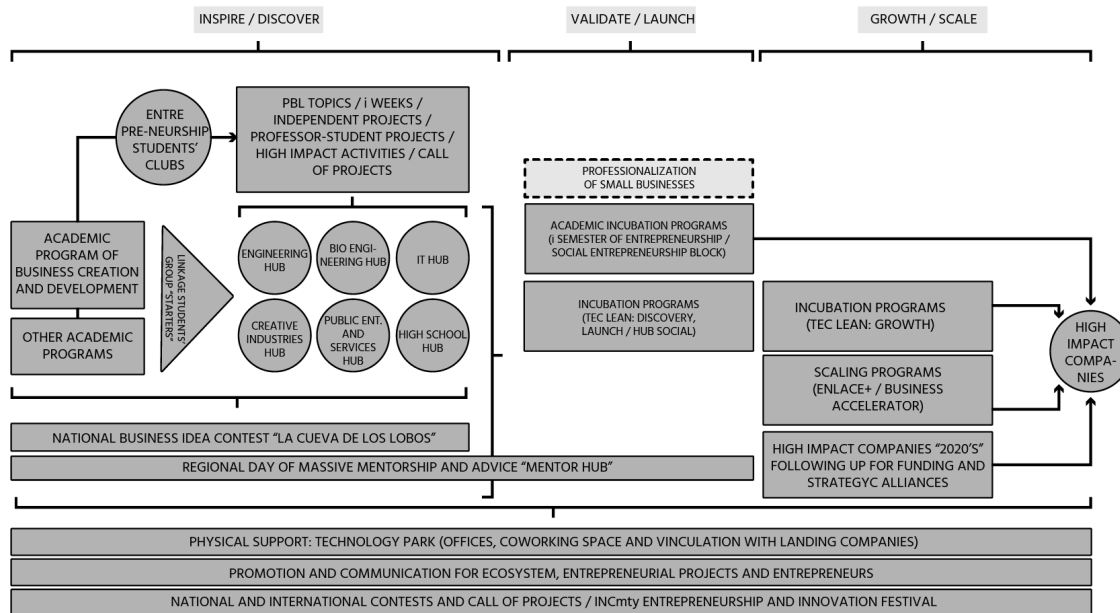
The elements of the university micro-ecosystem on the campus are structured with regard to the level of development of the entrepreneurial project, as mentioned before, and the level of development of the entrepreneur. All the offers (entrepreneurship ecosystem elements, actors and factors) are interconnected and managed by Eugenio Garza Lagüera Entrepreneurship Institute (IEEGL), in order to partner with potential founders throughout their entrepreneurial journey, to create a community, and ultimately, to generate regional development.

With the objective to create impact outside the walls of the university, the entrepreneurial micro-ecosystem of Tecnológico de Monterrey in Querétaro shares its programs, infrastructure and experience with other universities (regardless of the stage of their entrepreneurial ecosystem development), govern-

Entrepreneurship Micro-Ecosystems in Practice

Figure 2. Map of entrepreneurship micro-ecosystem at Tecnológico de Monterrey in Querétaro

Source: authors



ment offices, external actors and independent initiatives of the ecosystem. These strategic interactions allow for the expansion of the opportunities for different entrepreneurs in the ecosystem. Through these connections and interactions, student as well as external entrepreneurs are able to find solutions for their specific needs and foster their entrepreneurial development.

The entrepreneurial micro-ecosystem of Tecnológico de Monterrey in Querétaro is managed by the team of the IEEGL, which is hosted in the Business School. We believe that this arrangement is interesting to share, since in the authors' experience, the entrepreneurship initiatives are usually promoted by different entities in different universities, and often do not achieve a high level of systematisation. The IEEGL has a national director that leads a team of regional directors and national coordinators of academic affairs, social entrepreneurship, and business incubators. Querétaro is the main campus of its region, therefore, the regional director of the IEEGL has her office there and a team composed by the:

- Regional Department Director, who is responsible for the academic operation of the entrepreneurship courses, and for the recruiting and support to entrepreneurship teachers.
- Director of the Major in Entrepreneurship, who is responsible for the management of the program and service to its students.
- Regional Director of the Entrepreneurship Zone, who is responsible for all non-academic initiatives.
- Regional Director of Social Entrepreneurship, who is responsible for those entrepreneurial projects that strongly addresses a social problem

Each campus has a director or coordinator of the Entrepreneurship Zone that is considered the manager of the entrepreneurial micro-ecosystem. She is the champion that articulates internal and external relationships among all actors. In detail, this position is responsible for the:

- Development, articulation and management of business incubators and accelerators in the region through the deployment of incubation models (“Tec Lean”).
- Link with regional external actors such as accelerators, entrepreneurial capital funds, government, public and private programs to support entrepreneurs through the generation of experiences, events, services and public policies.
- Development and management of the network of mentors in the region.
- Design, development and execution of high-impact entrepreneurship experiences such as boot camps, challenges, national and international entrepreneurial competitions.
- Coordination of the participation of the campus in external events and competitions.
- Development and management of the portfolio of projects (“pipeline”).
- Management of entrepreneurship spaces.
- Coordination with academic schools to support initiatives that are sources of innovation.

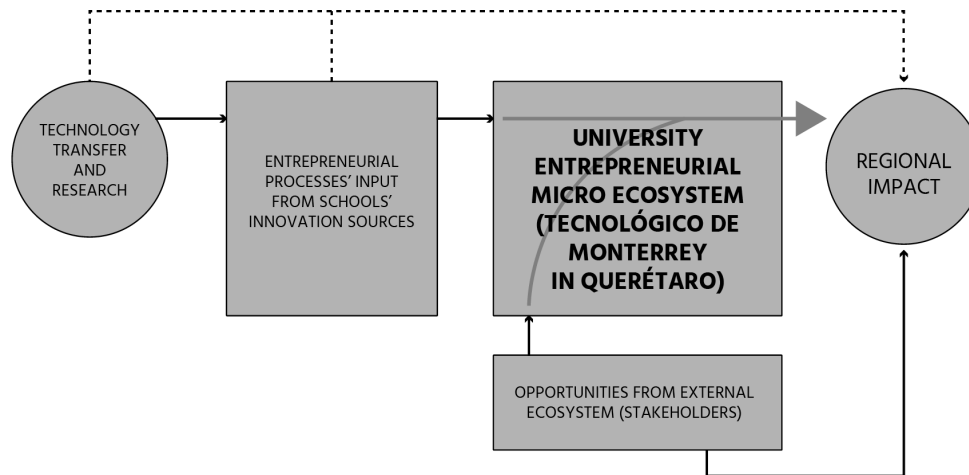
The team that supports the Director of the Entrepreneurial Zone will have as many people as needed by the number of entrepreneurs that they serve. In the case of Tecnológico de Monterrey in Querétaro, there are two people in the team of this person. This creates a valid structure for the management of the entrepreneurial micro-ecosystems on the campus level, and allows for coordination, as well as sharing of knowledge and best practices, and a clear leadership in the initiatives that foster entrepreneurship on a campus level.

Taking in account the entrepreneurial process inputs, generated through the innovation sources within Academic Schools structure, the potential creation of high-impact start-ups is boosted through the infrastructure, programs and team of the university entrepreneurial micro-ecosystem. The micro-ecosystem is fostered and influenced by Eugenio Garza Lagüera Institute of Entrepreneurship (IEEGL), which is nested within the Academic School of Business, however, has influence on the innovation sources and entrepreneurial process inputs from all the other schools. Part of the entrepreneurship institute’s mission is to increase the number of start-ups and companies created by students, professors and alumni. The ecosystem is therefore designed to both help students develop the necessary competencies, but also increases the possibility of generating high impact start-ups and companies within the schools and academic programs.

Important actors within the regional ecosystem map (Figure 3) are the local, national or international stakeholders, organizations or governmental offices and initiatives, or even other universities that manage opportunities from the external ecosystem (such as challenges, hackathons, events, competitions). The external stakeholders promote opportunities to develop business ideas and start-ups with financial support, exposure, high profile relationships and mentors; strengthening the initiatives and programs of the University Entrepreneurial Micro-ecosystem.

Lastly, there is the entrepreneurial micro-ecosystem on the university level, that takes as inputs both the products of academic schools, as well as the external opportunities, and potentiates these inputs in order to generate regional impact (through generation of innovative start-up companies, businesses, and individuals with entrepreneurial skill set).

Figure 3. Relationship of University's Schools and Stakeholders and its impact on Region's development
Source: authors



The case of Tecnológico de Monterrey in Queretaro, and its entrepreneurship micro-ecosystem provided us with the basis to define three layers of the micro-ecosystem framework. In the first layer we defined the way academic schools interact with innovation sources and generate entrepreneurial process inputs, specific for university campuses. We can argue that this process is unique for universities and allows these micro-ecosystems to develop innovation in a more efficient way if managed properly. In the second layer we outlined the tangible and intangible elements of the entrepreneurial micro-ecosystem as such. This layer represents a model for entrepreneurial micro-ecosystem that we believe constitutes added value for both university management and entrepreneurship leaders at university level. The third layer explains how the micro-ecosystem interacts with the regional entrepreneurial ecosystem, and as such becomes an engine of growth for both the entrepreneurs and the region.

DISCUSSION

The entrepreneurial micro-ecosystems as we describe them in this chapter, are a small integral part of the regional ecosystems, however on their own, form an entity that represents a specific context and environment, where entrepreneurs and other actors co-exist, cooperate, develop and grow businesses across different industries. There are cultural, social and material elements within the discussed case, that based on Spiegel and Harrison (2018) are the defining factors of an entrepreneurial ecosystem. The cultural elements represent the attitudes and the culture that fosters and promotes entrepreneurship, created through the more tangible as well as intangible elements of the micro-ecosystem. With the entrepreneurial classes and career, the events, and competitions, as well as the general entrepreneurial spirit that these create among the students and professors, the culture fostering entrepreneurship is embedded into the heart of the micro-ecosystem. The social element of the micro-ecosystem - the access to resources and the strength of the social networks within the campus and across the campus boundaries. The networking events, support services, the entrepreneurial open space, and the immediate availability of experienced mentors and entrepreneurs, both within professors and students, is a strong element of

the micro-ecosystem. The material element, are the tangible elements within the entrepreneurial micro-ecosystem defined in the case such as education programs, incubation programs, and other elements, however it is important to note that the IEEGL forms an integral and beneficial part of the material elements of the ecosystem, that provides structure and organization to the micro-ecosystem. Also, the definition of the functionality and strength of the ecosystem as defined by Spiegel and Harrison (2018) can be applied to the micro-ecosystem. The strength of the networks within and across the boundaries of the ecosystem, depends on the ability of the actors to develop a trusting culture, which is fostered by the faculty and mentors, and thus allows the entrepreneurs to access the resources provided within and outside of the micro-ecosystem. Among the resources are not only the traditional resources of an entrepreneurial ecosystem, but many campus-specific elements such as educational programs, the geographic and relational vicinity of both the incubator and entrepreneurship specific events but also the academic schools with all the technological and industry specific knowledge and machinery at the disposal of the nascent entrepreneurs.

From the perspective of the university entrepreneurial ecosystems literature, the layers of the outlined micro-ecosystem framework that we propose, are based and aligned with the layers defined by Miller and Acs (2017), and reflect the diversity, assets and the freedom of choice within the micro-ecosystem. Both internal and external entrepreneurs are potentialized when they encounter a university entrepreneurial micro-ecosystem highly systematic and important for the institution itself as argued by Davies (2001). The entrepreneurial student exists within the institutional context of a university, that refers to rules, regulations, support initiatives, shared values and norms, and knowledge about entrepreneurship (Ofstedal, 2018), however is at liberty to realize his entrepreneurial potential, through the interaction with the entrepreneurial micro-ecosystem.

If we take the economic development of Querétaro in the last few years and the recognition of the entrepreneurship institute of Tecnológico de Monterrey, as well as the functionality of the entrepreneurial micro-ecosystem at the Tec de Monterrey campus, it is fair to consider that the case-study that we use as a basis for our model could be considered a best practice. We advocate for the development of universities with a strong entrepreneurship micro-ecosystem, that put the entrepreneurs in the center (Feld, 2012), and at the same time strongly agree that these micro-ecosystems, besides support and creation of new enterprises, have to continue their task in the development of attitudes and values towards entrepreneurship, that add value to the society and can be considered as a positive spill-over of knowledge into the regional entrepreneurial ecosystem (Spiegel and Harrison, 2018). We also believe that the main added value of our work - to structure and help define the entrepreneurial micro-ecosystems at a university level, and shed light on the interactions within and across the boundaries of a university campus, is to provide a guideline and a basis for the micro-ecosystem directors and managers at universities not only in Mexico but internationally. These micro-ecosystem managers do not share much besides the responsibility, and rarely have the same position at their institutions. Our experience in the field leads us to believe, that these directors and managers, are often unaware that they are managing an entrepreneurial micro-ecosystem, and even if they are aware of this task, there is a lack of literature, tools and support systems for such management. We believe that our work can help them achieve a better understanding of their task and help them to create entrepreneur-centric support systems within and across the structure of their institutions in order to foster the micro-ecosystems that already exist at their campuses.

CONCLUSION AND FUTURE RESEARCH

The aim of this work was to discuss the role of entrepreneurial micro-ecosystems on a university level from a theoretical and practical perspective. In this particular case, we address the micro-ecosystem within the university presenting the case of Tecnológico de Monterrey in Querétaro, Mexico. Several initiatives within this institution foster the development of entrepreneurs, ranging from academic to extra-academic activities. As our model proposes, these activities may generate exponential results in terms of regional development, when used by researchers and entrepreneurs.

We understand that when researchers, students and external entrepreneurs use the resources of universities entrepreneurship micro-ecosystems, the impact produced in terms of regional development can achieve a higher level of potential. We suggest this is the case because these entrepreneurship micro-ecosystems enhance innovation and reduce risk through high-value networks and training, since entrepreneurial education and training provided by universities is a strategic tool for regional development (Galvão et al., 2018).

Finally, university entrepreneurial ecosystem is a new subject. And our work had a number of constraints and barriers. We based our modelling on our experience and data from Tecnológico de Monterrey campuses and the practices implemented by Eugenio Garza Lagüera Entrepreneurship Institute. The further development of the body of knowledge could benefit from the documentation of other cases, and studies that compare different interventions. For further research we propose comparing initiatives within the micro-ecosystems in the European universities and further on with universities located in the United States. At the same time, future research should focus on new strategies to measure the impact of these initiatives, for the better understanding of efficiency of the micro-ecosystems.

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Chapter 7

The Role of University as Institutional Entrepreneur in Regional Innovation System: Towards an Analytical Framework

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ABSTRACT

Recent literature has moved from a primarily economic perspective to awareness of the institutional role of a university in a regional innovation system. This chapter contributes to the scholarly discussions by combining the theories of institutional entrepreneurship and institutional logics to provide an analytical framework for understanding how universities can support institutional change in a regional innovation system. In particular, the authors consider the university as an institutional entrepreneur that not only initiates diverse changes in the institutional environment, but also actively participates in the implementation of such changes. The analytical framework is used to analyse the case of Tongji University in a regional innovation system in Shanghai, China.

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INTRODUCTION

Contemporary social changes have recently been described as a transformation from a knowledge society 1.0 to a knowledge society 2.0 (Cai, 2018a; Rutten & Boekema, 2012). The assumption of the knowledge society 1.0 is that “learning and knowledge creation as the principal drivers of regional development” (Rutten & Boekema, 2012, p. 982). The core assumption of the knowledge society 2.0 is that learning is a highly contextualized process and as such social capital plays a key role in learning and knowledge creation (ibid). The upgrading of knowledge-based society is connected with a shift from innovation system to innovation ecosystem (Jackson, 2011, p. 2; Oh, Phillips, Park, & Lee, 2016). The innovation ecosystem shares most of its features with the innovation system, which consists of complex functions and interactions amongst various organisations and institutions (Edquist, 1997; Lundvall, 1992). What is new in the innovation ecosystem is its ecological aspect, characterised by the interdependency among different collaborative actors and the co-evolution/co-creation that binds them together over time, along with the sustainable development dimension (Oh et al., 2016; Smorodinskaya, Russell, Katukov, & Still, 2017; Walrave, Talmar, Podoyntsina, Romme, & Verbong, 2017). Due to the features of “interconnect-edness” (everything is connected to everything) and “multi-locational” (knowledge flows and innovation processes take place in multiple geographical locations) in innovation ecosystem (Sotarauta, Heinonen, Sorvisto, & Kolehmainen, 2016, pp. 31-32), the social or institutional context of various innovation actors across geographical areas are becoming more important in analysing innovation process even at the regional level.

In such context, Cai (2018a, 2018b) calls for a new conceptual framework of socially responsible entrepreneurial university to replace entrepreneurial university. One of his major arguments is that in an innovation ecosystem, universities not only serve as a primary engine for economic growth through knowledge transfer as emphasized in the concept of entrepreneurial university (Clark, 1998; Etzkowitz, 2004) but also play an increasingly prominent role in transforming social values and shaping future society. As stated by the Chief of UNESCO for Higher Education, Peter J. Wells: “Perhaps never before in recent history has the role of higher education been so intricately tied to the economic, social and environmental fabric of the modern world” (Wells, 2017, p. 31). This paper aims to theoretically and empirically explore the role of universities in facilitating institutional conditions that are conducive to innovation ecosystems.

In a knowledge society 1.0 or innovation system, the university has been transformed from a secondary to a primary institution for economic growth (Etzkowitz, 2008), and economic growth is increasingly dependent on the cooperation of industry and knowledge production organisations, including universities (Lundvall, 1992). Hence, the main studies tend to explore universities’ economic contributions (Audretsch, 2014; Leisyte & Horta, 2011; Pinheiro, Langa, & Pausits, 2015), seeing universities as economic entities, commoditised knowledge producers, shapers of human capital, and crucial actors in networks (Boucher, Conway, & Van Der Meer, 2003). For instance, a number of concepts, such as those of the entrepreneurial university (Clark, 1998; Etzkowitz, 1983), academic capitalism (Slaughter & Leslie, 1997), Mode 2 knowledge production (Gibbons, 1998), and the third mission (Etzkowitz, Webster, Gebhardt, & Terra, 2000), all examine universities’ economic functions.

Nevertheless, an innovation system is not only economic and technological, but also concerned with institutional change or institutional innovation, because innovation systems consist of complex functions and interactions among various organisations and institutions (Edquist, 1997; Lundvall, 1992). Institution is a central concept in sociological institutionalism (Scott, 2001) and is generally understood as social

orders, social rules, or taken-for-granted norms and beliefs, which are seen by actors as natural, rightful, expected and legitimate (Cai, 2013). As human behaviour is largely constrained or driven by institutions, one key to facilitating behavioural change is through ushering in institutional change (Scott, 2001). The institutional configuration in a regional innovation system may facilitate or hinder the contribution of the university to regional innovation (Boucher et al., 2003). In an innovation ecosystem, the social or institutional dimension, particularly institutional innovation, is becoming more salient (Carayannis & Campbell, 2009; Sotarauta & Heinonen, 2016). This goes along with emerging interest of using institutional theory in innovation system research (Cai, Normann, Pinheiro, & Sotarauta, 2018).

In the literature, there has been growing interest in understanding the dynamics of institutional change in innovation systems (Lundvall, Johnson, Andersen, & Dalum, 2002; Martin, 2013; Perez, 2013), particularly concerning the role of actors and agencies (Sotarauta & Pulkkinen, 2011), supporting institutional logics (Cai, 2014b, 2015) and hybrid and conflicting institutional logics (Cai et al., 2018; Swan, Bresnen, Robertson, Newell, & Dopson, 2010). In addition, research attention increasingly focuses on the role of the university in the changing institutional context of the regional innovation system. Some discussions in the literature about such changing research agenda are provided as follows.

For instance, when explaining the arrival of the third academic revolution, Etzkowitz and Viale (2010) claim that the university becomes an increasingly important platform for societal transformation. In a review article, Paul and Jorge (2015) explicitly address the role of universities in a social capacity (including institutional environments), rather than in terms of economic growth alone. In a similar vein, Goddard and Vallance (2013) call for a change from the predominantly economic perspective of the role of universities in regional development to an integration of the physical, economic and social imprints of universities on regions (Cai, 2014c). In a study on university graduate employability, Cai (2014a) states that universities should not simply meet the demands of industry and the labour market, but should be proactive in shaping the future of the structure of the economy and labour market and introducing new values to society.

The importance of the university as a key agent for institutional change is explicitly addressed by Audretsch (2014, p. 313): “While the entrepreneurial university was a response to generating technology transfer and knowledge-based start-ups, the role of the university in the entrepreneurial society has broadened to focus on enhancing entrepreneurship capital and facilitating behaviour to prosper in an entrepreneurial society” .

Barnett (2011, p. 34) clarifies this point by identifying the similarities between an entrepreneur and an entrepreneurial university. While an entrepreneur attempts to move an entity X from point A to point B, with the aim of seeking profit but often taking some risk, the changes introduced and the risks taken by an entrepreneurial university are largely intellectual, cultural and social. This implies that when a university is becoming an entrepreneurial university, it should not merely focus on “enhancing internal collaborations (coupling) and fostering external partnerships (bridging)” (Pinheiro & Stensaker, 2014); it should also play a role as an institutional entrepreneur, taking action for institutional change (Battilana, Leca, & Boxenbaum, 2009). Such insights are in line with the call of Etzkowitz (2014, p. 1) to “expand entrepreneurship into a broader conception to map its various forms of commercial, social, cultural and civic entrepreneurship” .

In their recent book, *The Entrepreneurial University: Context and Institutional Change*, Foss and Gibson (2015) specifically examine entrepreneurship from the perspective of institutional change. The book discusses how internal institutional changes take place within universities, and how universities

interact with institutional environments to better perform their role in regional development. Similar discussions can also be seen elsewhere (Fayolle & Redford, 2014; Peris-Ortiz, Gómez, Merigó-Lindahl, & Rueda-Armengot, 2016)

Among various efforts to explore the role of universities in effecting institutional change in innovation systems, few have thoroughly explored the process from the perspective of institutional theory. Since the notion of institutional entrepreneur was systematically elaborated by Sotarauta and Pulkkinen (2011) in innovation system studies, enquiries about individual agency in innovation system has come into the centre of research agenda. However, there are few efforts to exploring university actors as institutional entrepreneurs. Even it has been recently argued that “the literature on system building and on institutional entrepreneurship have little overlap” (Kukk, Moors, & Hekkert, 2016, p. 1558).

The paper tries to bridge the gaps by providing an analytical framework for understanding the influence of universities on institutional conditions that foster regional innovation. In so doing, the authors integrate theories of the institutional entrepreneur (Battilana et al., 2009), institutional logics (Thornton, Ocasio, & Lounsbury, 2012) and regional innovation systems (Cai, 2014b). The framework will be applied to an empirical analysis of the role of Tongji University in transforming the institutional context of a regional innovation system in Yangpu District, Shanghai, China. The following research question underpins the framework: How has Tongji University changed institutional conditions in the regional innovation system of Tongji Creative Cluster, in Yangpu District, Shanghai, in which Tongji University is located? The authors selected this case because it demonstrates a unique and successful model of regional innovation system development (Cai & Liu, 2015).

ANALYSING THE ROLE OF UNIVERSITY IN INSTITUTIONAL CHANGES IN INNOVATION SYSTEMS FROM AN INSTITUTIONAL THEORY PERSPECTIVE

The underpinning analytical framework is mainly used to conceptualise institutional conditions in an innovation system and the agency of the University in changing those conditions. These two factors can be analysed using the institutional logics approach and the notion of institutional entrepreneurship respectively. In addition, the theories of institutional logics and institutional entrepreneurship are used to supplement each other. The concept of the institutional entrepreneur is very useful for understanding the role of universities in changing the institutional contexts of innovation systems, but its explanation of the mechanisms underlying the institutional changes is relatively abstract. The institutional logics approach can concretely define the meaning of institutions and is better able to explain the dynamics of institutional change, especially at the micro level. In the following sections, the authors will present insights into institutional entrepreneurship and institutional logics and integrate those insights to provide an analytical framework for elucidating actors' agency in changing institutional logics of a given innovation system as an institutional field.

Institutional Entrepreneurship

The notion of institutional entrepreneurship, which was originally introduced by DiMaggio (1988) as a way to reintroduce actors' agency into institutional analysis, refers to the activities of institutional entrepreneurs, who not only initiate diverse changes in the institutional environment but also actively participate in the implementation of such changes (Battilana et al., 2009). Institutional entrepreneurs may

initiate institutional change intentionally or unintentionally. They may have a high or low social status and “can be organisations or groups of organisations, or individuals or groups of individuals” (Battilana et al., 2009, p. 68). Leca, Battilana, and Boxenbaum (2008) report that institutional entrepreneurship is likely to take place in contexts with conflicting institutional arrangements. Leca et al. (2008) also highlight the importance of “multiple institutional orders” (p. 74) and suggest that “joint actions and interactions between institutional entrepreneurs” (p. 77) provide conditions conducive to institutional entrepreneurship.

The literature of both innovation studies and higher education research reports that universities have increasingly taken cross-border actions through various activities in their social engagement (Clark, 1998; Etzkowitz, 2008; Paul, 2018; Pinheiro, Benneworth, & Jones, 2012). Specifically, universities closely interact with industrial and government organisations in the knowledge society, which is, for example, the foundation of the Triple Helix model (Etzkowitz & Leydesdorff, 1997). In this context, universities are likely to be subject to multiple institutional logics (Liu & Cai, 2018) and thus have the potential to be institutional entrepreneurs.

Institutional Logics Perspective

The concept of institutional logics was originally used by Friedland and Alford (1991) and further elaborated by (Patricia H. Thornton & William Ocasio, 1999) Thornton and Ocasio (1999) and Thornton et al. (2012) to account for the complexity of institutional changes in an institutional system. An institutional system is constituted by institutional logics, which are “the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality” (Thornton & Ocasio, 1999, p. 804). In other words, “institutional logics are the shared conceptual and normative frameworks that provide guidelines for the behaviour of field participants” (Scott, Kirst, Biag, & Sipes, 2017, p. 8).

When it comes to the concept of an institutional system, one must make a distinction between this and the related concept of an organisational field. *Organisational field* as defined by DiMaggio and Powell (1983) refers to “the totality of relevant actors” or “those organisations that, in the aggregate, constitute a recognised area of institutional life” (p. 148). *Institutional field* is a concept proposed by Thornton et al. (2012) in institutional logics analyses. However, the concept has not been clearly defined by the author. A careful reading of Thornton et al. (2012) reveals three differences between institutional systems and organisational fields.

The first difference is that the boundary of an institutional system may cut across several organisational fields (Thornton et al., 2012), although, in some cases, an institutional system as a unit for institutional logic analysis can be an organisational field (Greenwood, Raynard, Kodeih, Micelotta, & Lounsbury, 2011) or a specific organisation (McPherson & Sauder, 2013). Secondly, while an organisational field is subject to the concept of *structuration*, resulting in less diversity within the field (DiMaggio & Powell, 1983), an institutional system may comprise mingling and conflicting institutional contexts (Thornton et al., 2012, pp. 61-62). Finally, the institutional system theory stresses the active roles of both organisational and individual participants of various types in the field, whose interactions may enable institutional changes (Thornton et al., 2012), while the organisational field theory mainly deals with the relations of similar types of organisations within a given institutional environment. Considering the analysis of the differences between the two concepts, we define institutional field as a system of multiple and sometime

contesting institutional logics, in which organisational and individual actors, possibly across boundaries of several organisational fields, are not only influenced by the logics but also foster changes of the logics through their interactions.

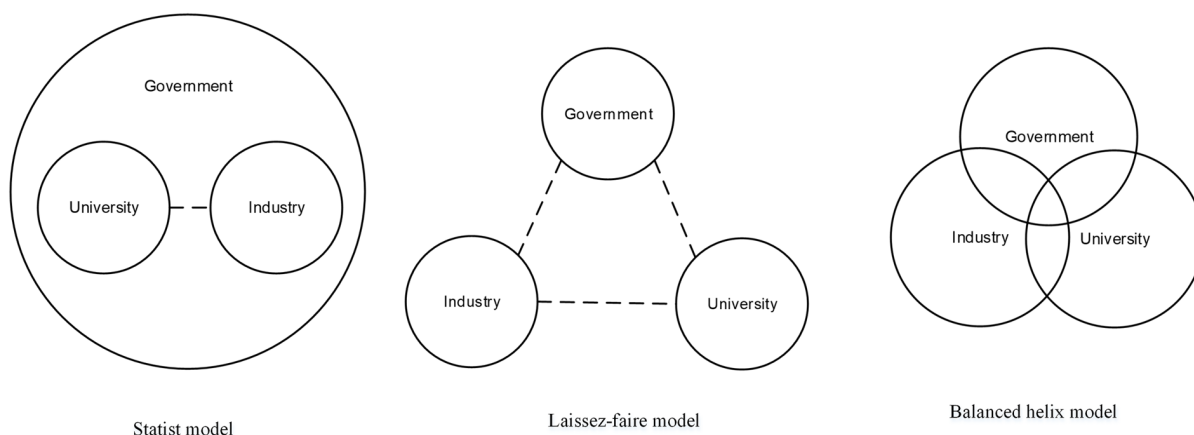
Innovation System as an Institutional System

An innovation system can best be seen as an institutional system because it consists of several organisational fields, such as academia, industry and government as typically discussed in the Triple Helix model (Etzkowitz & Leydesdorff, 1997). Although the concept of innovation system was originally developed for understanding national innovation systems, it has been mainly applied at the regional level (Braczyk, Cooke, & Heidenreich, 1998). In a similar vein, the concept of Triple Helix was originally developed by Etzkowitz and Leydesdorff (1995) to explain the dynamic interactions between the university, industry and government (in the form of ‘taking the role of the other’) for fostering entrepreneurship, innovation and economic growth in the knowledge-based society. Etzkowitz and Leydesdorff (2000) distinguish three types of Triple Helix models, namely the ‘statist model’, the ‘laissez-fair model’ and the ‘balanced model’ (Figure 1).

In the statist model, government controls both academia and industry, and is expected to take the lead in developing projects and providing the resources for new initiatives. In the laissez-faire model, industry, academia and government are separate from and independent of each other. These actors interact only modestly across strong boundaries. In the balanced Triple Helix model, as an ideal model, the three spheres overlap and collaborate. ‘The balanced configuration offers the most important insights for innovation, because the most favourable environments for innovation are created at the intersections of the spheres’ (Ranga & Etzkowitz, 2013, p. 239). The balanced model is considered an ideal Triple Helix, in which one key characteristic is that the university is transforming towards entrepreneurial (Etzkowitz, 2008).

From the institutional logics perspective, a regional Triple Helix system can be seen as an institutional system in which organisations and individual actors from different sectors interact with each other and thus are immersed in a multiple logic environment. The actors with crossing-sector experiences

Figure 1. Three triple helix models
Source: Etzkowitz and Leydesdorff (2000)



are likely to become institutional entrepreneurs to change the institutional settings in the institutional system of Triple Helix. Cai (2015) identified seven 'ideal' institutional logics aligned with 'ideal' triple helix interactions between university, industry, and government in an innovation system. These logics are: 1) Shared belief in technological innovation as the key to economic growth, 2) Market orientation; 3) Process management; 4) Effective IP protection systems; 5) Civil society; 6) Competitive market; 7) Democratic policymaking.

While using the Triple Helix model to comprehend the innovation system, the authors are aware of the critiques to the Triple Helix approach, e.g. for lacking theoretical foundations (Cooke, 2005, p. 1130; Shinn, 2002, p. 609; Viale & Pozzali, 2010, p. 576), being less contextual sensitive (Balzat & Hanusch, 2004; Cai, 2014b; Mowery & Sampat, 2004) and too normative (Benneworth, Smith, & Bagchi-Sen, 2015, p. 7). One of the most well-known argument is made by Carayannis and Campbell (2009), who claimed that the Triple Helix is shifting towards to the Quadruple Helix, adding the civil society as the forth helix.

Regardless of these critiques, the authors consider the Triple Helix approach useful in this study for three reasons. First, the authors see that the Triple Helix and Quadruple Helix are not competing approaches. Following the recent development of the Triple Helix thesis, the authors share the view that civil society is too important to be merely treated as an additional helix in the Quadruple Helix. Rather it is an institutional ground (Cai, 2014b, 2015) or "a launch pad for the take-off of triple helix interactions" (Etzkowitz, 2014, p. 19). Second, the authors acknowledge the theoretical weakness of Triple Helix, and thus when building the analytical framework in this study the authors also aim to enhance its theoretical grounds. Third, compared to other approaches to analysing regional innovation, e.g. innovation system (Edquist, 1997; Freeman, 1987; Lundvall, 1992) and open innovation (Chesbrough, 2003), "the Triple Helix model reduces the complexity of the dynamics at play in the innovation systems of the knowledge economy" (Zheng, 2010, p. 41). Such reduction in complexity is, however, a key theoretical advantage of a model according to the razor principle of Occam (Walsh, 1979). For example, the Triple Helix model has been successful used in analysing Chinese innovation systems (Cai & Liu, 2015; Etzkowitz & Zhou, 2018; Liu & Cai, 2018).

Axiom of Institutional Entrepreneurship from the Institutional Logics Perspective

The theories of institutional entrepreneurship and institutional logics shed light on how actors may induce institutional changes. Battilana et al. (2009) suggest that institutional entrepreneurs implement the changes by two means: firstly, by creating a vision for change, and secondly, by mobilising and motivating others to achieve and sustain the vision. The vision can be framed as 1) an exposition of the problems of current institutionalised practices, 2) the reasoning of a burgeoning institutional template, and 3) the promotion of a proposal for change. To realise the vision, institutional entrepreneurs can mobilise existing and potential allies in three ways, namely 1) developing narrative rhetorical arguments for change but referring to existing institutional templates through storytelling or theorising stories, 2) providing financial/material resources, and 3) utilising the formal and informal positions of the institutional entrepreneur.

While the institutional entrepreneurship literature better explains the enabling conditions and means of institutional entrepreneurs, it does not provide a micro-level account of how the entrepreneurship actually takes place. The institutional logics perspective (Thornton et al., 2012) offers supplementary insights in that it deals with how institutional entrepreneurs influence the attention, identities and goals of individuals so that new institutional elements or logics may be institutionalised.

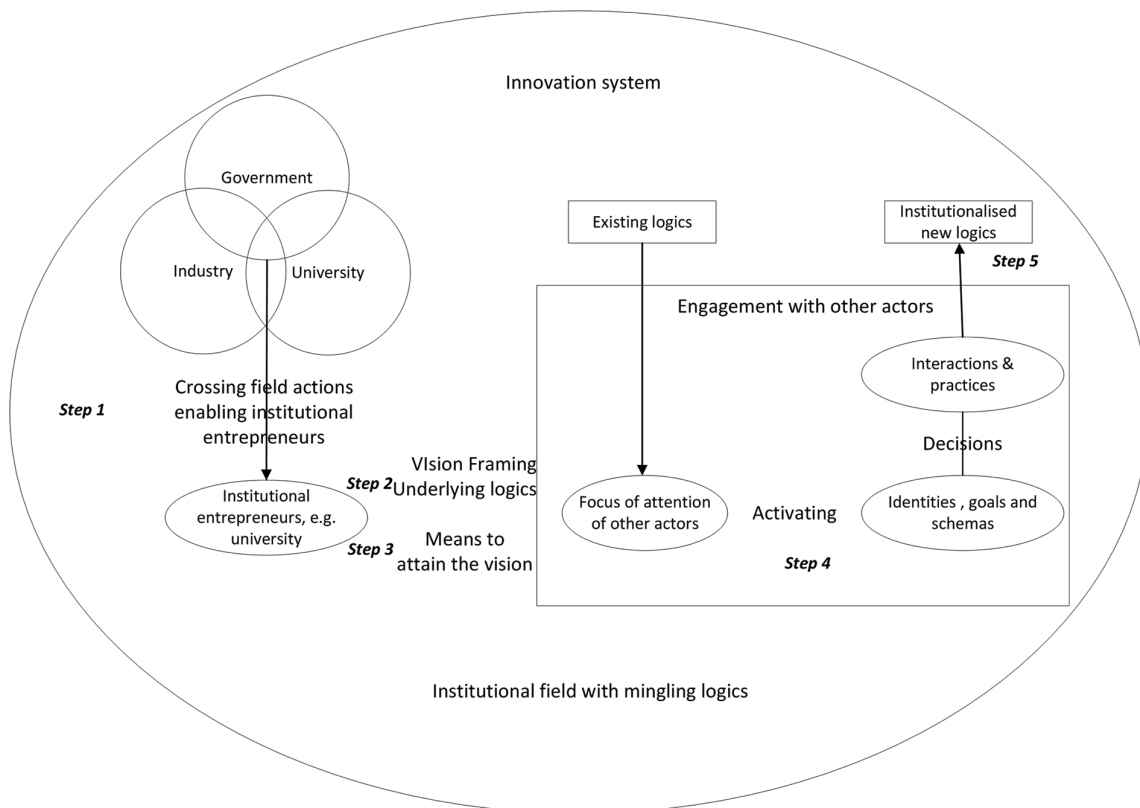
Institutional logics perspectives consider institutional changes as the process of migration of elements of institutional logics in an institutional field. Drawing on the concept of the transposition of schemas of Sewell (1992), Thornton et al. (2012, p. 61) propose the concept of institutional transposition for understanding the process of recomposing different institutional logics with the influence of certain actors or institutional entrepreneurs.

Regarding the role of actors' agency in institutional change or transposition, Thornton et al. (2012) stress the concept of "focus of attention". While both individual and organisational actors in an institutional field often have multiple social identities, goals and schemas that help social actors to process information and guide decisions, they tend to favour one set when taking concrete action, depending on their focus of attention. The actors' focus of attention is structured by the dominant logics in the field.

Analytical Framework

By combining the insights of institutional entrepreneurs and institutional logics, a micro theoretical explanation of institutional entrepreneurship in the context of a regional innovation system can be formulated as shown in Figure 2, implying a five-step analysis of institutional entrepreneurship, specifically with regard to how the university as an institutional entrepreneur influences the constellation and changes of institutional logics in a regional innovation system.

Figure 2. Axiom of institutional entrepreneurship from the institutional logics perspective
 Source: drawn by authors



The Role of University as Institutional Entrepreneur in Regional Innovation System

Firstly, and most importantly, conditions must be favourable to institutional entrepreneurs. Institutional entrepreneurs are most likely to emerge among those actors who have cross-sectoral actions (Battilana et al., 2009) and experience different institutional logics (Thornton et al., 2012). In the context of Triple Helix interactions, the university is exposed to the multiple logics of different sectors and, thus, has the opportunity to become one of the institutional entrepreneurs. While the institutional life may be stable in one sector, the involvement of other sectors often brings new logics, triggered and facilitated by institutional entrepreneurs through their visions and capabilities. Since institutional entrepreneurs trigger and facilitate institutional changes by framing new visions and using certain means, the analysis in the following two steps will deal respectively with the visions and means.

Secondly, in most cases institutional entrepreneurs adopt new logics that lead them to create new visions, and then they influence other actors with the vision, either intentionally or unintentionally. Thus, the following analysis identifies what new visions are initiated by the institutional entrepreneurs, as well as the new institutional logics underlying the visions.

Thirdly, to influence others with new visions, institutional entrepreneurs must employ certain means by creating a vision for change and by mobilising and motivating others to achieve and sustain the vision (Battilana et al., 2009). Framing the vision and the consequent interactions among the actors may result in new kinds of organisational practices, which in turn activate the available but less readily accessible logics in the field. Here, the focus of analysis is on identifying the means.

The fourth stage of analysis provides a micro-level account of entrepreneurship, which assumes that the changes of institutional logics in a given field are due to the shifting focus of attention and the activation of the hidden or implicit identities of individuals. Following the institutional logics approach, institutional entrepreneurs modify the visions of the other actors by redirecting their focus of attention. The new focus of attention may activate the hidden parts of the actors' identities, goals and schemas in the field. The institutional logics literature suggests that actors often have multiple identities and schemas, some of which are explicit and some implicit. For instance, Thornton et al. (2012, p. 17) maintain that all institutional logics, regardless of their levels, are "embedded in societal-level logics and subject to [the] institutional field-level change process". Therefore, although the actors' explicit identities and schemas are mainly informed by the prevailing logics in a given field, in which the actors have been mostly active as people living in a society, other logics and associated identities are available to the actors (albeit in an implicit manner) and may under certain conditions be activated.

Finally, the changes in the identities, goals and schemas of the actors in a regional innovation system, as well as the consequent interactions among the actors, may result in the emergence of new kinds of organisational practices, which lead to the institutionalisation of the new logics. The new logics (alternative logics or the blending of different logics) may become dominant or institutionalised in the field and, thus, the institutional change can be achieved, sometimes with unpredictable results.

Next, the authors will apply the analytical framework to a case study. In so doing, the authors can further justify the usefulness of the framework.

THE CASE: TONGJI CREATIVE CLUSTER

Method and Sources of Data

The authors employ a case study approach because the research seeks to understand the deep meaning of a phenomenon that is little-known and context-bound (Yin, 2003). In this paper, the authors selected the case of a specific regional innovation system (Tongji Creative Cluster in Yangpu District, Shanghai, China) because it demonstrates a unique and successful model of a regional innovation system development (Cai & Liu, 2015). Tongji University, located in Yangpu District to the northeast of Shanghai, has nearly 40,000 students and 2,770 teachers (as of December 2016). Tongji Creative Cluster was developed by combining the elite of the leading disciplines of the University (such as architecture, urban planning and civil engineering) to commercialise academic research and manage industrial linkages. It is the first and only national-level cluster based on knowledge-intensive services in China.

The main sources of data include academic publications, policies, and planning documents, as well as interviews conducted during the period December 2014 to January 2015. The interviewees included University leaders (two), academic entrepreneurs (two), firm managers (four) and government officials (two). All of them were heavily and actively involved in the development of the cluster at different stages. The interviewees were initially contacted through personal connections of the authors. These people were then asked to suggest other suitable informants from among their acquaintances, following the ‘snowball’ technique. The interviews were generally conducted at the workplaces of the interviewees, and varied in length from 30 to 60 minutes. Semi-structured interview questions were designed, which were guided by the analytical framework.

Tongji Creative Cluster as an Institutional Field and the Change of Institutional Conditions

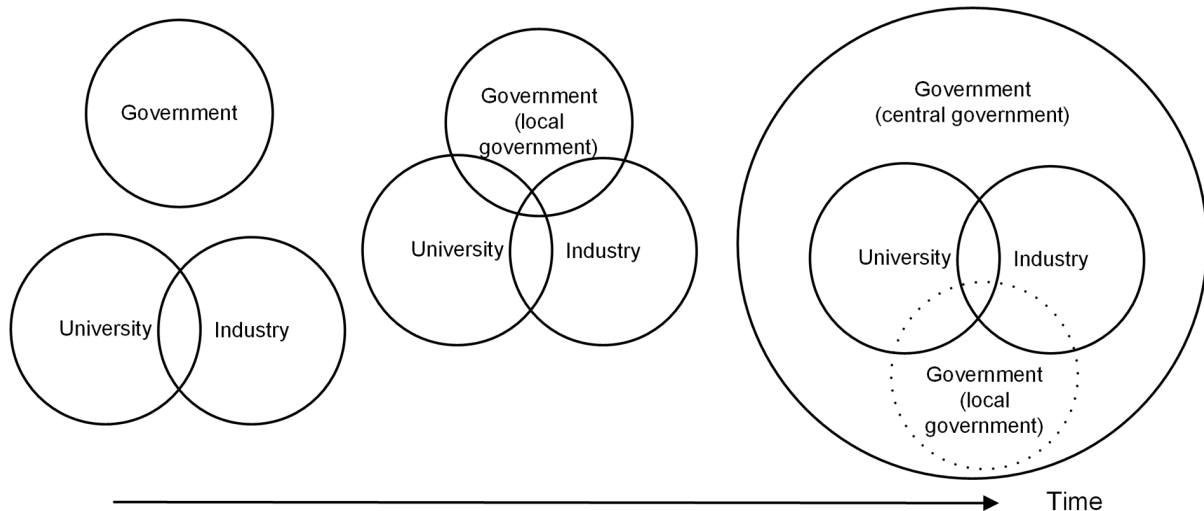
Referring to the Triple Helix model, Cai and Liu (2015) considered the development of Tongji Creative Cluster to be a “delayed government-led Triple Helix model” (Figure 3), in contrast to a common perception that the government always plays a dominant role in innovation systems in China (Etzkowitz, Dzisah, Ranga, & Zhou, 2007).

In the initial phase (1980s–1990s), the interactions between Tongji University and the surrounding industry were spontaneous, and there was no government interference. While these companies grew very fast, the cluster gradually attracted special attention from the local government, namely Yangpu District Government. The cluster then entered into a second development phase (2000s) in which the relations between the University, industry and (district) government closely resembled the ‘ideal’ balanced Triple Helix model. Here, the Yangpu District Government engaged as a partner, performing its role through “reflective control” (Etzkowitz & Leydesdorff, 2000). The local government provided financial resources to promote the development of the cluster and also created matching policies. In the final phase (2008 onward), the Shanghai Municipal Government and the central government became involved and took control of the overall development of the cluster.

When analysing institutional changes in the Tongji Creative Cluster, the authors focus on the institutional change in the first and second phases, because the model in the second stage is close to an ideal Triple Helix model (Cai & Liu, 2015). Regarding institutional changes the authors focus the analysis on the shift from a weak perception of the importance of knowledge in economic growth, with the main

Figure 3. Delayed government-led triple helix model

Source: Cai and Liu (2015, p. 26)



actions focused on reviving traditional industry in the 1980s–1990s, to a strong belief in knowledge as being the key to economic growth in the 2000s. The latter belief is reflected in the capitalisation on the expertise of the University and the incubation of small and medium companies to develop knowledge-intensive services in the areas surrounding Tongji University (Cai & Liu, 2015). The development of Tongji Cluster is also associated with other kinds of institutional changes. However, the institutional change regarding the shared belief in technological innovation as the key to economic growth is the most substantial one, thus providing the best opportunity to reveal the central role of Tongji University in introducing the institutional change. In the following analysis, the authors will illustrate how Tongji University played the role of institutional entrepreneur following the five-step analytical framework presented earlier.

ANALYSIS OF THE ROLE OF TONGJI UNIVERSITY IN INSTITUTIONAL CHANGE

Enabling Conditions of Institutional Entrepreneurship (Step One in the Analytical Framework)

The role of Tongji University as an institutional entrepreneur is mainly through its members, including University leaders who actively liaise with local governmental officials and industrial leaders, and those staff, students, and alumni who were initially engaged in University spin-off activities. In other words, these individuals are actual institutional entrepreneurs. They enable institutional entrepreneurship due to two fundamental conditions, namely: 1) access to multiple institutional orders to initiate new institutional logics; and 2) joint actions and frequent communication with other actors to influence the logics of others (Battilana et al., 2009; Thornton et al., 2012).

The cross-sector interactions of the institutional entrepreneurs were deeply embedded in the institutional context of China and Tongji University at that time. After the reform and increasing openness of China in the 1980s, the traditional means of income distribution in universities were eliminated. Personal income was largely dependent on the profits from research programmes. This generated enthusiasm amongst professionals to apply their knowledge and research results to commercial use and to build links with business communities.

At the same time, Tongji University offered an encouraging environment for entrepreneurial activities: no restrictions were placed on the engagement of teachers in entrepreneurial activities or the part-time jobs of students, nor was there any regulation of those activities that undertook commercial programmes by virtue of the University brand and intangible capital. The University only charged the staff a certain amount of money as a management fee, “usually 20 percent of the profit of each project” as explained by a University leader. By contrast, “if the projects were carried out in an independent company, the University charge was no more than 10 percent of the profit,” one enterprise manager stated. Therefore, most teachers and scholars preferred to run the business themselves in order to maximise the benefit to themselves.

The attitudes of the staff members influenced the students and graduates of the University to also engage in business operations. Some projects undertaken in external companies were selected as teaching examples in the courses of the University. The students were also encouraged to undertake internships and part-time jobs in external companies to gain experience and earn money. It has been reported in 2005 that 42.9 percent of the students in Tongji University had part-time jobs in Tongji Creative Cluster, of which 53.6 percent were involved in programmes related to their majors (B. Chen, Liu, Fan, & Peng, 2006).

As demonstrated in the 2012 official brochure of Tongji Creative Cluster, about 80 percent of the entrepreneurs in the cluster are employees, students, and alumni of Tongji University. These people, having gained experience in both the business and academic sectors, enjoy access to cross-sector logics. They also have more opportunities to communicate and collaborate with people in both academia and business.

Moreover, the cross-sector interactions included the local government, Yangpu District Government. Long-term and multi-level collaborations were conducted between Tongji University and Yangpu District Government. Since the beginning of the 2000s, the leaders of both Tongji University and Yangpu District Government have established regular communication channels in the form of joint meetings and seminars. Moreover, scholars of Tongji University often work as professional consultants in the government sector. Thus, these University leaders and consultants may have considerable influence over policymaking, which directly contributes to institutional change.

In summary, the cross-sector actions of some academics, students, and University leaders provide conditions for them to become institutional entrepreneurs who have the potential to trigger and facilitate institutional logics, primarily through formulating new visions.

New visions Created by the Institutional Entrepreneurs of Tongji University (Step Two in the Analytical Framework)

When Tongji Creative Cluster was undergoing fast development and its socio-economic effects began to show up, Yangpu District was suffering from urban decay as a traditional industrial base. The previously flourishing traditional industries in that district, such as textiles and manufacturing, could hardly adapt themselves to the new economic situation. The contribution of industrial added value to the urban added value in the Yangpu District decreased from 34.24% in 1992 to 18.57% in 1998, and even became

a negative force for economic growth (Li & Chen, 2005). The Yangpu District was under pressure to transform its economic development model. The prospering of Tongji Creative Cluster at that time provided an opportunity to promote the regional development of Yangpu District. As the TJU spin-offs were heavily based on technological expertise and know-how, such as in the disciplines of architecture and civil engineering, university leaders and academics engaged in spin-off activities (as institutional entrepreneurs) tried to influence other key actors in the region, such as the district government and other entrepreneurs, towards a shared belief that high value-added or knowledge-based products or services embedded in the university were the key to the success of industry and business in the district. As one professor acknowledged, 'teaching and research in the university provided lots of fresh ideas, innovative methods as well as cheap labour (the intern students) for the enterprise'.

Means of the Institutional Entrepreneurs to Influence Other Actors' Visions and Actions (Step Three in the Analytical Framework)

To sustain the vision, the Tongji University entrepreneurs mainly employed the following three means. Firstly, they made plans for the development of the cluster which entailed necessary institutional changes. They organised a special *Science and Technology Salon* and invited representatives of government and enterprise to participate, evincing powerful arguments for the orientation of the Cluster towards knowledge-intensive services. In 2007, Wan Gang, who was at that time the president of Tongji University and later became Minister of Science and Technology for China in the same year, proposed expanding the cluster around Tongji University together with some distant nodes and developing it into a knowledge-economy cluster. An attractive proposal for the development of the Cluster encouraged other actors to appreciate the vision created by Tongji University.

Secondly, the institutional entrepreneurs mobilised knowledge resources and financial resources to influence the visions of other actors. They provided consistent intellectual support, such as technical expertise and human capital, to the enterprises and government offices in the Cluster. These resources were imbued with ideas and values from the University. "Some research groups were directly organised as a company and ran businesses outside of the University," said one professor of Tongji University. This enabled a natural transition from the internal operations to external cooperation. Moreover, Tongji University spin-offs paid a huge amount of tax to the local government and provided many jobs for the local population (Yangpu District Government, 2011; Yuan & Zhao, 2011). The substantial economic contribution made by Tongji University to the region (Yangpu District) helped the government, industry and other actors in the Cluster to accept the vision created by Tongji University.

Thirdly, the institutional entrepreneurs utilised their positions to impart their vision to others. The urban planners employed by Yangpu District Government to design the blueprint of the Tongji Creative Cluster were also the entrepreneurs of Tongji University spin-offs. Due to their multiple roles, the academics influenced the vision of Yangpu District Government and therefore the vision of the University was directly incorporated in the planning policies of Yangpu District Government (Yu & Chen, 2005). Two other important figures were Wan Gang, mentioned above, and Wu Qidi, the former president of Tongji University who was appointed Vice Minister of Education in 2003. The endorsement of Wu and Wan helped to introduce the vision of Tongji University to the municipal and central governments through their position power. This resulted in Tongji Technology Park being recognised as a national example of entrepreneurial excellence in 2003, 2005, 2009 and 2010, respectively.

Changes in the Focus of Attention Among Other Actors (Step Four in the Analytical Framework)

As described in the analytical framework, institutional entrepreneurs implement institutional change by influencing the focus of attention of other actors. While the previous section presented the institutional entrepreneurship activities of Tongji University, as well as their possible influence over others with respect to institutional logics, here the authors describe behavioural changes of other actors, namely Yangpu District Government, the non-spin-off companies, and the more conservative academics.

Yangpu District Government

Yangpu District, as a traditional industrial region, was suffering from urban decay. The previously flourishing traditional industries in that district, such as textiles and manufacturing, had difficulty adapting to the new economic climate. The contribution of industry to the urban added value in the Yangpu District decreased from 34.24 percent in 1992 to 18.57 percent in 1998, and even became a negative force for economic growth (Li & Chen, 2005). The Yangpu District was under pressure to transform its economic development model and the growth of Tongji Creative Cluster at that time provided an opportunity to promote the regional development of Yangpu District.

In the course of frequent interactions with the institutional entrepreneurs of Tongji University, Yangpu District Government realised the economic value of higher education resources in the region and decided to make use of the spill-over effect of the University for enhancing economic growth. Given the advantages of Tongji University and the characteristics of its spin-offs, Yangpu District Government adjusted its strategy from developing university towns to focusing on high-tech enterprises, and then to incubating small- and medium-sized start-ups based on knowledge-intensive services. Furthermore, Yangpu District Government assumed the roles of land developer, venture capitalist, and business broker, in addition to governmental agency, to provide the necessary services and support for the development of the Cluster. For example, Yangpu District Government managed to meet the spatial expansion demand of the cluster and to optimise the urban land use structure in Yangpu District by expropriating and reallocating the land use rights of the different actors. It also set up several state-owned enterprises and collaborated with some commercial developers to promote development within the cluster.

Non-Spin-Off Companies

In business collaboration with the institutional entrepreneurs, many non-spin-off companies were clustered around Tongji University. They gradually became aware of the necessity of making full use of the University resources. One enterprise manager told us: “The internships and part-time jobs of the students provided a lot of cheap and intelligent labour for our company; some of them became full-time employees in our company after graduation.” Some design companies also wished to build long-term collaboration with the University by providing scholarships, and they were eager to participate in the academic activities of the University through seminars and conferences.

Conservative Academics and Students

Exposed to the visions of the institutional entrepreneurs, the more conservative academics began to pay increasing attention to technology transfer and became more interested in business activities, either setting up their own companies or working as professional consultants in other firms. This trend was intensified by the regulations of the University, which not only granted financial rewards, but also promoted opportunities for the staff according to their business project involvement.

Encouraged by the entrepreneurial teachers and colleagues, the students also took part in technology transfer and business activities at early stages of their studies. As one student mentioned, it was considered critical to their future career development to maintain their connections with the firms in the Cluster. In the process, the students gained professional experience, entrepreneurship knowledge, project management skills, market awareness, and social capital, which laid a solid foundation for their future careers. Many of them became skilled personnel in Tongji Creative Cluster.

New Logics Brought About by the Institutional Entrepreneurs (Step Five in the Analytical Framework)

Along with the influence of institutional entrepreneurs and the behavioural changes of other actors, a shared belief in knowledge as the key to economic growth was established in Tongji Creative Cluster. In the 2000s, Yangpu District Government issued a series of policies to institutionalise the new institutional logics initiated by Tongji University in the field (Table 1).

However, the shared belief on knowledge as the key to economic development and the role of the university in promoting such institutional changes also brings about potential anxiety about the nature of the university and generates doubt about the effectiveness of the university engagement activities. As many students and professors worried about, “the academic atmosphere in the university became

Table 1. Policies of Yangpu District Government to institutionalise the new logics

Year	Policies and programmes	Target actions	Authorities
2000	Decision to on universities to foster the economic and social advancement of Yangpu District	Encouragement of the role of universities in local economic development	Establishment of Yangpu District Government (Science and Technology Committee)
2004	Suggestions for strengthening and improving services to the enterprises	Establishment of an integrated platform to help enterprises solve management problems such as funding applications, personnel recruitment, vocational training, project evaluation, marketing and branding	Yangpu District Government
2005	Loan guarantees introduced for SMEs	Simplification of the financing and loan procedures for enterprises	Yangpu District Government (Finance Bureau)
2007	The 32 Measures on Talent to Develop Science and Technology	Efforts to attract highly skilled individuals through the provision of residence permits, tax exemptions, etc.	Yangpu District Government (Organisation Department)
2008	Introduction of measures utilise and manage the supporting funds for industrial development in Yangpu District	Detailed financial support for programmes with the potential for science and technology transformation	Yangpu District Government (Finance Bureau)

Source: drawn by authors

weaker and weaker. Few teachers would like to do teach and research whole-heartedly in the labs; they are eager to apply their knowledge into market. The job in the university was only a platform for them to get the market resources.” Such anxiety is in fact not a unique case in Tongji Creative Cluster, but a common concern in most entrepreneurial universities. As argued by Washburn (2005), the anxiety is not about the engagement of the university per se; rather it is because of the elimination of previously clear boundary between university and other organizational fields.

CONCLUSION

The paper contributes to the literature on the role of the university in changing the institutional context of innovation ecosystems. The analytical framework was developed by integrating two aspects of institutional theory, namely institutional entrepreneurship and institutional logic. On the one hand, the institutional logics perspective helps to identify the concrete institutional logics in the institutional field of Tongji Creative Cluster and provides a more detailed account of the process of institutional change. On the other hand, the institutional entrepreneurship approach is particularly useful when distinguishing between those actors initiating logics and those adopting them. For instance, this study considered the institutional entrepreneurs to be University leaders, employees and students engaged in the business operations of the University. The institutional entrepreneur theory also serves as a good analytical tool for understanding major institutional entrepreneurship activities. Whilst acknowledging the importance of social status in fostering institutional change, the study reveals that knowledge and cross-sector interactions are particular capabilities for enhancing universities’ institutional entrepreneurship.

In addition to verifying the analytical framework in the case analysis of the Tongji Creative Cluster, the empirical findings also challenge a prevailing view on institutional change in the regional innovation system, particularly in the context of China. It has been generally accepted that the multi-level governments were major agents in the institutional building of Tongji Creative Cluster (Yuan & Zhao, 2011). As Pavitt and Patel (Pavitt & Patel, 1999, p. 103) state: “The technological competitiveness of firms inevitably depends on national systems of innovation, and national systems of innovation inevitably depend on government policy”. Indeed, the development of national innovation systems in China comes from top-down initiatives (Etzkowitz et al., 2007, p. 16). Besides the importance of the national framework, the major government agencies for developing the economy and, specifically, regional innovation systems are at the provincial level (K. Chen & Guan, 2011) or even the sub-provincial level (Krug & Hendrichske, 2008). Whilst acknowledging the government agencies’ roles in changing the institutional context, for example, through formulating supportive policies in the economic, educational, technological, and other relevant fields, the study reveals the indispensable role of Tongji University as a major institutional entrepreneur for changing the institutional environment favouring regional innovation systems development.

Although our proposed analytical framework has been empirically tested in a specific context of Tongji Cluster development, which is different to regional innovation in many other countries and even within China, the framework is expected to be applicable in studies on the social role of university in contemporary society in general. Nevertheless, more empirical applications are needed to further test and improve the framework.

This paper also echoes and responds to the critical observation by Audretsch, Lehmann, and Wright (2014) that studies on technology transfer focus predominantly on the formal dimensions, for example, legislation, policies, and formal governance structures, while less attention has been paid to the informal dimension of technology transfer, particularly with respect to the role of individual actors in a university. The paper provides theoretical and empirical insights into dynamics beyond the formal structures of administration and leadership in the development of regional innovation systems with a focus on the role of the universities. For instance, as the case study indicated, the multiple roles of the University staff as academics, entrepreneurs, and government consultants/ministers enabled them to move flexibly between the different institutional fields in an innovation system, facilitating the communication and fusion of the different institutional logics. The personal relationships between the University leaders and the government officials also contributed to the acceptance of the institutional vision of University by the government.

Finally, the present study suggests that scholars in both higher education research and innovation studies should gain a broader understanding of the role of universities in the context of innovation ecosystems. This is reflected in recent studies calling for new concepts to grasp the nature of contemporary changes in higher education, such as the socially responsible entrepreneurial university (Cai, 2018b), the civic university (Goddard & Vallance, 2013) and the idea of a university ecology (Barnett, 2000; Wright, 2016). These concepts suggest a shift from a focus primarily on the economic functions of university, to more comprehensive university models, particularly those highlighting its role in transforming social values or building innovation ecosystems.

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KEY TERMS AND DEFINITIONS

Institutional Entrepreneur: The actors that not only initiate diverse changes in the institutional environment but also actively participate in the implementation of such changes.

Institutional Entrepreneurship: The activities of institutional entrepreneurs.

Institutional Field: a system of multiple and sometimes contesting institutional logics, in which organisational and individual actors, possibly across boundaries of several organisational fields, are not only influenced by the logics but also foster changes of the logics through their interactions.

Institutional Logics: The shared conceptual and normative frameworks that provide guidelines for the behavior of field participants.

Triple Helix: The dynamic interactions between university, industry and government in the form of ‘taking the role of the other’ for fostering entrepreneurship, innovation and economic growth.

Section 3

Chapter 8

Revisiting Functions and Roles of the Entrepreneurial University in Social and Economic Systems in the Regional Context

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ABSTRACT

Today, institutions are the primary factor shaping national and regional environments. Being a very conservative institution, the university undergoes tremendous transformational changes stepping in the domain of the third university mission. The rise and development of the entrepreneurial university as an institution manifests an ongoing process, the dynamics of which can be confirmed by quantitative and qualitative indicators relevant for social and economic development of the regions and territories. The chapter focuses on the functional institutional approach in assessing an entrepreneurial university as an important institution in the regional socio-economic system, including the innovation system as its part. Basing on empirical data, the functional analysis empowers to draw conclusion on certain characteristics of entrepreneurial universities to overcome the limitations embedded in the national settings.

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INTRODUCTION

Over last decades, universities have been undergoing a transformation as crucial institutional actors in innovation systems. One of the most reasons is the change of the nature of science itself that, therefore, results in the altering university roles in fundamental and applied research. Moreover, the changing university roles intervene with the entire innovation process enhancing the university influence and contributing to numerous aspects of sustainable socio-economic development. The chapter engages the reader in the discussion of using the functional approach for the analysis of the entrepreneurial universities in social and economic systems. The chapter studies innovation systems on both national and regional levels distinguishing the entrepreneurial university's social and economic roles on micro and macro levels. Basing on empirical data, the functional analysis empowers to draw a conclusion on certain characteristics of entrepreneurial universities overcoming the limitations embedded in the national settings.

FUNCTIONAL APPROACH FOR ANALYSIS OF INSTITUTIONS

There is a tendency to pay special attention to institutions as “root causes” of development, stressing the smaller importance of geographical and political factors (Johnson et al., 2003). Functional approach to the innovation processes analysis is an incremental tool for institutional theory since it allows to evaluate innovation systems' institutions and dynamics, to compare structure and functionality of the systems and to identify missing functions or system dysfunctions (Johnson, 2002). Edquist and Johnson (1997) are among the first researchers to identify three main functions of institutions such as reducing uncertainty by providing information, managing conflicts and cooperation, providing incentives. Labeling them as general functions of institutions, the authors describe their role in relation to innovation development in terms of (1) the allocation of resources on innovation and (2) evaluation of institutions as an obstacle or support to innovation (Edquist & Johnson, 1997). These three functions are reflected in the earlier work by D.North (1990), who does not apply the term “function”, but describes these areas as the activities of institutions.

The functions of the system (from the Latin word *functio*) could be understood and evaluated as behavior of a system, its role or mission. In the absence of a clear definition of the “function” category, the authors describe it as a sustainable activity for the benefit of the institutions of the system (Durkheim 1956). To specify the functions, it is needed to answer the question why the systems work exactly the way they work, because behavior or characteristics of the system are determined by the role or function of the system (Ackoff, 2000, p. 221).

In the works of different scholars, functions characterize the institutional environment of innovative multi-level systems, as well as the activities of the institutions in the environment in the process of generation, distribution, use of knowledge and innovation. R. Galli and M. Teubal (1997) specify functions associated with the process of the implementation of research and development. X. Liu and S. White (2001) allocate directions of activity for the creation, dissemination and use of technological innovations in the system through research activities, production, dissemination of research results to the end user, linking different areas of scientific knowledge and education. Hekkert et al. (2007) formulate the functions in terms of explaining the changes in the technological innovation system.

Revisiting Functions and Roles of the Entrepreneurial University in Social and Economic Systems

As the main function of the innovation system, Edquist (2001) calls the generation, distribution and use of innovation, but he also describes the additional activities as the main determinants of a function, i.e. factors that contribute its implementation. B-A. Lundvall (2010) believes that “functionalist” approach in Edquist’s research relies on systems theory used by engineers, while he himself rather stresses that such an approach may be useful for the policy design, as well as the comparative analysis of market and non-market economy.

The Organization for Economic Cooperation and Development (OECD) employs the functional approach to describe the structure of innovative systems in their institutional profiles specifying institutions on the policy formulation and coordination, funding of research activities, subsidizing and investing in R&D, bridging role, diffusion and transfer of technologies, promotion technology companies, providing human resources mobility (OECD, 1999).

ENTREPRENEURIAL UNIVERSITIES AND THE REGION

Rise of Entrepreneurial Universities

An entrepreneurial university is seen as a crucial institution in innovation systems. It is a new venture undergoing certain stages in its development as a complex socio-economic phenomenon underpinning its new roles. There are two institutional development stages that are clearly delineated in academic works:

- Early 80s – mid-2000s, when, as a rule, researchers approach evaluation of distinct university activities related to intellectual property, technology transfer, establishment of partnerships with industry, etc. (Dill, 1995; Chrisman et al., 1995; Röpke, 1998);
- Mid-2000s - present time, when an entrepreneurial university is comprehensively assessed as a multi-faceted institution described in terms of flexibility, strategic thinking, willingness to take on commitments, desire for autonomy and independence as a guarantee of the success (Guerrero et al., 2006; Etzkowitz, 2008; Gibb & Haskins, 2014). Here, the entrepreneurial university is considered as an extremely important actor in the regional economy, the integrator in the regional innovation system and requires a holistic approach to the assessment of university activities.

Researchers pay attention not only to the large national universities, but to regional universities that perform their functions as the local access universities (Goddard & Chatterton, 2003; Gunasekara, 2006). On the basis of empirical analysis, Bronstein and Reihlen (2014) present 4 entrepreneurial universities archetypes, reflecting the diversity of organizational forms of entrepreneurial universities with their varying capabilities and strategies: research-preneurial, techni-preneurial, inno-preneurial and commerce-preneurial. All four types of organizations are entrepreneurial universities, but the key institutional characteristics and roles played, determining their competitive advantages, such as organizational structure, human resources, financial resources, strategy, interaction with the environment are different.

University Institutional Functions and Roles

System paradigm describes economy as a set of functioning economic systems of different levels. In the process of socio-economic phenomena modeling classes of objects with different parameters are used, but they are all of a common origin (Kleiner, 2007). Structural models, first and foremost, represent the most significant relationship between elements. Functional models can reflect rapidly changing parameters. The system is understood as a “relatively isolated and stable part of the world in space and time..., characterized by internal and external integrity” (Kleiner, 2007, p.10).

The dichotomy of an entrepreneurial university as a complex socio-economic phenomenon suggests that it is perceived as an organization, and, of course, in the broader sense as an institution. However, in many studies, these notions are often used interchangeably. In this chapter, the author adheres to the distinctive definitions of an institution and an organization to explore the universities as institutions on the methodological level (in terms of its functions), as institutions and organizations on the systemic level (research and education clusters), as organizations on a practice-oriented level (specific higher education establishments).

Nowadays, literature distinguishes three major university functions. Firstly, it is education (education function) as an inherent and the oldest of the university’s missions. Secondly, it is research in universities (research function) that accounts only for several centuries, but these two university missions organically complement each other leading to a strong understanding of science and education as an inseparable ethos of any institution. Finally, the third university function is understood by some researchers as entrepreneurship in modern universities (entrepreneurial function). But quite often it is labelled as the third university mission which is commonly seen as the university serving the society.

To avoid confusion, it is reasonable to mention that there is a distinction between institutional university functions performed by modern universities in society and economy - universities play different roles in economic and social systems when they exercise three major functions. In social system, the entrepreneurial function of the university is to contribute to creation of business environment. In economic system, the university generates new businesses (companies, projects, ventures) per se. It should be noted that entrepreneurship is a broader and more universal term than the notion of innovation. Clark (1998) points out the unreasonable synonymous use of the terms “entrepreneurship” and “innovation”. The term “innovation” sounds more neutral, as it allows avoiding the negative connotation associated with the entrepreneurship, especially, for university practices. However, it is the term “entrepreneurship” which is more accurate in description of the processes taking place in higher education establishments. Nevertheless, for universities, implementing development programs and generating high-tech start-ups, the concept of “an innovation function” can be employed to emphasize university research applications to achieve long-term competitive advantages.

The reports of the annual competitions “Entrepreneurial University of the Year” (National Council for Entrepreneurship in Education, 2009, 2010, 2011, 2012, 2013) in the United Kingdom can provide enough empirical data to test the difference between the roles of entrepreneurial universities in economy and society when they fulfil their three major functions. This empirical data on the entrepreneurial universities in the UK mirrors socio-economic development of the nation and justifies entrepreneurial universities as institutions recognized by the government, business and society at the national level. There are four criteria groups formulated and assessed by experts: institutional environment, student engagement, innovative and entrepreneurial staff and entrepreneurial impact. These groups include the aspects that affect both internal and external environment of the university. The expert commission for the competi-

tion “Entrepreneurial University of the Year” does not set rigid standards with which universities must comply. Universities are characterized by several qualitative criteria with their quantitative justification (specified event / activity and the result of the implementation of the measures on the effectiveness and efficiency criteria defined by the university independently, based on the available resources).

Distinctive features of the use of such groups of criteria for the competition “Entrepreneurial University of the Year” can be various combinations of “self-identification” characteristics. There are some university activities which fall into the intermediate ‘hybrid’ spaces of two functions’ intersection area, i.e. research and entrepreneurship, education and entrepreneurship. Etzkowitz and Ranga (2010) introduce the notion of spaces (knowledge, innovation, consensus) that underpin the mechanisms by which different institutional spheres interact and co-evolve over time in knowledge-based regions. Meyer et al. (2013) refer to intermediary functions that organizations fulfill. On micro level, these hybrid spaces represent independent hybrid organizational practices or activities at the intersection of overlapping institutional spheres. Champenois and Etzkowitz (2018) argue that “boundary space” differs from “boundary line” stressing the role of boundary spanners acting as individual catalysts in institutional dynamics.

The Table 1 shows examples of the “self-identification” statements characterizing the implementation of the university’s entrepreneurial function for economic and social systems. Overall, universities implement their entrepreneurial function not only through the creation of high-tech businesses or technology transfer. Through the entrepreneurial environment, they are capable to generate any ventures, critical mass of which is essential for the healthy economy.

The rise and development of the entrepreneurial university as an institution manifest an ongoing process, the dynamics of which can be confirmed by quantitative and qualitative indicators that are relevant for social and economic development of the regions and territories. The dynamics manifest the entrepreneurial university as an emerging development institution impacting and contributing to the socio-economic development of the meso level innovative systems clusters and regional innovation systems.

Entrepreneurial University and Regional Embeddedness

Today, there is an ongoing institutional transformation of the universities due to numerous economic and societal challenges. Smart, sustainable and inclusive growth can be achieved through innovations at global, national, regional and local levels with a greater focus on the regional dimension. According to the European Union and its Practical Guide (European Union, 2011, p. i), regions are “important

Table 1. University entrepreneurial function

Social system - Entrepreneurial environment	Economic system - New ventures generation
<ul style="list-style-type: none"> ● Personal senior management leadership and commitment in the implementation of the university entrepreneurial function ● Building an entrepreneurial culture in the university ● Closer informal interaction of the stakeholders ● Involvement of all university personnel in the entrepreneurial activities, as well as through funding; ● Creation of a motivation system for personnel to be engaged in entrepreneurial activities ● Involvement of the graduates (through educational programs, projects, mentoring, etc.) 	<ul style="list-style-type: none"> ● Development of cooperation with regional business (contracts with SMEs and large companies) ● Generation of startups through various mechanisms; ● Raising capital to fund the university, joint projects and other projects (including venture capital) ● Creation of new workplaces by the university spin-offs and startups ● Encouraging university staff to dual employment and creation their own startups ● Developing clusters around universities or contribution to their formation and growth

sites for innovation because of the opportunities they provide for interaction between businesses, public authorities and civil societies”. Due to differences in regional priorities, activities may vary across regions and should be relevant to the operational programs, but “universities and other higher education institutions have a key role to play in knowledge creation and its translation into innovative products and public and private services”.

According to Audretsch (2015), the macro approach cannot provide prosperity and growth equally across cities and regions, consequently, regions become responsible for their future. “The key agenda for today is how to enable public authorities to promote the active engagement of universities and other higher education institutions in regional innovation strategies for smart specialization, in cooperation with research centers, businesses and other partners in the civil society. It is also important for academic and economic partners to explore the benefits they can expect from working together for regional development” (European Union, 2011, p. i).

At the level of regional innovation systems (RIS), the concept of national systems of innovation (NSI) emphasizes differences in the performance of innovation activities at the regional level, as well as economic growth in different countries at the level of individual territories. The formation of RIS can be considered in the context of designing and developing policies for systemic support of localized processes of generation, distribution and use of knowledge to ensure the innovative development and competitiveness of regional economies (Freeman, 1995; Cooke et al., 2000; Asheim & Coenen, 2006). Freeman (1995, p.5) stresses that the networks of relationships are necessary for any firm to innovate, therefore, regional systems of innovation remain essential to the analysis of institutional variety. Being one of the most popular approaches in research of innovative systems, RIS allows to substantively analyze and evaluate activities at the regional level in different directions. It can be about (1) generation of enterprises; (2) relationships between firms; (3) the interaction of companies and other actors of RIS; (4) the role of government policy in shaping the institutional environment in the process of generating, disseminating and using knowledge at the regional level; (5) the role of institutions and organizations in terms of the localized innovation activities (Asheim et al., 2003; Doloreux, 2003; Cooke, 2004; Asheim & Gertler, 2005; Doloreux & Parto, 2005). All the mentioned above activities relate to the localization of factors of socio-economic development. This approach was developed, in part, thanks to the theories of regional growth: agglomeration effects as for “industrialized core-agricultural periphery” (Krugman, 1991) and models of growth (Romer, 1989); growth poles (Perroux, 1955); local clusters (Porter, 2000); industrial districts (Becattini, 2004) and industrial spaces (Scott, 1988); technopoles (Benko, 2000); learning regions (Florida, 1995); innovative milieu (Maillat, 1995; Crevoisier, 2004).

There are two approaches to understanding RIS:

- RIS in the narrow sense as a network of interacting institutions and organizations for the implementation of the scientific function of universities, public and private research structures (Asheim & Coenen, 2006);
- RIS in a broad sense as all elements of the economic structure of a region and the institutional environment that influence learning, search and research processes (Lundvall, 2010).

Both approaches are based on using the advantages of a localized economy (for example, regional industrial clusters), localized centers of knowledge generation, urbanization processes and the development of agglomerations, as well as specific technological trajectories of regional development.

The geographical approach at the level of national innovation systems evaluates NIS as a single system at the macro level. Differences in structural and dynamic characteristics suggest the existence of different levels of dynamics not only at the level of different countries, but also at the level of different regions of the same country. For example, the OECD notes that the intensity of innovation development in the framework of some regions of one country should be 2 times higher than the national average (OECD, 2011). Regions may have different indicators of economic growth, poverty, investment in high-tech businesses, financing research and development, etc. Even though many approaches can be equally effectively used in the analysis of NIS and RIS, however, RIS differs radically (Korres, 2013).

RIS is a link in the meso level between the national innovation system and the local level from clusters of firms and organizations and serves as a practical tool for implementing policy decisions and practical measures related to ensuring the innovative development of the region and its competitiveness in general. It is the proximity of institutions and organizations within the framework of RIS that facilitates and accelerates the process of generation, distribution and use of knowledge and innovation. In the context of the development of RIS and clusters, it is important to emphasize the importance of horizontal links with knowledge generation centers. For example, the competitiveness of RIS and clusters is determined by the existence of close network cooperation of a systemic nature between business and university. Such cooperation covers not only companies of different sizes and knowledge generation centers, but also various organizations of the innovation infrastructure (scientific and industrial parks, business incubators, technology transfer offices, etc.).

When studying the place and role of the university in regional innovation systems in general and clusters in particular, two directions should be distinguished. The first is related to the evaluation of the university in terms of its results for the economic development of the region. However, the traditional interaction of the university is built not just with the business directly, but through clusters (Schrempt et al., 2013) (see Fig. 1). The economic contribution of the university itself as an organization to the gross regional product may turn out to be insignificant. However, in assessing the contribution of a cluster, the center of which is a university or actively interacting with a university, to the regional economy may be radically different.

The second approach, which is a broader and more comprehensive one, assesses the university in terms of its involvement in the socio-economic development of the region, the diversity of the socio-economic roles of the university as an institution of development in the region. Fig.5 presents a comprehensive vision of the university as a regional integrator (Goddard & Chatterton, 2003; Goddard, 2005).

The role and importance of the university in the regional innovation system are considered within the framework of the traditional paradigm of university activities, but new areas of activity are highlighted where the university becomes an active participant. Historically, the university's contribution to regional development has been evaluated and continues to be evaluated: (1) as an actor in the process of generating, spreading and using knowledge in cooperation with firms, industrial and innovation clusters through the implementation of research activities, which directly contributes to the economic development of the region and the growth of its technological potential (Yusuf & Nabeshima, 2006); (2) in the process of education and professional training for the economic needs, as well as training and education in a wider context as an increase in the general educational level (Arbo & Benneworth, 2007). Here, it is worthy to mention the role of the university in lifelong learning, capacity building of the region's human resources in a narrow sense and the development of the human potential of the region. The organizations implementing these tasks are institutions from primary to higher professional educational establishments and vocational training organizations.

Figure 1. University in the Regional Innovation System

Adapted by the author from (Schrempf et al., 2013)

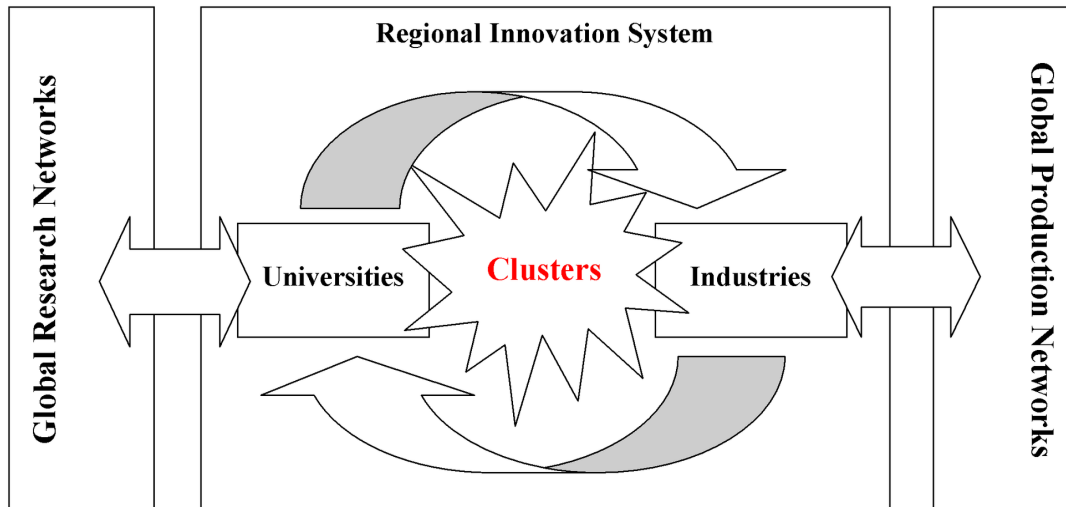
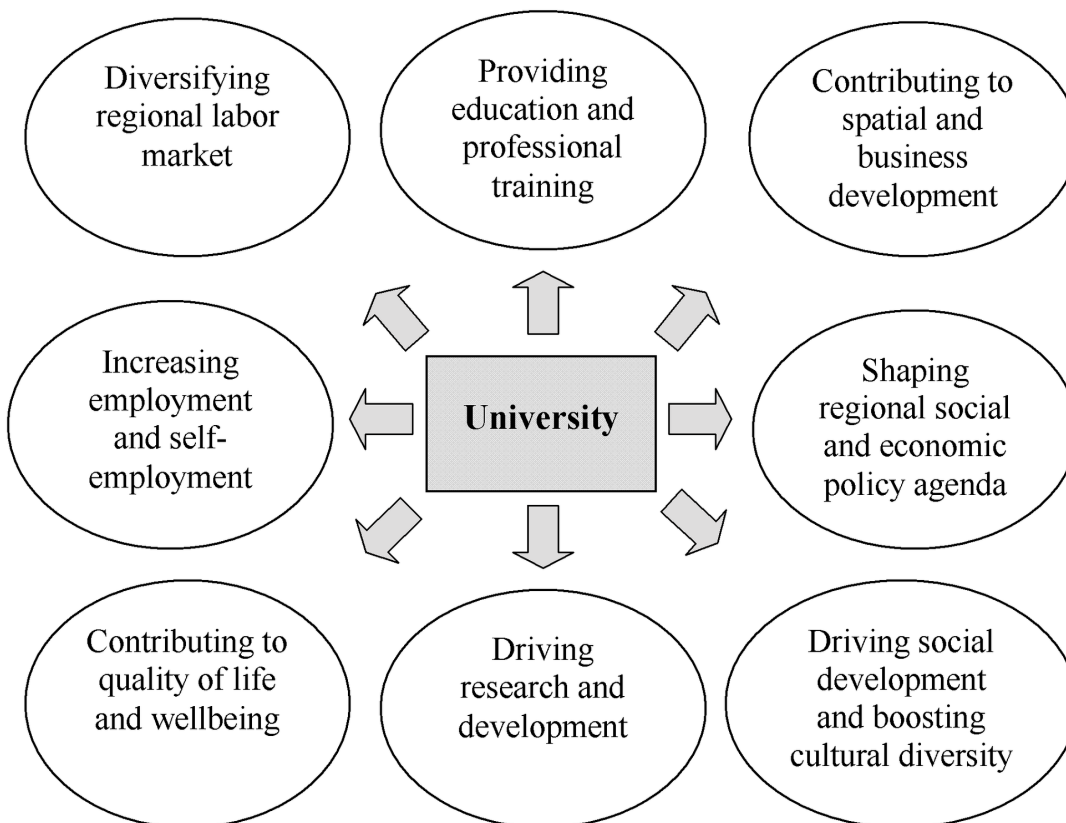


Figure 2. University as a regional integrator

Adapted by the author from (Goddard & Chatterton, 2003; Goddard, 2005)



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Additionally, today the university is considered as an important actor and a stakeholder of regional development in terms of its participation in the following activities:

1. Regional governance, due to importance of the university in formulating the needs of the socio-economic development of the region and formulating the regional development policy, as well as its place in regional decision-making, is increasing (Arbo & Benneworth, 2007);
2. Development of the attractiveness of the region for the flows of business, investment and human capital to the region (Benneworth, 2006; Benneworth & Hospers, 2006; Yusuf & Nabeshima, 2006) and generating a favorable environment for the territorial development of the region (Geiger, 2004);
3. As a proactive intermediary agent and mediator of network interactions between institutions and organizations at the regional level (Wolfe, 2005);
4. Sustainable development of the region through its educational, scientific and entrepreneurial activities, which, in turn, is associated with the implementation of not only economic and environmental objectives, but also with the development objectives of the region and the improvement of the well-being of its population (Goddard & Vallance, 2013; Harding et al., 2016).

A university in RIS is considered as a driver of regional development based on the localization of material and human resources. At this level, network horizontal interactions and communications come to the fore. The requirements for the university are not only education, research, but also the role of an intermediary and a mediator in the regional innovation system. Another system of indicators is entering the arena, including qualitative ones, which, as a rule, are not present in national statistics, but characterize the role of the university in creating the environment, building its relations with regional businesses and universities' social role and social engagements. Here, actors and types of interactions appear that are either not obvious or not significant at the macro level but are crucial for the competitiveness and efficiency of the regional socio-economic development.

The existing gap between the university performance in training the intellectual elite of the society and university engagement in the development of the socially responsible community in the region also hinders the practical implementation of the third university mission (Loredo, 2007; Trencher et al., 2013). In this regard, the initiation of the university function as a partner in regional development raises the issue of the university place identification in the social sector development of the university home cities and territories. For the implementation of the third mission, the university needs to become a driver of civic initiatives generation and development of communities that enhance conditions for coordinating the actions of the main participants in innovation and technological development in the region (Gulbrandsen & Slipersaeter, 2007). Here, a university to become an entrepreneurial entity, or entrepreneurial university (Etzkowitz, 2004), needs such prerequisites as maturity of communities which are prone to the regional social development. The university third mission anticipates the embeddedness of economic relations in the practices of social networks within the regions and territories (Granovetter, 1985). Therefore, the third university function can be implemented through the role of a driver for innovative, technological and social development within the region.

Foss and Gibson (2015, p.1) stress that universities worldwide are tasked with fulfilling and enhancing the third mission of "service" to help to stimulate and sustain economic growth, thus, they [universities] are being encouraged to take an entrepreneurial turn which is heavily influenced by the institutional

environment in which the university is embedded. To understand the university, it is important to underpin university organization level and institutional framework with in-depth comparative studies of the universities' samples in different regional contexts (Foss & Gibson, 2015).

A recent study by Guerrero, Urbano and Fayolle (2016) provides evidence that specifically informal factors (e.g., attitudes, role models) have a higher influence on university entrepreneurial activity than formal factors (e.g., support measures, education and training). Also, authors stress that their results also evidence a higher contribution of universities on regional competitiveness when they use social measures (talent human capital) instead economic measures (GDP per capita).

CONCLUSION

The rise of entrepreneurial universities (Etzkowitz, 2008) implies the necessity of regional governments of use the potential of such institutions to the fullest extent. The university third mission, which is fully articulated and integrated into official policy agenda, enhances a more responsible university role to meet current societal challenges. Despite the increasing role of the third-generation universities in their essence (Wissema, 2009) and the globalization of knowledge production, the university's operational role is within the region. Regional innovation and socio-economic strategies must incorporate in the official documents the responsibility of the triple helix actors to cooperate for the sake of a public good. The authorities should design the policy, offer a platform for a dialogue within the consensus space (Etzkowitz & Ranga, 2010), develop cooperation mechanisms for the triple helix actors' engagement in the regional development with the focus on the universities as the locus of talents, knowledge, technologies and ideas. Claus Schwab, the author of "The Fourth Industrial Revolution", underlines that the fourth industrial revolution is distinct by velocity, breadth and depth, as well as impact involving the transformation of entire systems across and within countries, regions and territories, industries, society and communities, but decision-makers are often too shortsighted and "caught in traditional, linear (and non-disruptive) thinking or too absorbed by immediate concerns to think strategically about the forces of disruption and innovation shaping our future" (Schwab, 2017). According to Etzkowitz (2013), a critical challenge for the regional governments is how to reinforce achieving competitiveness and make it possible for the region to become a world innovation hub, attracting and circulating talent and technology, internationally, but balancing this regional "stickiness" and retaining these crucial assets of talents, knowledge, technologies and ideas.

Universities recognized by researchers as critical stakeholders in national innovation systems, as they are both elements of the system and institutions affecting the generation, dissemination and use of knowledge. As a complex socio-economic phenomenon, the university implements its functions both in society and economy and is perceived as an institution to play multiple roles. Different national settings require the use of diverse approaches for the university performance evaluation. Nevertheless, it is possible to describe an entrepreneurial university through as an institution through the combination of characteristics and university functions on the practice-oriented, systemic and methodological levels.

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Chapter 9

The Entrepreneurial Dimensions of Transnational Education

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ABSTRACT

Transnational education is a growing trend in higher education that decouples learning from the location of the awarding institution. However, few studies of entrepreneurial universities have considered entrepreneurial universities in the context of the changing geographic landscape of education. This chapter examines the entrepreneurial dimensions of transnational education using empirical evidence from a transnational partnership between De Montfort University and Niels Brock Copenhagen Business College. The authors conclude that the commercialization of knowledge through transnational education requires processes and interactions that foster regional development and thus have implications for social and economic development.

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INTRODUCTION

Since the early 1980s, theories of economic growth have recognized the importance of education, innovation, and human capital formation as critical factors responsible for the development of a country's economy and the sustenance of long-term economic growth (Pelinescu, 2015). As global economies have transitioned to knowledge economies there has been an increasing demand for knowledge production and dissemination, accelerated by the globalisation of markets and progress in information and communications technologies. Against this backdrop, the activities of universities have grown as their role in knowledge formation and dissemination has become central to economic and social development. An increasing demand for knowledge growth from industry and government has led to the proactive measures of the "entrepreneurial university" that seeks to take a more active role in influencing economic and social change (Clark, 1998). The entrepreneurial university now contributes to economic and social development through the spillovers created from its multiple missions of teaching, research, and entrepreneurial activities (Guerrero et al., 2015).

Research on entrepreneurial universities has sought to explain the motivation, behavior, and impact of these organizations from perspectives of both internal processes as well as external influences (D'este and Perkmann, 2011; Guerrero et al., 2015; O'shea et al., 2005; Clark, 2004). However, few studies of entrepreneurial universities have considered entrepreneurial universities in the context of the changing geographic landscape of education. Transnational education, a growing trend in higher education, decouples learning from the location of the awarding institution. According to Madge et al. (2015), the "transnational eduscape" is rapidly changing, evidenced by such developments as prioritisation of internationalisation in higher education institutions (HEIs), establishment of higher education (HE) partnerships, and the creation of branches and satellite campuses around the world.

The international branch campus is a form of transnational education that is owned, at least in part, by a foreign higher education institution; operated under the name of the foreign education institution; and provides on-site face-to-face instruction leading to a degree awarded by the foreign education provider (Wilkins and Huisman, 2012; C-BERT, 2019). In 2016 there were approximately 250 international branch campuses serving 180,000 students around the world (Garrett et al., 2016). Some scholars view these arrangements as entrepreneurial activities offering financial, academic, and reputational advantages to universities (Shams and Huisman, 2012; Marginson, 2006; van Vught, 2008; Dunning and Lundan, 2008; McBurnie and Pollock, 2000). However, few studies have examined these activities to consider implications for regional development.

In what ways might transnational education, specifically in the creation of an international branch campus, demonstrate characteristics of entrepreneurship and regional development? In this chapter we examine this research question. A review of the literature is first presented in order to offer a framework for analysis. We then present evidence from a transnational partnership between De Montfort University and Niels Brock Copenhagen Business College using data collected through archival documents and direct observation in order to enhance our understanding of theoretical concepts and to examine those concepts within a natural setting (Zahra et al., 2014).

LITERATURE REVIEW

Knowledge based economies have driven industry, government, and universities to become increasingly interconnected as the boundaries that have traditionally divided them have been blurred and the traditional domain of each has become that of the other (Etzkowitz and Leydesdorff, 1995). Knowledge produced at universities is no longer for the sole purpose of education and research, but rather serves more pragmatic goals of making economic contributions to society. The benefits of commercialised knowledge spillovers in the form of spinouts, startups, patents, licenses, joint ventures, consultancy and contracts contribute to social and economic development (Meyer, 2003; Shane, 2004; Audretsch et al., 2012; Guerrero et al., 2015; Miller et al., 2018). These outputs are generally regarded to be the product of tacit knowledge production through university-industry research. As tacit knowledge is not easily transferred over long distances and cannot be purchased on the market, spillovers have been seen as localized effects that enhance regional competitiveness and entrepreneurial activity (Audretsch et al., 2012).

It has become increasingly common to assume that universities are automatic enablers of endogenous economic growth and a ‘locus for knowledge intensive transitions’ by virtue of their strong connections with industry and government in their different forms (e.g. Etzkowitz and Leyesdorff, 2000, p109). Yet, there is no *a priori* reason why knowledge transfer from university to local industry would be universal in form and frequency. A reasonable supposition is that whilst productive relations with stakeholders are a necessary precondition for knowledge transfer in its different forms, they are not a sufficient guarantee, given that different stakeholders have variable levels of knowledge and absorptive capacity, and also have markedly different attitudes toward collaboration. As a result, the possibilities for knowledge transfer leading to economic growth in a locality will be shaped by university and industry variations as well as the particular make-up of the ecosystem in which they are located (e.g. the interoperability and institutional thickness of an ecosystem, the credentials of different partners, the history of local leadership and collaboration, as well as the original knowledge form).

Asheim and Coenen (2005) distinguish between analytical knowledge bases and synthetic knowledge bases, which serve as indications of different mixes of tacit and codified knowledge, codification possibilities, qualifications and skills, required organisations and institutions involved, and specific competitive challenges from a globalising economy. The foundation of this distinction rests on competing understandings of knowledge and innovation. One view of knowledge emphasises its economic relevance and thus places value on codified knowledge that supports highly scientific “high-technology” industries (e.g. biotechnology and pharmaceuticals) and provides a competitive advantage in a knowledge economy. Here, an analytical knowledge base of deductive processes is necessary for the creation of new ideas and more radical innovations (Asheim and Coenen, 2005). Analytic knowledge as new scientific knowledge is predicated on formal R&D in universities and implies not only the dominance of codified knowledge due to patents and publications, but also formal R&D spaces (e.g. centres of excellence) and formal spinout arrangements with firms and external research organisations. In these scenarios, knowledge transfer will occur through specialist global pipelines, aided by the spatiality and the global reach of codified knowledge.

In contrast, a competing view of knowledge emphasises the value of learning over that of discovery and accepts the adaptation of existing knowledge as a significant component of knowledge production (Smith, 2000). Here, the knowledge economy is better described as a “learning economy” where innovation “may be brand new but are more often new combinations of existing elements” (Lundvall, 1994; Edquist, 1997, pg. 1). A synthetic knowledge base of inductive processes that rely on tacit knowledge,

application, and interactions with clients and suppliers is necessary for incremental innovation in existing products and processes, as well as those embedded in a locality (Asheim and Coenen, 2005). As such, the critical space for knowledge transfer moves from the formal centres of excellence on campus and global pipelines and communities of practice, to local social spaces, which enable interactive learning and the application of codified knowledge to real situations, and which is conveyed in the idea of knowledge transfer as proximity and propinquity (Boschma, 2005). Propitious spaces for synthetic knowledge transfer emerge from university-led networks, partnerships with local forms and sectors, and special initiatives through which knowledge transfer is enabled.

The notion of an “innovation system” usefully expresses the interaction and networks between public and private agents that allow for the rapid diffusion and exploitation of knowledge, skills and best practice, with activities of universities revolving around the common aspiration of learning. A university’s advanced role in knowledge transfer in a local ecosystem, presented as a territorial innovation system in several discourses, is encapsulated in the different conceptual and empirical works on *inter alia* the Triple Helix (Etzkowitz, 1994; Leydesdorff and Etzkowitz, 1998), Economic Clusters (Porter, 1990; Fujita, 1988; Fujita and Thisse, 2013; Krugman, 1991), and Learning Regions (Morgan, 1997; Lundvall, 1994). Etzkowitz’s (2003) Triple Helix model attempts to explain how entrepreneurial research universities function and how conditions for innovation in a knowledge-based society are improved. Key to the model are university-industry-government interactions where the university serves as a source of new knowledge and technology, government serves as a source of contractual relations that guarantee stable interactions, and industry serves as the locus of production.

Bringing these different aspects together it is apparent that the different commitments of universities along with their more recent commercial appetite for innovation as part of their so-called ‘third mission’ provides a framework for viewing the capabilities of the entrepreneurial university within a wider social-economic and political context or ecosystem (Molas-Gallart et al., 2002; Lebeau and Cochrane, 2015). As Scott (2013) explains, in a university context, the growing emphasis on applied research, consultancy, technology transfer and enterprise has accentuated the local such that knowledge and innovation is now seen as a crucial resource for achieving economic growth and collaboration and shared learning, the primary process by which this is realised at the local level.

CASE ANALYSIS

De Montfort University (DMU) is a public university located in Leicester, UK serving approximately 27,000 full and part-time students. Formerly named Leicester Polytechnic, the school historically offered apprentice training for local manufacturing, furniture, textile, engineering, and printing industries. The institution was granted university status in 1992 and changed its name to commemorate a local historical figure, Simon de Montfort, Earl of Leicester. Although the name and mission of the institution changed, the institutional memory of vocational training for local industry was maintained and has since manifest as a commitment to excellence in teaching and creating an impact on the outside world.

For example, the DMU Local initiative allows for local knowledge transfer to the ‘Square Mile’ area of Leicester, one of the most deprived areas of the city. Here DMU Local provides financial and academic space for students to provide teaching support in local schools, volunteering for local charities, as well as legal and business support to grow local businesses and boost local employment. There are a myriad of student volunteering and smaller-scale activities in the city of Leicester, as well as flagship

collaborative projects with stakeholders. The more recent 'Local +' initiative is designed to encourage local knowledge transfer by providing staff-based resources (financial and secondments of researchers) to tackle new problems for the city (e.g. smart city, wellbeing, ageing population). The DMU Global initiative provides financial space for students to transfer their knowledge to overseas locations. Programme activities include its international work with the United Nations on UN Sustainability Goals. Volunteer projects around the world include assisting asylum seekers, provide English language instruction, providing support to social enterprises, and building houses in deprived communities. Research ventures involving teams of faculty researchers, student-led start-ups, IP commercialisation, and collaborative arrangements with companies.

Innovative transnational education partnerships have also been a key activity of the university in expanding its impact. Partner schools around the world currently host international branch campuses in Singapore, India, Denmark, Hong Kong, and the Philippines. Students attending international branch campuses are enrolled at DMU and have access to facilities including online teaching and learning resources through virtual learning environments. Upon graduation they are awarded DMU degrees and certificates. This is in accordance with DMU's policy that these awards reflect achievement against established standards and are independent of location of mode of study.

The Master of Science in International Business and Management (MSc IBM), is a 1 ½ year full-time postgraduate study programme offered by Leicester Castle Business School at DMU in partnership with Niels Brock Copenhagen Business College (NB) located in Copenhagen, Denmark. The MSc IBM programme is a natural progression for undergraduate programme graduates as well as for other Danish and international students documenting equivalent qualifications and are particularly attractive to those wishing to pursue a career in general management or finance, human resource management, or corporate social responsibility in an international context.

The current partnership evolved from an existing relationship. From 1993 to 1997 students from 8 Danish business colleges participated in a Data-matician course held on the campus of DMU as well as on site with surrounding industrial partners in Leicester. Beginning in 1995, students studying Computer Science at NB who had also participated in the Data-matician course were accepted to the final year of the BSc (Hons) Computer Science and BSc (Hons) Software Engineering degree programmes at DMU. These activities yielded positive results over several years. In 1996, demand in the Danish market for business and computer science degree programmes led to discussions between NB and DMU's Business School and School of Computing Sciences to evaluate the suitability of a proposed franchise arrangement at the NB campus. This arrangement would benefit Niels Brock, a private institution, which under Danish regulations has the power to offer HE degree programmes but is prohibited from granting HE degrees. De Montfort University also recognised the recruitment potential from establishing a presence in Denmark. Other mutual benefits included the potential for staff exchanges, research, and joint consultancy work.

A top-up BA (Hons) in Business Administration was successfully introduced in 1999 as a franchise arrangement as defined in the DMU Code of Practice for Collaborative Provision. Under this arrangement Niels Brock, the partner institution, teaches modules developed and owned by DMU (in English). Other programmes, including the MSc IBM, were developed thereafter. The programme structure of the MSc IBM, specifically the sequencing of coursework, has been updated over time in order to foster student success. In addition, new degree offerings have been introduced at the NB campus over time. The partnership has expanded from the MSc IBM and a top-up Bachelor of Art (Hons) in Business Administration to include a Pre-Master Graduate Certificate in International Business and a new Bachelor of Science in Business Studies.

University as a Source of New Knowledge and Technology

De Montfort University dedicates significant resources into building its analytical knowledge base through its strategy for achieving international research excellence through research centres, and with synthetic knowledge through a variety of knowledge-led activities. Its strategic goals prioritise peer acceptance of research novelty through inter alia awards, research income, and papers, as well as localised civic learning with stakeholders and through students. Aspects of its strategic goals currently include increasing research income, research workload of staff, and the percentage of internationally co-authored papers at the institution (DMU Strategic Plan, 2018). Twenty-eight research centres and institutes contribute to this strategic goal through the pursuit of research in such areas as wellbeing, infrastructure, creativity, economic growth, business, and civil society.

In addition, DMU is the source of new knowledge in the form of disembodied knowledge flows. Smith's (2000) distinction between "embodied" and "disembodied" flows of knowledge is useful in identifying the key components of the technology. Here we define technology as the processes, techniques, and methods used in the production of goods and services. According to this distinction, embodied flows of knowledge are incorporated into infrastructures while disembodied flows of knowledge involve the use of knowledge (Smith, 2000). The content of course modules represents disembodied knowledge designed by module leaders at DMU, each an expert designated by the faculty. Module Leaders at DMU are responsible for academic leadership, management, and assessment and work closely with Module Tutors at NB who are responsible for delivering modules in Copenhagen and supporting student learning. Embodied knowledge flows from DMU to NB also facilitate learning through educational technology such as web-based virtual learning environments that manage course module content and assessments.

Government as a Source of Contractual Relations That Guarantee Stable Interactions

As a public institution, DMU receives funding from the government via the Office of Students (OfS). The OfS was established in 2018 as a regulating body to replace the Higher Education Funding Council for England (HEFCE) and the Office of Fair Access (OFFA). The OfS is sponsored by the Department for Education (DfE). The Quality Assurance Agency for Higher Education (QAA), responsible for the external evaluation of higher education institutions (HEIs) in the UK, is an independent body that collects and provides information to the OfS as to the quality conditions of HEIs in the UK. As autonomous institutions, HEIs in the UK are responsible for maintaining the quality of their programmes. The QAA produces and maintains the Quality Code for Higher Education that guides HEIs as to what they should be doing. Higher education institutions must meet the Quality Code standards in order to access funding, recruit international students, apply for degree awarding powers, or a university title. Evaluations are conducted every few years and provide guidance on such activities as admissions, assessment, curriculum, partnerships, student engagement, and concerns, complaints, and appeals.

The Danish Accreditation Institution, responsible for accrediting all higher education in Denmark, serves as the government body responsible for quality assurance in Denmark. However, as a private institution, NB has the authority to offer higher education programmes in Denmark but does not have the authority to award degrees. Niels Brock's status as a private institution of higher education requires

that the Danish Evaluation Institute (EVA), evaluates the MSc IBM every 3 years. Evaluations assess the quality conditions of the programme along such criteria as purpose, vision, content, structure, teaching, assessment, access, expertise, facilities, fees, and internal quality assurance mechanisms. Evaluations are made publicly available and are used by the Danish Immigration Service to determine the eligibility of education institutions in making decisions concerning student visas.

Industry as the Locus of Production

As an international branch campus, administrates the delivery of DMU's education programmes as a private enterprise, NB serves as an industry partner and is this the locus of production. De Montfort University's MSc IBM introduces a new educational offering to the host country that is otherwise not available and can be viewed as a product offering in Denmark's market for education. The MSc IBM is a British 3-semester university degree of 180 English credits, equivalent to 90 ECTS. A Master's degree awarded by a Danish HEI requires 120 credits. Therefore, the MSc IBM offers an alternative route for students seeking to earn academic credentials in a shorter amount of time. Other comparative differences offered by the MSc IBM include English language instruction, evaluation of assessments using the British marking scale, and the moderation of course marks by internal and external evaluators among others.

In the production of education programming, NB dedicates a larger proportion of its resources into developing a synthetic knowledge base, centered on its students. Historically the institution has defined its function as a provider of high-quality education, investing in its teaching resources with a focus on meeting the needs of its students. Instruction emphasises applied learning and is tailored to achieve that end. Innovation in this context comes in the creation of new teaching methods, community partnerships, and social spaces that are developed as a result of continuous interactions and feedback from students. Most students manage to find part time jobs and are thus able to apply their job experiences as empirical sites for testing business and management theories and models. This has been valuable for students undertaking their dissertation who choose to gather primary data. A recent faculty-student research project that evolved from a dissertation, for example, examined the influence of the recent General Data Protection Regulation law implemented by European Union (EU) on the organizational ecology of the software industry in Denmark.

DISCUSSION

Asheim and Coenen's (2005) work establishes notable differences between analytical and synthetic knowledge creation, which amounts to a higher and lower dependency on social contexts and different types of knowledge transfers spinouts from universities. While much of the national policy context privileges the analytic knowledge capabilities of prestige institutions, codified as intellectual property and patents, and embedded into global pipelines of excellence, it overlooks the more localised and applied knowledge transfer occurring in synthetic forms and through proximate social spaces, which is responsible for growing local economies. Examining these knowledge transfers alongside the location of entrepreneurialism yield different outputs, it is possible to detect 3 main types entrepreneurial activities in in the transnational education partnership presented in this chapter:

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- **Global Commercialisation of Scientific Knowledge:** The entrepreneurial university produces new knowledge in the manner described by Asheim and Coenen (2005), through analytic knowledge transfer where commercialisation occurs through such vehicles as IP commercialisation, transfer through global pipelines, and connecting communities of expertise.
- **Local Commercialisation of Adapted Knowledge:** The entrepreneurial university adapts existing knowledge in supporting commercialisation of ideas, bringing new ideas and services to local markets through such vehicles as student-led start-ups and collaboration with local institutions.
- **Transnational Commercialisation of Applied Knowledge:** The entrepreneurial university commercializes its educational programmes, bringing new education and training alternatives to the host country through the international branch campus partnership.

In characterizing regional innovation systems (broadly defined) Asheim and Coenen (2005) distinguish between territorially embedded regional innovation systems, regionally networked innovation systems, and regionalised national innovation systems. The key feature of territorially embedded innovation systems are firms and organisations that primarily utilise synthetic knowledge in localised activities and without much interaction with knowledge generating organisations. Firms and organisations that exist within regionally networked innovation systems are also active in localised activities, however they are strategic in their impacts on local infrastructure including cooperation with local organisations. Regionalised national innovation systems include firms and organisations who co-operate with actors from outside of the region in their innovation activities in attempts to create more radical innovations based on formal analytical knowledge. Based on this typology, it is clear that firms and organisations characterised by synthetic knowledge bases are more territorial in the innovation systems they belong to while those that are characterised by analytical knowledge bases belong to innovation systems that expand beyond regions. Regionally networked firms and organisations therefore have a mix of both analytical and synthetic knowledge bases.

CONCLUSION

In this chapter we examined the case of an international branch campus in order to better understand the entrepreneurial university. The case of the De Montfort University and Niels Brock partnership demonstrates the entrepreneurial dimensions of transnational education. In the partnership, DMU

Table 1. Transnational education partnerships as a form of entrepreneurialism.

	Global Commercialisation of Scientific Knowledge-	Local Commercialisation of Adapted Knowledge	Transnational Commercialisation of Applied Knowledge
Knowledge Base	Analytic knowledge	Synthetic knowledge	Synthetic and analytic knowledge
Location of Entrepreneurialism	Regionalised national innovation systems	Territorially embedded regional innovation systems	Regionally networked innovation systems
Output	New discovery and radical innovation	New applications and incremental innovation	New product offering in the market for education and process innovation

serves as a source of new knowledge and technology, commercializing its capital stock of analytical and synthetic knowledge. Niels Bock administrates the delivery of DMU's educational programmes, serving as the industry partner and locus of production. British and Danish government bodies regulate contractual relations in the form of quality assurance, serving to stabilize interactions. The triple helix of university-government-industry interactions helps to produce the process innovation of the MSc IBM, located within a regionally networked innovation system. By examining the entrepreneurial dimensions of transnational education, this chapter has served to build a foundation for future studies to consider the motives, behaviors, impacts, and influences of entrepreneurial universities in a changing eduscape.

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Chapter 10

Role of Universities on the Level of Regional Growth in Portugal

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ABSTRACT

Universities nowadays are considered key players in the development of entrepreneurial ecosystems and, thus, may impact regional development. This chapter analyzes the role of the university as a determinant of regional economic growth in Portuguese NUTS III regions, from 2004-2017. One-step and two-step system GMM estimation results show a statistically significant and positive impact of universities upon regional growth. Moreover, the magnitude of effects is transversely stronger in the long run, which requires the need to avoid structural breaks in public actions previously initiated in the past.

INTRODUCTION

Regions are endowed with valuable resources such as infrastructures and knowledge, which have the potential to boost the necessary conditions for the proliferation of innovation, economic growth and sustainable development (Etzkowitz & Leydesdorff 2000; Leydesdorff 2003). Recent years are characterized by increasing pressure for universities to have a more proactive role in the development process of regions (Etzkowitz & Leydesdorff 1995). Taking this overwhelming idea as the background of this study, our main goal is to analyze the role of universities as a determinant of the regional economic growth.

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Covering the time period 2004-2017, this study is applied to Portuguese regions, in particular by focusing on the level III of the Nomenclature of Territorial Units for Statistical Purposes (NUTS III) administrative regions. Previous studies addressing the theme of regional growth in Portugal (Antunes & Soukiazis 2006; Crespo & Fontoura 2007; Soukiazis & Proença 2008; Crespo et al. 2009; Ramos 2009) provide valuable insights concerning the dynamics of regional growth that characterizes this economy.¹ The present analysis not only considers universities as a determinant holding a direct effect on the regional growth, but also employs an innovative methodological approach to capture indirect effects of universities. First, the analysis is applied to a thirteen years period. Second, the generalized method of moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) is adopted, which allows surpassing debilities (e.g., endogeneity) typically associated with static panel data models (e.g., pooled ordinary least squares (POLS), fixed effects (FE) and random effects (RE)). As further discussed in Section 2, overcoming debilities of the static FE model is particularly important in this case study due to the impact of universities on covariates that are also likely to have a statistically significant effect on the *per capita* Gross Domestic Product (GDPpc) of the respective region.

The remaining of the study is organized as follows. Section 2 presents the theoretical background. Section 3 discusses the empirical framework (i.e. data, econometric specifications and methodology). Section 4 shows empirical results. Section 5 provides a robustness check. Section 6 concludes.

THEORETICAL BACKGROUND

There is a vast literature supporting the argument that universities have a relevant role in the dynamics of regional growth (Caffrey & Isaacs 1971; Elliot et al. 1988; Benneworth & Charles 2005; Arbo & Benneworth 2007; Benneworth & Hospers 2007; Goddard & Vallance 2011, 2013; Carayannis et al. 2018; Wakkee et al. 2019).

On the one hand, universities are large economic agents with a direct impact on local economic activities (Benneworth & Charles 2005; Benneworth & Hospers 2007). At the basic level, universities act as anchor institutions of local economies by ensuring employment across a wide range of occupations and consumption of goods and services (Elliot et al. 1988; Arbo & Benneworth 2007). Moreover, universities contribute to the cultural life and natural environment of the region where they belong to (Carayannis et al. 2018).

On the other hand, universities have a direct role in the creation and accumulation of human capital (Goldin 2016; Wakkee et al. 2019). Martin (1999) concludes that the most significant positive contribution made by universities to regional innovation is attributable to university graduates. In general, there is evidence that graduates are very mobile (Faggian et al. 2007; Whisler et al. 2008). However, Haapanen and Tervo (2012) find that most university graduates do not move from the region where they carried out their higher education during 10 years after graduation. Focusing on employment conditions at 1, 3 and 5 years after graduation, Bacci et al. (2008) reveals that about 90% of Italian graduates' work in the same region where they lived and completed their higher education. Apart from their graduates, universities are also powerful institutions in terms of attracting new human resources (i.e. talented students and staff) into the respective region.

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Furthermore, universities are providers of scientific knowledge, which is considered a crucial aspect for the proliferation of innovation activities within a region (Hessels & Van Lente 2008; Etzkowitz 2003). In this regard, a direct contribution of universities occurs either through consultancy services to the local community, commercialization of research and development (R&D) activities or through the incubation of new ventures (McMullan & Melnyk 1988; Etzkowitz & Leydesdorff 2000).

Krishna and Levchenko (2013) conclude that universities also have indirect effects on the regional GDPpc by taking into account their impact on the productive structure of regions. Indeed, the authors show evidence in favor of a positive effect of universities on the increasing relative share of high and medium technology sectors in the local economy. In addition, Ciccone and Papaioannou (2009) emphasize a positive relationship between the formation and accumulation of human capital and the proliferation of structural change. Whether this economic relationship leads to a positive regional growth rate is a controversial discussion (Hartwig 2012). Studies based on the cost disease argumentation exposed in Baumol (1967) reveal that structural change has a negative effect on the level of regional GDPpc (Nordhaus 2008; Hartwig 2015).² In contrast, studies based on evolutionary theories, Schumpeterian conceptions and structuralist approaches emphasize that the structural change has a positive effect on the level of regional GDPpc due to the necessity to satisfy demand-side needs either through new innovations (Justman & Teubal 1991) or by means of novel transformation processes (Metcalf et al. 2006) with a relevant impact on the dynamics of regional economies. Accordingly, regional GDPpc results from the specialization in economic activities of the secondary and tertiary sectors (Marelli 2004). Indeed, Aditya and Acharyya (2013) find that export specialization in high-tech goods is positively associated with economic growth. Moreover, Saviotti et al. (2016) justify the rise of disposable income based on the growing productivity of incumbent sectors combined with the employment effect associated with the emergence of new high and medium technology sectors. In the limit, one may observe the ascendance of new niches where a non-permanent monopoly can be established (Saviotti & Frenken 2008; Quatraro 2009; Bogliacino & Pianta 2013). This suggests that the relative importance of sectors characterized by high-income demand elasticity is expected to positively influence the regional GDPpc. Consequently, a structural change in favor of specialization in more advanced technological sectors presumably boosts the economic growth of regions (Peneder 2003; Hidalgo & Hausmann 2009; Silva & Teixeira 2011).³

Notwithstanding, this strand of research also highlights that the economic specialization *per se* does not constitute a sufficient condition to generate economic growth (Aditya & Acharyya 2013) since this is dependent on the dominant sector of the local economy (Teixeira & Queirós 2016). As such, from business innovation and human capital formation to community development and institutional capacity through an effective engagement in civil society, universities can make a truly relevant contribution for the regional development in a wide range of areas (Drucker & Goldstein 2007; Benos & Zotou 2014). When all these domains are effectively integrated, universities are said to occupy a proactive – instead of passive – role in the development process of a region (Etzkowitz & Leydesdorff 1995) and in the promotion of labor productivity gains (Andersson et al. 2004).

Having the above economic argumentation in mind, this study aims at estimating the short-term and long-term impacts as well as the direct and indirect effects on the level of regional GDPpc, which result from the role of universities within the respective Portuguese NUTS III region.⁴ Other covariates considered in the analysis include labor productivity, economic activity and structural change, which are all likely to be influenced by the presence of universities.

EMPIRICAL FRAMEWORK

Data

Data were retrieved from the Portuguese Statistics National Institute (INE). Table 1 defines the variables of interest and summarizes descriptive statistics. The panel dataset covers the 25 Portuguese NUTS III regions over the period 2004-2017.⁵

The operationalization of this study is performed using GDPpc as dependent variable. Since larger universities are likely to have stronger regional effects, we consider the stock number of graduates by local universities as a proxy for the presence and size of universities (Grad). In addition, a covariate representative of the proportion of women in higher education graduates (GF) is included. The electric power consumption (EL) and the total gross value added (GVA) are proxies for the intensity of economic activities in the region. Labor productivity is measured by the apparent labor productivity (LP) and the proportion of firms in high and medium-high technology sectors (HMH) is used as a proxy for the economic structure.

Table 2 presents the correlation matrix. In general, one can conclude that the analysis seems to be absent of multicollinearity concerns. This is because the correlation matrix reveals that there is no linear combination of independent variables, so that each coefficient is expected to have the correct sign under the absence of endogeneity concerns.

Table 1. Definition and summary statistics of dependent and independent variables

Acronym	Definition	Mean	Std. Dev.	Source
Dependent variable				
GDPpc	GDPpc is given by the GDP in purchase power parity (PPP) divided by the average annual resident population.	0.411	0.229	INE
Independent variables				
Grad	Stock or number of graduates in higher education institutions (HEIs).	0.589	0.201	INE
GF	Proportion of women in higher education graduates. Formally, GF is given by women graduates in HEIs divided by total graduates in HEIs.	0.456	0.245	INE
EL	Electric power consumption in kilowatts per hour (kWh). Electric power refers to “all the energy produced by hydroelectric, nuclear and conventional power stations, wave and tidal, wind and solar photovoltaic” (INE 2019).	0.380	0.223	INE
GVA	Total GVA at current prices (base: 2011 in EUR).	0.321	0.213	INE
LP	Apparent labor productivity (base: 2011 in EUR)	0.489	0.226	INE
HMH	Proportion of firms in high and medium-high technology sectors.	0.299	0.232	INE

Note: Summary statistics correspond to data after being processed. Data treatment includes the conversion of variables in absolute value to natural logarithm and normalization of all variables (Hancock et al. 1988; Hamilton et al. 2007).

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Table 2. Correlation matrix

	GDPpc	GF	Grad	EL	GVA	LP	HMH
GDPpc	1						
GF	-0.2170***	1					
Grad	0.1262**	-0.3146***	1				
EL	0.5168***	-0.3059***	0.5153***	1			
GVA	0.5146***	-0.3685***	0.6490***	0.9172***	1		
LP	0.8414***	-0.0334	-0.0709	0.3561***	0.2922***	1	
HMH	0.5188***	-0.3292***	0.6317***	0.8029***	0.8341***	0.3231***	1

Note: Symbols ***, ** and * represent one, five, and ten percent of significance level.

Econometric Specification

The empirical specification of the static panel data models (i.e. POLS, RE and FE) employed in this study is formulated as follows

$$\text{GDPpc}_{r,t} = f(\text{GF}_{r,t}, \text{Grad}_{r,t}, \text{EL}_{r,t}, \text{GVA}_{r,t}, \text{LP}_{r,t}, \text{HMH}_{r,t}),$$

where r refers to the region whereas t refers to the year.⁶ In turn, the empirical specification of the dynamic panel data models (i.e. difference GMM, system GMM) considered in this study follows the typical cross-regional catching-up growth equation clarified in Barro and Sala-i-Martin (2003)

$$\text{GDPpc}_{r,t} - \text{GDPpc}_{r,t-1} = f(\text{GF}_{r,t}, \text{Grad}_{r,t}, \text{EL}_{r,t}, \text{GVA}_{r,t}, \text{LP}_{r,t}, \text{HMH}_{r,t}).$$

The dependent variable $\text{GDPpc}_{r,t}$ corresponds to the natural logarithm of GDP per capita for region r in period t , which is influenced by the vector of covariates

$$X_{r,t} = \{\text{GF}_{r,t}, \text{Grad}_{r,t}, \text{EL}_{r,t}, \text{GVA}_{r,t}, \text{LP}_{r,t}, \text{HMH}_{r,t}\}.$$

Under the dynamic specification, the one period lagged dependent variable turns out to be a regressor.

Methodology

The optimal model to analyze the problem in hands is found by obeying to an endogenous process, which is detailed as follows. First, the three static panel data models are applied to take into account existing differences between Portuguese NUTS III regions (i.e. cross-sectional heterogeneity and regional behavior over time).

Second, two dynamic panel data models are applied to incorporate the dynamic adjustment of the dependent variable over time. Exploiting GMM estimators allows controlling for endogeneity of the lagged dependent variable in models where there is a correlation between explanatory variables and the error term. Overcoming the debility associated with the static FE model is particularly important in our case study because, as discussed in Section 2, human capital is likely to influence other covariates which, in turn, are likely to have significant effects on the level of regional GDPpc, thereby reflecting that bilateral causal relationships can persist.

To mitigate endogeneity concerns, Arellano and Bond (1991) propose the use of instrumental variables to deduce the GMM of corresponding moment conditions, namely by employing a difference GMM method. The basic idea is to eliminate individual fixed effects by proceeding with the first difference of the regression equation in the first place. Then, the lagged dependent variable is regarded as the corresponding instrumental variable of endogenous variables in the difference equation. Bond et al. (2001) confirm that, in finite samples, the difference GMM model may suffer from the weak instruments problem being, thus, characterized by a poor estimation precision since the endogeneity problem can still persist.

Arellano and Bover (1995) and Blundell and Bond (1998) propose a solution to this concern by including additional moment restrictions through the provision of a system GMM estimator in which a system of two equations is applied: an equation in differences instrumented by lagged levels and an equation in levels instrumented by lagged differences. As such, this method not only introduces more moment conditions to increase the efficiency of instruments but also transforms existing instruments to make them uncorrelated with the fixed effects. Besides reducing the imprecision and potential bias related to the difference GMM estimator, the system GMM estimator can correct the unobserved heterogeneity problem, omitted variable bias, measurement errors and endogeneity concerns (Arellano & Bover 1995; Blundell & Bond 1998; Bond et al. 2001). Furthermore, Roodman (2009) states that a system GMM estimator is efficient and robust to heteroscedasticity and autocorrelation.

In this study, the lagged dependent variable is considered the internal or endogenous instrument. Additionally, year dummies ranging between 2004 and 2011, population density and mean value of pensions paid by the social security are used as external or exogenous instruments when resorting to dynamic panel data models.⁷ Furthermore, it is also important to highlight that the number of instruments must be lower than the number of units or groups of the panel in GMM. Otherwise, estimates are considered invalid (Roodman 2009).

Third, it is worth emphasizing that the dynamic panel GMM estimation can be divided into one-step and two-step estimations. In this study, we present the two options to reinforce that both cases yield qualitatively similar results.

Fourth, we follow the rule of thumb proposed by Bond et al. (2001) to choose between the difference GMM and the system GMM. In a first step, the dynamic model is estimated through POLS and fixed effects. The coefficient associated with the lagged dependent variable under the POLS (fixed effects) serves as upper (lower) bound, respectively. In a second step, the dynamic model is estimated through difference GMM. If the coefficient associated with the lagged dependent variable is close or below the fixed effects estimate, then the GMM estimate is downward biased because of weak instrumentation such that the system GMM estimator should be adopted.

Fifth, GMM diagnosis requires to execute a test to check for autocorrelation or serial correlation of the error term and a test to check the validity of the instruments.

On the one hand, in order to ensure that the moment conditions are not overly constrained, the number of instrumental variables must not exceed the number of endogenous variables. For lagged endogenous variables and weak exogenous variables to be valid as instruments, it is necessary that the transient disturbances in the base model are free of autocorrelation (Blundell & Bond 1998). This would imply that the disturbances in the differenced model have a significant first-order correlation. For this purpose, the Arellano–Bond tests for first-order (i.e. AR (1)) and second-order (i.e. AR (2)) serial correlation in first-differenced residuals are considered (Arellano & Bond 1991). Because the first differences of independently and identically distributed (iid) idiosyncratic errors will be serially correlated, rejecting the null hypothesis of no serial correlation in the first differenced error at order one does not imply that the model is incorrectly specified. However, rejecting the null hypothesis that the differenced error term is second (or higher) order serially correlated implies that the moment conditions are not valid. Contrarily, the failure to reject the null hypothesis of no second-order serial correlation implies that the original error term is serially uncorrelated and the moment conditions are correctly specified. That said, we restrict our focus on analyzing the p-value associated with the AR (2) statistic. If the AR (2) statistic test is not significant such that the observed p-value is above than the critical p-value of 0.05, then the null hypothesis cannot be rejected and, consequently, the absence of second-order serial correlation cannot be rejected.

On the other hand, the validity of the moment conditions can be tested by Sargan and Hansen tests, whose null hypothesis is that instruments are overall exogenous and, thus, valid. The Sargan test statistic has well-known behavior only when disturbances are homoscedastic (Iqbal & Daly 2014). Additionally, the Sargan test may have low power to reject the null hypothesis, instruments may be only valid when the sample size is small and tend to over-reject the null hypothesis of serial uncorrelated errors in case of one-step GMM estimations (Arellano & Bond 1991; Bowsher 2002). Based on debilities associated with the Sargan test and knowing that the Hansen test is the most adopted in econometric practice (Chen & Sun 2014), the latter is considered to assess the validity of the instruments. If the Hansen test is not significant such that the observed p-value is above than the critical p-value of 0.05, then the null hypothesis cannot be rejected and, consequently, the overall validity or exogeneity of the instruments cannot be rejected.

RESULTS

Analysis

Table 5 in the Appendix presents the static panel data models, as well as the POLS and FE models with lagged dependent variable to perform the rule of thumb proposed by Bond et al. (2001) in order to choose between the difference GMM and system GMM. Hausman test results demonstrate that FE is the optimal static panel data model. One can observe that the sign of the estimated coefficients may not be adequate (e.g., sign of the estimated coefficient associated with HMH is negative), which indicates that the optimal static panel data model may suffer from endogeneity problems, thus, legitimizing the necessity to move toward dynamic panel data models. Results of the rule of thumb proposed by Bond et al. (2001) show that the estimated coefficient associated with the lagged dependent variable under the difference GMM is strictly below the estimated coefficient associated with the FE model with lagged dependent variable, which implies that the system GMM should be adopted.

Benchmark Outcomes

Table 3 presents the short and long run coefficient estimates of the relevant dynamic panel data model.

One should start by emphasizing that the empirical performance of the system GMM estimation is satisfactory and robust. The test of second-order serial correlation AR (2) shows the absence of a second-order serial correlation problem since the AR (2) test statistic is unable to reject the null hypothesis of no second-order serial correlation (p-value equal to 0.940 under one-step system GMM and equal to 0.804 under two-step system GMM). The Hansen test for over-identification indicates that the null hypothesis of exogenous instruments is not rejected (p-value equal to 0.169 under both the one-step and two-step system GMM). Moreover, note that the total number of instruments (i.e. 24) is strictly below the total number of units, NUTS III or groups of the panel (i.e. 25), which means that coefficients resulting from the system GMM estimation are valid. Finally, results under the one-step system GMM are qualitatively similar to results under the two-step system GMM. Hence, for the purpose of the interpretation of coefficients, we hereinafter restrict the focus on the two-step system GMM estimation results.

Let us focus on short run coefficients. The time dependence parameter presents a statistically significant and positive impact on regional GDPpc. *Ceteris paribus*, an increase of 1% of the GDPpc in period $t - 1$ implies and increase of 0.38% of the GDPpc in the current period. Since the coefficient estimate of the lagged GDPpc variable is significant, positive and lower than 1, it conveys the typical conditional convergence result towards the long run equilibrium. Accordingly, regions with a lower initial level of GDPpc present, on average, higher growth rates (Martin & Sunley 1998; Silva & Teixeira 2011; Bauer et al. 2012).

Table 3. Empirical results (benchmark)

Covariate	System GMM			
	One-step		Two-step	
	SR	LR	SR	LR
GDPpc _{t-1}	0.342* (0.197)		0.382* (0.206)	
GF	0.073*** (0.022)	0.110*** (0.027)	0.072** (0.026)	0.116*** (0.034)
Grad	0.106** (0.048)	0.161** (0.075)	0.120** (0.051)	0.195*** (0.074)
EL	-0.363** (0.164)	-0.551* (0.286)	-0.454** (0.173)	-0.735* (0.390)
GVA	0.464** (0.183)	0.705** (0.314)	0.534*** (0.183)	0.865** (0.382)
LP	0.637** (0.230)	0.968*** (0.153)	0.636** (0.230)	1.030*** (0.194)
HMH	0.014 (0.074)	0.022 (0.114)	0.038 (0.074)	0.061 (0.124)
Obs.	325	325	325	325
Instruments [Groups]	24 [25]		24 [25]	
AR(2) [Hansen statistic]	-0.07 [16.51]		-0.25 [16.51]	

Note: Robust standard errors in parenthesis. Symbols ***, ** and * represent one, five, and ten percent significance levels. GMM stands for generalized method of moments, SR stands for short run and LR stands for long run.

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The direct role of universities in the region, which is captured by covariates GF and Grad, also presents a statistically significant and positive impact on regional GDPpc. As postulated in the specialized literature (Barra & Zotti 2017), the result related to covariate Grad suggests that regions with a higher number of graduates sustain a higher level of GDPpc, which meets the expectation that the presence of Universities has a significant and positive impact on regional GDPpc, and the effect is positively related to the size of the universities. In particular, an increase of 1% in the number of graduates implies, on average, a 0.12% increase in GDPpc.

Moreover, the impact of the interaction term between universities and female graduates on the dependent variable also appears to be significantly positive. Thus, regardless of human capital has a significant, positive and direct impact on the level of regional GDPpc, similar is applied to its indirect effect via the provision of higher education to women. We then conclude that, for the period under scrutiny and for the set of 25 Portuguese NUTS III regions, regional economic growth level is heavily explained by the presence of Universities. In particular, an increase of 1 percentage point (pp) in the share of female graduate implies, on average, a 0.07% increase in the GDPpc level. This effect might be explained by several reasons which worth to explore. One reason might be student mobility. As said earlier, there is evidence that graduates do not move much from the region where they carried out their higher education. Eventually, this effect might be stronger for female.

Mutatis mutandis, similar statistically significant and positive impact is observed in labor productivity. Portuguese NUTS III regions have the incentive to attract firms that employ individuals with high skills and knowledge because those tend to be more productive (Hartwig 2012), and more capable of enhancing the emergence of new products, services and processes (Zagler 2009). Therefore, the GDPpc level of Portuguese NUTS III regions that observe labor productivity gains are expected to sustain a positive trend. Indeed, results suggest that a 1% increase in labor productivity implies, on average, an increment of the annual GDPpc level by 0.6%, which is aligned with Bodman and Le (2013)'s findings. It is also worth clarifying that this covariate holds the highest elasticity among all covariates in spite of turning to have an elastic nature only in the long run.

The intensity of economic activities, which is a dimension captured by covariates EL and GVA, also presents interesting results. Additional EL is a sign of additional costs associated with the intensification of economic activities. Hence, EL captures the cost perspective with the intensification of economic activities such that a negative impact on regional GDPpc is, *a priori*, expected. Usually, past contributions have difficulties in finding a unilateral relationship from EL to GDPpc due to the absence of endogeneity correction (Huang et al. 2008). Since GMM overcomes this concern, our results turn to corroborate the persistence of a significant and negative impact of electricity consumption on regional GDPpc. *Ceteris paribus*, an increase of 1% in the electricity consumption results, on average, in an annual GDPpc reduction of 0.45%. Since Portugal is a small open economy, this finding suggests that the country is essentially characterized by a reactive internal economy relatively to the price of electricity and, thus, heavily adaptive to the reference oil price of international markets. Consequently, when the reference oil price increases then similar is applied to the electricity price, which has a negative impact on electricity consumption. Since end users trade-off this consumption by savings, it follows that regional GDPpc increases. *Mutatis mutandis*, the opposite argument is applied to the case of oil price reduction.

In turn, additional GVA is a sign of additional revenues associated with the intensification of economic activities. Hence, GVA captures the revenue perspective with the intensification of economic activities such that a positive impact on regional GDPpc is, a priori, expected (Justman & Teubal 1991; Ciccone & Papaioannou 2009). Our results corroborate the argument that a higher GVA results in higher production, innovation and progress, which increases the level of regional GDPpc.

In relation to structural change, one can conclude that the regional economic growth level is not explained by the dynamics of an increasing but rather tenuous share of knowledge-intensive activities. Although the result indicates that, on average, an increase of 1 pp in the share of firms in high and medium-high technology sectors implies an increase in GDPpc of 0.06%, one can observe that the estimated coefficient lacks statistical significance. This implies that a significant effect of structural change on regional growth levels is expected to hold only in a long term perspective, despite already yielding the correct sign in the short run.

Finally, let us focus on long run coefficients. We conclude that the significance and sign of the estimated coefficients are unchanged, but the magnitude of effects transversely increases. This means that all covariates have a stronger impact on the dependent variable in the long run equilibrium, which suggests the necessity of continuity in the execution of incentive policies has a mandatory nature and it constitutes a socially desirable action. Hence, policy actions and measures of actuation should not be subject to structural breaks either in the public spectrum (e.g., elimination of innovation agencies) or at the private sector level (e.g., investment blockings), for instance, due to changes in political cycles.

Robustness Check

Several studies focused on technical particularities of the econometrics field recognize that the use of lagged instrumental variables with the GMM method may not be adequate given that researchers simultaneously try to control for unobserved heterogeneity and include lagged and endogenous regressors, which can cause serious estimation problems (Moral-Benito et al. 2019).⁸

As such, recent studies propose the estimation of coefficients through a linear dynamic panel data estimation method by resorting to either quasi-maximum likelihood (QML) or maximum likelihood (ML) method under a structural equation modeling (SEM) approach based on the rationale that this alternative method is substantially more efficient than the GMM method when the normality assumption is met. In addition, the alternative method suffers less from finite sample biases (Williams et al. 2019). Table 4 compiles short run and long run coefficients resulting from the application of the QML-SEM with fixed effects.

In terms of expected signs, one can conclude that the estimated coefficients obtained with this extension are qualitatively similar relatively to those yielding under the benchmark approach. Indeed, the unique difference relies on the fact that covariates GF and Grad turn out to lack statistical significance, which suggests the persistence of statistically significant effects of universities on the regional GDPpc only through the indirect channel, particularly via the covariate GVA, which turns out to have an elastic relation with the dependent variable. As such, even though universities may no longer sustain a statistically significant direct effect on the GDPpc of Portuguese NUTS III regions through the formation of new graduates, benchmark results remain qualitatively valid in the indirect channel being, therefore, sufficiently robust with respect to the applicability of different methodologies.

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Table 4. Empirical results (extension)

	QML-SEM	
	SR	LR
GDPpc _{<i>t-1</i>}	0.444*** (0.098)	
GF	0.005 (0.008)	0.009 (0.014)
Grad	0.019 (0.037)	0.034 (0.070)
EL	-0.064* (0.038)	-0.115 (0.074)
GVA	1.663*** (0.304)	2.992*** (0.377)
LP	0.293*** (0.036)	0.528*** (0.064)
HMH	-0.004 (0.048)	-0.007 (0.086)

Notes: Robust standard errors in parenthesis since these were computed using the vce (robust) option. Symbols ***, ** and * represent one, five, and ten percent significance levels. SR stands for short run, while LR stands for long run. The sample consists of 325 observations. QML-SEM stands for the unconditional quasi-maximum likelihood estimators of Hsiao et al. (2002) under a structural equation modeling approach, which is implemented for a linear dynamic panel model with fixed effects. Convergence achieved after 20 iterations with $f(p) = 797.902$. Additional details can be consulted in Kripfganz (2016).

CONCLUSION

Considerable expectations prevail on recent innovation strategies in which universities assume a pivotal role in the social and economic spectrum of a region. Currently, universities are viewed as a critical asset particularly, though not exclusively, in less favored regions. Bearing in mind the argument that the successful mobilization of universities can have a positive effect on regional economies, determinants of GDPpc imminently derived from the role of universities at the Portuguese NUTS III regions level are analyzed through static and dynamic panel data models by focusing on the time period 2004–2017.

We initially confirm that the optimal model to analyze our problem is the system GMM. Thereafter, one-step and two-step system GMM estimation results show a statistically significant and positive impact of universities through human capital formation in general and female graduates in particular, labor productivity and intensity of economic activity on the level of GDPpc. Furthermore, the magnitude of the effects is transversely stronger in the long run, which requires the need to avoid structural breaks in public support programs that have been previously initiated in the past. The covariate representative of structural change has a non-significant, though positive, impact on the level of GDPpc thereby implying that the continuity of public policy actions on this domain is clearly advised, so that structural transformation is capable of assuming a significant scale in the future.

In terms of policy recommendations for the small open economy under analysis, results suggest that the promotion of economic growth in Portuguese NUTS III regions should be neither contemplated by merely investing to increase the scale of universities nor by only establishing standard forms of passive education. It seems necessary to rethink the focus of universities and to adapt the careers of respective professionals and educational offers to new realities (e.g., digital, green and circular economies). Addi-

tionally, the transition of the higher education system toward a logic dominated by societal and regional needs seems to be advised, but not in a reactive way. Universities must be ambitious and visionary in their regional role by acting in a prospective way, thus, anticipating local needs in terms of competencies and knowledge, which requires to assume a front-runner role in education, innovation and scientific achievements. This implies not only a global vision, but also the need to strengthen the triple industry-university-government helix model at the regional level. As defended by Ortega-Argilés and McCann (2018), universities co-working with public authorities have the potential to move from being actors located in a given region to become integral part of that region either by contributing to the design and implementation of smart specialization strategies or through the development of learning and capacity systematic processes with an imminently local nature.

The reference literature is useful in this domain since it reveals several examples of best practices across different European regions. Benneworth (2005) reflects on the success case of the University of Leuven in Belgium. Benneworth and Pinheiro (2017) and Benneworth et al. (2017a) give emphasis to success cases related to the University of Twente in the Netherlands, the University of Tromsø in Norway and the University of Oulo in Finland. The discourse of the authors claims that these universities are representative of place-based leadership in regional innovation systems (RISs). Such a promising concept pretends to restore both agency and territorial needs to key organizations such as universities. However, the effectiveness of place-based leadership requires to take into account not only the specific dynamics of each region, but also the accommodation of flexibility by universities in order to facilitate institutional entrepreneurship and structural change.

Nevertheless, several tensions can be identified even in these successful cases (Benneworth et al. 2017a). Benneworth et al. (2017b) and Benneworth et al. (2017c) consider that universities currently face extensive pressures to transform every aspect of their institutional existence, raising questions on whether third mission outputs can truly be defined as reasonable strategic objectives of HEIs. This concern assumes even more relevance when the core of the debate relies on the Portuguese NUTS III regions because local realities of Southern European countries seem to be different from those observed in Central and North Europe. If Portuguese universities are expected to have a central role in delivering societal benefits to the respective region, then some flexibility should be placed in national higher education policies whose main objective consists of defining benefits enjoyed by universities when there is a strategic interaction with other regional stakeholders. Rather than the persistence of strategic substitutability, this implies that the actuation domain of Portuguese universities should be characterized by the presence of strategic complementarity between the satisfaction of national directives and the maintenance of the endogenous characteristics of each region.

Furthermore, despite knowledge structures and university activities contribute to regional development through fostering integration, collaboration and localized learning, the gradual adaptation of universities to regional dynamic processes also seems to encompass critical aspects that go beyond the limited scope of this study. As such, future research focused on the role of Portuguese universities in the regional development is expected to move toward the comprehension of the extent to which internal institutional configurations of universities affect the production of regional benefits (Sánchez-Barrioluengo & Benneworth 2019) in alternative areas other than the economic spectrum.

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ENDNOTES

- ¹ Crespo and Fontoura (2007) and Crespo et al. (2009) explore the impact of foreign direct investment (FDI) spillovers on regional convergence, while Ramos (2009) analyzes regional development and sustainability indicators. Antunes and Soukiazis (2006) highlight the role of European structural funds for regional convergence at the NUTS III level, whereas Soukiazis and Proença (2008) include tourism as a potential factor of regional growth.
- ² The argument considers that most economies moved from productive sectors characterized by rapid productivity growth (e.g., manufacturing) to non-productive sectors characterized by stagnant technologies (e.g., public services, construction).
- ³ This is because high and medium technology sectors tend to offer better wages, thus, attracting more qualified individuals and causing direct effects on regional growth through the dissemination of new forms of production, efficient allocation of resources and alleviation of capacity constraints (Zagler 2009; Noseleit 2013).
- ⁴ Section 2 is a mere systematization of the major roles of universities in a region. Much more could have been written about this domain of knowledge. Rigorous literature reviews and additional details can be observed in Arbo and Benneworth (2007) as well as in Goddard and Vallance (2013).
- ⁵ Data and code used in the present analysis are freely available for the interested reader and both can be downloaded from the following link: https://gitlab.com/vmsrib/pt_regional_role_of_universities.
- ⁶ Needless to say, there is no unobserved heterogeneity between regions under the POLS since this model specifies a constant coefficient across units. In opposition, the unobservable region-specific effect is considered an intercept (included in the error component term) under the FE (RE) model being, therefore, correlated (uncorrelated) with the regressors, respectively.
- ⁷ Population density (social security pension) has been frequently used as covariate in previous studies and, based on Sterlacchini (2008) and Wei and Hao (2010), it is expected to present a positive (negative) association with GDPpc, respectively. Note that the use of instruments aims at increasing the efficiency of the estimation since instruments should be correlated with the vector of covariates, but orthogonal to the error. The choice of population density and mean value of social security pensions as external instruments is justified by their strong correlation with the regressors, while holding a reduced error. Moreover, the use of year dummies as external instruments is justified by the need to capture the effectiveness in the application of public policies (i.e. they constitute proxies of policy learning or, similarly, they capture the effectiveness in the execution of public policies). The choice of 2004-2011 year dummies as external instruments is justified by the assumption that this corresponds to the time period where there is effectiveness in the execution of public policies and, consequently, an effective learning policy such that year instruments representative of this time span influence the vector X, but are not correlated with the error. In opposition, year dummies representative of 2013-2017 serve as controls but not as instruments based on the argument that an effective learning policy of the most recent past still did not occur. Finally, the dummy variable representative of the year 2012 was disregarded.
- ⁸ In the present empirical application, criticism may emerge on the choice of instruments and the presence of omitted variable bias. The alternative estimation method is also frequently considered due to the presence of time invariant covariates. As a remark, Sánchez-Barrioluengo & Benneworth (2019) recognize that the ML-SEM method is preferred to the generalized least squares (GLS) method.

APPENDIX

Table 5. Auxiliary results

Covariate	POLS		RE	FE		Difference GMM	
	Without LDV	With LDV		Without LDV	With LDV	One-step	Two-step
GDPpc _{t-1}		0.924*** (0.016)			0.422*** (0.097)	0.175 (0.178)	0.190 (0.198)
GF	-0.087*** (0.024)	-0.004 (0.007)	0.016 (0.014)	0.012 (0.012)	0.006 (0.008)	0.009 (0.018)	0.008 (0.017)
Grad	-0.096** (0.042)	0.011 (0.013)	0.032 (0.055)	0.004 (0.050)	0.019 (0.039)	-0.015 (0.050)	0.002 (0.056)
EL	-0.194*** (0.066)	-0.051** (0.020)	-0.098* (0.057)	-0.075 (0.052)	-0.065 (0.041)	0.139 (0.177)	0.099 (0.158)
GVA	0.399*** (0.079)	0.058** (0.025)	1.119*** (0.219)	2.274*** (0.228)	1.797*** (0.298)	2.459*** (0.714)	2.198*** (0.770)
LP	0.754*** (0.028)	0.068*** (0.014)	0.456*** (0.038)	0.436*** (0.325)	0.309*** (0.036)	-0.001 (0.100)	0.041 (0.090)
HMH	0.140*** (0.046)	0.015 (0.014)	-0.027 (0.076)	-0.035 (0.078)	-0.019 (0.053)	-0.111* (0.054)	-0.108 (0.066)
Constant	0.041 (0.029)	-0.008 (0.009)	-0.153** (0.060)	-0.502*** (0.080)	-0.473*** (0.078)		
F or W stat	234.34***	2638.39***	232.44***	55.55***	67.54***	135.79***	71.29***
R ²	0.804	0.983	0.546	0.408	0.556		
Nr. Observations	350	325	350	350	325	300	300
Nr. Instruments						23	23
Nr. Groups						25	25
Hausman			94.34***				
BP LM test			1540.31***				
AR(2)						1.21	1.63
Hansen						20.75	20.75

Note: Standard errors in parentheses. LDV stands for lagged dependent variable, POLS stands for pooled ordinary least squares, GMM stands for generalized method of moments, FE stands for fixed effects, RE stands for random effects and BP LM stands for Breusch and Pagan Lagrangian multiplier. Symbols ***, ** and * represent one, five, and ten percent significance levels. F statistics is calculated under POLS and FE, while Wald statistics is calculated under RE. The root mean square error (RMSE) under POLS without LDV equals 0.102, while being equal to 0.030 under POLS with LDV. Corr (u_{it}, X_{it}) under FE without (with) LDV equals -0.897 (-0.886), respectively. Corr (u_{it}, X_{it}) is calculated only under FE, while it assumes a null value under RE being, therefore, replaced by the theta parameter (i.e. fraction of the error explained by the unobserved region-specific heterogeneity) which is equal to 0.933.

Chapter 11

Universities and Human Capital as Regional Determinants for High-Growth Firms

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ABSTRACT

Universities have been increasingly asked to play a core role in the growth of the region where they locate as they hold valuable resources for innovation and growth. This study addresses the role of Universities as a location determinant for firms' high growth, in addition to other location and firm level variables. Indeed, academia diverted increasing attention to high growth firms (HGFs), but an important aspect that has been relatively absent from HGFs research is the 'geography' and location aspects of where these firms grow. The study is conducted in Portugal, and draws upon firm-level information from IES (Inquérito Empresarial Simplificado), which contains detailed balance sheet and income statement information for firms in all sectors of activity in Portugal, covering a time span of 9 years, from 2006 to 2014. Knowing the regional factors that drive growth at the firm level helps to implement more effective enterprise policies.

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INTRODUCTION

To understand the sources of firm high growth is a central aspect for today's economies since it is known that a small number of high-growth firms are responsible for a great share of job and income creation (Acs et al., 2008; Coad et al., 2014; Anyadike-Danes et al., 2015; Anyadike-Danes and Hart, 2015). Fast growing firms have been therefore hailed as a vital source of economic competitiveness and embraced as swords for alleviating unemployment and promoting economic growth (Henrekson and Johansson, 2010; OECD, 2010).

The challenge for economies lies in boosting growth, not just by fostering new entrepreneurial activities, but also by improving the growth potential of existing firms. This study explores whether Universities can play a role on this regard. Indeed, universities have been increasingly asked to play a core role in the growth of the region where they locate. They hold valuable resources for innovation and growth (Etzkowitz and Leydesdorff, 2000; Leydesdorff, 2003). Yet, we could not find empirical studies exploring the role of Universities as determinants of firm high growth. Indeed, academia diverted increasing attention to HGFs, but an important aspect that has been relatively absent from HGFs research is the 'geography' and location aspects of where these firms grow. Despite the overwhelming research in the field, little is known about location specific issues related to HGFs (Henrekson and Johansson, 2010; Bogas and Barbosa, 2013; Coad et al., 2014; Giner et al., 2017).

Within this background, this study explores the role of universities as a location determinant of firms' growth at regional level. Doing so, the authors bring to the literature new insights. First, they explore a special type of firm growth, high growth. The authors provide new evidence about the influence of universities through their direct and indirect impact upon human capital in the region, on the probability of firms obtaining high-growth rates and, therefore, being high growth firms (HGFs). In addition to test the relevance of the presence of universities in the region, through their contribution to capital augmentation in a region, the authors explore other regional / location characteristics. Results on the importance of location attributes for firm performance are rather important from the economic policy perspective. Knowing the regional factors that drive growth at the firm level would help to implement effective innovation policies.

The study is conducted in Portugal, and draws upon firm-level information from IES (Inquérito Empresarial Simplificado), which contains detailed balance sheet and income statement information for firms in all sectors of activity in Portugal. The edition at our disposal covers a time span of 9 years, from 2006 to 2014. Additional data was gathered from INE and DGES.

Results show that the presence of Universities in the region is positive but not significant as determinant for firms' high growth. Human capital reveals negative and significant. The results signal the effect that competition for scarce resources is likely to have upon firms' high growth. Otherwise, our results signal that firms may benefit from being located in geographic agglomerations, especially with high population density. Companies in dynamic locations can have access to a larger local market and to an existing pool of employees, thereby lowering their search and transaction costs in recruiting.

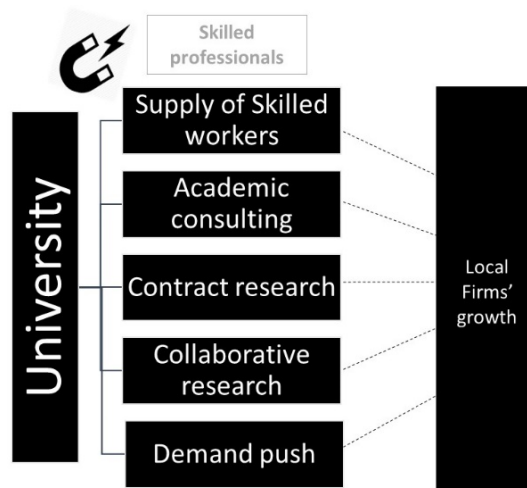
The chapter is structured as follows. The next section addresses the theoretical background. Then, the authors, describe the data underlying this study, as well as the methodology used. The empirical results are presented in section 4. Section 5 concludes and derives implications from our study.

BACKGROUND: UNIVERSITIES AS LOCATION DETERMINANTS OF FIRMS' GROWTH

Among other effects, universities can play a pivotal role in the context of regional entrepreneurial dynamics and firms' growth. The existence of universities in a region is an asset likely to affect firms' growth. Several authors discuss how proximity to universities and research facilities as well as the level of human capital in a region potentiate firm formation rates, high-growth and firms' survival (Acs and Mueller, 2008; Audretsch and Dohse, 2007; Acs and Armington, 2004; Woodward 1992; Eriksson and Rataj, 2019). This impact upon local firms' growth can occur through several channels, and some of these are reflected in Figure 1. One of them is the direct role that universities have on the creation and accumulation of human capital within a region (Martin, 1999; Goldin, 2016; Wakkee et al., 2019) meeting the skills needs of the local labor market. Through their teaching at undergraduate and postgraduate level, universities have the potential to add to the stock of human capital by means of graduate recruitment into regional businesses, possibly following work placements as part of the student's degree. More particularly, through graduate's knowledge exchange between researchers and businesses takes place. Universities can also act as a powerful magnet for attracting talented students and staff into the region from other parts of the country and even from abroad. The large pool of qualified labor supply is likely to contribute to local firm's competitive advantage.

Universities also contribute to firms' growth through the provision of innovation related services, within university-industry collaborative linkages (Rybnicek and Königsgruber, 2019). Otherwise, universities bring together in a certain location numerous clients, which provide a demand push for growth in geographically close firms.

Figure 1. Impact of universities upon firms' growth in a regional setting



DATA AND METHODOLOGY

Empirical Setting and Data

Portugal is an appropriate setting to study this issue for several reasons. First, unlocking the growth potential of the private sector has continuously been at the center of the discussions on how to boost economic growth in Portugal, but it has intensified during and after the recent economic crisis. Second, albeit being a relatively small economy, Portugal suffers from structural regional unbalances in terms of economic, social and demographic indicators. There is a lack of clear understanding if these unbalances apply to the case of HGFs. Second, to the best of authors knowledge, the link between universities and firm growth has not been explored in the Portuguese case. Finally, the availability of company information for all firms that are active in Portugal for a 9-year period (i.e. from 2006-2014) enabled to compute high growth patterns in a comprehensive manner.

The authors draw upon firm-level information from IES (Inquérito Empresarial Simplificado), which contains detailed balance sheet and income statement information for firms in all sectors of activity in Portugal. Our working sample is formed by continuing incumbent firms from 2006 to 2014. Additional data was gathered from INE and DGES.

Methodology

Defining High-Growth

Our computation is based in Bianchini et al. (2016) to define high growth in the period (2007–2014). Data from the year 2006 are used to identify firms already in activity, and to define firms and locations' characteristics at the beginning of the analyzed period. Annual growth of firm i in year t (gS_{it}) was obtained as the difference of firm size (S_i) between year (t) and year ($t-1$):

$$gS_{it} = S_{it} - S_{i,t-1} \quad (1)$$

$$S_{it} = \log(S_{it}) - \frac{1}{N} \sum_{i=1}^k S_{it} \quad (2)$$

being firm size (S_{it}) measured as either number of employees or sales, adjusted by the average size of the N firms of the same (4-digit) sector. Hence, firms' annual growth rates were normalized by the annual sectoral average. The annual growth for each year of the period 2007–2014 was also computed.

High-growth (HG) firms are those companies whose average growth rate during the crises period (from 2007 up to 2014) falls into the top 20% of the average growth rates distribution, in terms of at least one of the two growth measures (number of employees or sales). Once that the authors identify HG firms through annualized average growth over a long period, they avoid the confusing effects imposed by the typical instability of growth patterns over time.

Econometric Approach and Explanatory Variables

Methodologically, the authors, followed 2 steps. First, the authors, explored the geography of HG at district level.

Second, they applied a multinomial logistic regression model to test if presence of university and the human capital in the region are likely to impact upon the odds of a firm being HG. The binary dependent variable is 0 for a firm being non-HG and 1 for HG. As explanatory variables it were considered location and firm level variables. As location determinants, the main variable of interest relates to the presence of university and human capital. The presence of university was measured by the number of graduates by high education institutions (HE) in the district divided by the number of persons at work in the district. The authors considered regional human capital measured by the ratio of population with higher education divided by total population.

They added other location and firm level variables, which are typically found in the literature as determinants for firm growth (Coad, 2009; Henrekson and Johansson, 2010; Coad et al., 2014; Dillen et al., 2014; Hölzl, 2014; Daunfeldt and Halvarsson, 2015; Bianchini et al., 2016; Satterthwaite and Hamilton, 2017). Table 1 summarises the variables used.

In Table 2 the authors report the summary statistics for the variables used and the correlation matrix is provided in table 3

RESULTS

High growth firms account for about 22% of the total sample (Table 4).

Turning to an analysis by district, high growth is a phenomenon present in all districts, but mainly concentrated in the costal districts, as reflected in Figure 2.

Table 1. Explanatory variables

	Variable	Description	Source
Location variables	University presence (and size)	Number of graduates by high education institutions in the district/ number of persons employed all sectors in the district	DGES and BPortugal
	Human capital	Population with higher education/ population, by district	DGES and INE
	Concentration firms	Total number of firms / area (KM2), by district	BPortugal
	Population density	Population/ area, by district	INE
Firm level variables	Size	Log number employees	BPortugal
	Age	2006-year of foundation	BPortugal
	Productivity	value-added over total labor costs	BPortugal
	Profitability	EBITDA over total assets (ROA)	BPortugal
	Liquidity	ratio between assets and liabilities	BPortugal
	Innovation	Intangible assets	BPortugal
	Internationalization	the share of exports on sales	BPortugal

Universities and Human Capital as Regional Determinants for High-Growth Firms

Table 2. Descriptive statistics

Variable	Pooled Sample						Non-manufacturing						Manufacturing					
	Obs	Mean	Std.	Min	Max		Obs	Mean	Std.	Min	Max	Obs	Mean	Std.	Min	Max		
Graduates	190 118	0,04347	0,027863	0,000	0,235		164 908	0,043693	0,027868	0	0,235	25 210	0,042015	0,027781	0	0,235		
Human capital	190 132	0,108568	0,031367	0,071	0,155		164 920	0,110229	0,031882	0,071	0,155	25 212	0,097707	0,0252	0,071	0,155		
Agglomeration	190 132	20,61998	25,60546	0,251	149,81		164 920	21,3989	26,32146	0,251	149,81	25 212	15,52484	19,55818	0,251	149,81		
Concentration VVN	190 132	1,85E+07	2,11E+07	91345,000	2,90E+08		164 920	1,93E+07	2,16E+07	91345	2,90E+08	25 212	1,34E+07	1,70E+07	91345	2,90E+08		
Pop density	190 132	500,9008	375,3408	15,000	1469,363		164 920	511,0019	379,0577	15	1469,363	25 212	434,8256	342,797	15	1469,363		
Size	190 132	9,544653	90,53864	0	15216,5		164 920	7,866569	93,32474	0	15216,5	25 212	20,52156	68,61242	0	3518,5		
Age	190 125	12,37591	12,81656	0	217		164 914	11,95792	12,59213	0	190	25 211	15,11007	13,89085	0	217		
Productivity	158 850	1,794922	3,300879	-88,051	86,682		135 513	1,848797	3,518821	-88,052	86,682	23 337	1,482079	1,466489	-41,6287	48,205		
ROA	187 957	0,070641	3,522443	-260,122	1426,286		162 985	0,069208	3,779984	-260,122	1426,286	24 972	0,079989	0,36465	-22,3533	28,496		
Liquidity	174 644	3,535256	7,33316	-19,726	99,551		150 560	3,719196	7,689206	-19,7267	99,551	24 084	2,385363	4,336546	0	94,3946		
Internationalization	190 132	3,795988	15,34369	0	100,029		164 920	2,815566	13,31245	0	100,029	25 212	10,20925	23,84922	0	100		
Innovation	118 563	107071,8	4703612	0	9,54E+08		101 576	83806,96	3949450	0	9,54E+08	16 987	246187,1	7818347	0	7,09E+08		

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Table 3. Correlation matrix

Graduates	1											
Human capital	-0,044	1										
Agglomeration	-0,263	0,311	1									
Pop density	-0,296	0,485	0,825	1								
Size	-0,015	0,027	0,018	0,026	1							
Age	-0,028	0,108	0,047	0,072	0,076	1						
Productivity	0,007	0,008	0,004	-0,001	-0,007	-0,033	1					
ROA	0,002	-0,018	-0,013	-0,019	0,005	-0,010	0,192	1				
Liquidity	0,006	0,025	0,0239	0,036	-0,017	0,076	0,057	0,030	1			
Internationalization	-0,029	-0,038	-0,028	-0,009	0,071	0,039	0,007	0,022	-0,020	1		
Innovation	-0,004	0,020	0,008	0,011	0,369	0,019	0,006	0,001	-0,005	0,019	1	
Concentration_VVN	-0,219	0,740	0,373	0,620	0,027	0,097	0,003	-0,018	0,029	-0,02	0,015	1

Table 4. High-growth firms

	Total		Manufacturing		Non-manufacturing	
	N. of firms	%	N. of firms	%	N. of firms	%
High growth	42579	22.39	6232	24.72	36347	22.04
Non high-growth	147553	77.61	18980	75.28	128573	77.96
Total	190132	100	25212	100	164920	100

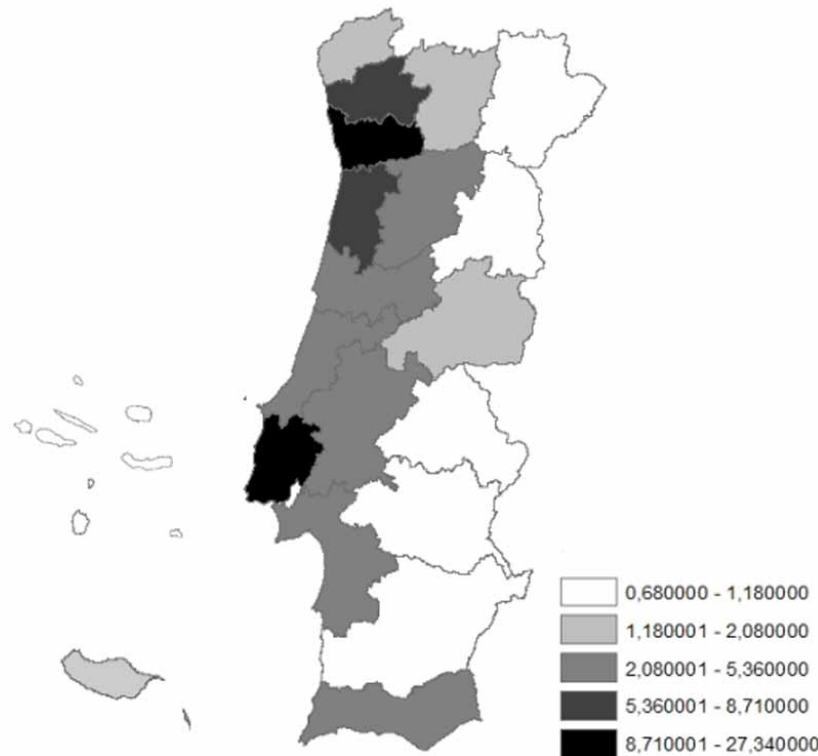
The dispersion of HG across districts, to a large extent, resembles the distribution of firms in the country, with a clear concentration in the coast in a tract that extends from Braga towards Lisbon, the picture is similar for manufacturing and services. Hence, the results signal that not all regional economies benefit equally from the growth of HGFs, in terms of employment or other positive spillovers.

In Table 5, the authors report their results for the multinomial logit model, where they include location and firm-level variables. As proposed by Bianchini et al. (2016), the authors, considered a lag between initial firm characteristics and growth status.

In what regards our main variables of interest, the presence of Universities, here represented by the number of graduates, it reveals positive but not significant. Human capital reveals negative and significant, in all models. Several reasons might justify this finding. One of the most plausible relies on the fact that when the level of education of the population is higher, recruiting may imply higher costs and, therefore, penalize firm growth. The results for concentration, negative and significant, also signal the effects of competition for scarce resources.

Otherwise, our results signal that firms may benefit from being located in geographic agglomerations, especially with high population density. Companies in dynamic locations can have access to a larger local market and to an existing pool of employees, thereby lowering their search and transaction costs in recruiting.

Figure 2. Share of HG on total number of firms by district, Portugal



As far as firm-level variables is concerned, manufacturing firms of larger size tend to grow less, while for services the relation is the opposite. Age, otherwise, reveals negative and significant in all cases. Hence, younger firms tend to grow faster. Productivity and profitability are both determinants for high-growth. It is also worth to note that growth is likely to be dependent on higher debt, as high-growth firms tend to have lower liquidity.

Finally, the results support the argument that internationalization stimulates growth. The internationalization variables appear significant and positive in all models. The effect of innovation is not so clear-cut. Despite being positive and significant, the coefficient is null.

FUTURE RESEARCH DIRECTIONS

This chapter addresses the role of Universities as agents likely to promote firm growth, being a novel contribution on that regard. The focus has been upon the supply of skilled professionals. In future studies the measure for human mobility from the University to local firms could be improved. Otherwise, future research could explore the role of Universities as determinants for growth through other channels. Collaborative relationships between universities and industry, in particular the role of practices such as collaborative research, university-industry research labs, contract research and academic consulting could be analysed. As appointed by Rybnicek and Königsgruber (2019), many aspects of these relationships remain under-researched.

Universities and Human Capital as Regional Determinants for High-Growth Firms

Table 5. Multinomial logit model

Dependent variables	Pooled sample			Non-manufacturing			Manufacturing		
	Coef.	S.E	Z	Coef.	S.E	Z	Coef.	S.E	Z
University graduates	0,116	0,274	0,43	0,148	0,300	0,49	0,757	0,678	1,12
Human capital	-2,154***	0,377	-5,71	-1,909***	0,401	-4,77	-2,499*	1,345	-1,86
Agglomeration VVN	0,000*	0,000	1,68	0,000**	0,000	2,17	0,000	0,000	-1,32
Concentration (firms)	-0,006***	0,001	-9,85	-0,006***	0,001	-9,64	-0,004**	0,002	-1,99
Pop density	0,000***	0,000	9,43	0,000***	0,000	9,39	0,000**	0,000	2,26
Size	0,000**	0,000	3,00	0,000***	0,000	3,43	-0,001*	0,000	-1,74
Age	-0,025***	0,001	-32,35	-0,026***	0,001	-29,47	-0,022***	0,002	-13,04
Productivity	0,021***	0,002	9,11	0,019***	0,002	8,02	0,111***	0,016	6,99
ROA	0,042*	0,022	1,93	0,023	0,017	1,37	0,522***	0,134	3,89
Liquidity	-0,002*	0,001	-1,73	-0,001	0,001	-0,65	-0,020**	0,007	-2,92
Internationalization	0,005***	0,000	12,52	0,006***	0,001	10,24	0,003***	0,001	4,47
Innovation	0,000**	0,000	2,19	0,000	0,000	0,85	0,000**	0,000	2,22
Const	-0,778***	0,036	-21,44	-0,833***	0,039	-21,33	-0,734***	0,120	-6,12
Number of obs	97177			81562			16615		
LR chi2(11)	1655,65			1389,02			404,030		
Prob > chi2	0,0000			0,0000			0,000		
Pseudo R2	0,0152			0,0153			0,022		

*** significant at 0,001; ** significant at 0,05; * significant at 0,1

CONCLUSION

Focusing on our main aim, our results regarding the impact of graduates might come as a surprise, but they do not put into question the potential role of universities on regional growth. Indeed, university students might be from outside the region and even from other countries, and indigenous students might not stay in the region after graduation. Regarding the effect of human capital, in our view, our results do not deny the importance of high qualifications. Instead, they signal that regional and local strategies should consider the need to promote a relatively diversified business structure demanding diverse resources, such as a diversity of employees' skills and capabilities in a region. As Bogas and Barbosa (2013) found, this factor explains in a significantly way the probability of firms being high-growth. Their results show that regions with different types of employees enhance the probability of a firm here located to be of high-growth. As Brown and Mason (2012) and Audrestch et al. (2019) highlighted recently, there is the need to put in place policy instruments aimed at augmenting innovation-driven growth across a broad spectrum of industries and regions.

Moreover, the impact of universities upon firms' dynamics and regional growth might occur through other channels, not well captured through the variable the authors have used here. As advanced by Benos and Zotou (2014) and Drucker and Goldstein (2007) among others, from business innovation, human capital development to community development and institutional capacity through an effective engagement in civil society, universities can make a truly relevant contribution for regional development in multiple domains, which were not accounted for in this study.

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Chapter 12

Economic Contribution of University Spin-Off: A Regional Study of the Spanish Case


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ABSTRACT

University spin-offs (USOs) are drawing increasing interest among both academic and institutions, given their potential contribution in the economic development. In order to obtain empirical evidence about the impact of Spanish USOs, this chapter analyses the population identified in 2013, revealing a limited impact in the business fabric, into job creation and to generating wealth, but major differences among regions. To identify which factors are related to a greater or lesser impact of USO in the regions they are located, the authors apply a logistic regression data panel for the 2012-2015 period. The results show that some traits of USOs and their parent universities determine a greater number of employees, but the particularities of the environment in which they operate, only affect to USOs belonging to the ITC sector. The findings could support public institutions about the types of policies should be promoted to improve the economic contribution of USOs.

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INTRODUCTION

The importance of higher education institutions in regional economic development has been extensively evidenced in the literature (Drucker and Goldstein, 2007; Caniëls and van den Bosch, 2011). Their direct impact as employers and purchasers of goods and services is further enhanced by their training of human capital and creation of new knowledge through scientific research (Uyarra, 2010; Rodrigues and Melo, 2013). However, for society to be able to effectively benefit from universities' huge socio-economic potential, research results need to be disseminated, applied and economically exploited (Berggren and Lindholm Dahlstrand, 2009). Hence, since the late 20th century, the governments of developed countries have passed some legislation to stimulate the growth of university research through the establishment of public-private research partnerships, the creation of specialized transfer units, and the setting up of science parks and business incubators (Lockett et al., 2005; Fryges and Wright, 2014). It can be said that the first of these laws is the US Bayh-Dole Act, which granted universities property rights over their inventions, thus providing them with an alternative source of financing other than public funds (Goldstein, 2010). Due to the positive result of this act in US (Hayter, 2015)¹, certain European and Asian countries² have adopted similar legislations in order to promote more active participation by universities in technology transfer (Shane, 2004; Mustar et al., 2008; Grimaldi et al., 2011). Spain has been no stranger to this process, and has implemented policies to promote the carrying out of research of excellence "aimed at contributing to the advancement of knowledge, to innovation, to improving people's quality of life, and to companies' competitiveness" (Article 41.1. of Spain's Organic Law on Universities, 2001).

Together with the support of public institutions, the development of the information society and other areas of knowledge, which require continuous technological innovations, have all led to an increase in technology transfer activities from the university to the industry (Rothaermel et al., 2007). In this regard, Etzkowitz et al. (2000) suggest that from different starting points, but worldwide, a pattern of transformation towards an entrepreneurial university is emerging, in response to the increasing importance of knowledge in national and regional innovation systems. Thus, universities' genuine missions of producing knowledge and subsequently disseminating it through teaching and scientific publications have been complemented by a third mission, where three main facets converge: entrepreneurship, innovation, and social engagement (Vorley and Nelles, 2008). While the triple helix model, where the interactions between universities, industries and government bring to an improvement in innovation processes, the engaged university approach goes further, as it advocates the active and initiating role of universities in regional development, being the academic entrepreneurship an important mean to achieve it (Caniëls and van den Bosch, 2011; Fromhold-Eisebith and Werker, 2013).

Even though research can be marketed through patents, licenses and collaboration between universities and industries, the creation of spin-offs (USOs) has been identified with the archetype of the entrepreneurial university (Harrison and Leitch, 2010). Given their perceived importance in the economic and technological development, in the last decades USOs is drawing increasing interest and is sparking political and academic debate (Shane, 2004; Wright et al., 2008; Vincett, 2010; Hayter, 2013). From an academic viewpoint, they have become the focus of many studies which, from different scientific disciplines and under diverse theoretical approaches, address topics related to their creation, their functioning or their economic impact (Mustar et al., 2006; Helm and Mauroner, 2007; Rothaermel et al., 2007)³.

Economic Contribution of University Spin-Off

The emergence of new companies is beneficial for the region in which they are established, because they contribute to filling market niches and foster a competitive environment, which has a more relevant long-term economic impact (Gumbau, 2017). In the specific case of USOs, this benefit could be even greater, because they make it possible for society to take advantage of the knowledge and innovation originating at universities, by promoting the development of new products and services of considerable economic value, and generating quality jobs (Shane, 2004; Fini et al., 2011; Criaco et al., 2014). Thus, this kind of companies has become widely accepted as a key part of regional innovation activities (Benneworth and Charles, 2005; Block et al., 2017).

However, whereas it has been shown that innovative entrepreneurship is a regional phenomenon (Block et al., 2017; Fritsch and Aamoucke, 2017) there is insufficient empirical evidence of the economic importance of USOs in the regions where they are located, especially in Europe (Berggren and Lindholm Dahlstrand, 2009; Bigliardi et al., 2013). Specifically, few studies have been carried out from a regional perspective (Bathelt et al., 2010; Corsi and Prencipe, 2018) when they would be relevant for identifying the heterogeneity existing in sub-national contexts (González-Pernía et al., 2013). As regards Spain, there are different papers analysing the factors determining the creation of USOs and their characteristics (Gómez et al., 2008; Rodeiro et al., 2010; Gómez-Miranda and Román-Martínez, 2016; Rodríguez-Gulías et al. 2016), but there are no studies on their contribution to the economy (Iglesias et al., 2012).

Moreover, although a company's contribution to regional competitiveness is clearly linked to how efficiently it performs (Clayman and Holbrook, 2003), articles focusing on the performance of USOs over prolonged periods are scarce (Harrison and Leitch, 2010; Hayter, 2013). On the other hand, those what focus on the institutional and environmental factors affecting USOs performance show inconclusive or conflicted conclusions (Mathisen and Rasmussen, 2019).

Therefore, the present paper has a twofold goal. The first one is to obtain empirical evidence of the economic contribution of Spanish USOs under a regional perspective. To do so, some key variables to local economic development, such as jobs and creation of wealth have been analysed. After detecting an unequal distribution of USOs impact, the second aim is to identify which factors are associated to an USO achieves a greater figure of employment than others, and the possible influence of the own features of regions where they are located. The results obtained will contribute to bridge the gap in the research and allow owners and institutions to take the appropriate measures and to propose policies that improving the performance of USO, which leads to a greater impact contribution of these companies to the regional economy.

The research has been designed following a multivariable approach that combines aspects related to the business model, by analysing the economic activity of USOs (Mustar et al., 2006), together with the institutional perspective, by considering factors connected to the environment (Guerrero and Urbano, 2012), and the endogenous growth theory (Urbano y Guerrero, 2013), by linking the technology existing in the region to economic development (Benneworth and Charles, 2005, Corsi and Prencipe, 2018; Schmitz et al., 2017).

The study is based on the population of Spanish USOs identified in 2013 and their location in the 17 autonomous communities⁴. The database comprises information about the characteristics of the USOs, the university from which they stemmed, and the environment in which they operate. To assess the contribution of these factors to the impact of these companies on the economy, probit regression models for panel data have been applied.

The rest of the paper is organized as follows. Next section addresses the theoretical framework of research: the approaches followed when studying USOs are reviewed, the papers studying their effects on the economy are documented, and the factors that may influence their action are identified. Next, we conduct our study, but we propose earlier the research design and describe the methodology applied to give responses to our research questions. The empirical analysis has two parts. Firstly, the economic contribution of USOs by region is quantified, and secondly, the factors that determine said impact are identified. Lastly, we discuss the results obtained and give some recommendation to public policy and concluding remarks.

BACKGROUND

Effects of USOs on the Economy

A reference point for addressing the impact of USOs on the regional economy could be the study conducted by Fritsch and Mueller (2004). The authors identified jobs, unemployment, added value, production and productivity as direct effects of entrepreneurship; as indirect effects they stated the displacement of competitors and an improvement in supply conditions and competitiveness. As mentioned before, these effects become more evident in the case of USO, because their innovative nature fosters the emergence of new products and creative solutions to problems, which in turn leads to improved competitiveness of the respective industries and to job growth (Fritsch, 2008). This phenomenon is clearly observable in USA, where USOs have been involved in the birth and growth of new economic regions such as such as Silicon Valley and the Route 128 area.

As regard to Europe, Berggren and Lindholm Dahlstrand (2009) studied the regional effects of USOs in Sweden. Whereas direct impact is usually measured by jobs or added value, USOs can also be considered to have an indirect impact on the region's economy, because their innovations are often exploited outside the companies themselves. For their part, Benneworth and Charles (2005) developed a conceptual model of how USOs can improve their locals' economies, focusing on peripheral regions, such as Newcastle in the UK, and Twente in the Netherlands. To this end, they identified the benefits that these companies bring to their regions, classifying them according to whether they have a direct or indirect effect on the economy. The direct benefits are linked to the type of companies that USOs usually are. Thus, they tend to be high-tech employers, paying good salaries and promoting entrepreneurship, and they maintain their ties to the parent institutions through technology transfer, hiring, and research collaborations. The indirect effects are linked to their potential as training for new entrepreneurs, their contribution to creating regional technology clusters promoted by technology spillover, and the enhancement of business support services.

Based on said study, Iacobucci and Micozzi (2015) drew up a set of indicators to measure the impact of these benefits within Italy. Regarding direct effects, to evaluate the USOs' capacity to create high-tech jobs, they combined the number of employees and the activity sector; to quantify the USOs' capacity to contribute to high-tech entrepreneurship, they considered the number of promoters and the activity sector; lastly, to estimate the links between university research and the needs of the market, they utilized the number of subsidies received and of contracts formalized with the parent university. With respect to indirect effects, they used indicators such as the presence of foreign companies among the shareholders, the formation of technological clusters, collaboration with other companies, and the

existence of incubators or of entrepreneurship courses. Corsi and Prencipe (2018) go further the above research, exploring if the USOs could partially enhance the competitiveness of regions in which they are located. After analysing data from 952 Italian USOs of 20 different regions, they describe a positive impact of the number of USO from a given university on the degree of regional competitiveness, measured by GDP per capita, number of patent applications and number of R&D workers, quantified at regional level. In particular, their results show that the more competitive regions present higher number of USO, reinforcing the results of Iacobucci and Micozzi, (2015). In this way, they conclude that the impact of USOs on the local economy depends on the own features of the local economy.

In view of the above, it is easy to deduce that measuring the economic effects of USOs is a complex endeavour. On the one hand, effects are achieved when the number of companies and employees reaches a critical mass, which means they need to have been established for some time (Fritsch, 2008). On the other hand, a correlation can be observed between direct and indirect impact, and this makes it difficult to distinguish between cause and effect. For example, the existence of USOs in a given region leads to certain indirect effects such as the formation of technology clusters, the existence of incubators, or training courses. But, in turn, these instruments bolster the direct effects, insofar as they influence the emergence and survival of new USO (Meoli and Vismara, 2016) and, consequently, the creation of jobs. To the extent that a causal ambiguity has been evidenced between entrepreneurial activity and business competitiveness (Audretsch and Peña-Legazkue, 2012) as well as between entrepreneurship and innovative capacity (Block et al., 2017), it is also possible to establish an ongoing relationship between the presence of USOs and economic development. This is because an economically advanced region can be expected to have a greater number of USO, but, in turn, the concentration of this type of companies enhances that territory's level of competitiveness. Thus, as pointed out by these authors (Audretsch and Peña-Legazkue, 2012), unravelling the workings of this circle is a complex endeavour, because it is difficult to assert which circumstance determines the other.

Factors Determining the Company's Performance

In order to USOs effectively contribute to economic growth they have to survive and succeed (Clayman and Holbrook, 2003), events that depend on the USOs performance. The most appropriate measures for assessing it are those related to traditional financial variables (Bigliardi et al., 2013), such as the volume of income (Harrison and Leitch, 2010), the cash flows (Ensley and Hmieleski, 2005) or their profitability (Löfsten and Lindelöf, 2002). But, its success can also be associated to its impact in the region in which it is located, so that the number of employees in the USO has also been used as a measure of performance (Zhang, 2009, Cantner and Goethner, 2011).

The complexity of the business world results in the existence of a great many parameters and circumstances that condition the company's performance. USOs are no strangers to this situation, but their distinct nature has drawn the attention of researchers. In this regard, Helm and Mauroner (2007) carried out an exhaustive analysis of 71 articles determining their performance, and found three kinds of factors: the founder, the environment and the company itself. This work has recently been completed by Bigliardi et al. (2013), who have proposed a model for evaluating the performance of USOs. After thoroughly reviewing the literature and applying the Delphi method to a group of 20 experts in the field⁵, they classified the factors influencing the performance of USOs into four groups. Specifically, they identified factors relating to the characteristics of the university, of the founder, of the environment and of the technology.

The wide literature focused on identifying the differences between USO and no USO leads to pose that the origin of USO endowing them with a distinctive set of features, which determine the way in which the companies perform⁶. As regards the founders, their motivation, autonomy, leadership, responsibility, experience, training and career orientation have been linked to the USOs' performance. Results reveal that the founders of successful USOs show a need for independence and achievement, as well as wide-ranging experience in industrial acquisition and cooperation both inside and outside the market sector (Helm and Mauroner, 2007). Touching on financial aspects, the presence of the parent university in the USOs' capital has been adopted by several authors to measure performance, and it has been found that it affects their growth (Iacobucci and Micozzi 2015), but not their size (Corsi and Prencipe, 2015). This mixed evidence confirms the difficulty in establishing the financial structures that USOs should adopt, because this depends on other factors such as entrepreneurs' risk aversion, market conditions, and even the activity being carried out. Thus, most papers recognize that the sector in which they operate is related with their performance (Zhang, 2009), and it has been found that USOs dedicated to product manufacturing obtain better results than those geared at providing services (Bolzani et al., 2014). On the other hand, several studies have shown that innovation has a positive association with business performance, specifically in SMEs (Block et al., 2017). Thus, aspects such as the level of technological maturity, innovative capacity, or experience in R&D can be included among the technological characteristics influencing USOs' performance (Helm and Mauroner, 2007; Clarysse et al., 2011).

It has been stated that USOs is a local phenomenon as they are closely connected to their home university, are linked to their few customers and supported from local administration (OECD, 2001). With regards to the links with the university from which they stem, Egelin et al. (2004) argue that the proximity allows USOs founders to maintain the links to their former colleagues and to follow conducting joint research with them. Therefore, the characteristics of the parent universities are expected to influence the performance of USOs (Colombo et al., 2010, Corsi et al., 2017). Indeed, given that their purpose is to exploit research results, it could be considered that the universities research quality influences their performance (O'Shea et al., 2005; Gómez et al., 2008). Moreover, it has been proved that companies with close ties to their university, and which establish research networks with it, have greater growth (Bigliardi et al., 2013; Mustar et al., 2006). Another factor to bear in mind when evaluating the performance of USO is the degree of support received from the university (Ayoub et al., 2017; Slavtchev and Göktepe-Hultén, 2016), materialized in the provision of financial resources (Lockett et al., 2005; O'Shea et al., 2005; Gómez et al., 2008), mentoring (Vohora et al., 2004), or the assignment of physical spaces by the university (Rodeiro et al., 2008). The literature also offers different results regarding the effect of technology transfer offices, technology parks and/or business incubators on the performance of USO (Gilsing et al., 2010; Benghozi and Salvador, 2014).

Lastly, it must be taken into account that the characteristics of the environment also affect USO' performance. Indeed, given that the context offers companies a series of physical and intangible tools and resources (Fini et al., 2011), it is to be expected that the location of USO in areas with a high level of economic development will have a positive impact on their performance (O'Shea et al., 2008; Corsi and Prencipe, 2015). Thus, it can be said that the economic development, the level of technology and the infrastructures existing in the region (Rodeiro et al., 2008; Iacobucci and Micozzi, 2015), are circumstances that influence the performance of said companies.

ECONOMIC CONTRIBUTION OF SPANISH USO

Research Design

This study has been drafted following the approach of the Spanish Network of Research Results Transfer Offices (OTRI Network, 2005), which considers USOs to be those companies promoted by academics to commercially exploit the outcomes of their research, either for industrial purposes, or with the aim of providing services. This definition holds the common attributes that can be found in the literature (Pirnay et al., 2003), because knowledge is not required to be formal or to be protected by licenses or patents, nor is the university required to maintain participation in them (Harrison and Leitch, 2010; Benghozi and Salvador, 2014). Thus, the USOs identified for this study are those categorized by Fryges and Wright (2014) as hybrid academic spin-offs.

Even though there is a growing interest among researchers in the spin-off phenomenon, the studies analysing the contribution of USOs to the economy with a regional perspective are scarce (Corsi and Prencipe, 2018). This is of particular interest because, as will be shown in the following section, the number of USOs located in each region is appreciably diverse and, moreover, the structural economic inequalities among Spain's different regions are well known. On the basis of these considerations, we have posed the following research questions:

- What is the economic effect of Spanish USOs on the different region?
- Which factors may explain the greater or lesser impact of USOs on regional economies?

The creation of this type of companies has steadily gained importance as a technology transfer mechanism for Spanish universities. However, and despite their growing importance, Spain has no official databases or lists of the population of USOs. That being the case, it was necessary to conduct a search for the USOs that are currently operating in our country. For this purpose, in early 2013 we looked up the websites of Spain's 61 universities and their respective OTRIs. In this process we found a total of 904 companies, but in many cases the information came from lists of companies that are in some way related to the university, because USOs were not clearly identified. Therefore, the next step consisted in cleaning up this database and selecting only those companies that met the requirements, mentioned above, to be considered university spin-offs. Specifically, an individualised search was carried out for all companies located in technological parks or business incubators. Those which did not refer expressly to their university origin were deleted, as were those that, having stemmed from a university, had been created by university graduates and not by researchers. Also excluded were those companies whose formal existence could not be verified, and those that were being liquidated. Finally, the database, which can be considered the population existing at that time, comprised a total of 499 USOs linked to 45 universities.

As we only had the name of each USO, the information about them was obtained by a company dedicated to collecting and processing information about corporations⁷. Specifically, we asked for the values in 2012 for those USOs that had been created until 2011 to obtain data from those companies that had exceeded the incubation period. The information available for the 499 USOs identified is the corporate name, its domicile, the university it stemmed from, the activity it carries out⁸, and, based on it, its level of technology⁹.

In order to answer the first research question, we obtained empirical evidence of the direct economic effect of Spanish USOs on the regional economy in 2012. To do so, we carry out a combined analysis to relate the USO's geographic location with three key variables to local economic development: number of companies in the region¹⁰, employment and economic wealth.

With regard to the second question, to answer it is necessary to identify the factors that contribute to a USO having a greater impact than others on the economy of the region where it is located. In the light of the review conducted above, the impact of USOs on regional economies has been measured by the number of employees. Following a criterion similar to that of Iacobucci and Micozzi (2015), two groups are defined, as a function of the values of the dependent variables, considering the arithmetic mean of the indicators as the cut-off point (see description in appendix). Thus, the group of USOs with the greatest impact on the economy comprises those whose dependent variable has a value equal to or higher than the arithmetic mean of said value for the total number of USOs considered in this study.

With regard to the factors explaining the economic impact of USOs, on the basis of the review of the literature carried out in background section, aspects relating to the characteristics of companies, of their parent university and of the environment where they are located have been taken into account. More specifically, the features of companies are related to their activity, their technological level, their age, and their manner of funding; the characteristics of the university of origin refer to the number of USOs created and the assistance they give to their USOs; finally, the environmental conditions involve the percentage of technological companies and the gross domestic product per inhabitant. The full description of the variables can be found in the appendix.

Based on the 499 USOs identified, we proceeded to complete the data of a four-year period (2012-2015) in order to conduct a longitudinal analysis. Specifically, we collected some economic and financial variables, such as number of employees, value added, turnover, total assets or grants received by USO from SABI database.

Given the dichotomic nature of the dependent variable, the appropriate methodology is the probit regression analysis for panel data, as it makes it possible to assess the contribution of different factors (measured by independent variables) to the occurrence of an event (measured by a dependent variable). Taking into account that the sector in which the companies operate could condition their results (Zhang, 2009), and following Ayoub et al. (2017), we have considered the USOs belonging to three sectors: Manufacturing (Manu), Information and Communication Technology (ICT) and Professional, scientific and technical activities (PSTa). Afterwards, those companies liquidated, had no activity, presented any mistakes in their information or whose indicators included outliers, were eliminated in this part of study. Therefore, the final sample comprises 190 USOs, representing nearly 40% of all registered USOs. 24 of them are manufacturing companies, 34 belong to ICT sector and 130 to PSTa sector.

A Regional Vision of Economic Impact of Spanish USO

The geographic location of Spanish USOs by region (Figure 1) shows that 68% of those registered in early 2013 are located in 3 of Spain's 17 regions. Specifically, Andalusia is home to 172 USOs, which means that 34% of all those companies have been established in universities located in this region. Catalonia is next in importance, with a total of 110 companies, representing 22% of all USOs registered at the time of this study. Finally, the Autonomous Community of Madrid is home to 57 companies, representing

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11% of the sample. At the other extreme, La Rioja is marked by an absence of USOs. As regards the other regions, only Valencia and Galicia have more than 30 USOs; Aragón has 17, the Basque Country 16, and in the others, generally speaking, there are fewer than 15 USOs.

It must be borne in mind that the number of universities varies significantly between regions. In this sense, Andalusia, Catalonia, Madrid and Valencia have the most universities (9, 8, 7 and 5, respectively). In Castile and León and in Galicia there are 3 universities; the Canary Islands, Murcia, Navarre and the Basque Country each have 2; whereas the rest of the regions each have a single university.

In addition to the number of universities, it is interesting to analyse the number of teaching staff¹¹ in each region, because these are, ultimately, the potential founders of USOs. As expected, generally speaking, the regions with the largest population are those with the largest teaching staff. However, the creation of USOs does not follow this pattern. Indeed, the teaching staff of the Balearic Islands seems to be the greatest entrepreneurs, because 24 USOs per 1,000 teachers have been founded in that region. This is followed by Andalusia and Cantabria, with 17 USOs, and Catalonia with 15. At the opposite end we find Castile and León, the Canary Islands, Navarre and Asturias, regions where 2 to 3 USOs have been created per 1,000 teachers, while the national average stands at 9. It is striking to find that the Autonomous Community of Madrid, which has universities with a long-standing research tradition and which generates 18% of Spain's GDP, has only 6 USOs per 1,000 teachers.

Figure 1. Distribution of USOs by autonomous community and size of the university (499)

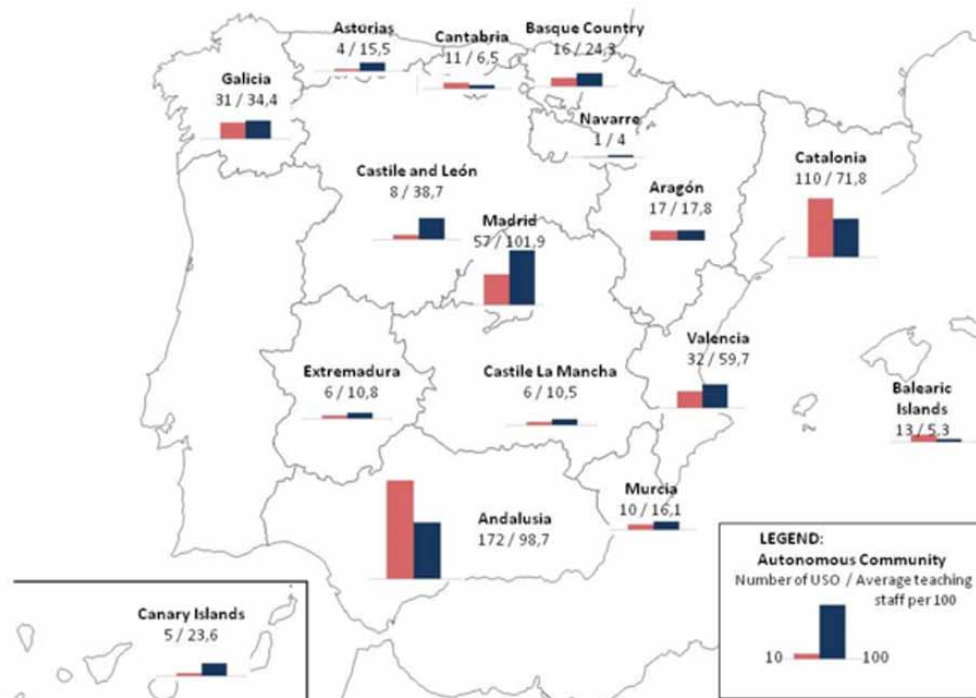
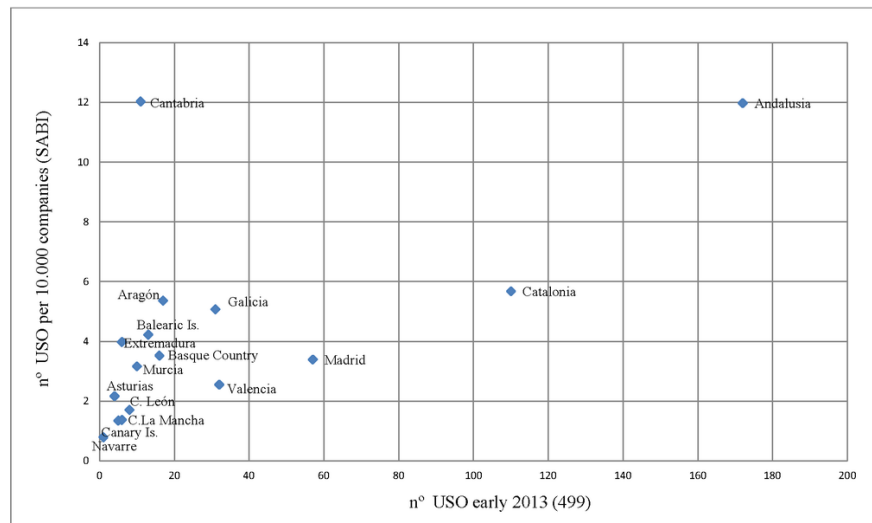


Figure 2. Importance of the number of USOs by autonomous community (499)



After identifying the location of USOs, the next step is to quantify their importance within the business fabric. To do so, two indicators have been combined: the number of USOs located in each region and the number of USOs per 10,000 companies in the region in early 2013¹². They are both represented in Figure 2, where four areas can be observed.

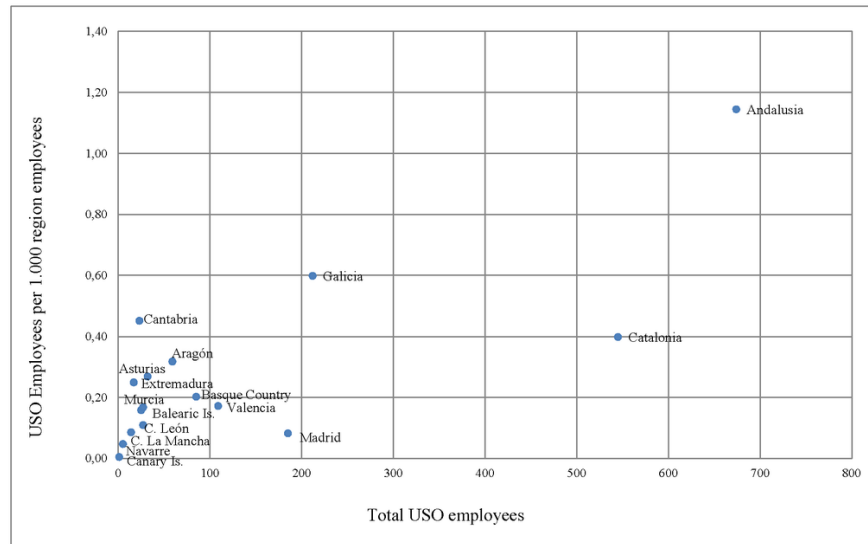
The upper right quadrant includes Andalusia, a region where universities are playing a crucial role in creating USOs, both in terms of their large number and of their significant weight among all companies. This takes on even greater relevance bearing in mind that, if per capita GDP is used as a reference for measuring the level of development, Andalusia is at the bottom of Spain's ranking. In the lower right quadrant are two regions, Catalonia and Madrid, whose universities are also creating a large number of USOs, with a relative impact on the business sector. This is due to the fact that both regions are among those with the highest level of economic development, have the best infrastructures and, historically, have been home to a larger number of companies. In the upper left quadrant, we find Cantabria, where its university, despite not having created a great number of USOs, has had an important impact on the region's business fabric. Lastly, the lower left quadrant includes the regions with universities that are not very active in creating USOs, or which despite being active in this regard, do not have an important effect on the whole, because they are highly industrialized regions (Valencia and the Basque Country).

In order to estimate the economic importance of USO in a region, we will now analyse these companies' contribution to jobs and added value in the region where they are located.

After linking jobs generated by USOs to those existing in each region (Figure 3), five of them can be observed to stand out from the others. In the case of Andalusia, USOs contribute significantly to employment, because there are a large number of such companies and, moreover, on average they hire more employees than the average of companies in this region (6 versus 4 employees). In Galicia, the average staff of USOs is also larger than the regional average (8.2 versus 5.8), which distinguishes it from other region with the same number of USO. In Catalonia, a region with a long tradition of entrepreneurship, USOs are similar in size to other companies, preserving their importance within the sector. Conversely, USOs in Madrid have very little repercussion on job creation in the region, because 17% of Spain's

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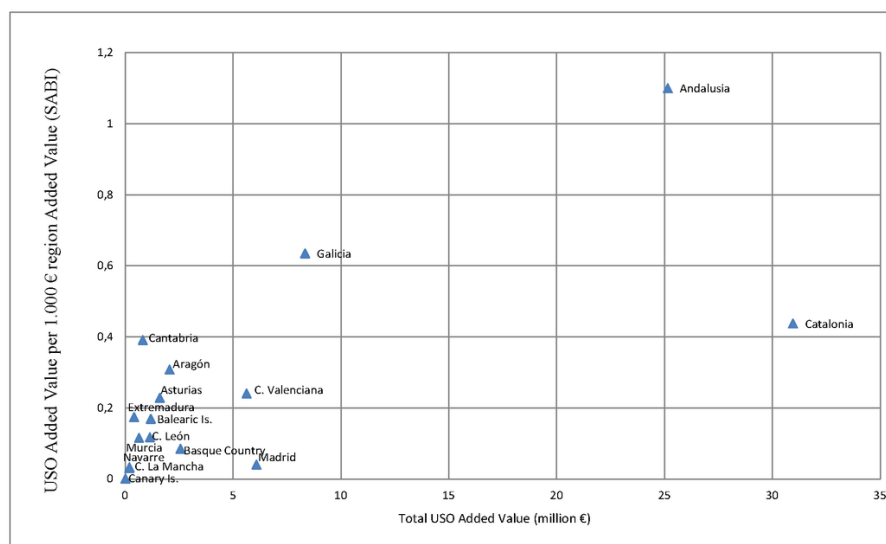
Figure 3. Contribution by USOs to jobs in the autonomous community



companies—and also Spain’s largest companies—are located in that region. Also striking is the case of Cantabria, where the number of USOs is significant with regard to the other region; however, this importance is not reflected in employment, given the small number of jobs created by these companies.

Whereas employment is of great importance for a region’s economic development, the wealth generated by companies is brought about by their added value, a magnitude that can be assimilated to the Gross Domestic Product used in National Accounts. It can be observed in Figure 4 that USOs in Catalonia, as a whole, are those contributing the most wealth to the economy (31 million euros), as they obtain

Figure 4. Contribution by USOs to the added value of the autonomous community



the greatest average added value per company and per employee. However, USOs in Valencia produce similar amounts as regards average added value, even though the total amount is slightly higher than 5 million euros because there are only 16 technological USOs. As for Madrid, where USOs are small in size, the total added value is only 6 million euros.

The comparison between the added value provided by USOs and the total generated in each region illustrates the real importance of these companies in the regional economy. In the case of Catalonia, USOs create considerable value, but so do the region's companies; therefore, their importance in the sector is not as significant as in the cases of Andalusia and Galicia, where USOs make a greater contribution to increasing the wealth generated in the region. Once again, the scant repercussion of USOs in the more industrialized regions, such as Madrid and the Basque Country, is confirmed.

Factors Related to the Economic Impact of Spanish USO

The analysis of Spanish USOs' effect on the economy through their contribution to the business fabric, to job creation and to generating wealth has revealed major differences among Spain's regions. Given the role that academic entrepreneurship can play in a region's economic growth, we consider of interest to identify the factors that may determine a greater or lesser job creation and, consequently, a greater or lesser impact of this type of companies on the economic development of the areas in which they are located.

The variable definition used in the study and their descriptive statistics are presented in Tables 2 and 3 in Appendix. Once USOs with missing values in these variables was removed, the number of USOs in the study is 192 with observations between 2012 and 2015.

The dependent variable "USO-Employee" is dichotomic. It is therefore natural to use probit regression models for panel data to estimate their determinants. Given the constant nature of some of the explicative variables we have used random effect models. Results are presented in Table 1 distinguishing among 3 types of USOs: manufacturing (model I), ICT (model II) and professional, scientific and technical (model III) companies. We have also estimated logit regression models obtaining similar results (Table 4 in appendix).

The first model, applied to manufacturing companies, makes it possible to characterize the Spanish USOs-Manu that have a higher number of employees with regard to those that have a lower number. The function comprises two variables with positive and statistically significant coefficients. One of these variables measure features of the USOs. Specifically, the USOs that are more likely to have a larger staff are those receiving the most economic assistance in the form of capital subsidies (USO-Assistance). Only one variable related to the university's characteristics was statistically significant (UNI-Space), as it was found that if USOs stem from universities that assign physical spaces for the establishment of this type of companies, they are more likely to hire a greater number of people. Lastly, it should be noted that the two variables related to the traits of the environment were not statistically significant.

In the second model, for ICT sector, the function includes five statistically significant. The characteristics of those Spanish USOs-ICT that more impact on the economy through the generation of job are their age (USO-Age), the number of USOs created by their parent university (UNI-N°USO) and the assignment of physical spaces by the university (UNI-Space). In these variables, all the relations are positive. Moreover, the two variables related to the peculiarity of the environment were also statistically significant (LOCAL-Technology and GDP). It was observed that the location of USOs in regions where

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the GDP per inhabitant are higher than the national average has a positive impact on their number of employees. However, the location of USOs in regions where the percentage of high technology companies are higher than the national average has a negative impact on their number of employees.

The third model shows the features of USOs that, performing professional, scientific and technical activities, have a higher number of employees with regard to those that have a lower number. In this case, the USOs that are more likely to have a larger staff are those belonging to high or medium-high technology sectors (USO-Technology), the oldest USOs (USO-Age) and those receiving the most economic assistance in the form of capital subsidies (USO-Assistance). Thus, one variable related to the university's characteristics was statistically significant (UNI-Space). Once again, the relation between assign physical spaces and a mayor number of employees is positive. However, as same as the manufacturing sector, the variables related to the traits of the environment were not statistically significant.

Table 1. Probit regression models

VARIABLES	Model I MANU	Model II ICT	Model III PSTa
USO variables			
USO-Technology	0.446 (1.531)		2.626* (1.374)
USO-Age	0.294 (0.233)	2.816*** (0.774)	1.096*** (0.315)
USO-Assistance	2.005* (1.198)	2.125 (4.440)	1.879 (1.170)
University variables			
UNI-No.-USOs	0.0635 (0.0904)	0.562*** (0.192)	-0.0859 (0.0757)
UNI-Space	4.496* (2.429)	11.43* (6.494)	2.339* (1.382)
UNI-Economic support	1.718 (2.697)	0.681 (5.984)	1.306 (1.742)
Local variables			
LOCAL-GDP	4.694 (10.80)	102.0** (51.49)	-2.059 (10.62)
LOCAL-Technology	8.325 (125.5)	-1,234* (654.3)	-63.39 (139.9)
Years			
	2012	Ref.	Ref.
	2013	0.671 (0.981)	-4.584* (2.488)
	2014	-3.584** (1.453)	-20.65*** (5.542)
	2015	-3.592** (1.737)	-27.91*** (7.831)
Observations	104	136	520
Number of USO	26	34	130

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

For all type of USOs, the probability that have larger staff decreases with the years in compare to 2012.

In short, the results obtained show that certain variables associated to USOs and their parent universities affect their levels of performance and, consequently, determine the economic impact of USOs on the geographic area in which they operate. The assignment of physical spaces by their parent universities have turned out to be statistically significant variables in the three models considered, and therefore affect the economic impact of USOs regardless their activity. On the other hand, the particularities of the environment in which they operate, only have a statistically significant relation with the USOs belonging to the ICT sector.

DISCUSSION

The creation of companies that exploit and market university research results constitutes an important mechanism for knowledge spillover, job creation and economic growth (Smith and Bagchi-Sen, 2012; Audretsch et al., 2013; Fromhold-Eisebith and Werker, 2013). Thus, USOs have become a relevant topic in entrepreneurship research, which has mainly considered the factors relating to their creation. But, this kind of research has to be completed with empirically studies focused on the USO's success and their economic impact upon on a regional basis (Hayter, 2013), in which the moderating effects of their parent universities and the context they where they operate are taking into account (Miranda et al., 2018).

Given that, particularly in Europe, there is insufficient empirical evidence of the economic importance of USOs in the regions where they are located (Berggren and Lindholm Dahlstrand, 2009; Bigliardi et al., 2013), this paper aims to obtain empirical evidence about the economic contribution of Spanish USOs to the region where they are located. Also, we determine the factors—related to the USOs, to their universities of origin, or to the environment—that could explain the greater or lesser economic contribution of this type of companies. Consequently, the results obtained will contribute to bridge the gap in the research and allow owners and institutions to take the appropriate measures and to propose policies that improving the performance of USO, which leads to a greater impact contribution of these companies to the regional economy.

The paper is based on the information available for 499 Spanish USOs. Given that 68% of them are located in 3 of Spain's 17 regions (Andalusia, Catalonia and Madrid), a high regional concentration of USOs can be observed. Thus, as is the case in other countries such as Italy or the USA (Iacobucci and Micozzi, 2015; O'Shea et al., 2008), the distribution of USOs in Spain is considerably dependent on universities and, consequently, on the geographic context.

Individually, the emergence of a new company is beneficial, because it contributes to filling market niches and increasing competition, thus promoting economic efficiency. Moreover, USOs specifically make it possible for society to benefit from the knowledge and innovation created at universities, by fostering the development of new products and services of considerable economic value, and generating quality jobs (Criaco et al., 2014). However, our study findings lead us to conclude that the real impact of these companies on the local economies varies among Spain's regions. More specifically, Cantabria, and, particularly, Andalusia, showcase the key role that the entrepreneurial activity of universities can play in creating the region's business fabric. But the other regions in Spain still do not have large groups of USOs with significant weight in the business fabric. This may be because this process requires a great deal of time to produce visible results (Vincett, 2010).

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Furthermore, our results support the claim made by Audretsch and Peña-Legazkue (2012), who pointed out that, given the fact that a country's entrepreneurial capital is not evenly spread out among sub-national territories, the economic impact of the emergence of new companies may be unequally spread out in local regions. Specifically, Spain has two regions, Andalusia and Galicia, where USOs have a significant impact, both in terms of job creation and in terms of generation of added value. However, in other regions their impact is limited, either because the USOs are small, or because—as is the case in Catalonia and Madrid—even though a considerable number of jobs are created and the figures for added value are important, these regions' significant business fabric and economic development dilutes the positive effects of USOs.

Given that, in general, the economic impact of Spanish USOs is limited, identifying the factors that may determine their level of impact on regional economies is a priority. To do so, probit regression models for panel data have been obtained in order to find out which aspects relating to the USOs themselves, to their parent universities or to the environment can explain how they achieve greater employment levels. As the company performance could be conditioned by the sector where they operate, the USOs have been classified according to the type of activity they carry out. In this way, three models have been applied.

As regards the variables relating to the characteristics of the USOs themselves, it is worth mentioning that their age is a positive determining factor of their impact when they operate in the ICT sector or carry out professional, scientific and technical activities. This finding contradicts the results of previous research (Iacobucci and Micozzi, 2015). This may be due to the fact that in labor-intensive industries, when Spanish USOs are in their early years of life, they are particularly sensitive to the impact of the passing of time on the number of employees. In addition, and as it has been seen in other research studies, the performance of USO is also influenced by their technological level and by their manner of funding (Zhang, 2009). However, our study has revealed that the impact of these variables depends on the sector of activity where the company operates. Specifically, in PTSA sector a USO's level of technology has a positive impact on job creation. On the other hand, manufacturing companies, more capital intensive and thus have greater financing needs, receiving subsidized funds has a positive impact on the creation of job.

It is also confirmed that certain characteristics of the universities of origin affect the performance of Spanish USOs (Colombo et al., 2010), namely, the assignment of physical spaces by the university, a result which is in line with preceding research (Rodeiro et al., 2008). This could be due to the fact that in Spain, the high price of purchasing or renting premises is a significant burden for companies, regardless of their activity sector. Thus, the possibility of obtaining premises in which to carry out their activities constitutes important savings, which can be assigned to another type of expenditure and investment that will, foreseeably, lead to increasing the number of employees hired by the company.

The number of USOs created by their parent university has only been statistically significant in the ICT sector. Some authors have proved that companies with close ties to their university, and which establish research networks with it, have greater growth (Bigliardi et al., 2013; Mustar et al., 2006). Owing to in the ICT sector highly specialized activities with a high level of technology are developed, it is feasible that, as the number of USOs created in the University grown, the greater the research networks will be established, which will lead to a growth of the companies.

In line with Bolzani et al. (2014), the variables concerning to the environment have also been statistically significant, even if the study we have done explains that it occurs only for Spanish USOs that carry out activities related to information and communication technologies. In particular, the GDP per capita in the region where they are located constitutes a determining factor for a USO to have more employees

than the national average. It would be argued that higher the level of wealth in a region, higher demands of products and services related to ICT sector. However, the technological level of companies located in the same region is a conditioning factor for a USO to have fewer employees than the national average. And this, probably, because the higher the percentage of technology companies in the region, the less market niche that could be occupied by the USOs. Previous research provides empirical evidence that contexts that offer companies physical and intangible tools and resources affect the creation of USOs (Fini et al., 2011). Our study allows for further knowledge of this issue as it shows that, once a USO has been created, if it operates in the ICT sector, some traits of environment also are associated to job creation.

Finally, our results show that, with respect to 2012, the probability of a USO having more employees decreases with age, regardless the sector where they operate. The serious economic crisis that, started in 2008, affected most of the developed countries may explain this fact. In particular, Spain, as regards the unemployment rate, is not been able to recover the values prior to the crisis.

Moving on to consider the variable not selected in the models, it can be concluded that, the fact that the university provides—or not—economic support, probably have an impact on their creation (Di Gregorio and Shane, 2003; Helm and Mauroner, 2007), but not on their economic contribution to regional development.

If the aim is for USOs to have an effective impact on local economies, the results obtained beg the question of which type of policies should be promoted in order to improve their performance. In this sense, the findings concerning the variable measuring the assistance received by USOs are particularly significant. With regard to assistance in the form of capital subsidies, previous research (Gómez-Miranda and Román-Martínez, 2016) has found that in Spain the granting of such assistance is linked to offsetting unfavourable economic situations. In any case, given that this variable has proved significant in manufacturing sector, it may be concluded that adopting this type of measures has a direct impact on the regional economy, because it contributes to increasing the companies' number of employees.

Furthermore, taking as a reference the results related to the type of assistance provided by the parent university, only the assignment of physical spaces has a positive impact on the USOs' activity. Thus, universities and other public institutions should consider the advisability of replacing the provision of direct economic assistance with other ways of channelling resources which, involving the direct granting of productive capital, will probably have a positive impact on creating a larger number of jobs and, ultimately, on achieving a greater level of business success and regional economic impact.

FUTURE RESEARCH DIRECTIONS

Since it can be considered that most of the USO is still in the early stages of development, and hoping the overall economic situation will be better in next years, it could update the economic contribution of USOs taking into account the value added or turnover they achieve.

On the other hand, some regions have shown a disparate behaviour with regard to the performance of USOs located there and their regional economic situation. For this reason, a, it would be interesting to study in deep the territorial factors that may explain this fact, considering the characteristics of the founder or incentive policies of regional public institutions.

CONCLUSION

Leaving aside the quantitative importance of the results, our study shows that it is possible to overcome the theoretical arguments about the limited scope of USO to improve the economic performance of less successful regions (Benneworth and Charles, 2005). This requires that policy-makers and universities working together on the basis of knowledge of the local innovation environments to design regional innovation policies to encourage the creation and consolidation of innovative companies among which, undoubtedly, are the USO.

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ENDNOTES

- ¹ In spite of the influence of the Bayh-Dole Act on academic entrepreneurship has been widely recognized in the literature (Wright et al., 2008; Grimaldi et al., 2011), some authors have limited its effectiveness. Thus, it has been suggested that the commercialization of research results financed with federal funds have not had the expected effect, and that the current model of university ownership may not be the best one in fostering entrepreneurship (Smith and Bagchi-Sen, 2012).
- ² Such as UK, Germany, Belgium, France, Sweden (Wright et al., 2008), Denmark, Austria, Norway, Japan (Grimaldi et al., 2011).
- ³ Indeed, the literature on spin-offs originates in such diverse scientific fields as economics, sociology, strategy and management, regional policy and innovation systems (Gilsing et al., 2010), and it includes theories such as the resource-based view (Lockett and Wright, 2005; Hayter, 2013; Corsi and Prencipe, 2015; O’Shea et al., 2005); the business model approach (Berbegal-Mirabent et al., 2015); the knowledge spillover theory of entrepreneurship (Hayter 2013; Corsi and Prencipe, 2018), and regional innovation systems (Fromhold-Eisebith and Werker, 2013).
- ⁴ First-level territorial division of Spain (equivalent to NUTS-2), in which each unit keeps legislative and administrative autonomy. Hereinafter region to facilitate the reading.
- ⁵ The panel comprised 4 academics whose main field of study is technology transfer, 10 managers of Italian USOs belonging to Italian universities, and 6 people employed by said USOs as managers or R&D managers.
- ⁶ Among others, Cantner & Goethner (2011), Clarysse et al. (2011), Colombo & Piva (2010), Enssley & Hmieleski (2005), Prokop et al. (2019), Stephan (2014), Wennberg et al. (2011) or Zhang (2009).
- ⁷ Axesor, Conocer para decidir, S.A.
- ⁸ According to Spain’s National Classification of Economic Activities (CNAE), 2009.
- ⁹ To this end, the classification followed was that of Spain’s National Statistics Institute (INE), which identifies—in accordance with OECD criteria and on the basis of the CNAE’s headings—the manufacturing and services sectors that use a higher level of technology than others.
- ¹⁰ The information on the number of companies in each Autonomous Community has been found in the SABI (Iberian Balance Sheet Analysis System) database.
- ¹¹ ”Average teaching staff” indicates the mean of number of teacher present in the region in the 2006-2010 period. In order to simplify the figure, it has been expressed in base 100. Source: Observatory of Spain’s University Institute of Specialised Education (<http://www.iune.es>).
- ¹² The information about the number of companies was found in the SABI database, applying the same criteria as in the selection of USOs. Specifically, the number of companies refers to those created before 2011 which were alive in early 2013, when we did the searching, whereas the value added and number of employees are referred to 2012.

APPENDIX

Table 2. Definition of variables

Variable	Description
Dependent variable: USO-Economic Impact	
Number of employees	1: The number of USO employees in 2012 is equal or higher than the average of the Spanish USOs in 2012 0: The number of USO employees in 2012 is lower than the average of the Spanish USOs in 2012
Independent variables related to USO characteristics	
USO-Technology	1: The USO operates in high-tech or medium-high-tech sectors 0: If not
USO-Age	Number of years since USO creation until 2012
USO-Assistance	1: The importance of the subsidies in the whole financing of the USO is equal to or higher than the average of the Spanish USOs 0: The importance of the subsidies in the whole financing of the USO is lower than the average of the Spanish USOs
Independent variables related to University characteristics	
UNI-No.-USOs	Number of USOs created in the parent university of USO in 2012
UNI-Space	1: The parent university assists USO by ceding physical space 0: If not
UNI-Economic support	1: The parent university provides financial aid to USO 0: If not
Independent variables related to environment characteristics	
LOCAL-GDP	Logarithm of GDP per capita
LOCAL-Technology	1: The USO is located in an region where the percentage of high-tech companies over the total number of companies in the region is equal to or above the national average 0: The USO is located in an region where the percentage of high-tech companies over the total number of companies in the region is lower to the national average

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Table 3. Descriptive statistics

Variable name	Year	Min	Max	Mean	SD
Number of employees	2012	0	1	0.265	0.443
	2013	0	1	0.260	0.440
	2014	0	1	0.120	0.326
	2015	0	1	0.109	0.313
USO-Technology	2012-2015	0	1	0.578	0.495
USO-Age	2012	1	21	5.432	3.443
	2013	2	22	6.432	3.443
	2014	3	23	7.432	3.443
	2015	4	24	8.432	3.443
USO-Assistance	2012	0	1	0.219	0.414
	2013	0	1	0.208	0.407
	2014	0	1	0.203	0.403
	2015	0	1	0.193	0.395
UNI-No.-USOs	2012-2015	1	45	18.83	12.65
UNI-Space	2012-2015	0	1	0.552	0.499
UNI-Economic support	2012-2015	0	1	0.469	0.500
LOCAL-GDP	2012	2.73	3.42	3.078	0.222
	2013	2.73	3.41	3.069	0.226
	2014	2.73	3.42	3.083	0.228
	2015	2.78	3.46	3.124	0.226
LOCAL-Technology	2012-2015	0.27	0.08	0.050	0.017

Table 4. Logit regression models

VARIABLES	Model I MANU	Model II ICT	Model III PSTa
USO variables			
USO-Technology	0.446		2.626*
	(1.531)		(1.374)
USO-Age	0.294	2.816***	1.096***
	(0.233)	(0.773)	(0.315)
USO-Assistance	2.005*	2.125	1.879
	(1.198)	(4.437)	(1.170)
University variables			
UNI-No.-USOs	0.0635	0.562***	-0.0859
	(0.0904)	(0.192)	(0.0757)
UNI-Space	4.496*	11.433*	2.339*
	(2.429)	(6.493)	(1.382)
UNI-Economic support	1.718	0.681	1.306
	(2.697)	(5.985)	(1.742)
Local variables			
LOCAL-GDP	4.694	101.979**	-2.059
	(10.80)	(51.469)	(10.62)
LOCAL-Technology	8.325	-1,234*	-63.39
	(125.5)	(654.065)	(139.9)
Years			
2012	Ref.	Ref.	Ref.
2013	0.671	-4.585*	-1.636**
	(0.981)	(2.487)	(0.776)
2014	-3.584**	-20.649***	-7.530***
	(1.453)	(5.539)	(1.544)
2015	-3.592**	-27.914***	-9.468***
	(1.737)	(7.826)	(1.837)
Observations	104	136	520
Number of USO	26	34	130


Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Section 4

Chapter 13

Regional Policy Implications of the Entrepreneurial University: Lessons From the ECIU

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ABSTRACT

The chapter addresses the question of how universities respond to regional policy, and in particular, the ways in which academics are motivated and encouraged by regional development policies. The chapter specifically asks whether entrepreneurial universities create frameworks which allow university actors to positively contribute to collective development activities (such as clusters or technology transfer networks) by building new kinds of regional institutions. The chapter uses examples from three universities that all seek to be actively regionally engaged. This chapter identifies the factors that both encourage but also discourage these individual actors and notes that ongoing connections between individual academics and regional partners are critical to ensuring this constructive collaboration. The chapter contends that regional innovation policy should devote more resources to building these critical links.

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INTRODUCTION

It is increasingly common to assert that policy-makers are demanding that universities make themselves more relevant to society with more useful knowledge. In response to this, some have argued for a new ideal type of university which places creating societal impact at the heart of its institutional mission (Alain & Redford, 2014; Benneworth, 2014). It is widely agreed that this new ideal type of university develops new internal governance approaches that allow them to encourage external engagement, whether in terms of the kinds of strategic projects they pursue, their support infrastructures for knowledge exchange or even how internal culture regards external engagement. Clark (1998) proposed the idea of the entrepreneurial university, as a university which managed to align these various elements in self-reinforcing ways, building engagement into the institutional DNA of the university. Although many other ideal types have been promoted for engaged universities, what all these models have in common is the notion that university engagement relies upon a set of institutional alignments, from the steering centre to the individual academics.

These are not exclusively academic notions - they have emerged in the literature in response to this policy enthusiasm amongst regional policy-makers to make universities more engaged. And in focusing on 'universities' as institutions, they fail to address one of the critical characteristics of the university, that universities are 'loosely coupled communities' (Weick, 1976; Reponen, 1999). Although universities have undoubtedly become more centralised in governance and management terms in recent years, they remain knowledge institutions. The knowledge processes of teaching and research vary widely between different disciplines and reflect different contexts, making it hard to create singular policy structures to steer them (Benneworth, Pinheiro, & Karlsen, 2017). This is also true for university engagement activities, what Laredo (2007) referred to as the 'Third Mission', where there has been a tendency for universities to focus on supporting and creating infrastructures for income generation activities such as licensing or contract research. This ignores the many other ways in which academics come into contact with societal partners, and through which their research may be useful, and has framed the idea of the entrepreneurial university as a top-down institution that steers its staff towards acts of commercial engagement.

We contend that the idea of the entrepreneurial university could be enhanced by decentring the notion of entrepreneurship away from commercial acts of technology transfer towards the ways in which university actors create knowledge that is useful for external partners. We propose to focus on how individual academics, undertaking a range of entrepreneurial activities within their knowledge processes, shape the wider institutional environment and support structures for entrepreneurship; conceptualising these individuals as "institutional entrepreneurs" (Garud, Hardy, & Maguire, 2007). We consider the ways in which these university institutional entrepreneurs attempt to create new activities to respond to regional knowledge needs, addressing particular problems that external partners such as businesses face in accessing university knowledge. These individual acts of institutional entrepreneurship have the potential to grow and concatenate into a broader process of institutional change within universities, shaping the universities' internal institutional pillars to increase this overall orientation towards creating useful knowledge for external actors. To do that, we ask the research question: How do entrepreneurial universities create (or do not) frameworks which enable purposive actions by academic actors to participate in regional development outcomes?

To answer this question, we develop a conceptual framework to explore these acts of institutional entrepreneurship where academics incorporate regional partners in their teaching, research and third mission activities. We explore this framework with case studies of three universities which have all re-

cently been active at the institutional level in seeking to promote regional entrepreneurship activities in various ways, engaging with policy-makers in these processes. We focus on three concrete projects in these institutions, namely the Fraunhofer Project Center in Twente, the Aveiro Creative Science Park and the Aalborg Matchmaking system, to examine whether these projects drove wider institutional changes and increased the entrepreneurial orientation of their universities as a whole. We highlight that these efforts were successful but at the same time policy interventions can create tensions for institutional entrepreneurs by making it harder for them to construct these activities in ways that meet both university and regional needs. We conclude that a new approach is needed to understand how universities contribute to regional innovation-based development and recommend that policy-makers develop more nuanced instruments and tools to empower institutional entrepreneurship by individual academics rather than focusing on high-level contracts with the university steering centre.

BACKGROUND

Regional Innovation Ecosystems, System Failures and Filling the Gaps

Today, universities are seen as important innovation and knowledge capital creators and circulators (Yigitcanlar, 2010), expected to contribute to their immediate surroundings by enhancing its innovation capacity and thereby spurring economic development (Arbo & Benneworth, 2007). Within these discussions, the regional innovation system (RIS) has emerged as a common approach highlighting how knowledge and innovation can be created through interactions between different institutions and actors, differentiating here two subsystems, the knowledge generation and the knowledge exploration subsystem (Asheim, Grillitisch, & Trippel, 2016; Cooke, Gomez Uranga, & Etxebarria, 1997). Driving knowledge-based regional development requires ensuring that these actors are effectively coordinated to better orchestrate the exchange of knowledge between them, thereby facilitating innovation.

The RIS approach has often been interpreted to mean that problems in regional innovation systems are either due to missing elements or to weaknesses in orchestration between the subsystems. From 2000 until the mid-2010s, the common policy approach was addressing regional innovation weaknesses by identifying gaps within RISs and then developing new activities and intermediaries to fill those gaps. This systemic understanding has led to the idea that if components are missing in the RISs or if the orchestration of the system components is not successful, innovation is less likely to happen. But the RIS model is essentially a static model with a regional map providing nothing more than a snapshot of the current situation (Edquist, 2010), lacking any analysis of regional developments. Therefore, this ‘mapping and gap-filling approach’ cannot hope to provide the tools to build change or solve the problems of less innovative regions (Boschma, 2014).

Following Benneworth et al. (2017), we argue that gaps in regional innovation systems cannot ‘just’ be filled in a simple manner. There is no ‘ideal’ RIS model against which a region can be compared to identify gaps, and from which best practices can be cut and pasted in order to raise levels of innovation and ultimately economic growth. Following Edquist (2010), we note that effective improvements to regional innovation arrangements are constructed at the micro-scale by actors situated within these evolving regional contexts. These micro-scale improvements initially represent a single act of knowledge exchange between an academic and a user, but over time, the interaction can become consolidated into

a relationship, and possibly even a network. This network then may influence other partners, creating behavioural changes at the wider regional level that may, therefore, improve overall regional innovation performance.

Institutional Entrepreneurship

We create a framework to conceptualise how individual academics construct innovation relationships that have the potential to have this wider systemic effect. We use a lens of institutional entrepreneurship, which offers “a way to reintroduce actors’ agency to institutional analysis” (Leca, Battilana, & Boxenbaum, 2009, p. 3). Institutions are the socially constructed rules of the game (North, 1990) defining agents’ behavioural patterns within their institutional system. Systematic and institutional change is a complex process involving different agents, continuously influenced and constrained by the very institutions they are trying to change. Sotarauta and Suvinen (2017, p. 12) highlight that institutional change, often construed as being straightforward (“melt the old, change, freeze again”), can, in reality, be seen as “processional” and a nonstop equilibrium-seeking patchwork of action. Institutional entrepreneurs are often not as ‘free’ as expected due to “rigid structures, politics, major economic layers, and formal policies” (Sotarauta & Pulkkinen, 2011, p. 101). Understanding and stimulating institutional change requires a focus on the agents and activities attempting that change, with Benneworth et al. (2017) suggesting a focus on those institutional entrepreneurs who “mobilize resources and actionable knowledge to create/transform ‘institutions’ [...] to address RIS inefficiencies” (p. 237).

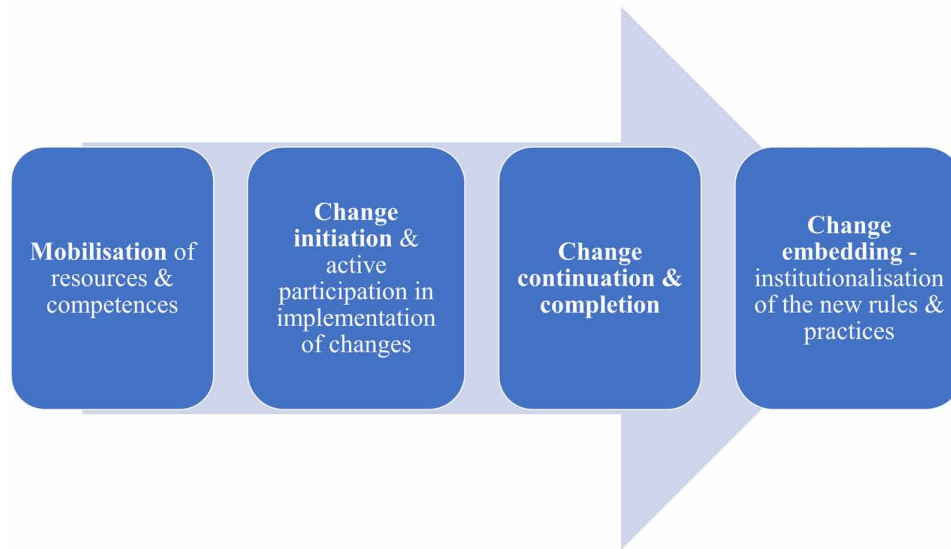
Institutional entrepreneurship is understood as a form of agency with a processual and collective nature - different institutional entrepreneurs are mutually inter-dependent on each other and their collective activities. Institutional entrepreneurs can only change institutions through collective action, necessitating mobilisation and cooperation with allies (Leca et al., 2009). Effective institutional entrepreneurship does not simply require identifying or empowering “heroic” leaders but includes the mobilisation of skills, resources, and constituents, as well as the de-legitimisation of existing arrangement while establishing and legitimising new arrangements. Sotarauta and Suvinen (2016, p. 7) suggest that activities of institutional entrepreneurs can be distinguished into four phases (Figure 1) with earlier phases initiated through individuals in unplanned and indirect processes, conducted in a very personal and intuitive manner.

Academics as Institutional Entrepreneurs

Sotarauta and Pulkkinen (2011) highlight that relatively little academic and policy literature addresses individuals’ roles as active change agents in regional development. In this chapter, we therefore address the roles of academics as individuals building innovation activities with regional partners that may ultimately lead to new systematic opportunities for regional economic development (Battilana, Leca, & Boxenbaum, 2009; Garud et al., 2007; Sotarauta & Pulkkinen, 2011). This has been relatively ignored in recent years, with notable exceptions such as Pugh, Lamine, Jack, and Hamilton (2018) who examine the role of academics from entrepreneurship departments in driving regional economic development, and by Aranguren, Guibert, Valdaliso, and Wilson (2016) who study universities and academics that seek to act as ‘change agents’ in the development processes of their regions.

Any attempt to address academic institutional entrepreneurship need to account for the fact that universities are loosely coupled communities (Weick, 1976), in which different actors have different behavioural repertoires that relate to the needs of their knowledge processes (teaching, research and en-

Figure 1. Activities by institutional entrepreneurs (after Sotarauta and Suvinen, 2016)



gement). Thus, the university actors undertake engagement in ways that fit with their own knowledge needs: The biotechnologist licenses technology to a business or the humanities scholar works to help a museum produce a popular, accurate exhibition catalogue. Those engagements may involve the various activities in Figure 1 and therefore represent acts of institutional entrepreneurship that both support the innovation activities as well as change the nature of the host institution they are in. Those development outcomes “require social action by knowledgeable pioneering individuals, universities, companies and/or governments” (Simmie, 2012, p. 769). Conversely, the “unplanned, highly personal and intuitive nature of institutional agency” (Ritvala & Kleymann, 2012, p. 493) can be observed in that academics often do not realise the depth of their activities and the impact those can have.

To date, there has been a tendency to assume that university agency lies with senior management and that effective regional engagement starts with those managers identifying ‘regional needs’ with which the university can align as an institution. Thus, the role for academics becomes reduced to implementing what those senior principals demand (top-down change). By contrast, we contend that effective regional engagement involving knowledge activities must be initiated by individual academics building links with regional partners in ways that allow that knowledge to flow. Here, the role for senior managers is changing universities in ways that allow those academics to develop connections that support the underlying knowledge activity (bottom-up change).

This requires extending the scope of analysis beyond the formal mechanisms and structures created by universities for the purpose of engagement. We specifically zoom in on the pathways that academics themselves create to facilitate informal, soft activities and engagement that often happen through networks. As Pugh et al. (2018) find, “informal linkages to the region have a more complex structure, formation and enactment, and are often curated or developed by individuals” (p. 1850). Softer, networked activities mobilised by institutional entrepreneurs may ultimately have wider institutional effects, both by interacting with and becoming integrated into the formal engagement infrastructure, but also in shaping the creation of new formal policies and strategies related to regional engagement.

In this chapter, we therefore operationalise our overarching research question using these concepts to ask: How can regional policy activate and support university institutional entrepreneurs active in their regions? We focus on the ways in which academic institutional entrepreneurs were empowered or constrained to undertake acts of institutional innovation creating soft networks, and the consequences that had for the embedding of those soft networks within their parent universities' hard infrastructures and central strategies and policies. We aim to understand how regional policies can support those institutional entrepreneurs already engaged and motivate those actors that are not.

METHODOLOGY AND CASE STUDIES

Methods

In this chapter, we seek to apply our conceptual framework to understand whether institutional entrepreneurs can drive internal-institutional change through their engagement activities. Our conceptual framework identifies a potential mechanism by which this happens, namely mobilisation processes leading to change in universities' institutional pillars, but we do not yet understand the ways in which these mechanisms link to institutional change. We therefore seek to sharpen our conceptual framework, better define the categories in our model and understand their relationships and dynamics. This requires creating a deep understanding of the empirical situations in which individual behaviours and events can be meaningfully identified as corresponding with elements of our model. This suggests the need for a qualitative approach generating deep understanding. We also want to create a more general model and therefore - to avoid our refinements reflecting one outlying situation too closely - we choose a comparative case study approach, generating a deep understanding of multiple cases from which our underlying conceptual model can be enhanced. We thus need to select a number of cases where there are observable occurrences of university academics creating engagement activities that have broader impacts at the university institutional level.

Consequently, we select cases from universities in regions where there is a long history of the universities engaging with regional partners to improve their regional environments. We selected three universities that are members of the European Consortium of Innovative Universities (ECIU), a group of universities "with collective emphasis on innovation, creativity and societal impact, driving the development of a knowledge-based economy" (ECIU, 2019a; see next section for more detail). We selected three examples of researcher-led engagement projects that had some kind of visible effect on the engagement, namely the Fraunhofer Project Center at the University of Twente, the Creative Science Park around the University of Aveiro and the Matchmaking Scheme around Aalborg University.

The data for the three cases were collected through 21 interviews with academics and key policy stakeholders in all three regions as well as document analysis, always aiming to ensure the case studies' direct comparability. The documents, such as newspaper articles, project reports and collaboration agreements, were used to contextualise the information given within the interviews. The interviews followed a semi-structured pattern with an interview guide that assured the overall direction; the diversity of interview partners as well as the particular questions and thematic focus varied from case to case. Within the three cases, it is possible to see the effects played by different regional contexts, in terms of different regional settings, university management styles and regional stakeholders. The interviews were conducted under a condition of confidentiality and anonymity; thus, the interview partners identities cannot be exposed.

Introduction to the Case Studies

The ECIU is a consortium of universities who profile themselves in terms of the contributions they make through their entrepreneurial, proactive and innovative regional engagement practices. Founded in 1997, the universities in the consortium emphasise innovation and entrepreneurship and aim to develop an entrepreneurial and innovative culture within their walls as well as bring it to industry and overall society. They describe themselves as “pioneers in pursuing an innovation agenda” (ECIU, 2019b) and have shown to develop a wide set of experiences on how to deal with innovation and entrepreneurship in their education and research activities as well as their knowledge exchange activities. ECIU universities claim to be regionally focused and to facilitate internal as well as external innovation and entrepreneurship and represent a reasonable sample of universities within which we might be able to address our research question. All three universities showed relevance to regional governance arrangements, extending their traditional education and research missions to include missions of industrial and regional engagement. In 2019, the ECIU was one of 17 Consortia awarded European University status by the European Commission (EC, 2019).

University of Twente (UT)

UT is located between the cities of Enschede and Hengelo in the Twente Region on the Netherlands’ eastern border. The technical university was created 1961 to “reanimate” a region suffering from the consequence of an economic downfall driven by the decline of the textile industry and associated sectors such as metal-working and precision engineering (Benneworth & Hospers, 2007). Created as an “innovative and experimental institution... [that] survived largely by reinventing itself as a source of new growth for the region” (Benneworth & Pinheiro, 2017, p. 311), the UT’s regional mission has materialised itself through different activities and projects according to different leadership styles and prioritisation efforts. Early examples of this are the implantation of the spin-off & entrepreneurship programme TOP since 1984, the creation of the business and science park Kennispark together with other regional stakeholders in 1989 as well as the role of the UT in diverse regional development programmes and boards nowadays. More recently, the emphasis has shifted to creating strategic investment and reach-out units, such as the Fraunhofer Project Centre, which will be the focus of the UT case presented in this chapter.

University of Aveiro (UA)

UA is situated in the Centro Region of Portugal in the municipality of Aveiro, one of the constituent members of the inter-municipal community of the Region of Aveiro (CIRA) which counts 370,000 inhabitants in total. The university was created in order to focus on and attend to regional needs, with many of the initial degree programmes being focused on meeting the demands/needs of the local industry (Rodrigues & Teles, 2017). Being committed to its region and the extant regional partners since its creation in 1973, it has developed a range of infrastructures facilitating knowledge exchange and technology transfer such as the technology transfer unit UATEC, incubator facilities, a pro-rector for interinstitutional cooperation in the areas of regional development and policy and a vice-rector for university-society cooperation. Working together in close partnership to define the Territorial Development Strategies for the 2008-2014 and 2014–2020 periods created a close relationship between the university, CIRA and the business association AIDA. Since 2007, these partners have worked to realise

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the Creative Science Park of the Aveiro region which opened in 2018. This example provides the basis for the empirical evidence regarding the Aveiro case, which focuses specifically upon consistency and commitment of engagement between the partners.

Aalborg University (AAU)

AAU was established in 1973/74 as part of wider attempts to maintain the region's attractiveness and renew the local industries, then dominated by construction, shipbuilding, food and agriculture. The university is located in Aalborg the capital of the North Denmark Region, encompassing 11 municipalities with a population of 580,000. The first degrees established showed a strong emphasis on technical and engineering fields, ensuring a strong connection between AAU and regional industries. The pedagogical model of problem-based learning (PBL) was established at the point that the university was created, enhancing the engagement with external partners through applied project work of students. Today, the regional industry has a strong technology focus and is R&D-based – characteristics that are often claimed to relate back to the AAU. Examples of strong engagement between the university and the regional stakeholders are AAU's engagement in the science park NOVI and common cluster initiatives that are internationally known (such as the ICT cluster BrainsBusiness). The initiative analysed in the next section is a Matchmaking System established to create clearly defined connectors between AAU and its external partners.

INDIVIDUAL INSTITUTIONAL ENTREPRENEURSHIP PROCESSES

In this section, we set out the activities undertaken by academics as institutional entrepreneurs following the four-step framework outlined above. The case of the Fraunhofer Project Center illustrates the energy and effort required to fit an external partner into a university campus, even where the university had notionally created a set of mechanisms to make it easier for external agents to set up within the former campus area. The Creative Science Park case in Aveiro illustrates the ways in which academics can create a conceptual space for a notion then mobilising policy partners to support and realise that notion, even if the passage of the idea to those partners can lead to unpredictable deviations from the original academic idea. The Matchmakers scheme at Aalborg University highlights that institutional entrepreneurs can and do thrive perfectly well away from the managing centre, and even if senior university managers withdraw support for a scheme, institutional entrepreneurs may continue their activities despite these policy shifts.

Fraunhofer Project Centre

The creation of the FPC can be traced back to a long-standing set of *ad hominem* collaborations between researchers at the University of Twente, and those at the Fraunhofer Institute, Europe's largest application-oriented research organization, at the level of central management as well as specifically with the Aachen Institute for Production Technology (IPT). In January 2017 the UT, Fraunhofer IPT and Saxion University of Applied Sciences established a joint Fraunhofer Project Centre (FPC) for 'Design and Production Engineering in Complex High-Tech Systems'. This had been prompted by a number of UT academics visiting Fraunhofer installations in regions similar to the Twente region, which in turn kick-started a discussion amongst different partners within Twente as to whether a project centre in Twente could serve as a mechanism to link the UT with local SMEs.

In mobilising the opportunity to create a Fraunhofer facility at the University of Twente, it was necessary to find a way to fit that external structure into the overall structure of the university. The FPC was initially placed within the department of mechanical engineering, but it became quickly evident that a department did not have the necessary flexibility in terms of risk management or staff policy to support this centre. To promote the idea of the FPC as a university-wide activity, project leaders projected the idea that it offered a wide range of institutional connections and opportunities, with minimal risk. The decision of the university board to approve the formal establishment of the system indicates that some manner was found to fit FPC into the university's structure. However, project staff reported that simply arranging this fit between the FPC model and the UT business model involved a substantive and draining struggle for the project leaders before any progress had been achieved around the practicalities of establishing and developing the centre. Indeed, the difficulties that were experienced in fitting FPC into the structures of the UT led some interviewees to remark that simply getting the permission of the university felt like a victory in itself.

Change initiation happened when the idea transformed into a project and the search for a suitable funding model started. The German Fraunhofer funding model envisaged that there would be a mix for the funding of 1/3 public money, 1/3 private investment/industry and 1/3 project money. Fitting that funding model into the Dutch environment was an institutional challenge faced by the actors involved. Different institutional entrepreneurs within UT were able to activate their regional networks to arrange that the Province of Overijssel would cover the public financing element. An FPC manager commented, "I cannot say that it only [worked out] because of personal relationships, but if you have a good story, and you know who to access and you make them understand the rationale behind the direction you want to go, you can convince them". Similarly, several private companies - many regional - were introduced to the FPC initiative, and first "quick scans" would later lead to bigger projects. The brand name of Fraunhofer - as well as already existing connections to the industry (for instance through student placements) - were regarded as being supportive in creating a base of interested companies.

Although the centre was initiated and running, the continuation of change turned out to be complicated as the FPC did not fit into the prevailing institutional setting of the university. Thus, many small developments, ideas or changes became disruptive and required immense efforts by the institutional entrepreneurs. Examples for these challenges were the initial lack of interest and motivation of professors to participate in Fraunhofer projects due to academic pressures, the prohibition on putting up a sign of the centre due to university rules that forbade names and logos around the campus, issues around square meter rent prices for the Fraunhofer installations, etc. It became clear that building upon what had already been established was difficult. Objectively the project was fulfilling every expectation that was set out; "we had a business plan and we are always above the expectations", nevertheless, tensions prevailed.

Finally, subsequent events revealed that only limited institutional embedding had taken place. The mismatch of the Fraunhofer Project Center with the institutional systems of the UT was laid bare as the institutional entrepreneurs found themselves having to continuously push for the FPC to take the next small steps in its development. At the time of writing a discussion of moving the FPC to the adjacent Business and Science Park - therefore offsite from the university - had started. A person involved in this process claimed that with this step, it would "become really visible as a separate entity" and would be able to interact closer with the industry. At the same time, instead of becoming more embedded in the university's infrastructure, the FPC would be leaving the university system to become independent of the university. We contend that this fits with the idea of the FPC rationally not fitting in the university and "being treated as a foreign body".

Creative Science Park of Aveiro Region

The Creative Science Part of the Aveiro Region was opened in 2018, after a formation process between a set of diverse stakeholders lasting more than ten years. The project started with some very enthusiastic stakeholders within the university that had the idea of building upon the already existing relationship with regional governmental bodies such as municipalities and the inter-municipal community (CIRA) as well as with companies and industry associations. A professor involved in the process explained “it all started exactly in the university and then we looked for partners in the region. Then we started to discuss with the municipalities. It evolved from that”. While different ideas about what could be created (such as an industrial area or a real estate park) were exchanged between the partners and the feasibility of the different ideas was checked, the idea of a science park that would not lead to increased competition between the already existing industrial zones of the municipalities emerged.

In terms of mobilisation, different institutional entrepreneurs within the university clearly played different roles in the project. There was extensive research conducted by different actors on possible science park concepts that would fit with the regions setting and necessities. These ideas were exchanged back and forth between the university actors and other stakeholders, with the aim of defining the ideal science park model that would suit everyone’s interest. An UA employee involved at this stage of the process highlighted the ability of the involved institutional entrepreneur in “understanding the language of people in the region” and being able to translate between different stakeholders. Through the institutional entrepreneur’s international networks direct connections and communication with science parks around the world were established, experiences exchanged and even some fact-finding mission to science parks conducted.

Change initiation happened when an (apparently) joint decision on the science park model was made and funding distribution between the partners was agreed upon as well as external funding secured. The chosen model, heavily based on the science park in Tampere (Finland), was explained to focus on the existing companies in the region, and a university employee explained that it would be “closer to firms than the traditional science and technology park”. What was not clear to the different stakeholders at this phase was that they had only supposedly agreed on a model, while in later stages it was notable that especially the municipalities were still hoping to attract new companies – thereby seeing it primarily as a real estate project. As was later to become clear, there was no real consensus on the content of what had been agreed, whether it was to construct a set of technology transfer services or to attract new businesses, and it was the latter that was important to municipalities. A university employer critically claimed that “what they [the other participants of the study trips] saw were buildings and not so much these institutional bases, which is much more important than the building”.

The failure of understanding each other’s definitions of the ‘common idea’ – and realising that there was not as much commonality as assumed – was the start of a change continuation coined by complications and drawbacks. Competitions around the selection of the suitable location of the future science park as well as comprehensive changes within the UA teams were reported by the interview partners. Especially the second point, of university employees leaving their positions within the teams that were engaged with the science park process, shows that IE became disengaged at this stage. An interview partner involved before and after these changes explained that with the entrance of a new rector team a “more traditional way of seeing these sorts of knowledge transfer” was introduced, thereby challenging the perspectives and activities conducted by many of the IEs. As the different partners were busy fight-

ing their own battles of location and team membership, they failed to present themselves as a coherent body standing against additional external pressures - such as demonstration of an environmental agency against the chosen location - that emerged along the way.

The story of the science park and the role of the academic institutional entrepreneurs shows nuances of successful change motivation and initiation as well as complications throughout the change imitation and embedding. While the university and the respective IEs were very enthusiastic in the beginning and conducted extensive groundwork, the model of the park as well as the changing support through a new rectory team, suddenly turned the process around. The original plans of the institutional entrepreneurs were thus questioned, the university interests not guaranteed – one could even say they were trumped - and therefore many institutional entrepreneurs disengaged. The science park was still opened, taking double the time than originally planned, and the university's engagement within this process was slowed down.

Matchmaking System

In 2007-2008, Aalborg University - in cooperation with the North Denmark Region - initiated the creation of a new cooperation infrastructure between the university and its external partners, especially those in the business promotion system. The new infrastructure had the goal to facilitate the exchange of knowledge between the university and external stakeholders, with a particular focus on companies such as SMEs who had limited connections to AAU - often found in the outermost areas of the region. This new infrastructure was to consist of two elements, a matchmaking secretariat tasked with handling project management as well as the organisation of matchmaking activities and so-called 'matchmakers' tasked with becoming knowledgeable intersections between the university and third parties. Three categories of matchmakers were created: (1) university-internal matchmakers (researchers in each faculty), (2) university-external matchmakers (in municipalities, business associations and other institutions) and (3) student 'matchers' (students with special responsibility for promoting the students' collaboration with the business community).

The project was initiated by different stakeholders around AAU Innovation, aiming to create new entry and exit points to and from the university. A university manager very involved in this process explained that the goal was not to centralise engagement tasks but to mobilise more stakeholders and 'build' new doors. They clarified that they were applying a 'no-wrong-door' policy in contrast to the often praised 'one-door' policy. This model was seen as a clear fit to the regional needs and funding was made available by the regional growth forum, a body combining different stakeholders within the field of regional development who are involved in the decisions on the distribution of European and national funds (OECD, 2009). In the first phases of funding, the matchmaking secretariat was installed and the identification and induction of matchmakers started. The deans of the different departments, as well as managers of municipalities and business associations, were asked to appoint matchmakers within their institutions. Interview partners claimed that most of these newly appointed matchmakers were already engaging with external partners and therefore did not have to change their activities in any significant way.

Change initiation happened in that the appointed matchmakers started getting to know each other personally - as well as the institutions which they were representing - through first meetings and activities. An example of such a meeting was the annual matchmaking conference in which keynotes were given, institutions introduced and an informal way of getting to know each other was established. While some of these activities were described to be rather symbolic and it was questioned whether they fulfilled the matchmaking purpose – such as the official awarding of 'matchmaking certificates' – other participants

explained that they were able to create new contacts and a better understanding of the partners' needs and possibilities through the new matchmaking infrastructure. In parallel, the matchmaking secretariat started introducing activities such as 'municipality tours' (taking students to companies in specific municipalities) or 'solution camps' (a company posing a particular challenge and students participating in a structured process of defining possible solutions to it). These different activities were said to have systemised some of the existing activities and created new forms of engagement.

After the first years of the matchmaking project terminated, some internal changes of the university management, a restructuring of AAU Innovation and changes in the leadership of the university as well as the matchmaking project marked a change in the project's development. While the matchmakers that were already well connected continued with their matchmaking tasks, potential new matchmakers (who received the matchmaking tasks when people left their positions) were often not aware of what this actually meant. An external matchmaker claimed that they were never contacted, did not know what was going on within the university and had no clear idea of what the task actually entailed. New leadership started setting new priorities, aiming at one-door-policies and introducing the idea that engagement and collaboration had to bring clear advantages for AAU. While the system still received funding, the new priorities shifted the nature of the infrastructure. A manager within the system explained that while the "old innovation director was very much focused on listening to what's going on out there and what the [potential external partners] want", the new management was focused on the university's needs and prioritised the educational system. This new focus of the matchmaking project was said to be on proactively connecting students to companies, giving external matchmakers as well as researchers a passive role.

In the beginning, the project, activities and tasks were managed flexibly and engagement between stakeholders was said to have started to grow. Nevertheless, the long-term changes that were hoped to be achieved according to the original plans of the matchmaking system were not easily embedded into the university structure. A manager within the matchmaking project claimed that the system was not "properly implemented at the university". While the model of systemic transformation seemed to have worked in the first years, it failed to deal with internal tensions inside the university after leadership changes and an exogenous transformation occurred due to the shift of priorities. While different disciplines had different knowledge and production needs (different doors), the matchmaking infrastructure seemed to have been a better fit for some departments than for others. Thus, the attempt by the second team of matchmaking leadership to streamline knowledge engagement and create one rational entry system to the university challenged the idea of the original IEs.

FACTORS AFFECTING REGIONAL INSTITUTIONAL ENTREPRENEURS' BEHAVIOUR?

We have asked the operational research question of how regional policy can activate and support university institutional entrepreneurs active in their regions. On the basis of the three case studies, we can recognise different elements that motivate and advance institutional entrepreneurs as well as elements that demotivate or even block the advancement of institutional entrepreneurs. We outline the most salient positive and negative elements and then identify how regional policy can make use of these elements and play to the intrinsic motivation of academics, in devising mechanisms that allow academics to flourish as institutional entrepreneurs. These factors are summarised in Table 1.

Table 1. Factors that encourage and discourage university institutional entrepreneurs

Factors encouraging institutional entrepreneurs	Factors discouraging institutional entrepreneurs
Regional partners signalling to IEs that their ideas are of value and should be considered	Impossibility for long-term planning in term of the IEs due to continuous university-internal changes
Regional partners considering the ideas of IE and entering into co-creation processes to develop the ideas further	Inflexibility in terms of creating settings that allow trial and error phases for testing new projects and institutions
Continued support of external partners through complicated times even after some IEs disengaged	Complications in actually connecting global pipelines with local partners

Source: Author's own elaboration

Firstly, what helped the institutional entrepreneurs in our cases was the fact that regional partners provided academics with clear value signals. In all three case study regions, the academics – motivated by the wish to ‘create something big’ within their particular academic context – started talking to regional partners from institutions such as companies, municipalities or cities. This was most obviously evident in the case of Aveiro and Twente, where the IEs were already very well connected to mayors and leaders of the main business associations (Aveiro) as well as regional companies and decision-makers at the Province level (Twente). Thus, the IEs were able to approach people directly and translate their ideas into concrete plans (a science park or a Fraunhofer centre) that were received by regional partners with interest and support. The fact that regional partners signalled to IEs that their ideas were ‘something worth doing’ then gave the academics the signal to keep working on it internally.

Secondly, the co-creation of the ideas is related to the issue of value signalling. Regional partners did not straightforwardly adopt the academic ideas but rather took a step forward together - from discussing all the possibilities to deciding which possibility they want. By constructively thinking through the academic’s initial idea, regional partners and IEs created something around which the partnership could coalesce to co-create a proof of concept. The best example of this was seen in Aveiro with the emergence of the idea of creating the science park as a project owned and realised by all regional partners as a joint initiative. Similarly, in North Denmark, the business development offices of municipalities, the regional growth house and representative of industry associations became involved in co-defining who their regional matchmakers would be and how they would evolve within the matchmaking infrastructure. Thus, the academics were particularly motivated by the encouragement and involvement of regional partners in translating their initial idea into reality.

Our case studies all show that continued support and engagement from external stakeholders through difficult periods was vital for the initiatives’ survival. Stakeholders such as governmental bodies or business partners kept engaged in the different projects even after some academic IEs disengaged because of internal hurdles or personal complications/disagreements. The matchmaking infrastructure provides an interesting case in this regard, with some partners disengaging after internal university changes triggered complications in the change process; Nevertheless, there were some partners from the region and the municipalities that did not withdraw at that point, and kept engaging with the IEs to sustain the project and develop it further. Similarly, in the case of the Aveiro CSP, changes in the stakeholder constellation saw some IEs leaving the project, and leadership was then adopted by other partners. Although these partners might have shifted the priorities of the project significantly and lengthened the duration of the creation of projects, it is clear that this ongoing support was necessary to ensure that the science park was eventually created.

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There were also elements that blocked the IEs in the three different cases. Firstly, internal institutional change was undermined by the fact that there was no possibility for the IEs to plan or think long-term. A significant example of this was the changes in the matchmaking project after institutionalisation seemed to have been working effectively in the first years. The changes in the university and matchmaking leadership, the modification in terms of priority areas, and the projectisation of the matchmaking infrastructure clearly slowed down the embedding process and prevented institutionalisation. Similarly, due to the commencement of a new rector in 2018 at the UA, a race to deliver the CSP started because the outgoing rector wanted to be in a position to formally open this new infrastructure. It was then opened while still being largely empty and some interview partners claimed it had been opened prematurely.

Secondly, we identify examples of missing flexibility in terms of the setup and installation of these new projects within the existing university infrastructures. In the case of the FPC in Twente, difficulties appeared when the center was first attached to a specific department – experiencing restraints in terms of hiring new personal and financial freedom. Thus, IEs promoted the idea of de-coupling the centre from any department and leaving it ‘independent’ under the direct supervision of the university board – a process that sapped time, resources and energy, with the university not being prepared or sufficiently flexible to accept such a new setting.

Finally, in all three regions, the IEs aimed to create global pipelines into local buzz partnerships, but because they were located in university settings, achieving this global-local cross-fertilisation was not always easy. This was most evident in Twente and Aveiro: The FPC was created with the goal to conduct internationally relevant research in the area of design and production engineering which was then supposed to be applied to regional SMEs. While the FPC effectively built global connections, it did not necessarily create the intended local buzz – the focus on local cross-fertilisation was partly replaced by focusing on international companies from anywhere in the Netherlands and Germany. In Aveiro, the CSP was aimed at attracting international researchers, themes and projects that would then connect to the regional companies and create local buzz in the 11 municipalities.

CONCLUDING DISCUSSIONS: CREATING REGIONAL POLICIES THAT SUPPORT ACADEMIC INSTITUTIONAL ENTREPRENEURS

This operational analysis provides the basis to address our overall research question of how entrepreneurial universities create (or do not) frameworks which enable purposive actions by academic actors to participate in regional development outcome. By exploring three case studies of institutional change processes initiated by academics in universities claiming to be highly engaged and open to their surroundings and innovative change, we highlighted several elements that variously enabled change or hindered change embedding respectively. We explored how institutional entrepreneurs in universities can create new institutions through a process in which change is first mobilised, then initiated and continued and finally embedded (Figure 1). In the following, we will thus explore what regional policy can learn from the above outlined motivating and blocking elements and how it can react in order to secure more institutional entrepreneurs. These policy findings are summarised in Table 2.

In terms of value signalling and co-creating ideas and projects, regional policy could create a mechanism/apparatus that links academics with intangible ideas to potential beneficiaries who could signal their potential value in a resultant tangible project. This is particularly important as by giving regional partners the opportunity to signal that the academic’s ideas are valuable and important and by partici-

Table 2. Potential policy interventions to better support university institutional entrepreneurs

Supporting encouragement of institutional entrepreneurs	Addressing discouragement of institutional entrepreneurs
Create an apparatus that allows academics to translate intangible ideas into deliverable, tangible outcomes	Secure long-term frameworks by demanding institutions to sign up for long-term planning periods
Create opportunity spaces for regional stakeholders to co-create and test ideas	Encourage the creation of 'test spaces' in institutions that allow for checking whether/how new institutional settings could work
Continue support even through complicated phases as the partners might need some time to re-focus	Target the regional and international stakeholders and create opportunities to combine their knowledge, interest and aims

Source: Author's own elaboration

pating in the creation of a common project. Additionally, this helps to create common ground between academics and regional partners, and to legitimate those projects internally, in turn allowing academics to mobilise internal support. Regional policies should support regional stakeholders through difficult phases, as the constellation of engaged partners might change and new stakeholders - together with the still central IEs - might require additional time. Whilst it is inevitable that the constellation of partners will shift during projects, there is a need to ensure that policies do not abruptly withdraw support and legitimacy from IEs as this has a general undermining effect on the legitimacy of engagement as an academic activity.

In terms of the need for the possibility of institutional entrepreneurs to plan long-term, the regional policy should encourage universities not to change priorities continually and instead support long-term trajectories. We noted that academics can become demotivated by shifting internal strategic frameworks and university priorities. Regional policy should seek to persuade universities to commit to engagement frameworks for a long-term period, allowing IEs more reasonable timeframes to actually initiate, continue and embed change. Secondly, regional policies should encourage universities and other institutions to become more flexible in terms of testing new institutional setups. This could give IEs the opportunity to test the projects and find a suitable setting in which they can flourish. Finally, regional policy needs to stimulate IEs to build broader international connections that are relevant for the regional stakeholders through facilitating universities to attract international knowledge and translate as well as embed this knowledge to regional needs. Policy has to work on both sides, the international and local. A key challenge here for regional policy-makers is understanding the correct balance of fundamental research, necessary to create the global pipelines, and how to ensure that globally active academics can be coupled with regional partners to use that global knowledge to create local buzz.

We know the limitations of drawing broader conclusions from three case studies, nevertheless, we seek to claim that this chapter allows us to highlight the important role of institutional entrepreneurs in universities for the engagement with the region and the start of new institutional practices. Through considering the link between institutional entrepreneurs and regional policy, we find that regional policy has an important role to play in the regional entrepreneurial ecosystem. As evidence from Nieth (2019) has suggested, tensions that might arise can be due to potentially institutional mismatches that undermine and undercut the necessary linkages between partners for effective knowledge exchange and hence universities contributing to regional development. We conclude that - because the connections between the IEs and regional partners are vital to the activities undertaken - encouraging and building these links is a critical element that should be enhanced through regional policy.

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Chapter 14

Entrepreneurial Universities and Regional Innovation: Matching Smart Specialisation Strategies to Regional Needs?

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ABSTRACT

Universities are expected to play a leading role in the smart specialisation strategy process, However, a gap between discourse and practice is marking the RIS3-related regional development programmes, which can be extended to the involvement of universities in the process. A mismatch can be speculated between the expectations towards universities' roles in RIS3 implementation and actual practice, and its repercussions on a regional innovation ecosystem. This chapter addresses the extent to which the role played by universities in a region's innovation and entrepreneurial practice aligns with the smart specialisation strategic outline. As an in-depth case-study of the University of Aveiro (Portugal), it draws on both quantitative and qualitative data, with an analysis of RIS3 approved projects in the Portuguese NUTS II Centro region, and interviews with key actors within the university and the regional administration. Through this, it weighs the contribution of entrepreneurial universities to the RIS3 goals, drawing lessons for public policy and discussing the future of RIS3.

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INTRODUCTION

Universities are expected to contribute to the development of their regions, not just through their teaching and research missions, but increasingly through a “third mission” of dynamic engagement with external, and mainly regional partners (Charles, Kitagawa, & Uyerra, 2014; Chatterton & Goddard, 2000). In turn, the promotion of interaction between the university and other regional institutional actors through diverse engagement mechanisms is believed to stimulate innovation processes (Uyerra, 2010). Adapting to the strain of these growing expectations, and in search of alternative funding sources, universities have assumed a more entrepreneurial approach in their regional engagement. This is exemplified by their involvement in the development of incubators and science parks, and by their increasing pursuit of contract research, consultancy services and partnerships (Jongbloed, Enders, & Salerno, 2008). The importance of these relationships has been progressively underlined and encouraged in the political discourse, more evidently within EU’s most recent Cohesion Policy, which in its incorporation of the smart specialisation concept has linked structural funds (SF) and ERDF particularly to research and innovation initiatives (Goddard, Kempton, & Vallance, 2013).

Universities are also considered crucial institutions in the regional development dynamics associated with smart specialisation, and particularly the research and innovation smart specialisation strategies (RIS3). The basic underlying argument is that development potential inherent to the knowledge generation, diffusion and dissemination capacity of academia is instrumental in a regional development policy context inspired by the smart specialisation concept (Begg, 2016). In other words, universities are expected to play a leading role in strategy implementation, relying on what is unique in a given region, namely the R&D and innovation domains in which that region can hope to excel (Foray, David, & Hall, 2009).

There is, however, evidence that a gap between discourse and practice is marking the RIS3-related regional development programmes (e.g. Iacobucci, 2012; Kroll, 2017), particularly evident in less-developed regions (LDRs), and which can be extended to the involvement of universities in the process. Universities themselves manage different forms of incorporation of the RIS3 processes, which are very much dependent on territorial context, historical legacy (Breznitz & Feldman, 2012) and overall entrepreneurial architecture (Salomaa, 2019). As can often be the case of universities in peripheral regions, even entrepreneurial ones, if there is a divergence between the universities’ activities and the needs of the surrounding local innovation ecosystem (Charles, 2016), it is likely entrepreneurial spillovers will remain minimal (Brown, 2016) and RIS3 processes fail to further them. Accordingly, one can speculate about a mismatch between the expectations towards the role of universities in RIS3 implementation and actual practice, and its repercussions on a regional innovation ecosystem.

This chapter reflects on an entrepreneurial university’s potential to contribute towards regional development through its involvement in the RIS3 process and resulting projects funded through SF. Empirically, it presents an in-depth case study of a university – the University of Aveiro – in a particular regional context – the less-developed Centro NUTS II region of Portugal –, aiming to address the relation between the regional government authority, the RIS3 process and the university in responding to regional needs and in fomenting the innovation and entrepreneurial ecosystem. The study strives to contribute to the debate on the implementation issues of regional policies driven by smart specialisation, focusing particularly on the role of academia.

BACKGROUND

Knowledge-Based Innovation Policy: RIS3 and Universities' Role in Creating an Entrepreneurial Ecosystem

Scholars from the fields of regional studies and economics have widely acknowledged innovation, in the form of creative technological discovery, as a key factor in unlocking territorial development and competitiveness (Freeman, 2002; Gibson & Naquin, 2011; Krammer, 2017; Rosenberg, 2004). As conceptualisations evolved, innovation processes transformed from more linear, chain-like technical models to more systemic frameworks that considered their spatial, organisational and institutional dimensions (Cooke, Gomez Uranga, & Etxebarria, 1997; Etzkowitz & Leydesdorff, 2000; Landabaso, 1997; Lundvall, 2010). In the latter, innovation was finally perceived as an inherently complex, interactive, territorial and combinatorial process between markets, policy, science, technology and, ultimately, knowledge and learning (Edquist, 1997; Santos & Caseiro, 2015). Territorial competitiveness, in this sense, is progressively dependent upon the generation of knowledge and the promotion of collective learning mechanisms (Morgan, 1997; Santos & Caseiro, 2015). This has been approached paradigmatically in the literature on innovation systems and the 'learning region', which brought the role of knowledge and institutions to the centrefold of these dynamic and creative innovation processes (Gunasekara, 2006; Lundvall, 2010; Morgan, 1997).

Institutional and social dimensions are thus assumed by some authors (Morgan & Henderson, 2002; Morgan & Nauwelaers, 2003; Santos & Caseiro, 2015) as equally, if not more important than infrastructural and fundamentally quantitative and economic factors in fostering territorial competitiveness and innovation, particularly in less-developed and peripheral regions. For example, regional actors should not just be able to access knowledge but also have the capacity to learn and adapt, something facilitated by relational processes (Godin, 2006; Morgan, 1997). As such, regional and innovation policies seeking to address the issue of territorial competitiveness and 'bridge the gap' between more and less-developed regions have started emphasising institutional capabilities and endogenous potential by fostering interaction among regional actors to spur collective learning.

In the European context, the recent cohesion policy framework of smart specialisation emphasises this approach (Foray et al., 2009; Fröhlich & Hassink, 2018). As the basis for interventions in research and innovation through the European Regional Development Fund (ERDF), the smart specialisation concept and resulting strategies (Smart Specialisation Strategies – S3 – or Research and Innovation Strategies for Smart Specialisation – RIS3) are now an integral part of any EU region's economic development efforts, and an ex-ante condition to access regional funds. The guiding principles of smart specialisation consider the collaborative character of innovation within a participatory process designated as the entrepreneurial discovery process. Within it a diverse set of regional stakeholders and institutions (e.g. local and regional government, industry, universities and research institutions, third sector organisations, entrepreneurs) come together to discuss and develop regional futures, progressively identifying and supporting areas of strategic potential that can generate competitive regional advantage (Foray & Goenaga, 2013). By setting R&D and investment priorities based on regional uniqueness, S3 not only inherently emphasises endogenous potential and place-based (rather than 'one-size fit all') innovation strategies (Barca, McCann, & Rodríguez-Pose, 2012), but also increases the focus on knowledge-based and collaborative innovation as a way to boost regional competitiveness and development (Santos & Caseiro, 2015). Thus, universities have been brought to the centrefold of regional innovation policies, with RIS3

highlighting them as key institutions in guiding the strategy process and the identification of regional advantages and trends (Foray et al., 2009). By helping leverage existing knowledge stock to create new regional trajectories through the diversification and upgrading of the R&D system, entrepreneurial and regionally-engaged universities, in particular, have become a critical asset for the design and implementation of RIS3 strategies to better connect with regional context and needs (Santos & Caseiro, 2015).

Entrepreneurial and Regionally-Engaged Universities

Universities' roles have shifted throughout the years in the face of both external demands and endogenous processes that required their engagement with society (Clark, 1998; Etzkowitz et al., 2008). Whereas in the past their mission was that of predominantly disseminating knowledge through teaching, the concept of research-based teaching presented in the 19th century by Wilhelm von Humboldt added to universities the function of knowledge producer. More recently, expectations regarding universities' ability to drive economic development and innovation dynamics (Etzkowitz & Leydesdorff, 2000; European Commission, 2011), to anchor and combine global knowledge assets with local processes, and to create a potential for regeneration and development, particularly at the regional level (Charles, 2016), have influenced the incorporation of a "third mission" of external and regional engagement within these institutions. This typically refers to activities of social, entrepreneurial and collaborative character undertaken by universities with external partners (Etzkowitz & Leydesdorff, 2000; Zomer & Benneworth, 2011), potentiated by proximity and territorially-specific processes, and therefore more emphasised at the local and regional level (Morgan, 1997). These shifts in the academic *ethos* reflect a clear trend in institutional adaptation, a transition from knowledge for its own sake to knowledge valued by its applicable potential, and even beyond with more network-based knowledge generation/creation activities (Etzkowitz & Leydesdorff, 2000; Gibbons et al., 1994).

With society now relying primarily on (scientific and technological) knowledge to be able to compete in an increasingly globalised economy, a greater emphasis has thus been placed on a university that can contribute towards the development and competitiveness of its surroundings (Brown, 2016; Etzkowitz & Leydesdorff, 2000; Gunasekara, 2006). State agencies have increasingly sought to support "third mission" activities, to interlink knowledge producers and users, and to maximise the impact of universities in the region (Brown, 2016; Drucker & Goldstein, 2007; Etzkowitz & Leydesdorff, 2000). This is particularly the case of regional innovation policies like S3, which by considering universities' potential in building-up regional economic, technologic and institutional capacity, progressively brought them to the forefront of regional innovation and entrepreneurial ecosystems (Audretsch, 2014; Brown, 2016; Charles et al., 2014; Cooke et al., 1997).

Universities' incorporation of the "third mission" and their more pronounced role in economic development inevitably materialised in a more entrepreneurial turn (Etzkowitz & Leydesdorff, 2000), with the emergence of new functions and bodies that could facilitate the connection between knowledge and the territory. Specialised infrastructures were created for this effect, namely technology transfer offices, incubators, science parks and other intermediate facilities that could promote and manage this relationship with external entities (Brown, 2016; Jongbloed et al., 2008). This could thus stimulate the innovation system in which the university was integrated, accruing alternative funding sources and outside recognition in the process. In seeking to play a more prominent role in knowledge-based innovation processes alongside other relevant institutions in the region, like industry and the state, the university has become more entrepreneurial, more active in its interactions with other actors and in the combined performance

of its main missions (teaching, research and engagement) (Etzkowitz & Leydesdorff, 2000). As Santos & Caseiro (2015, p. 541) state, this requires universities to be imbued with a sense of discovery and risk, to approach knowledge as “an asset which can be created, developed, transmitted and valued,” and to take on a more anticipative, active and strategic role in the promotion of its transfer to society (Etzkowitz & Leydesdorff, 2000).

Contribution of the Entrepreneurial University to Regional Innovation

An entrepreneurial university is thus believed to have the potential to foster interactivity and collective initiatives in a regional context (Clark, 1998; Etzkowitz & Leydesdorff, 2000), adapting its organisational architecture in the face of external demands and according to its institutional objectives (Clark, 1998; Etzkowitz et al., 2008). The regional and institutional context, such as funding availability and financial constraints, local employment opportunities, and other socio-historic factors will therefore be highly influential in defining the entrepreneurial universities’ regional role (Breznitz & Feldman, 2012; Salomaa, 2019). If the university’s entrepreneurial endeavours are disconnected or disassociated from the regional socio-economic landscape, knowledge spillovers and effective learning dynamics are less likely to occur. This is particularly the case in LDRs, where the knowledge being produced and transferred is often unable to be absorbed by the local economic and entrepreneurial ecosystem (Bonaccorsi, 2016; Brown, 2016). Despite such restrictions, universities are widely acknowledged as sources of knowledge that can stimulate the regional economy. They present and stimulate generative, absorptive, collaborative, and leadership capacities (Goddard et al., 2013) that can play a key role for innovation policy initiatives to build new niches of knowledge and have impactful and positive outcomes.

According to Santos & Caseiro (2015), the concept of the entrepreneurial university and the smart specialisation framework are mutually reinforcing and amplified. A university that pursues an entrepreneurial approach, promoting an adjusted institutional architecture and culture (Salomaa, 2019) and facilitating collaboration with regional partners, can be easily linked with the more relational and networked vision of innovation present in S3. Furthermore, by encouraging an entrepreneurial mindset and ultimately a society that stimulates a culture of “risk, search and discovery” (Santos & Caseiro, 2015, p. 541), entrepreneurial universities can more easily identify, exploit and carve out unexplored economic opportunities – a central tenet within the S3’s entrepreneurial discovery process. In turn, S3 aims to support regional innovation capabilities on pair with entrepreneurial universities by fostering actor networks and interaction and enhancing collective learning processes capable of producing strategic knowledge. Ultimately, universities’ roles in the RIS3 as relevant stakeholders and social connectors, partner institutions, policy actors and knowledge producers can be of great importance to strategy implementation, and enable the construction of a sustainable entrepreneurial ecosystem (Santos & Caseiro, 2015).

It is nevertheless important to recognise that the promotion of an entrepreneurial culture or of the “third mission” more generally within universities is not straightforward and far from reaching effective institutionalisation and operationalisation (Fonseca, 2018). The integration of entrepreneurial activities with more traditional academic functions is still incongruent and disordered, lacking clear strategic institutional alignment capable of directing such activities and with little incentives in place to support academic engagement. Despite entrepreneurialism in academia being partly driven by the need for alternative funding sources, monetary incentives seem insufficient (D’Este & Perkmann, 2011), with these activities that not being prioritised and rarely playing a role in academics’ career evaluation.

Can the Entrepreneurial University Help Match RIS3 to Regional Needs?

RIS3 can be summarised as an attempt to create a regional and dynamic entrepreneurial ecosystem conducive to territorial collective learning and innovation (Santos & Caseiro, 2015). In practice, while smart specialisation has gained momentum as a policy concept and instrument (Foray, David, & Hall, 2011), it has been faced with several implementation difficulties, particularly in the case of LDRs (Krammer, 2017). More developed regions with stronger innovation and entrepreneurial ecosystems generally succeed in supporting innovation endeavours, namely in translating knowledge into the productive sector. However, LDRs can face certain shortcomings that hamper this: insufficient and/or inefficient locally-based R&D activities; a lack of absorptive capacity for R&D by local firms; and a weak or fragmented entrepreneurial ecosystem, with a lack of interaction between economic and institutional agents (Bonaccorsi, 2016; Huggins & Johnston, 2009; Krammer, 2017). More generally, RIS3 are still believed to have a weak conceptual basis, hindering the effective leverage of collective processes. Kroll (2017) highlights that current regional stakeholder participation and consultation in RIS3 cannot be rightfully called entrepreneurial discovery processes, as the bartering of individual interests still overshadows larger community-oriented visions and practice. Iacobucci (2012) warns RIS3 can tend toward ambiguity by diluting the focus on R&D-based innovation and specialisation, and that regions with weak research infrastructure may need a balanced mix of research and innovation policy to help correct infrastructural problems and simultaneously stimulate the innovation system.

In this, the presence of an entrepreneurially-veered university in a region can substantiate the current smart specialisation framework by providing the RIS3 process with key incremental organisational support, promoting an entrepreneurial culture within the region and among regional actors that can strengthen regional competitiveness and development. While this potential is present, universities' role in effectively linking the RIS3 with the regional fabric, and in developing collective learning and absorptive capabilities, is still unexplored (Santos & Caseiro, 2015). Without disregarding other actors' contribution to RIS3 and in the building of the entrepreneurial ecosystem (Santos & Caseiro, 2015), or the role of policy in creating the conditions for such a system to emerge (Huggins & Johnston, 2009), this chapter considers relevant to explore the role of entrepreneurial universities as key actors in driving RIS3 policy and in linking it with regional needs, analysing their agency in the process, in particular in the formulation and implementation stages.

THE CASE OF THE UNIVERSITY OF AVEIRO: RESEARCH AND INNOVATION POLICY AND REGIONAL PRIORITIES

This section focuses on the participation of an entrepreneurial university in the RIS3 strategy process. It considers the engagement in both the formulation and the implementation stages of the process to provide a more comprehensive view of a university's influence on the policy's orientation, its own adaptation to the strategy and, its contribution to its application. While it discusses the issue of universities' contribution towards matching a RIS3 to regional needs in a specific institutional and geographic context, the intent is to draw theoretical reflections and policy lessons that will allow for broader consideration.

A single case-study approach was deemed fitting by the authors given its potential for more in-depth exploration (Flyvbjerg, 2006). The University of Aveiro (UA), in Portugal, was chosen for three main reasons. First, it is a relatively young university that has assumed a strong connection to its region since

its creation in the 1970s, embodying an entrepreneurial discourse and approach in regional engagement. Second, its location in the peripheral and less-developed regions of Centro (NUTS II) and Aveiro (NUTS III) provides a useful context to explore the matching of entrepreneurial and innovative activities with regional needs in an LDR, where there may be shortcomings in infrastructural, institutional and connective capabilities. Third, UA has been increasingly active and involved in regional innovation policy and SF projects at regional, sub-regional and local level, engaging often as a relevant partner to government authorities and other relevant institutional stakeholders. More prominently, and as will be discussed in this chapter, UA has participated in the RIS3 of Centro region for the period 2014 to 2020, and has partnered with the sub-regional authority of Aveiro region – the Intermunicipal Community of the Region of Aveiro (CIRA) – in the design and management of SF for two territorial development strategies in the periods of 2007-2013 and 2014-2020.

Concretely, this chapter draws on data from the Centro regional authority (CCDRC) concerning projects financed by the Portugal 2020 programme (supported by the ERDF, and therefore S3) from 2015 to 2019. The available data (CENTRO 2020, 2019), last updated on March 31st, 2019, provides information on the set of supported innovation projects, namely their geographical and sectoral distribution, the partners involved and the volume of allocated funding. It thus permits investigating the extent to which the projects match the specialisation domains of the RIS3, as well as the nature and focus of universities' involvement. Complementing this is a qualitative analysis of 31 semi-structured, in-depth interviews with key actors within the university and the regional (CCDRC) and sub-regional (CIRA) administrations, conducted by the authors in Spring and Autumn of 2018. Discussions centred on the extent and nature of UA's engagement within these strategies, particularly the RIS3; UA's institutional and organisational adaptation in the face of its engagement in regional innovation policies; and, finally, the dynamics of UA's participation in RIS3 Centro-funded ERDF projects. The interviews cover 21 projects funded from the scheme, 10 of them small-scale grants for intellectual/industrial property projects, mainly covering patent costs for promising research outcomes. These were centrally applied and managed by UATEC, UA's technology transfer office. The other UA-led projects vary from large-scale initiatives within regional "platforms", to small and medium size projects with a stronger regional focus. Two of these projects strive to reinforce internationalisation by encouraging researchers to bid for grants from Horizon 2020, whereas the others have stronger links with external stakeholders such as local businesses and government authorities.

Brief Picture of the Regional Context

The Centro region (Figure 1) is located in the central-most area of continental Portugal, benefitting from a strategic positioning between the country's major metropolitan centres – Lisbon, the capital, and Porto. Centro is one of seven Portuguese administrative regions, corresponding to the NUTS II European statistical subdivision, and encompasses approximately 30% of the country's total area, with a population of over 2 million inhabitants (European Commission, 2019). This population is unevenly spread out throughout the region, with a greater density in the more urbanised coastal areas (like Coimbra, the region's capital, and Aveiro), and a characteristic 'desertification' of the more rural interior, except for some urban centres (e.g., Viseu, Castelo Branco).

In economic terms, its GDP corresponds to roughly 19% of the national one, but its purchasing power is still below both national and European averages (European Commission, 2019). It is considered an LDR in a country that is, nevertheless, a moderate innovator, according to the EU's Regional Innovation

Figure 1. Map of Portugal displaying nuts ii statistical divisions and the nuts III Aveiro Region



Scoreboard of 2018. Given that the region encompasses a great territorial area, Centro benefits from a rich variety of (natural) resources that have contributed to its economy becoming relatively diversified. It is both competitive in low technological industrial sectors – like ceramics, agro-food and forest industries – and increasingly in medium to high-tech sectors – namely ICT, biotechnology and health, renewable energies – which are bringing new applications to more traditional industries (Rodrigues & Teles, 2017).

Centro is the third highest ranked region in Portugal in gross expenditure on R&D with growing investment over time (European Commission, 2019). In this, its economy and innovation-related endeavours, Centro owes a lot to its higher education institutions, which include three universities – the University of Coimbra (UC), University of Beira Interior (UBI) and University of Aveiro (UA) – five public polytechnics and many other private education and research institutes. Nearly half of the R&D expenditure in the region results from activities implemented by higher education institutions, with businesses following suit and lastly government and other private institutions (European Commission, 2019).

Not following a regionalised tradition, Portugal's central government is the one responsible for regional development and, in the most part, for the definition of research and innovation policies. Regional commissions, such as the CCDR of Centro, possess administrative and financial autonomy but are merely decentralised bodies of the central government. Their competencies include, nonetheless, regional and urban planning and development, environment, inter-regional and transnational cooperation, and the management of financial instruments and EU programmes based on funds allocated to Portugal (European Commission, 2019). The RIS3 Centro is one such instance. By designing a RIS3, the region can access ERDF, and aim to enhance its overall performance in GDP and R&D in the national context and reinforce internal territorial cohesion and resilience (European Commission, 2019). To achieve this, and together with regional stakeholders, eight strategic priorities have been defined in RIS3 Centro, linked to the above-mentioned main regional industrial sectors but also including sea-related economic activities and tourism. Combination of these areas has been promoted through three main transversal scopes: i) sustainable industrial productivity; ii) energy efficiency; and iii) rural innovation (CCDRC, 2014b). The 2014-2020 RIS3 was implemented within the overarching CENTRO 2020 strategy, which had around €1.8 billion of European Regional Development Funds (ERDF) and €404 million European Social Funds (ESF) to work with (European Commission, 2019). Within this (CCDRC, 2014a), ten priority axes were defined to orient investment, namely:

1. Research, development and innovation (IDEIAS);
2. Competitiveness and internationalisation of the regional economy (COMPETIR);
3. Develop human potential (APRENDER);
4. Promote and stimulate employability (EMPREGAR and CONVERGIR);
5. Strengthen social and territorial cohesion (APROXIMAR and CONVERGIR);
6. Affirm the sustainability of resources (SUSTENTAR);
7. Affirm the sustainability of territories (CONSERVAR);
8. Reinforce institutional capacity of regional entities (CAPACITAR);
9. Reinforce the urban network (CIDADES);
10. Technical assistance.

According to the available data set of CENTRO 2020's funded projects (CENTRO 2020, 2019), from 2014 until March 2019 an open call process yielded the approval of 5166 projects to a total funding of €1.303.231.907,03. While the majority of these were granted to the private sector (Figure 2 and 3), other regional bodies, like scientific and knowledge institutes and sub-regional and local government authorities, were able to become main beneficiaries in these projects. Intermunicipal communities, in particular, having been allowed since 2008 the partial management of regional funds provided their elaboration of a territorial development plan, emerged in this 2014-2020 period as major actors in RIS3 project management and fund implementation, granting local government nearly 20% of the allocated funding (Figure 2).

While territorial cohesion was one of the main goals in the elaboration of the RIS3, the data still demonstrates the existence of an asymmetry in fund allocation (Figure 4), a result of coast-interior economic disparities. Sub-regions like Aveiro, Coimbra and Leiria, benefitted from more developed industrial and service sectors, as well as institutions – such as UA and UC – capable of providing greater support to innovative initiatives. At the exception of the sub-region of Beiras e Serra da Estrela, where the UBI has made efforts in stimulating the surrounding economy, the other more rural and peripheral regions were inevitably at a disadvantage in the attraction of investment.

Entrepreneurial Universities and Regional Innovation

Figure 2. Centro 2020 distribution of approved funding by organisation type

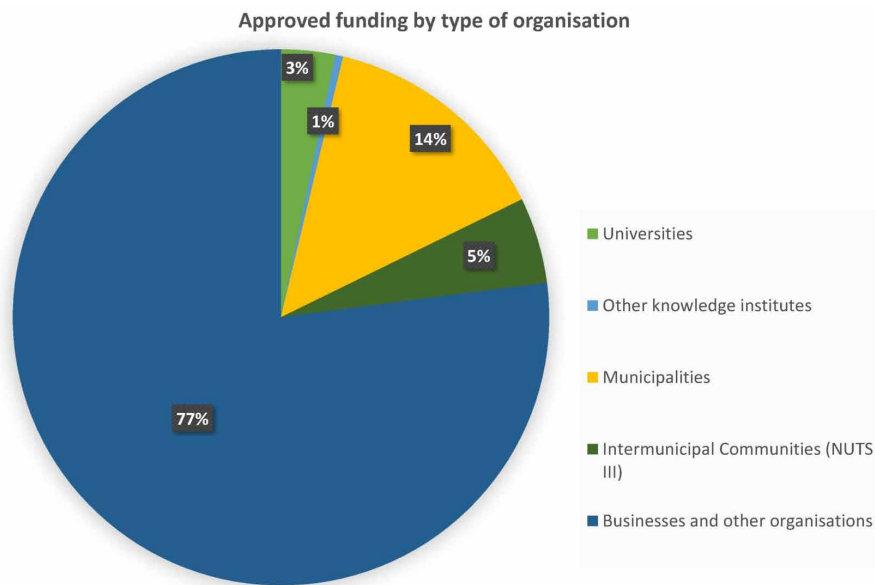


Figure 3. CENTRO 2020 distribution of approved projects by organisation type

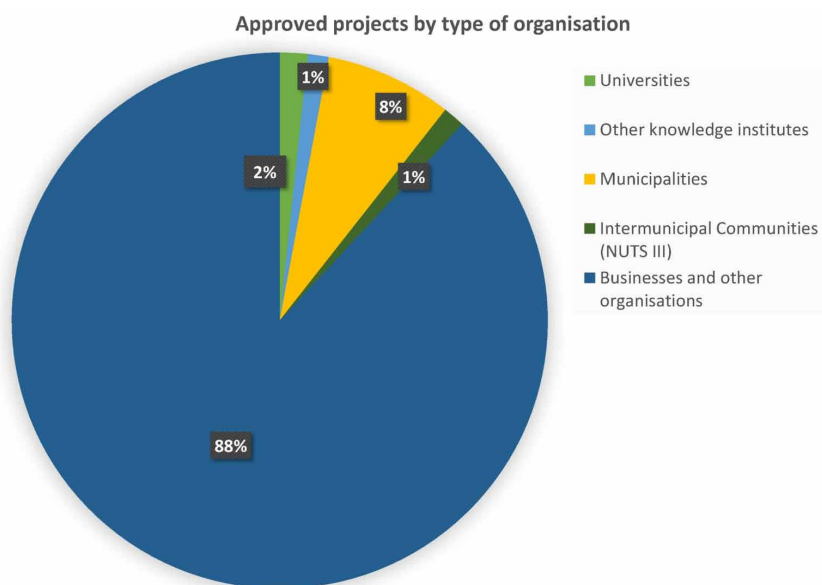
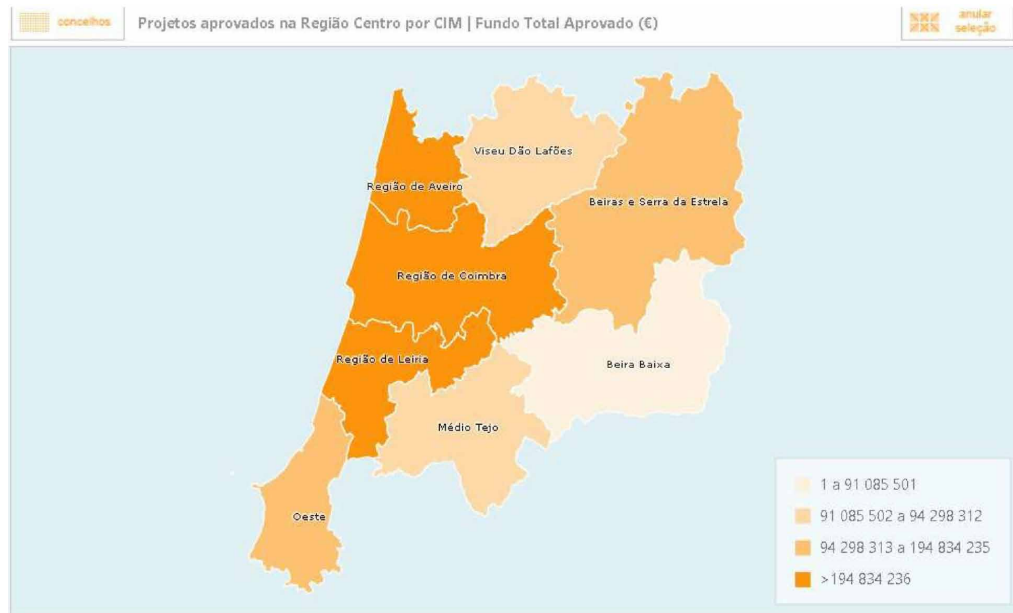


Figure 4. Distribution of approved funding (€) in the Centro region by Nuts III
 Source: Centro 2020 (2019)



Universities in the RIS3: UA's Engagement, Alignment and Entrepreneurial Practice

Considering knowledge institutions and, particularly, universities as central actors in the S3 and overall regional innovation policy process (Foray et al., 2009), it is curious to observe that in the Centro region, these bodies were only the main beneficiaries in 3% of the projects and 4% of the allocated funding. Their role in the process, nevertheless, cannot be solely perceived by this factor. Their engagement in the strategy's formulation and involvement in projects where they were not necessarily the leading actor, should be explored as well, and that is how the authors approach the case of UA. First, dissecting the capture of RIS3 projects and funding of each of the three Centro region's universities, there is a clearer competition between UA and UC: while UA was able to attain the approval of more projects (47 projects in total), with less projects the UC was granted more funding (Figures 5 and 6). The UBI has, so far, accrued the less projects and funding. This dynamic can be partly explained by historical, contextual and institutional aspects.

Of the three universities located in the Centro region, only the UC is over 50 years old. It was created in the late 13th century and is one of the oldest universities in Europe. Unsurprisingly, it is a pivot in the Portuguese higher education (and political) system and has been associated with a more traditional academic orientation. On the other hand, UA and UBI are two young entrepreneurial universities created in the 1970s, a time of massification and restructuring of higher education in Portugal, and as a result of a need for innovative alternatives in a period of industrial decline. This beginning led UA and UBI to structure their organisations to respond to new academic and societal challenges, and thus become more entrepreneurial. In the case of UBI this was nevertheless more difficult to accomplish, as its surrounding region faces characteristic problems of the Portuguese interior: ageing population and insufficient infrastructure and communication links that hinder the formation and stimulation of an innovation system.

Entrepreneurial Universities and Regional Innovation

Figure 5. Centro 2020 distribution of university-led projects by institution

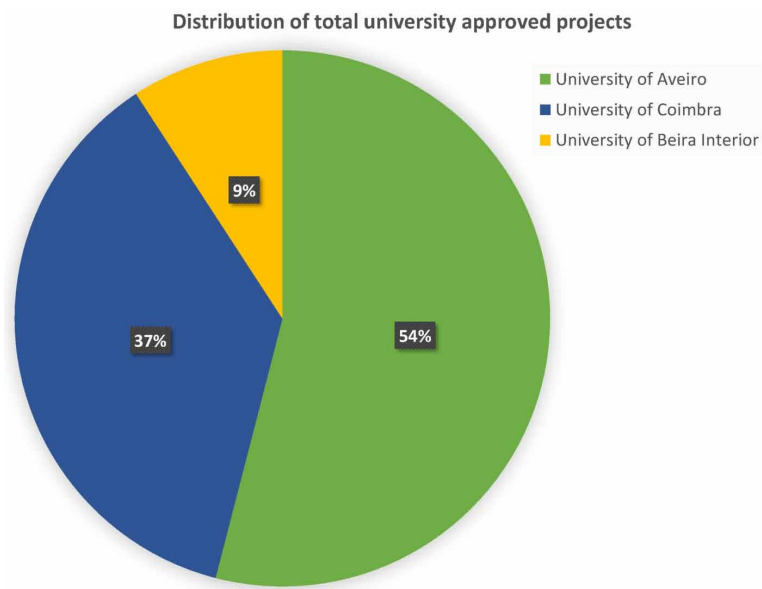
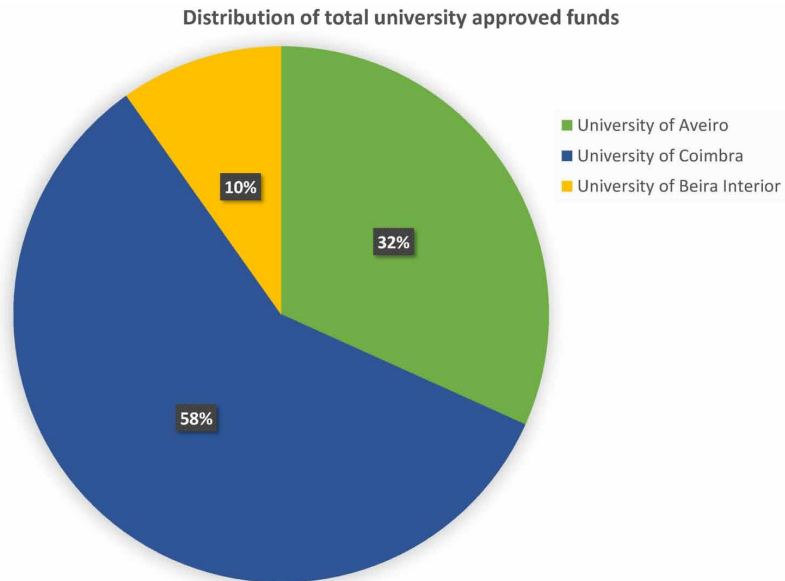


Figure 6. Centro 2020 distribution of university-led project funding per institution. author's own analysis



Focusing on UA, as an interviewee confessed, “we can say that university of Aveiro from the beginning, from its origin was much more outward looking to its regional ecosystem, let’s say, than the others.” Its creation was the result of local lobbying for a knowledge institution that could revitalise and support the increasingly stagnant industry. But it was nevertheless an already highly-industrialised coastal region with good links to the main economic and knowledge hubs: Porto, Coimbra and Lisbon. Its implantation was also accompanied, in the same decade, by the opening of the Innovation Centre of Portugal Telecom in the city of Aveiro, in whose facilities the university started its activities. UA’s initial regional orientation inevitably became strongly defined by regional needs and industry demands, with a focus on characteristic regional sectors (e.g. ceramics and materials, agro-food), and new areas of scientific and technological potential (e.g. ICT, sea and environment, tourism, biosciences and pedagogy) (Rodrigues & Teles, 2017). To support this, UA has created several interface units to build its academic strengths and stimulate entrepreneurial endeavours. Namely, the Office for University-Business relations, that has created a portfolio of university resources and contacts available for firms; UATEC, a more proactive structure that has sought to strengthen internal coordination and external network collaboration; key management positions and boundary spanners, like the Vice-Rector for University-Society relations and the Pro-Rector for Regional Development, the latter specifically responsible for managing cooperation with government authorities; and other bodies like the incubator and the new science park that are helping to promote technology transfer and business creation.

Besides the more common university-business relationship within the entrepreneurial framework, UA has also been consistently and increasingly engaged with the local and regional government. This is more evident in its consultancy work with surrounding municipalities and in its partnership agreements with CIRA, which sought UA’s collaboration in developing two territorial development plans for the periods of 2007-2013 and 2014-2020 (Fonseca, 2019; Rodrigues & Melo, 2013; Rodrigues & Teles, 2017). The university was thus well-positioned to significantly contribute to the RIS3 policy process and engage more extensively with its immediate region to maximise the outcomes. UA was involved in the regional and sub-regional policy formulation stages. In the RIS3 process, it was present as a stakeholder at the table to assess opportunities in the territory and guide the discourse. Namely, UA participated in several thematic and working groups that advanced the discussion on the priority sectors and transversal areas of RIS3, specifically leading the working group and RIS3 platform on Sustainable Industrial Solutions. Interviewees unanimously considered UA as one of the most active and participating stakeholders, designating representatives to all working tables. One interviewee from CCDRC presented some reasons as to why UA’s role in the RIS3 might have been so relevant:

Aveiro had a strong role, not just as a university, but... a lot of the companies and some of the autarchs were connected to Aveiro. For example, to discuss ICT, I know that a lot of people from Aveiro participated, both from the university and the pole that is physically situated in Aveiro. (...) Aveiro is also a region that has a strong component of science and technology. It has some of the competitiveness poles that were invited to participate in RIS3. So, it had already people that were perhaps more aware of the RIS3 discussion dynamics.

The existing entrepreneurial fabric within the Aveiro region, and the heightened connectivity between it and the university, therefore created the opportunity and the entry points for the university to be more engaged within the policy process and shape the emerging discourse. As another interviewee stated, “[The University of] Aveiro benefits from being more integrated in the regional ecosystem”. They go on

to give the example of UA's commitment to the region in the form of its close partnership with CIRA, considering it as a "meaningful" demonstration of the university's active support and effort in aligning the regional policy at multiple levels.

UA's organisational structure was also highlighted as a facilitating factor for more strategic and unified dialogue between the institution and the regional authority. Specifically, UA has no faculties. Instead, it is endowed with a 'matrix structure', in which above the departments there is only the rectory. This allows, according to an interviewee, for a clearer direction and alignment between the management level and the rest of the university, as "messages flow much more smoothly to the departments and it's easier to engage." Internally, UA has chosen to adapt to the S3 framework by creating eight so-called "technological platforms", cluster-like networks for regional engagement and project stimulation, focused on the themes defined within the RIS3 Centro and its own disciplinary strengths (e.g. sustainable habitat, agro-food, sea, smart communities, moulds and plastics). While the CCDRC has still not integrated these platforms within its overall plan of action, their creation was associated with regional priorities, and it was an adaptation where UA remains at the vanguard of other Centro universities.

Therefore, it appears that in the early stages of the process UA played a relevant role by not only seeking to participate in the dialogue between stakeholders organised by the CCDRC for the RIS3 – i.e. the entrepreneurial discovery processes – but also in creating and promoting this interchange and connectivity in its immediate surroundings, namely by its cooperation with CIRA and the creation of organisational structures to support knowledge transfer and network collaboration (e.g. technological platforms). For interviewees from the CCDRC, this interaction, paired with the transmission of expert knowledge and the promotion of learning dynamics, was the most important contribution of universities in the RIS3, and their main aim with the process. It was also a big advantage in the project proposals that included universities. According to an interviewee, "[universities] understood better than others how they should present their projects, and that to align themselves with RIS3 they needed to state how what they were proposing could have an impact. We are not experts in those small, these specific scientific fields." Ultimately, UA was the main beneficiary in 47 RIS3 projects, mainly within the priority axes of IDEIAS, COMPETIR, and APRENDER, the three most related with research, education and competitiveness, emphasising their role in stimulating regional knowledge-based innovation. With these projects UA accrued € 13 488 934,37. Nevertheless, through their partnership with local municipalities and CIRA, they became involved in cultural and natural heritage and digitalisation projects relating to the axes CONSERVAR and CAPACITAR, which on their own granted funding of over € 4 million. In this sense, the degree of UA's regional engagement through the RIS3 Centro appears much more diversified.

Implications in Implementation

Historically, SF instruments have been an important source of funding for universities in the Centro region and, particularly, for UA. As one interviewee remarks, they have enabled significant investments for capacitation and the upgrading of infrastructure and resources: Many things were constructed, like the incubator, many labs in all the universities of the region, Aveiro, Coimbra... research centres that are associations of universities and companies, all funded by FEDER in the last 30 years.

Nevertheless, while this same investment has improved UA's entrepreneurial capacity to connect to its region, there has been a shift not only in the availability of funding, but also in the way this funding and projects is viewed within the academic institution. Although there is currently more emphasis regarding research and development projects over capital/infrastructure projects, SF from CENTRO

2020 are being resorted to more as a question of ‘survival’ of the academic institution rather than as a means of reinforcing institutional engagement with regional development activities. This has made the latter somewhat unimportant on both an institutional and individual level. Interviewees suggested that the reinforcement of entrepreneurialism has translated into an almost forceful pursuit of funding for academics to maintain their position: “you have to fund yourself and that’s it.” That same ‘survival’ through SF funds was echoed throughout the institution, where “the orders are that the university should go for anything we can” or otherwise “many things would stop. Because there is no budget for research.”

There is an evident, stronger push from the university to apply for external funds, and CENTRO 2020 was considered one of the most accessible funding sources. ERDF funding was seen by academic interviewees as a valuable tool to interact with local SMEs. However, a number of challenges associated to its utilisation by UA still remain, from academics lacking the skills to collaborate with businesses (“to change your paradigm as a scientist, to think about the productive sector, it is a huge challenge”), to UA not viewing collaboration as valuable as researchers would hope (“...the ultimate mission of knowledge institutions, which is to bring to the productive sector the knowledge generated in the university, I think that this is not valued”). Academics’ motivation to engage with local stakeholders and respond to regional needs thus greatly varied. Whereas some researchers sought to engage with regional development projects to give back to the community, serve local companies and transfer academic results, others did not distinguish between regional, national or even international project activities. As one interviewee admitted, “the origin of the money does not matter much”. They also pointed out that “what really counts is the possibility to establish networks”, which suggests the establishment of collaborative partnerships with other actors is seen as relevant for increasing the success of project bids, the quality of research and, somewhat, for the continuation of innovative endeavours.

The unimportance of regional engagement activities was also explained by a lack of strategic management, accompanied by cultural issues and its insignificance in universities’ national evaluation framework. However, in many cases personal commitment and the ability to understand regional needs, to “speak the language of the people in the region – and translate the position of the university to the municipalities,” was considered a key feature in establishing projects and collaboration with stronger regional focus. According to interviewees, building a strong relationship with local authorities required individual engagement and commitment, and a lot of effort on UA’s part. Today, these links are more established.

Even though UA has been one of the key players in the RIS3, interviewees found that the regional strategy was not well communicated from the top-level. While UA’s matrix structure could have allowed for a broader informed interest, integration and coordination regarding the policy’s progress, due to a lack of strategic planning and effective management many academics are not considering S3 relevant or they are unaware of what it entails. Nonetheless, researchers involved with SF projects have articulated the potential regional impact of their research activities in the bidding phase. This was considered a good exercise for increasing academics’ mindfulness of societal needs as well as a way to establish a closer connection with the community.

Frequently highlighted regional benefits of SF projects’ activities included promoting research, providing information for policy-making processes, developing links with businesses and job creation, especially in regional priority sectors like ceramics and ICT. Part of the UA-led CENTRO-FEDER projects have propelled grassroots endeavors and multidisciplinary collaboration around these themes, both within UA and with external partners. SmartWalk¹ is a positive example of a student-led initiative growing into a bigger project in the health sector:

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We are in the health department; we work with them (public sector). UA chose to intensify this cooperation with hospital and primary care. I think it's important, maybe because it's my area, to also intensify the social care. Because they really need technologic solutions.

Such projects were considered beneficial for the region, but typically their continuation after the pilot phase – and more importantly, the end of the project funding – depends on local agents' commitment. Ultimately, while SF funding opportunities can make “universities keener to cooperate with regions and regional agents,” in practice, the regionally-funded SF projects were not perceived as very aligned with RIS3 objectives. The latter also have a minimal role in the projects' design; only larger scale institutional initiatives had a somewhat strategic approach to regional development, whereas smaller SF projects were designed more opportunistically by individual researchers. One of these large-scale institutional initiatives designed at the rectory level – CENTeR – focuses on communities' role in innovation processes. It was described as a successful example of an entrepreneurial discovery process to scale up a certain a regionally relevant substance area. This contrasts with smaller, more specialised SF projects focusing on fundamental research. As one of the interviewed UA researchers stated, “there's always, always a box that we need to fill in, trying to mention and justify why this research is aligned with the RIS3... I really don't believe that it has an impact.”

In some CENTRO 2020 calls, there are limitations about the amount of applications per institution, which can create internal competition, but also lead to more collaboration. As one researcher admits, “if it wasn't for this funding opportunity, we would not be working together (internally) as intensively as we are now doing.” On the other hand, it can also force universities to manage project portfolios more strategically in the future. Some of the interviewees believed that this strong relationship with government authorities has had an impact on the amount of granted project funding:

There is a really good relation between the university and CIRA, and the city [of Aveiro], a very good one. And that type of interaction helps us to get structural funds. Because we understand the reality and they understand the HEIs' role. And perhaps it's one of the reasons that we have so many SF projects funded.

Interviewees agreed that the knowledge UA has provided to both regional and sub-regional entities has played an important role in improving collective learning, particularly considering that more scientific and technical language of innovation is not these authorities' central domain. Nevertheless, they suggest there is still a lot of work to be done in optimising communication. Ultimately, the steering impact of regional funding instruments was repeatedly emphasised and considered positive as SF programmes are promoting new ways of collaborating and pushing academics to work more closely with their regions. As a UA professor remarked, “the most effective way of putting universities to work according to the direction of S3 is through funding. It's the only way, I think.”

Challenging Entrepreneurial Universities' Regional Impact

The role of entrepreneurial universities in stimulating regional innovation has been widely emphasised in the literature, particularly for their capability in valuing knowledge and translating it into a useful asset for society. This chapter sought to understand if, in a context of smart specialisation in which regional priorities, knowledge-based innovation and collective learning mechanisms are being prioritised, the

entrepreneurial university emerges as a key actor in the process. Particularly, if the regional potential of an entrepreneurial university is furthered or realised in this policy framework, namely through its effective collaboration in the RIS3 policy formulation process and in the implementation of the resulting projects.

Within the RIS3 Centro process analysed, knowledge institutions, but especially universities, were considered key actors, and they were integrated as much as possible in the entrepreneurial discovery process being carried out. Some universities had the capacity or the will to do so more than others, and UA was seen by interviewees as standing out in this aspect. These opportunities for universities and other stakeholders to interact within this entrepreneurial discovery process organised by CCDRC allowed for the establishment and/or the strengthening of networks, observed by interviewees within the regional authority as later leading to projects.

In the implementation stages, UA can also be considered as possessing the organisational structure and institutional partnerships needed to maximise its gains in SF and manage its involvement with other regional actors. Aside from the bodies and infrastructure already in place within the university that had been supporting its entrepreneurial activities throughout the years – e.g. UATEC, the incubator, the University-Business office and the Pro-Rector for Regional Development – others were created specifically to answer the challenge being posed by the S3 framework and the regional authority – namely UA's Technological Platforms, and more recently, the science park, which aims to be a connecting point between regional stakeholders.

Regarding projects in which UA was involved in, it is possible to draw some lessons about the impacts of these innovation endeavours in regional development:

1. UA was able to leverage its own internal resources and regional capabilities to influence the RIS3 entrepreneurial discovery processes and increase the probability of getting projects funded. This was enabled by its established regional ties and the dedication of key boundary spanners within UA and partner organisations.
2. SF projects were found to promote (even basic) research, job creation and university-business links in regional priority sectors, and encourage evidence-based policy. Nonetheless, fundamental research projects were found to be forcefully and opportunistically 'shoved' into the RIS3 box, questioning researchers' projections of regional impact.
3. Funding often enabled grassroots projects to scale up (e.g. SmartWalk), and garner multidisciplinary collaboration. This can be a way of promoting regional engagement in the broader academic community. However, while considered regionally beneficial, such projects often end after the pilot phase, with their sustainability dependent on local partners' commitment.
4. Larger scale projects were more strategically aligned to RIS3 and purposefully designed for sustained regional impact (e.g. CENTeR). Smaller projects tended to be more individualistic (focused on one researcher, unit or field, rather than multidisciplinary) and opportunistic ('stretching' the project's alignment with RIS3 goals to get funding). Collaboration may thus result in more effective planning and accountability.

Ultimately, UA was the main beneficiary in 47 CENTRO-FEDER projects, but it was its multiple partnerships and agreements with other regional actors, particularly with CIRA and local government, that enabled it to be a partner in a few other projects throughout the region. Through them, UA contributed not only to projects within the more common academic scope of education, research and innovation, but also to those within the areas of sustainability, environment, culture and public services. Its connection

to the region, and its interaction with multiple local actors, allowed it then to upgrade regional R&D and knowledge assets and to diversify its natural range of action to respond to regional needs in a more comprehensive manner. This follows Brown's (2016) and Santos and Caseiro's (2015) argument that entrepreneurial universities should expand their activities to realms beyond those typically associated with commercialisation and technology transfer. Instead, and especially in LDRs and peripheral regions, the involvement of universities in institutional capacity-building can be fundamental for more directly matching regional priorities and funding with regional needs (Fonseca, 2019).

There are, nonetheless, hindering factors in UA's contribution to the implementation phase of RIS3 that can potentially be expanded to universities in other contexts. While SF, and the projects thus supported, have been historically important for UA and other universities in the region, enabling investments in the capacitation and upgrading of infrastructure and resources, there are insufficient institutional mechanisms and culture that can enable their linkages with a regional mission. There is a push at the institutional level for academics to apply for such project funding, but this is viewed as opportunistic and necessary for the survival of their research, and in no way related to a pursuit for a strategic orientation to regional priorities. Ultimately, communicated strategic planning regarding regional engagement is lacking from the institutional level, leaving academics' engagement endeavours feeling 'scattered' and lacking concrete long-term impact.

There is, nonetheless, potential for the 'combination' of entrepreneurial universities and RIS3. Interviewees believed that the required consideration of impact in the SF bidding process was a much-needed prompt for academics to reflect societal needs and outreach. It was also widely agreed that SF projects helped promote research, developed links with businesses, and provided crucial information and knowledge for policy processes. Even though all UA-led SF projects might not have been intentionally directly aligned with RIS3 objectives, despite such expectations in the strategies and funding guidelines, especially when the university itself has engaged in the policy-design process, the wide-range of benefits can sustain the argument that they served to substantiate UA's regional engagement and even the current S3 framework. The lingering interactivity present in UA's surrounding region was enhanced as a result of this policy intention set with the RIS3, that provided a clearer direction to regional needs. In turn, UA provided the key organisational support and played a role in building the needed institutional capacity to implement RIS3, echoing Fonseca (2019) and Fröhlich & Hassink (2018) conclusions. UA's efforts to support the entrepreneurial ecosystem and stimulate collective learning, and the positive impact of its projects, suggest the university provided RIS3 with more much needed tools for what is the first specialisation period.

From Policy Discourse to Integrated Collective Learning

The strategy processes initiated with RIS3 are still in the beginning stages of what is an experiment of spurring collective vision-definition for a region. One of the interviewees stated that it was unclear for anyone involved "how that definition was going to relate with the design and implementation of the funds", leading regional authorities to often seek to "maintain the maximum space possible to accommodate what was their maneuverability for the implementation of the community framework programmes." Therefore, it is pressing to understand if the rhetoric of valuing endogenous resources, of defining and identifying regional opportunities through the pursuit of collective network processes for knowledge-based innovation, is being translated into practice. As a key actor in stimulating these processes, the

entrepreneurial university (namely UA) was chosen for this analysis, as through its multidisciplinary and varied engagement mechanisms it had the greatest potential in bridging this dichotomy between discourse and practice. While the data suggests this, there is a need for further work to attain this:

1. Enhancement of communication, so it is more frequent and effective about regional strategy/objectives. Most academics were unaware of the smart specialisation framework and its particularities in the Centro region. In Centro, regional actors were uninformed about achievement of RIS3 goals and the overall development of the process. The clarification of what the regional authority expects of each actor could boost participation and accountability. Enhancing communication both within the university and between it and all stakeholders and regional actors on RIS3 objectives and the development of the policy process could allow for better actor integration throughout the process and permit more effective and strategic coordination. It is a task of not only the regional government authority, but also of each institution involved. Universities, given their loosely-coupled character, would find in this a worthy challenge that could define an oriented regional mission and promote internal interactivity.
2. Foster the involvement of often-excluded actors in order to avoid individual interests and ‘monopolies’ to overshadow community-oriented visions and practice. In the case of this chapter, an excluded actor could refer to the UBI, a university in a peripheral and less-favoured setting that faded in its involvement relative to the other universities. It could also extend third sector organisations or other actors that do not benefit from being a part of a dynamic entrepreneurial network and region, but that can nevertheless bring something to the table.
3. Emphasise the collective and immaterial benefits that can emerge from the strategy process, namely the fostering of collective learning dynamics, of which territorial competitiveness is often dependent on. Promote stakeholder linkages that go beyond economic outcomes and that present a pedagogical and innovative approach to their interactions and projects, in order to build wider institutional capacity.

For universities, the main key lesson to consider is the need for a strategic orientation for regional engagement from the institutional level (i.e. top-managers). While UA entertained a regional connection from its creation, this discourse often clashes with the more strategically defined and goal-oriented teaching and research missions. If regional engagement was given institution-wide objectives (e.g. 30% of overall projects including regional collaboration and/or regional impact) and incentivised (e.g. providing schedule flexibility for academics more oriented towards engagement to be able to focus on such projects) (Fonseca, 2018), academic projects might consider effective regional impact and go beyond mere questions of “survival” and “opportunism”. Benefits from regional engagement also need to be stressed, namely the opportunity for networking and sustained collaborative activities and for the creation and improvement of the innovation and entrepreneurial ecosystem.

FURTHER RESEARCH DIRECTIONS

Further study to complement this assessment could comparatively explore each actor’s role within the RIS3 process to evaluate their impact in promoting dialogue and the strategy’s implementation. Similarly, a more granular, in-depth analysis of each funded project led by the university has the potential to

identify further organisational constraints and provide a detailed evaluation on the effective impact of these projects on regional development. Lastly, an analysis of other universities in other contexts where RIS3 is taking place would enrich the debate and strengthen reliability of the findings.

CONCLUSION

The results obtained from this analysis allow for an overall assessment of the level of involvement of an entrepreneurial university in the RIS3 process, and how this played a part in matching the S3 domains with regional needs. They also weigh on the contribution of entrepreneurial universities to the general and fundamental goals of the RIS3 approach, drawing lessons for public policy and opening the discussion on the future of RIS3 in EU regional policy. As such, the chapter addresses the extent to which the role played by universities in a region's innovation and entrepreneurial practice matches smart specialisation strategies to regional needs.

The case of the University of Aveiro, located in the Portuguese Centro region, enabled the furthering of this debate as it provided a perspective of an entrepreneurial university within the context of an LDR, that nevertheless strives to actively engage in the regional policy process. Observed difficulties include the promotion of an effective link between regional domains defined within the regional policy to the academic community, as university's institutional strategic and engagement mission is not always communicated and operationalised successfully. It is possible to discern the inefficiency of certain institutional mechanisms that may be hindering regional engagement, particularly in the framework of entrepreneurial universities. Nevertheless, the S3 framework and the funding therein provided seems to have contributed to more directly link UA's research to regional needs, going beyond this chapter's initial propositions. In turn, the university's strong local partnerships enabled it to more effectively leverage the received funding, and advanced and diversified its action throughout the region, ensuring the promotion of a more dynamic entrepreneurial ecosystem and collective learning.

There are, therefore, clear and broad benefits to be had in entrepreneurial universities' more active involvement in the RIS3 process. While UA benefitted from an early connection to the region, it sought to build upon this by linking its infrastructure and organisational bodies to regional priority areas. This has permitted it to distinguish itself from other universities in the region, in the country, and to be a renowned institution in those same key areas (e.g. ceramics, ICT, sea and environment). Other universities that might lack either the infrastructure or a strong regional network may benefit from this example by defining a regional strategy that can allow them to prioritise on a few key strengths and contacts. This network can then be developed with the proper commitment. But it is nevertheless important to emphasise the role of effective institutional mechanisms, culture and of the diverse set of actors that complement this work.

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KEY TERMS AND DEFINITIONS

Entrepreneurial Architecture: The routines, norms, structures and channels that influence the behaviour of individuals within a certain strategic mould and enable the flow of knowledge and innovation from the university to society. Vorley and Nelles (2009) have proposed a framework to illustrate the internal mechanisms involved in how entrepreneurial activities are embedded into the core institutional missions of the university. Salomaa (2019) has expanded this conceptualisation of entrepreneurial architecture to include contextual influences.

Entrepreneurial Ecosystem: The socio-economic environment shaping and fostering local and regional entrepreneurship as an economic development strategy. Within this framework, actors orient their focus to regional development and value-creation. The entrepreneurial ecosystem encompasses key players that are adopting an entrepreneurial mindset (risk and discovery) and developing related activities. It is considered by Santos and Caseiro (2015) as a required element for the implementation of a collective strategy and learning approach based on innovative assets and opportunities, and the result of dynamics between entrepreneurial universities and smart specialisation strategies.

Entrepreneurial Discovery Process: A bottom-up learning process which frames the interaction and inclusion of varied regional actors (policy, business, academia, social sector) who provide their knowledge and expertise. This helps in the analysis of regional strengths and in the identification and exploration of emerging trends and opportunities to define and shape the regional strategy for heightened competitiveness and development.

Entrepreneurial University: Universities that contribute to the development of the wider entrepreneurial and innovative environment, on a regional, national and international level. These higher education institutions consider knowledge as an asset that should be approached dynamically – to be created, transmitted and developed. Seeking to seize new opportunities in this, entrepreneurial universities often take on a more pro-active and strategic role in society and the market.

Less-Developed Regions: An economic categorisation of the European Union’s cohesion framework. In the period 2014-2020, less-developed regions were considered those that had a GDP less than 75% of the EU average. They would thus be eligible to receive more funding.

Smart Specialisation: An academic concept that entered the forum of EU policy. It is characterised by a place-based, tailored approach, contrasting the previously criticised “one-size fits all” policies. Smart specialisation also seeks to encompass a broader view of innovation, beyond technology-oriented approaches. It aims toward the identification of regional strengths and strategic areas of intervention. These are identified and defined through a knowledge-based analysis and a regional stakeholder involvement in an entrepreneurial discovery process, supported by monitorisation and constant adaptation as challenges and opportunities emerge.

Smart Specialisation Strategies (S3) or Research and Innovation Strategies for Smart Specialisation (RIS3): A strategic approach defined by the EU and implemented in the 2014-2020 framework. It targets support for research and innovation, aiming to supplement previous industrial policies to include more educational and innovation policy approaches. Specifically aimed at the regional level for a more granular, place-based approach to EU cohesion, it is a process of identification, definition and development of regional strengths for enhanced competitiveness. While S3 engenders the involvement of varied regional stakeholders in the strategy process, it highlights the role of higher education institutions as guides in what is ultimately a knowledge-based innovation strategy.

Third Academic Mission or “Third Mission”: Term asserting the additional responsibilities of universities in engaging with society and responding to market demands and developmental needs. Besides the other two core functions of teaching and research, universities are now imbued with a “third mission” of external, and often, regional engagement, through which they aim to create strategic links with other societal agents.

ENDNOTE

- ¹ A Smart Cities project for active seniors. More information at <https://uaonline.ua.pt/pub/detail.asp?lg=pt&c=55630>

Chapter 15

High Hopes: Regional Policy Expectations for the Entrepreneurial University

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ABSTRACT

The regional impact of entrepreneurial universities is a well-researched topic, but less attention is paid to the expectations of the regional policy institutes toward the university. This chapter investigates the regional policy expectations toward the university and what the influence of the university to these expectations is. This study is based on a technological university case in a peripheral region in Finland. The results of the study show that the existence of a single university leads easily to a university-dominant policy and thus to a regional policy lock-in. Consequently, the implementation of the regional policies can be in the hands of the university, leaving other regional stakeholders with a minor role. In order to fully utilize the potential of the university to address the specific regional challenges, the university should not only be seen as a locus of new spin-offs and start-ups, but rather as a producer of qualified graduates and future entrepreneurs.

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BACKGROUND

Across the globe, universities have a significant economic impact on regions. Earlier research shows that a 10% increase in the number of universities in a region is expected to lead to about 0.4% higher GDP per capita in that region (Valero & Van Reenen, 2019). Universities' influence on regional economic development is fostered by linear knowledge transfer mechanisms, human capital and innovations (Valero & Van Reenen, 2019), as well as a combination of teaching and research activities of universities with entrepreneurship support and programs among faculty and students (Bramwell & Wolfe, 2008; Lawton Smith & Bagchi-Sen, 2012). However, the benefits of technology transfer activities of universities not only depend on the features of universities, but also on regional networking activities (Lawton Smith & Bagchi-Sen, 2012) and other institutional and structural aspects in which universities are located (Uyarra, 2010).

This study takes a special focus on a technological university case in a peripheral region and analyzes the regional policy perspective to understand the regional expectations toward the university. Earlier literature has emphasized the role and impact of the university on the regions (Audretsch, Hülsbeck, & Lehmann, 2012; Bramwell & Wolfe, 2008; Guerrero, Urbano, & Fayolle, 2016) and brought up evidence of operations and mechanisms through which universities can benefit their immediate surroundings (Guerrero, Urbano, Fayolle, Klofsten, & Mian, 2016; Lawton Smith & Bagchi-Sen, 2012).

However, little attention has been paid to the other side of the continuum, i.e., the expectations that the region is setting for the university. In this perspective, earlier studies have stressed that the characteristics of the region have an effect on the expectations and impact of the university (Bergmann, Hundt & Stenberg, 2016; Schaeffer & Matt, 2016). In other words, the interaction between the region and the university within metropolitan areas is likely to be different from that of peripheral regions. In peripheral regions, the role of the university is likely to be drastically larger, since the university can become a hub organization in regional entrepreneurial ecosystems (Schaeffer & Matt, 2016) and peripheral regions tend to be more dependent on the income and innovation of universities (Huggins & Johnston, 2009)

In this chapter, we continue from the themes raised by Brown (2016). He proposed that the entrepreneurial spillovers from universities may be exaggerated, especially in some peripheral regions. In that sense, the regional expectations may be unrealistic in terms of the universities' direct impact on the regional economy, or not enough attention is paid to specificities of local entrepreneurial ecosystems when designing regional innovation policy instruments (Brown, Gregson, & Mason, 2016). On the other hand, the regional policies may exaggerate the regions' absorptive capacity to assume the scientific and technological innovations in the local business processes. Brown (2016) also points out that in peripheral regions the university may be in a position where it can have a strong impact on the regional policy expectations toward the university. In such cases, universities' dominant role through 'institutional capture' can result in a 'policy lock-in' in regions. While there may be several signs of institutional capture in the regional policy, it is also evident that the regional policy seeks to address specific development needs through the help of a technological university. This research aims to find out the expectations of the regional policy institutions toward the university in addressing the regional challenges, and what the influence of the university itself to the formation of these expectations is. This paper contributes by showing that the policy lock-in is preferable situation for most of the policy decision-makers in the region. Furthermore, it seems that the university focus guides the organizations to invest the regional and local resources to the same direction. In that sense, the policy lock-in may be an important way to reach economies of scale in the regional development. However, the similarity of the policy documents and unanimity of decision makers may be a source for collective blindness in the region.

This chapter starts with a brief literature review on the regional roles of universities. Next, it introduces the case of the South Karelia region in Finland. Following that, the expectations of the local and regional policy institutes are presented. Finally, the chapter suggests solutions, recommendations and future research directions, as well as draws some conclusions.

REGIONAL ROLES OF UNIVERSITIES

While practically all universities affect their immediate context, entrepreneurial universities are special cases in this respect, as they aim for regional impacts. Entrepreneurial universities have included economic and social development in their mission beyond their traditional tasks of research and teaching (Etzkowitz, 2003). The development of entrepreneurial universities has accelerated along with universities adopting new responsibilities of knowledge transfer and technological innovation (Bramwell & Wolfe, 2008). This is due to the internal development of universities and external influences, such as the increased need for new knowledge in regions (Etzkowitz, 2003; Etzkowitz, Webster, Gebhardt, & Terra, 2000; Goldstein, 2010; Lahikainen, Pihkala, & Ruskovaara, 2018). In academic research, the narrow view on entrepreneurial universities focusing on the commercialization of research through patenting, licensing and spinoffs is dominant (Mascarenhas, Marques, Rei, Anderson, & Santos, 2017; Tripl, Sinozic, & Lawton Smith, 2015). However, the contributions of entrepreneurial universities have been found to be much wider. In addition to research commercialization activities, the entrepreneurial universities provide regional entrepreneurial and innovation ecosystems with human capital, knowledge capital and entrepreneurship capital (Audretsch, 2014; Guerrero et al., 2016b).

Following the broader definition, entrepreneurial universities have adopted entrepreneurial management styles; they act entrepreneurially with their students and staff and interact with their outside environment in an entrepreneurial manner (Guerrero et al., 2016a). Moreover, an entrepreneurial university provides entrepreneurship capital that consists of leadership for creating entrepreneurial thinking, actions and institutions (Audretsch, 2014). In sum, the entrepreneurial university can be defined as a university that aims for better sustainability for itself by creating, disseminating and applying knowledge for economic and social development (Schmitz, Urbano, Dandolini, de Souza, & Guerrero, 2017).

Furthermore, universities may play an important role in creating and connecting entrepreneurs in their networks and thereby enabling entrepreneurs to acquire resources, knowledge and support from their regional stakeholders (Spigel & Harrison, 2018). In the regional policies, universities may be expected to carry out these facilitating roles and thereby promote regional entrepreneurship. However, as in the case of Sussex University in the UK (Martinelli, Meyer, & von Tunzelmann, 2008), the regional impact of universities can be lower than the regional stakeholders wish. For example, a significant number of a university's actual collaborative partners might be located outside the region, or the forms of collaboration do not meet with the expectations of local businesses. Additionally, different modes of technology transfer are favored in different disciplines, e.g., certain disciplines tend to focus on collaborative research and consultancy, and others on the creation of new IPs and start-ups (Martinelli et al., 2008).

Universities have multiple regional roles, and the different roles consist of different actions and mechanisms through which they occur. National and regional innovation and research policies tend to explicitly or implicitly reflect one or a combination of several of these roles and the interaction mechanisms associated with them. The diversity of the roles and expectations related to these roles gives rise to potential contradictions or conflicts of policy rationales and objectives (Uyarra, 2010). Despite this

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complex setting, policy-makers tend to consider universities as highly flexible, integrated and strategic actors, which in turn puts pressure on universities to respond to multiple policy expectations (Uyarra, 2010). Moreover, regional policies tend to focus on science and technology neglecting the needs of local companies (Huggins & Kitagawa, 2012). For example, if universities are assumed to provide the local companies with high-quality research to enhance their innovation capabilities, but it is forgotten that knowledge transfer is not a linear process but a bi-directional and reciprocal one, there is a risk that universities become 'ivory towers' with little relevance to the local economy due to their lack of absorptive capacity (Brown, 2016; Uyarra, 2010). At the other end of the continuum, universities can be considered as 'engaged' universities where the focus is on universities adapting to the regional needs at multiple scales of engagement. For example, 'economic governance' includes activities such as designing and running programs to support entrepreneurship, innovation and business growth and engaging with local and regional policy-makers (Pugh, Hamilton, Jack, & Gibbons, 2016). However, the university's role in 'economic governance' can lead to strategic-level discussions and statements without clear commitment and concrete actions unless more flexible regional funding arrangements are provided (Uyarra, 2010) or strategic goals and academic incentives are aligned (Lahikainen et al., 2018a). If the various missions of universities are aligned and they are complementing rather than competing with each other, universities can act as network enablers and neutral intermediaries, provoking reflection and interaction between actors (Pugh et. al., 2016).

Lawton Smith and Bagchi-Sen (2012) propose that universities' becoming active regional agents depends on 1) the internal characteristics of the university, 2) how the university responds to exogenous shocks, 3) the nature of national and regional funding that stimulates universities' third-task activities, and 4) the attributes of the region. For the creation of regional impact by universities, there must be a match between the assets of a university and regional conditions. The national and regional policy measures that can promote entrepreneurial actions of universities include regulation of IPRs, support for establishing technology transfer offices (TTOs), science parks and incubators, as well as the promotion of academic spin-offs (Trippel et al., 2015). The regional conditions include e.g., local absorptive capacity, i.e., local firms that are capable of engaging with the university, and competitive infrastructure including science parks, incubators and venture capital, as well as innovative local firms and high-quality local labor markets (Lawton Smith & Bagchi-Sen, 2012).

A strong entrepreneurial culture is needed to enhance networking between the entrepreneurs (Spigel & Harrison, 2018). Especially, for the universities in peripheral regions networking and focusing on outreach activities are important (Guerrero, Urbano, Cunningham, & Organ, 2014). Case study from Latvia shows that universities' impact on sustainable regional development is higher in regions, where university networks are strong than in peripheral regions where universities have less impact on entrepreneurial activities (Erina, Shatrevich, & Gaile-Sarkane 2017). Case study from Ireland and Spain suggest entrepreneurial activities and outreach with the surrounding region can be enforced by strong leadership across the university (Guerrero et al., 2014). In a similar vein, the study of Goldstein and Glaser (2012) on the universities participating in the governance of local and regional development highlight that leadership and interpersonal working relationships among leaders may play more important role than formal governance structures.

Universities located in large metropolitan areas form a self-reinforcing loop together with the surrounding economy. These areas with a high concentration of companies and industries create more demand for university products (education, contract research, trained labor and new technology, for example). Universities, in turn, respond with providing better products in close cooperation with local

companies (Lendel, 2010). The regional attributes are not that attractive in more peripheral regions. While the concept of an entrepreneurial university seems promising for these regions, entrepreneurial spillovers of universities might not meet these expectations due to a disconnect between universities and the surrounding regional entrepreneurial and innovation ecosystems in the creation of university-based spinoffs (Brown, 2016). Moreover, the expectations for universities to provide high-level entrepreneurship education may be unreasonable (Laukkanen, 2000). Especially in non-mature contexts, universities can end up as hub organizations in regional entrepreneurship ecosystems (Schaeffer & Matt, 2016). However, universities' leading role in the policy-making might lead to institutional capture that results in a university-dominant policy (Brown, 2016).

CASE: SOUTH KARELIA REGION IN FINLAND

Methodology and Data Sources

There is a broad range of case studies investigating the impact of universities in different regions, however studies from the policy perspective have received less attention (see e.g. Brown, 2016; Goldstein & Glaser, 2012). To examine this less frequently studied perspective and to cover the regional expectations toward the university, this research utilizes a qualitative case study methodology, focusing on the special case of South Karelia in Finland

The empirical data contains a set of 11 central local and regional strategy documents. As the objective of this study is to recognize the regional policy towards the university, the local and regional strategy documents form the most relevant data source. To triangulate the findings from the strategy documents and to assure the validity of the study (Yin, 2009) interviews among the local and regional policy decision-makers were conducted. The data collection was based on purposive sampling, more specifically on critical case sampling (Patton, 2015). Strategy documents and interviewees were selected based on the prior knowledge on the most relevant policy documents and actors. The data sets are can be considered to be representative, since they cover all the key documents and the key experts from the most central local and regional policy institutions.

The data analysis was conducted in two phases. The strategy documents were analyzed manually by searching all the references related to university and its functions. The strategy documents were analyzed with the content analysis method (Patton, 2015) The transcribed interviews were firstly coded by using the NVivo software to identify the expectations of the policy-makers Then, secondly, the strategy documents and the interview data was analyzed by using modified pattern matching (Yin 2009) to identify and categorize the expectations of local and regional policy actors toward the university.

The regional and local policy documents that are used in this study are described below.

The regional policy documents:

- **Regional Development Plan:** The regional development plan of South Karelia 2018–2021 acts as the main strategic roadmap for the entire region. It is coordinated and drafted by the Regional Council of South Karelia in cooperation with all relevant regional stakeholders, including municipalities, regional development agencies, educational institutes and governmental organizations, as well as numerous non-profit organizations operating in the region. The university is represented as an institution, as well as by separately named experts.

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- **Regional Innovation Strategy:** The strategy is led by the Regional Council of South Karelia and is based on the regional development plan. The aim of the plan is to gather the specific business development targets of the region. It also acts as a Research and Innovation Strategy for Smart Specialization (RIS3) in the region.
- **Regional Business Strategy:** The strategy is drafted in cooperation with the South Karelia Chamber of Commerce, Entrepreneurs of South Karelia (regional branch of the national interest and service organization for small and medium-sized enterprises) and LUT University. The aim of the strategy is to highlight the views of the local businesses in the future, development targets and challenges of the region.
- **Regional Performance Objectives:** The set of regional performance documents consists of 5 annual documents that cover the years 2014-2019. The documents are issued by the Centre for Economic Development, Transport and the Environment of Southeast Finland (ELY Centre). These strategy documents set the annual targets for the regional development areas that are related to industrial policy, employment, environmental protection and sustainable development.
- **The Entrepreneurship Education Strategy of Southeast Finland:** The strategy is a guiding document that presents concrete aims for students, teachers and educational organizations to meet by 2020. The strategy defines targets for all education levels from primary schools to higher education institutions and it was prepared in a group representing a wide variety of stakeholders from educational organizations, municipalities and regional development agencies.

The local policy documents:

- **Lappeenranta Strategy 2033:** The strategy covers the development targets of the city of Lappeenranta related to topics such as the well-being of the citizens, the prosperity and image of the city, digital processes, finance and financial and human resources.
- **The growth agreement between the city regions of Lappeenranta and Imatra:** The agreement covers the years 2016-2019 and it is drafted by the city mayors, the leader of the Regional Council, the rector of LUT, the rector of Saimaa University of Applied Sciences and the director of the Centre for Economic Development, Transport and the Environment of Southeast Finland. The theme chosen for this agreement is business solutions for carbon neutrality and circular economy.

All the strategy documents analyzed in this study are published in Finnish and the citations presented in the findings section are direct translations from Finnish to English.

The interview data consists of eight thematic interviews lasting between 20 and 60 minutes. The interviewees are central policy-makers in the region, such as the heads of regional development companies and development directors of the regional council and the city of Lappeenranta, as well as representatives of governmental organizations operating in the region (see Table 1). The interviews were conducted with one key informant per organization. The interviews of the policy decision-makers bring further insights into the contents, implementation and challenges of the policy. Furthermore, they highlight the relationship between the university and the regional policies.

Table 1. Interviews conducted

Organization	Title of the interviewee
Centre for Economic Development, Transport and the Environment of Southeast Finland (ELY Centre)	Head of Unit at Employment, Business and Industry
City of Lappeenranta	Development Director
Imatra Region Development Company Ltd	Managing Director
Regional Council of South Karelia	Director for Regional Development
South Karelia Entrepreneurs Association	Managing Director
Startup Mill (incubator owned by the cities of Lappeenranta and Imatra)	Innovation Manager
TEKES - Finnish Funding Agency for Technology and Innovation	Senior Advisor
Wirma – Development Company of the City of Lappeenranta	Senior Advisor

South Karelia Region

The South Karelia region is located in Southeast Finland. It consists of 9 municipalities and has around 129,000 inhabitants. One of the biggest forestry industry clusters in Europe is located in the region, and the renewal of the forestry industry is one of the key challenges in the region. Even if the accessibility of the region is good, the challenge is that it is not connected to the growth centers of Finland. Other challenges are related to demographic change and the supply and demand of the competent workforce, as well as the creation of new businesses and innovations (Regional Development Prospects in Autumn 2018).

LUT University (LUT) is the only university operating in the region, and it is located in the city of Lappeenranta, the region's capital city. LUT, a relatively young and small university that was established in 1969, has approximately 5,500 students and 1,000 faculty members. LUT is highly focused and emphasizes clean energy and water, circular economy, sustainable business and entrepreneurship in its strategic mission.

The Regional Council of South Karelia acts as a central governing body of the region and has a statutory responsibility for regional development and planning. The EU's regional objective program for South Karelia has partly been prepared in the Council, as it also implements and coordinates various projects. The Centre for Economic Development, Transport and the Environment (ELY Centre) of Southeast Finland is responsible for the regional implementation and development tasks of the central government.

EXPECTATIONS OF LOCAL AND REGIONAL POLICY-MAKERS FOR A UNIVERSITY

The analyzed policy documents show good awareness of the challenges in the region: the region needs to improve the productivity of work, gain more dynamism in the business sector, increase the education level of the population, increase the R&D intensity and increase the level of employment. The university is expected to address these regional challenges. Furthermore, the university itself actively engages in the formation of regional policies. The chapters below present the findings based on these two dimensions.

University to Solve Regional Challenges

Part of the expectations set in the policy documents are based on the regional challenges. The objectives are twofold. First, the university is expected to produce new innovations that will make Southeast Finland a leading region in the exploitation of new energy-efficient and environmentally friendly technologies and thereby attracting a qualified workforce and new businesses in the region. Second, the objectives related to university students staying in the area after graduation seems to be a way to increase the education level of the region and influence the demographic distribution of the population.

On the regional level, the regional development plan, regional strategy, regional innovation strategy and regional business strategy form a coherent whole. All the above-mentioned strategy documents expect the university to provide new technological innovations, especially in the field of cleantech and green energy, in cooperation with other stakeholders and provide high-quality education.

The regional development plan acknowledges the need to integrate university students in the region, as well as integrate education with local business. LUT is expected to take a strong role in strengthening the local knowledge base and offering high-quality education that attracts international interest, thus increasing the internationalization of the region. In the regional development plan, specific emphasis is put on the university's role in strengthening the knowledge base in the region and creating new knowledge-intensive companies. The strategy acknowledges that in a national comparison, the region's strengths are R&D intensity and productivity, with the educational level and industry dynamics (indicator of an industrial renewal) being on an average level, and unemployment being higher than the national average in Finland.

Furthermore, the regional development plan states that LUT University will strengthen the knowledge cluster, which consists of different learning environments, research labs, support services and research projects. The specific development targets in which HEIs are involved include 1) enhancing the collaboration between educational institutes in innovation and commercialization actions based on knowledge-intensive development work, 2) strategic partnerships of educational institutes and industry, 3) strengthening the R&D cluster through external funding, and 4) modelling of the regional service-path for knowledge-based growth enterprises in cooperation with educational institutes and development agencies.

The mission statement of the innovation strategy shares a similar viewpoint with the regional development plan. As follows, the innovation strategy states that LUT University forms the core of the innovation ecosystem in the region:

The innovative actions of South Karelia are based on a strong university campus, cooperation between different stakeholders and knowledge-intensive growth entrepreneurship.

Close cooperation between the different actors and a focus on internationalization in all its actions are described as specific features of the innovation ecosystem. Indicators that are followed include the number of patents, national funding on R&D and new business creation, the ratio of R&D expenditures in companies, the share of university graduates in the population, the number of development platforms and development of growth companies (turnover and jobs). The knowledge-intensive entrepreneurship is to be strengthened by combining acceleration and incubation closer together, thereby enhancing networking and the entrepreneurial culture. The knowledge-base and internationalization of South Karelia are to be further enhanced by increasing the collaboration between international students and local companies.

In the regional policy documents of the governmental ELY Centre of Southeast Finland, LUT University's focus areas of water purification, energy efficiency and renewable energies are acknowledged

under the heading ‘Promoting the growth of the leading business sectors, especially through pilot and demonstration activities.’ Apart from that, LUT University is not mentioned in the policy documents of the ELY Centre of Southeast Finland.

The Entrepreneurship Education Strategy of Southeast Finland has a strong focus on entrepreneurial teaching and students. HEIs are encouraged to support student entrepreneurship and the internationalization of students. Additionally, HEIs are encouraged to include entrepreneurship in their strategic mission, provide pedagogical support for teachers and enhance the networking of students’ entrepreneurial societies with the associations and networks of business life.

The Lappeenranta 2033 strategy document sees Lappeenranta as an attractive university city for companies. To a large extent, the strategy bases itself on the potential that university students can bring to the region to improve the biased demographic distribution of the population. Currently, the city and the surrounding region are not attractive enough for the students, since only 12% of the business students and 21% of the technical students stay in the region after their graduation. In the strategy, the collaboration between the students and companies is highlighted, and students are considered to bring a positive image to the city. The measures to improve the situation include conducting a partnership agreement with the student union, financial support for summer jobs and making company assignments more visible. Furthermore, according to the city strategy the university is expected to bring growth to the region. New jobs within the university are expected, and the university incubator is predicted to produce five new companies annually. The strategy sets expectations for new businesses in the area of water purification technology – one of the university’s focus areas. According to the strategy, the role of the university is to produce new start-ups and spin-offs in its expertise field, and the city’s role is to concentrate on serving the existing companies.

Furthermore, in a strategic agreement with the neighboring cities of Imatra and Lappeenranta that is entitled ‘From carbon neutrality and circular economy solutions to economic growth in cooperation with companies and research,’ the focus areas of LUT are selected as priorities that can lead to new businesses. The document identifies three spearhead development targets and concrete investment and financial plans for implementing them. LUT acts as one of the development platforms in research. Regarding the commercialization of research outcomes, the cities provide support in building the development platform and establishing piloting sites. The agreement mandates the application of EU and national funding to partly fund the strategic actions.

The interviews that were made among the local and regional policy-makers confirm that joint strategic targets and goals make the cooperation between the university and other regional stakeholders easy. This applies to both cooperation with the university administration and with the professors and researchers. However, some challenges are identified in terms of utilizing the full potential of students, especially international students, and the commercialization of research outcomes. The interviewees shared the opinion that the joint goal should be the creation of new jobs and growth for the companies in a way that would lead them to recruit more and more university students. It is expected that the students’ entrepreneurial society, i.e., a student-led organization aiming to foster an entrepreneurial mindset and the entrepreneurship of university students, would be an actor that root the entrepreneurial culture further in the region. However, at the same time, it is recognized that such an entrepreneurial society would mainly operate in English, on account of the active participation of international students in its activities. This may hinder finding a common interface with the local SMEs, which are not that used to operate in English. In that sense, the absorptive capacity of the regions is rather low. Additionally, the interviewees were of the opinion that the students’ entrepreneurial society could activate more students

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in research commercialization actions in addition to enhancing students' entrepreneurial intentions in general. Overall, it is thought that more volume and centralization in research commercialization actions are needed because the volumes of established companies are limited, hence not enough knowledge accumulates. Additionally, further networking and collaboration is needed in spreading the information on the university inventions to local companies.

Despite the aligned strategies, the implementation of the goals seems challenging. The challenges in the implementation phase relate to the lack of private and public funding, which also do not meet each other. It would be important to find more local companies that would have the capacity to commercialize innovations. The growth potential of the local companies seems very limited. Additionally, governmental programs and the EU funding targeted for the regions do not meet with the regional goals and needs.

University's Influence on Regional Policy

In most of the strategies, it seems evident that the region closely follows the university policy. The strategies emphasize technological viewpoints, and the steps needed for the region are expected to take place within the university.

The regional development plan states the following:

With the help of LUT University, it is possible to find solutions to major global problems. The region's environmental and energy expertise is based, in particular, on LUT's expertise and on networks, businesses, innovations and commercialized products that are formed around LUT. In its strategic areas of expertise, LUT seeks partnerships across Finland and globally. LUT produces more than half of Finland's energy-related research, so its networks and impacts naturally extend beyond South Karelia.

Furthermore, the regional innovation strategy applies the features of the trailblazer strategy that is the theme of the current university strategy. The selected key development areas are aligned with the university's expertise, which are clean energy and environment, new industrial applications and materials and intellectual services. LUT is defined as the heart of the region's innovation ecosystem, and it is expected to produce new spin-offs and start-ups and act as an R&D partner of the local SMEs and large companies.

Clean energy and environment are selected as focus areas of the innovation strategy. Target measures include testing and piloting solutions related to energy and clean environment. This testing and piloting environment is expected to gain international recognition and interest. Additionally, the strategy states that the university belongs to a consortium together with large companies, SMEs and regional development companies that develop new industrial applications and materials, as well as digital services.

The Entrepreneurship Education Strategy of Southeast Finland introduces self-reviewing instruments for teachers working at all education levels. The Measurement Tools for Entrepreneurship Education, prepared by LUT, are intended to help teachers and educators evaluate their entrepreneurship education related activities and develop their actions based on the feedback generated by the tools.

The university's influence in the strategic agreement between the cities of Imatra and Lappeenranta is significant. The whole agreement is based on the strategic focus areas of LUT. The three spearhead development targets are: 1) processing of waste and industrial residues; 2) development of an emission-free energy system; and 3) water purification technology. In addition to the spearhead development

targets, the agreement includes additional targets that are: 1) LUT becoming the first entrepreneurial university in Finland according to OECD standards; and 2) development of education and research that enhances internationalization, education export and entrepreneurship.

The university's engagement in the Lappeenranta 2033 strategy is not that visible, since the strategy calls upon the university to address the regional challenges, particularly the demographic ones. However, the strategy is in alignment with the university's mission, since it emphasizes the city of Lappeenranta as an eco-friendly city that enhances circular economy based on the university's expertise. Additionally, the concept of a 'Junior University' is included in the strategy. The Junior University is a cooperation model that introduces local primary and high school students to university education and enhances their interest in science, technology, engineering and mathematics (STEM).

According to the interviews, the university's influence on the region is indisputable. In practice, the future and vitality of the region is based on the existence of the university. Even greater expectations are placed on the university to produce new innovations and business. It is expected that the university will take on a leading role in the region in guiding its strategic focus and in innovation actions. The selection of strategic focus areas is seen as a step in this direction. There are hopes for entrepreneurship and new business creation to have even greater importance in the university's mission than it currently has. At the same time, it is acknowledged that the university's strategy is the most entrepreneurial among the strategies present in the region.

The university's important position in the region also poses challenges. The university is considered to be not only a regional actor, but also an actor with national and international influence. This fact can be contradictory with the pronounced regional role of the university, and in a similar vein with the region pushing to increase the university's regional role even further.

According to interviewees, the university's successful regional role depends, in addition to focused strategic choices, on the large number of professors and researchers who see the regional development not only through basic research but also through a broader scope in enhancing growth and creating new jobs in the region. Researchers in the field of energy technology are particularly recognized for their innovative and inclusive ways of working. Additionally, the presence and commitment of the university management to the region is important.

Discussion

The results of this study show that expectations of regional and local policy-makers for a university can be enormous and that the policy visions on the socio-economic development of the region can be based on the university's success to provide a high-quality workforce and create new spin-offs and start-ups. Furthermore, the university has become a hub organization in the regional entrepreneurship ecosystem (Schaeffer & Matt, 2016). In all the strategy documents the university is explicitly mentioned by name, but the naming of other stakeholders is somewhat lacking, even if cooperation and the regional innovation ecosystem is regularly emphasized.

In general, the regional strategies are vaguer, emphasizing the university's innovation potential rather than the local strategies. The local strategies are more concrete than the regional ones, defining the roles of different actors in a clearer fashion and including more concrete development targets. The Lappeenranta 2033 strategy differs from other strategies in the sense that it has put more emphasis on the potential of university students enhancing the vitality and attractiveness of the region than in the technology transfer.

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Especially at the regional level, the university is seen through a narrow perspective, meaning that the university is mainly seen as a provider of new technological knowledge that can be commercialized (Huggins & Kitagawa, 2012; Trippel et al., 2015), even if the strategies acknowledge the importance of students. As an exemption, the regional strategy on entrepreneurship education strategy that gives guidance to teachers in all levels of education, including the university. In some of the strategies, the development of entrepreneurial culture is mentioned. However, it is neither specifically singled out as the university's responsibility nor as the responsibility of any other stakeholder. This implies that stronger leadership could produce more efficient outcomes in entrepreneurial activities in the region (Goldstein & Glaser, 2012).

The university's strong influence on the contents of the regional strategy documents is evident. The context of this case study shares similar features with the study of Brown (2016) that pays attention to a potential regional policy lock-in. The university-dominant policy and regional policy lock-in seem to be true for the South Karelia region, and this situation has its pros and cons. The definite advantage is that having a strongly focused technological university present in the region makes the definition and implementation of the smart specialization strategy for the region plausible. On the other hand, concentrating on the few selected focus areas means that the region will be dependent on these selected focus areas that might be vulnerable to changes in laws and dominant technologies. In addition, developing the selected focus areas requires heavy investments and external funding. Furthermore, concentrating on a few focus areas might mean that not enough resources and attention is directed to the development and strengthening of other sectors that might support the industrial renewal of the region. In this sense, the region may suffer from collective blindness and thereby waste emerging opportunities in the region.

SOLUTIONS AND RECOMMENDATIONS

The paper has several solutions and recommendations to be followed in the cases of peripheral entrepreneurial universities. It seems clear that the role and impact of a single university may be exaggerated in the peripheral regions. This situation may lead to a regional policy lock-in, i.e., it may be challenging to form new policies supporting other measures than those related to the university. Furthermore, the impact of the university on the eventual regional performance may be exaggerated. This fact may lead to biased investments in the regional investment policy. Third, directing so much attention to the university may lead to less attention for the other actors in the regions, such as SMEs, other educational institutes, etc. This may result in unequal development of the actors in the entrepreneurial ecosystem, causing the absorptive capacity of the region to stay low.

The alignment of the strategic mission between the university and regional public policy institutions is a clear advantage that serves the future development of the region. However, in order to fully exploit the common goals, national strategies and funding instruments should be aligned as well. Additionally, more attention needs to be directed to the aspects of human capital (Guerrero et al., 2014), networking (Erina et al., 2017), as well as leadership and personal relationships (Goldstein & Glaser, 2012). The aspects of human capital matter, since entrepreneurs and the networking possibilities of universities may play an important role in creating and connecting entrepreneurs in their networks, thereby enabling entrepreneurs to acquire resources, knowledge and support from their regional stakeholders (Brown, 2016; Spigel & Harrison, 2018). For example, in order to utilize the international students – as emphasized in strategies – measures to increase the absorptive capacity of local SMEs need to be increased. Additionally,

the strategies related to the regional implementation and development tasks of the central government should have a broader view on universities' role in the region and thereby also align national funding instruments aiming for demonstration and piloting actions better with the regional needs.

In conclusion, the industrial renewal of the region could be further enhanced by moving the strategic focus from the university primarily as a producer of new start-ups and spin-offs toward a more holistic view that emphasizes the human capital development and social networking among all the stakeholders in a concrete manner - including the students and entrepreneurs. This is important, since annually around 20% of LUT's incoming students are international, and these international students, together with other university graduates, offer a huge but still underutilized potential for the region. The university, together with other regional actors, could have more influence on enhancing the absorptive capacity of the local companies so that they would be able to better benefit from the university students and graduates. As the region aims for internationalization and suffers from a decreasing and ageing population, the tighter engagement of students in the regional innovation and entrepreneurship ecosystem is essential.

FUTURE RESEARCH DIRECTIONS

Entrepreneurial universities have received much attention in academic literature. However, in many studies, entrepreneurial universities are investigated from a narrow perspective, with the studies concentrating on the aspects of technology commercialization (Mascarenhas et al., 2017). Following Brown (2016), we have suggested that the university may reach a dominant position in regional policy in peripheral regions, thus resulting in a regional policy lock-in. Further studies are needed to create an understanding of the lock-in and more in order to understand the ways that peripheral regions could avoid institutional capture while benefiting from the presence of the university. More information is needed to uncover the routes through which the interaction between universities and regions could operate in mutual benefit and synergy.

Furthermore, while attention is given to the regional impact on universities, less attention is given to how regions exploit the potential of universities (Tripl et al., 2015). These facts call for more research on entrepreneurial universities as members in regional entrepreneurial ecosystems. From a policy perspective, universities' contributions should be investigated through a larger spectrum than just seeing universities as institutions providing economic growth by the commercialization of research outcomes. For example, the engagement of students in the entrepreneurial actions of universities and thereby in the regional entrepreneurial ecosystem would provide an interesting research avenue, since entrepreneurs and a high-quality workforce form the basis for regions' competitiveness and help balance the biased demographic distribution, especially in peripheral regions.

CONCLUSION

The specific aim of this study was to investigate the expectations of the regional policy institutions toward the university and the influence of the university for the regional policies. The roles of entrepreneurial universities and universities' socio-economic impacts are extensively studied in the academic literature, but less attention is given to how the regions define the different roles and expectations for the university, as well as how the university itself influences these definitions and expectations. To address these ques-

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tions and investigate the phenomenon further, we selected a case region located in Southeast Finland that represents a peripheral region and is dominated by a single university that has a strong technological and entrepreneurial focus.

This study is consistent with the findings of Brown (2016) claiming that the existence of a single university in a peripheral region easily leads to a university-dominant policy and thus to a possible regional policy lock-in. Consequently, the implementation of the regional policies can also be in the hands of the university, leaving other regional stakeholders in a more supportive and inactive bystander role. This might lead to a strong technology focus in regional policy action (Huggins & Kitagawa, 2012) and cause weak absorptive capacity of local companies. This, in turn, might hinder industrial renewal and lead to high unemployment rates. In order to fully utilize the potential of the university to address the specific regional challenges, the university should not solely act as a locus of new spin-offs and start-ups. Rather, the university should pay attention to the mechanisms of integrating university graduates in the region as future employers and entrepreneurs and have stronger networks with the regional stakeholders (Guerrero et al., 2014; Erina et al., 2017).

The study has its limitations. First, it applies a single case study method; therefore, the results of the study reflect the specific peripheral region in a specific national context. In this case, the results reflect a region having a single, strongly focused and technological university, which enjoys the status of an autonomous institute governed by public law. Second, this chapter is based on the selected set of regional strategy documents and the interviews representing the main policy institutions in the region. Further data sets, such as interviews among larger stakeholder groups and more detailed analyses of other public documents and websites, could have enriched the study.

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