

# **Entrepreneurship, Technological Upgrading and Innovation Policy in Less Developed and Peripheral Regions**

**Edited by**

**Ivano Dileo  
Manuel González-López**

**Volume 15 Issue 3  
2019**

**The JOURNAL OF ENTREPRENEURSHIP, MANAGEMENT AND INNOVATION**

is an interdisciplinary, double blind-reviewed journal, emphasizing theoretical and empirical articles in entrepreneurship, management, innovation and related fields. The journal is published both in printed form and on-line at [www.jemi.edu.pl](http://www.jemi.edu.pl).

**THE ENTREPRENEURSHIP AREA OF THE JOURNAL**

The entrepreneurship area of the journal covers the three major topics: 1) venture creation and small business, 2) the impact of entrepreneurship on economic growth including local and regional development, and 3) entrepreneurial attitudes and motives. We invite original papers of theoretical and empirical nature, rooted in the disciplines of economics, management, sociology, political science, and psychology. The interdisciplinary research is encouraged to assure a comprehensive approach to the topics discussed and to advance both theory and practice.

**THE MANAGEMENT AREA OF THE JOURNAL**

Management as a thematic scope of the journal focuses on theoretical and empirical considerations of various areas, such as: human resources management, process management, strategic management, intangible assets management. We particularly welcome articles interpreting contemporary problems of economy based on knowledge and innovations. Moreover, a vital area of investigation is the analysis of the issue of measuring and managing intellectual capital, methods of assessing and evaluating intellectual capital both on enterprise and economy levels. A related area is also the concept of knowledge management in an enterprise, including modern methods of knowledge management and methodology of knowledge audit.

**THE INNOVATION AREA OF THE JOURNAL**

The innovation area of the Journal's focus will emphasize a broad range of topics and approaches, including (but not limited to): 1) role of private and public sector in development and diffusion of innovations, 2) product, process and business model innovations, 3) profiles of innovative products, structures and processes, aimed at improving management practice and providing inspiration for entrepreneurs, 4) comparative analyses of national, regional policy or sector issues, such as R&D trends, patents, citations etc., 5) theoretical work on economic, organizational and scientific aspects of innovation, encouraging the search for inspirations from various disciplines, including natural sciences, arts and humanities.

**EDITOR-in-CHIEF**

Anna Ujwary-Gil, Institute of Economics, Polish Academy of Sciences, Poland

**Associate Editors:**

Marta Gancarczyk	Jagiellonian University; Poland: Entrepreneurship Area
Marzena Starnawska	University of Warsaw; Poland: Entrepreneurship Area
Krzysztof Klineciewicz	University of Warsaw; Poland: Management Area
Jon Mikel Zabala	Deusto University, Donostia-San Sebastian, Spain: Innovation Area
-Iturriagoitia	
Michał Jasieński	Ph.D. from Harvard University (Graduate School of Arts and Sciences): Innovation Area

**Editorial Board:**

Marina Candi	Reykjavik University, Iceland
Jerzy Cieślík	Kozminski University, Poland
Wojciech Czakon	Jagiellonian University, Poland
Dominique Dehay	Universite de Rennes II, France
Christiana Drake	University of California, USA
Jorge Alberto Durán	Universidad de Las Américas
Encalada	Puebla, Mexico University of Agder, Norway
Anna Fornalczyk	Comper Fornalczyk and Partners General Partnership, Poland
Jörg Freiling	University of Bremen, Germany

Cleotilde Gonzalez Carnegie Mellon University, USA  
Manuel González López University of Santiago de Compostela, Spain  
Vadim Grinevich University of Southampton, UK  
Jon Mikel Zabala Deusto University,  
-Iturriagoitia Donostia-San Sebastian, Spain  
Beata M. Jones Honors Faculty Fellow, Texas Christian University, USA  
Patrick Lambe Hong Kong Polytechnic University, Hong Kong  
Csaba Makó Szent István University– Centre for Social Sciences Hungarian Academy of Sciences, Hungary  
Roger Normann NORCE Norwegian Research Centre, Norway  
Yevhen Pentsak Kiev Mohyla Business School, Ukraine  
Randall H. Stitts Sul Ross State University-RGC, USA  
Kazimierz Śliwa Andrzej Frycz Modrzewski Cracow University, Poland

**Statistical Editors:**

Katarzyna Filipowicz Chief Statistical Editor, Jagiellonian University, Poland  
Paweł Dykas Jagiellonian University, Poland  
Robert Syrek Jagiellonian University, Poland

**Language Editor:**

Peter Reeves Anglo House, UK

**Managing Director:**

Natalia Potoczek Institute of Economics, Polish Academy of Sciences, Poland

**PUBLISHERS**

'Cognitione' Foundation for the Dissemination of Knowledge and Science; os. Bohaterów Tobruku 5, 34-400 Nowy Targ, Poland; [www.fundacjacognitione.org](http://www.fundacjacognitione.org); e-mail: [fundacja@cognitione.org](mailto:fundacja@cognitione.org); KRS: 0000587704. Journal website: [www.jemi.edu.pl](http://www.jemi.edu.pl)

Wyższa Szkoła Biznesu – National Louis University, ul. Zielona 27, 33-300 Nowy Sącz, Poland. Partner website [www.wsb-nlu.edu.pl](http://www.wsb-nlu.edu.pl)

**JEMI IS INDEXED AND ABSTRACTED IN**

Web of Science Core Collection; ANVUR; ERIH PLUS; CEON; GALE Science in Context: Academic OneFile, Business&Company Profiles, Business and Economics Theory, General Business File ASAP, GREENR, Infotrac Custom Journals, International Business; Cabell's Directories; Directory of Open Access Journals (DOAJ); EBSCO; Google Scholar; Index Copernicus; CEJSH; NLU-Library; Ulrichsweb; WorldCat; SSRN; ARIANTA; Electronic Journals Library; E-journals.org, BazEkon; WSB-NLU Institutional Repository.

**COPYRIGHT AND OPEN ACCESS LICENSE**

JEMI is an Open Access journal published under the terms of the Creative Commons CC-BY. More information on the CC-BY license is available at:

<https://creativecommons.org/licenses/?lang=en>  
<https://creativecommons.org/licenses/by/4.0/legalcode>

**The original version:** Online first

**ISSN 2299-7075 (PRINT)**

**ISSN 2299-7326 (ONLINE)**

**ISBN 978-83-954496-2-8 (PRINT)**

**ISBN 978-83-954496-3-5 (ONLINE)**

**Cover:** Joanna Długosz

**Typesetting and printed by:**

Wydawnictwo i Drukarnia NOVA SANDEC  
ul. Lwowska 143, 33-300 Nowy Sącz, [www.novasandec.pl](http://www.novasandec.pl)



# Table of Contents

<b>From the Editors</b>	<b>7</b>
Ivano Dileo, Manuel González-López	
<b>The role of firm-level factors and regional innovation capabilities for Polish SMEs</b>	<b>11</b>
Lukasz Arendt, Wojciech Grabowski	
<b>The uneven regional distribution of projects funded by the EU Framework Programmes</b>	<b>45</b>
Pedro Varela-Vázquez, Manuel González-López, María del Carmen Sánchez-Carreira	
<b>Family management and Industry 4.0: Different effects in different geographical areas? An analysis of the less developed regions in Italy</b>	<b>73</b>
Marco Pini	
<b>An innovation policy framework for upgrading firm absorptive capacities in the context of catching-up economies</b>	<b>103</b>
Agné Paliokaitė	
<b>How local resources shape innovation and path development in rural regions. Insights from rural Estonia</b>	<b>131</b>
Merli Reidolf, Martin Graffenberger	
<b>Business ecosystems policy in Stra.Tech.Man terms: The case of the Eastern Macedonia and Thrace region</b>	<b>163</b>
Charis Vlados, Dimos Chatzinikolaou	



---

## From the Editors

This special issue of the journal tries to shed light on how innovation processes occur in less developed regions by examining which factors affect these processes and how they differ substantially between the less developed and the more developed areas in Europe. There are significant differences in innovation capacity among the lagging-peripheral and the more developed regions. Recently, the downgrading of traditional manufacturing and districts-based models in Europe has also highlighted the importance of enhancing relationships between the global and local-regional networks of entrepreneurs and innovators. The transfer of resources alone is not enough to create competitive regional economies in a global world. In this regard, innovation policy may be crucial in designing new paths for development and increasing innovation in peripheral regions.

The issue consists of six articles. All of the papers focus on analyzing various aspects of the less developed and peripheral areas within a European context, and look at innovation issues from different research perspectives and methods. In particular, four papers are related to innovation in SMEs and Smart Specialisation Strategy, innovation and the regional allocation of coordination–participation in projects across EU regions, innovation policy and firm absorptive capacities, and innovation linkages with path development in rural areas. One article is based on the relationship between family firms and the propensity to invest in innovation, comparing the more and less developed macro geographical areas. The final paper concerns the nexus between policy planning and the local business ecosystems' innovative and competitive competence.

The first paper by Lukasz Arendt and Wojciech Grabowski focuses on indirectly assessing the impact of innovation policies conducted in Polish NUTS 2 regions within the framework of Regional Innovation Systems and Smart Specialisation Strategy. Interestingly, the authors combine firm-level data with meso data in a multilevel setting and observe that Polish SMEs in less developed regions mostly depend on in-house capabilities, rather than on regional innovative potential, to introduce different types of innovations. Another observation is that Polish SMEs are more likely to innovate if they have an R&D department, a higher quality of labor, realized investments and

---

---

they use ICT. Finally, regional policies in these less-developed regions should focus more on linking firm-level factors with regional innovation systems, so as to enhance companies' innovation capacity.

The article by Pedro Varela-Vázquez, Manuel González-López and María del Carmen Sánchez-Carreira presents a consistent descriptive analysis concerning the regional allocation of coordination and participation in projects under the 6th and 7th Framework Programmes (FPs), as well as the funds allocated by the ongoing Horizon 2020. By comparing the 6th and 7th FPs, the authors show the existence of a slight reduction in the disparities, in particular, due to the higher participation of regions from Spain, Portugal, and Italy. The results show some interesting insights, as it emerges that developed regions account for most of the participation in projects and funds from the FP instruments. Concerning less developed regions, an uneven geographical distribution of projects and funds leads to the reinforcement of pre-existing industrial and innovation hubs.

The third paper is by Marco Pini. The author investigates whether, in less developed regions, family businesses run by outside managers show a higher propensity to innovate (investing in Industry 4.0) than those where the managers are family members. This research focuses on the impact of digital innovation between the less developed Italian regions (Southern) and the more developed regions (the Centre-North). The results show that in Southern Italy, family businesses are more likely to invest in digital technologies when the firm is run by an external manager and spends on R&D. However, in less developed regions, R&D requires new competencies and capabilities. Hence, innovation policies should be based on specific "innovation patterns" defined within individual regions, not only in terms of R&D incentives, but also in encouraging a policy mix approach that is not entirely based on R&D and technology issues.

The fourth paper, written by Agnė Paliokaitė, refers to the "regional innovation paradox," i.e. the low absorption capacity of public funds for innovation shown by less developed region. The author has carried out an analysis of innovation policies applied to central and eastern European countries between 2007 and 2013. She finds that policies hardly promote structural changes as they mainly focus on improving the capacities of mature sectors and on adopting existing technologies. In this sense, the results suggest that a more tailored approach to innovation capacity building is needed, taking into account the current capacity levels within the target groups.

The fifth paper, by Merli Reidolf and Martin Graffenberger, analyses the role of local resources for firm innovation and path development in rural areas. Based on the case of Estonia, they find that rural resources (physical, human, immaterial, social and community, and financial) have the potential to extend and upgrade regional development paths, and to enrich existing

---



---

paths with additional functions. However, merely relying on rural resources to facilitate substantial changes in regional paths does not suffice.

Finally, the sixth paper which has been written by Charis Vlado and Dimos Chatzinikolaou analyses the case of business ecosystem policy from a physiological and evolutionary perspective, the so-called “Strategy, Technology and Management” which represents the organic center of the produced innovation, inside a socioeconomic organism. By studying the case of the Eastern Macedonia and Thrace region, one of the less developed regions in Greece, they present an introductory and qualitative field research. The authors outline a new possible direction for policy planning and implementation in order to expand the local business ecosystems’ innovative and competitive competence, especially in the context of a less developed region, by the usage of the ILDI (Institutes of Local Development and Innovation) mechanism.

We would sincerely like to thank the authors for their contributions to this special issue. The articles offer us the opportunity to evaluate various facets underneath innovation issues within the context of different peripheral areas. We also thank all the reviewers for their commitment, and for contributing to improving the quality and reliability of the articles. Finally, our special thanks go to the Editor in Chief, Prof. Anna Ujwary-Gil, for her tireless and valuable effort in producing this journal. And, lastly, we hope that all of our readers around the world find these articles an inspiration to conduct more research on these topics in the future.

**Ivano Dileo**, Guest Editor, Department of Political Science, University of Bari Aldo Moro and ICEDE Research Group, Italy.

**Manuel González-López**, Guest Editor, Department of Applied Economics, University of Santiago de Compostela and ICEDE Research Group, Spain.

---



# The role of firm-level factors and regional innovation capabilities for Polish SMEs

Lukasz Arendt<sup>1</sup> , Wojciech Grabowski<sup>2</sup> 

## Abstract

*The paper elaborates on the innovativeness of Small and Medium-Sized Enterprises in Poland from the regional perspective. The empirical evidence is based on data collected among 820 Polish SMEs which actively use ICT tools in their business processes. Identifying firm-level (internal) and regional drivers of innovations in these enterprises was the main aim of this study. The originality of the utilized research approach lies in combining within one framework firm-level data with meso data describing the innovative potential of the regional environment and using multilevel random-effects models to analyze the relevance of firm-level and regional drivers of SMEs' innovativeness. By deploying a regional random effects approach, we assessed indirectly the effectiveness of innovation policies conducted in Polish NUTS 2 regions within a RIS and S3 framework. Interestingly, the research hypothesis, stating that regional (external) factors are more important to enhance innovativeness of SME than firm-level (internal) drivers, was verified negatively. The study revealed that SMEs in less-developed regions of Poland rely more on in-house capabilities, than on the regional innovative potential, to introduce different types of innovations. This suggests that the S3 framework in less-developed regions should concentrate more on linking firm-level factors and regional innovation systems to enhance companies' innovation capacity.*

**Keywords:** SMEs, innovations, less-developed regions, multilevel probit model

1 Lukasz Arendt, Ph.D., Department of Economic Policy, Faculty of Economics and Sociology, University of Lodz, P.O.W. 3/5, 90-255 Lodz, Poland, e-mail: lukasz.arendt@uni.lodz.pl (ORCID ID: 0000-0002-0596-0196), corresponding author.

2 Wojciech Grabowski, Ph.D., Department of Econometric Models and Forecasts, Faculty of Economics and Sociology, University of Lodz, Rewolucji 1905 no 39, 90-214 Lodz, Poland, e-mail: wojciech.grabowski@uni.lodz.pl (ORCID ID: 0000-0002-0888-7852).

Received 30 July 2018; Revised 19 January 2019, 11 March 2019; Accepted 13 March 2019

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

---

## INTRODUCTION

---

Innovation capacity at the enterprise level (micro) is, to a large extent, dependent on the meso and macro-level drivers related to the innovation climate, as well as the systems and processes which constitute innovation policy. From this point of view, Central and Eastern European countries (CEECs) face additional challenges compared to countries with an advanced market economy system (e.g., the EU15). It seems that insufficient development of social capabilities is the main issue hindering the catching-up process in CEECs – this includes such institutional factors as the availability of an educational system which provides high-quality human capital and managerial skills; a stable and efficient political system; and financial institutions which enhance capital accumulation and its transfer into innovative investments (Bakovic, 2010; Kleibrink, Laredo, & Phillip, 2017). As a consequence, the economies of Central and Eastern Europe have been lagging behind global leaders regarding innovativeness. The problem has been more severe in the case of less-developed regions, which have rather weak social (and economic) capabilities to enhance innovations. At the same time, however, their need to be innovative is relatively strong – this situation is known as the “regional innovation paradox” (Oughton, Landabaso, & Morgan, 2002). Although CEECs and their regions have taken a major step forward in terms of developing coherent innovations policies within the framework of the EU’s cohesion policy, innovative capacity at the macro and micro level is still relatively low.

Poland is an example of a country which transformed its economy from being centrally-planned to a market economy. It recovered from a severe economic slowdown in the first half of the 1990s, becoming one of the best-performing countries in the group of post-communist economies which joined the European Union in and after 2004. However, as Ghinararu (2017) argues, practically all CEE countries (and the regions within these countries), including Poland, are at the periphery of the EU core. Importantly, the contemporary understanding of the periphery goes far beyond the notion of geographical distance, but takes into account other “measures” of proximity – e.g. institutional, organizational, economic base (supply-side), or network-oriented cooperation (Dahl Fitjar & Rodriguez-Pose, 2011), and is very focused on different forms of relationships between regions on a local and global scale (Burcher, Habersetzer & Mayer, 2015). Poland, and the Polish regions, surely should not be perceived as peripheral in the European Union in the spatial dimension; however, all NUTS 2 regions, except for Mazowieckie, are still categorized as less-developed in terms of economic and innovation potential.

Though regional factors are important in explaining the innovativeness of enterprises (Sternberg & Arndt, 2001; Golejewska, 2018), not much attention

has been devoted to the role of regional drivers in explaining innovativeness at the micro-level, including CEECs. Numerous studies based on CIS questionnaires (Lewandowska & Kowalski, 2015; Lewandowska, 2016; Szczygielski & Grabowski, 2014; Szczygielski, Grabowski, & Woodward, 2017) do not take into account regional variables. Moreover, in the studies devoted to the role of ICT in explaining the innovativeness of Polish enterprises, only dummy variables associated with consecutive regions are taken into consideration (Arendt & Grabowski, 2017). Such an approach makes it possible to measure only fixed differences in innovation behavior. In order to identify random differences in the propensity to innovate, differences in the impact of consecutive variables among regions on the innovativeness as well the role of regional variables, then the parameters of the multilevel model should be estimated.

The paper focuses on the innovativeness of Small and Medium-Sized Enterprises from a regional perspective - at the NUTS 2<sup>3</sup> level in Poland. One unique feature of the approach utilized in this study is that the empirical analysis covered only those SMEs which actively use Information and Communication Technologies (ICT) in their daily operations. It implies that the study deals with companies which are, by definition, more innovative than the “average enterprise” in Poland, as there is a positive relationship between ICT utilization and innovativeness (Arendt & Grabowski, 2017). The main goal of the paper is to identify the firm-level (internal) and regional drivers of innovation in Polish SMEs<sup>4</sup> which use ICT tools. Among the research questions addressed in this paper (which may be perceived in terms of the specific goals of the study) include the following:

- How do ICT use and co-innovative sources of productivity influence SMEs’ innovative potential at the micro-level?
- What is the impact of regional innovation capacity on innovations in Polish SMEs?
- What is the relative significance of internal (company) and regional (external) drivers of companies’ innovativeness in different NUTS2 regions?

Though there are some studies in which the role of internal (within a firm) and regional factors were analyzed (Sternberg & Arndt, 2001; Broekel & Boschma, 2016), to the authors’ best knowledge, there is a lack of studies combining, within one framework, the role of firm-level factors, regional capacity and regional random effects as determinants of SMEs’ innovativeness. By using a multilevel approach, the study reveals which

<sup>3</sup> We refer to the NUTS 2013 classification.

<sup>4</sup> When describing the results of our study in this paper, we use the terms “companies”, “enterprises”, and “SMEs”; however, one should bear in mind that we are referring to Small and Medium-Sized Enterprises that use ICT.

factors (firm-level or regional) play a more profound role in explaining the innovativeness of SMEs in Poland.

The next section discusses, in a synthetic manner, the types of factors which determine innovations and regional innovation policy approaches. It is followed by a presentation of the research methods used in measuring the innovation capacities of regions and explaining the innovativeness of SMEs. This section expands the literature review. The fourth section describes the results and discusses the empirical study. The last section concludes.

## LITERATURE BACKGROUND

---

### Innovation drivers and regional innovation policy

An enterprise's innovativeness is driven by factors which can be classified into two broad categories: internal and external. Additionally, external factors may be split into three sub-categories: regional, extra-regional and technological – including innovation policy (which, in fact, is a mix of actions taking place at the regional and extra-regional level). Internal factors include, among others, organizational structure, R&D spending, the quality of the personnel or the attitude of the management and line workers towards innovations. In the group of external factors we may distinguish the availability of skilled labor, the performance of regional infrastructure, R&D facilities (regional), market development and demand, industry performance, competition, technical progress (extra-regional), and support schemes in terms of R&D efforts, cooperation (technology and innovation policy) (Sternberg & Arndt, 2001; Kosala & Wach, 2011).

The quite detailed statistical analysis by the European Bank for Reconstruction and Development (EBRD, 2014) as well as analyses conducted in other studies (see, e.g., Martinez-Roman & Romero, 2017) reveal that among the main drivers of innovations we may find the following:

- company size and age (innovations are more common among larger enterprises that have operated on the market for a long time. At the same time, start-ups are perceived as an important group of innovators);
- ownership (foreign ownership gives more opportunities to innovate);
- internationalization (exports support innovations as fixed costs may be spread among a larger number of clients. Moreover, exporters meet more competition so are more prone to innovate in order to create competitive advantage) – see Boermans and Roelfsema (2012);
- R&D spending – R&D investments are positively correlated with innovations, especially in high-tech manufacturing (see Griffith, Huergo,

- Mairesse, & Peters, 2006; Van Leeuwen & Klomp, 2006; Raffo, Lhuillery, & Miotti, 2008; Masso & Vahter, 2008, for studies based on CIS data);
- the availability of skilled human resources – having qualified personnel is crucial not only for creating innovations but also for the adoption of those which are already on the market (see Rodriguez-Pose & Comptour, 2012);
  - ICT utilization – broader ICT usage in enterprises increases the probability that innovations will be introduced (see Polder, Van Leeuwen, Mohnen, & Raymond, 2009; Hall, Lotti, & Mairesse, 2013; Nguyen Thi & Martin, 2015; Arendt & Grabowski, 2018);
  - the business environment (strong rule of law, low taxation, and reduced bureaucracy are perceived as innovation drivers).

These factors encompass both internal and external drivers of companies' innovativeness, and, in many cases, are inter-related. It should be emphasized that many of the above-mentioned drivers fall into the category of "co-innovative sources of productivity," which includes the use of ICT, organizational change (including changes in business processes), the organization of work, or investing in employees' skills (Torrent-Sellens & Ficapal-Cusi, 2010), and plays an important role in enhancing productivity in Polish companies (Arendt & Grabowski, 2017).

The problem of creating an innovation-supporting socio-economic milieu has not only a theoretical but also a very practical meaning. This practical approach has evolved from the concept of a National Innovation System (NIS), through a Regional Innovation System (RIS), to the most recent Smart Specialisation Strategy (S3). From the point of view of enhancing innovations at the regional level, RIS and S3 are the most influential concepts, since a "one-size-fits-all" approach to innovation policy has proved to be ineffective (Sörvik, Teräs, Dubois, & Pertoldi, 2018). Both RIS and S3 have been the building blocks of the European Union's innovation policy. Importantly, reforms of the EU's cohesion policy have moved towards more region-oriented solutions, enhancing potential economic growth and innovativeness, even in less developed or peripheral European regions.

RIS as a theoretical concept has been discussed academically since the early 1990s – it may be perceived as both a goal and a toolbox for developing innovation policy at the regional level. It is a framework in which interactions (cooperation) between companies, institutional milieu, and support infrastructure are interlinked and create a basis for innovation and entrepreneurship. In the RIS approach, it is assumed that proximity between different stakeholders makes it easier to share and accumulate knowledge (especially in knowledge-intensive regions), which is more complicated in the case of cooperation between stakeholders from different regions

(Capello & Lenzi, 2015). Within this framework, Isaksen and Trippel (2014a) distinguished three types of RIS: organizationally thick and diversified (well-performing regions characterized by many different industries and a well-developed support infrastructure); organizationally thick and specialized (regions with a highly specialized support infrastructure and less diverse industries); and organizationally thin (regions often dominated by traditional industries with a low capability of support infrastructure). The concept of RIS has been further developed by the inclusion of dominating modes of innovation, leading to the emergence of STI (Science, Technology and Innovation) or DUI (Doing, Using and Interacting) approaches (Jensen, Johnson, Lorenz, & Lundvall, 2007). The development of RIS has fueled actions aimed at clustering, and it seemed to be more promising than NIS in terms of enhancing innovation capabilities at the regional level. However, one of the main weaknesses of the RIS approach has been weak territorial anchoring in the local institutions and structures (Isaksen & Trippel, 2017).

The weaknesses of RIS have been eliminated to a large extent within the S3 concept, which was proposed by the Knowledge for Growth expert group, and then integrated into the regional policy framework (Varga, Sebestyén, Szabó, & Szerb, 2018; McCann & Ortega-Argilés, 2015). In comparison with RIS, the novelty of the Smart Specialisation Strategy, which is rooted in the place-based paradigm, is found in the following features (Uyarra, Marzocchi, & Sörvik, 2018):

- decisions on specialization priorities involve many actors from different areas of expertise, which means it is a process of entrepreneurial discovery rather than a top-down manner of introducing innovations (which is in line with the belief that no single agent has a complete/comprehensive understanding of the economy/regional economy – thus, the role of government is to coordinate the actions of different agents – see Varga et al., 2018);
- the main focus of S3 is put on innovation domains, not sectors;
- there is an outward orientation – meaning the strategic perspective should be developed which takes into account the relative position of the region in a national and international context (D’Adda, Guzzini, Iacobucci, & Palloni, 2018).

S3 contribution to regional growth is described by three pillars: specialization (concentrating resources on selected fields/industries to achieve a critical mass); strong path dependence (innovation capacity is embedded in the industrial structure of the region); and linkages between specialization domains (spillover



effects are stronger if newly developed/introduced technologies are related to those which already exist in the region – see D’Adda et al., 2018).

It has been argued that approaches to innovation systems which have been introduced in highly-developed (core) regions are often inappropriate for less-developed (peripheral) regions. It has become evident that enhancing innovations requires that specific challenges and needs of the region be taken into account<sup>5</sup> - in the case of the EU’s less-developed regions, innovation policy must go beyond R&D and S&T indicators (Rodriguez-Pose, 2014). Since regional systems of innovation play an important role in enhancing regional development, they should be complemented by “geographically sensitive” actions to counteract specific issues at the periphery (Hall & Donald, 2009). Isaksen and Trippel (2014b) argued that models of endogenous regional growth are incapable of describing the path development of less-developed regions as development and innovations are linked to the knowledge base which is available inside and outside the region.

This gives a critical argument towards the Smart Specialisation Strategy concept – since S3 is a place-based policy, which, to a large extent, relies on the innovation capability of the region, less-developed regions lack the research and knowledge base on which the strategy might be built (D’Adda et al., 2018). Another issue is the lack of internal critical mass required to trigger innovation processes – that is why intra-regional cooperation is crucial to enhance companies’ innovativeness in such regions (Sörvik et al., 2018). It has been argued as well that the effective enhancement of a smart specialization strategy in less-developed regions requires the incorporation of human development and R&D promotion actions into the S3 framework (Varga et al., 2018). Also, the RIS concept has been criticized regarding its relatedness to less-developed regions – Almeida, Figueiredo and Rui Silva (2011) argued that even at the beginning of the second decade of the 21<sup>st</sup> century, the concept of RIS was still vague, and thus using RIS as a policy tool by less-developed (follower) regions may be challenging. Moreover, Capello and Lenzi (2015) emphasized that the RIS concept is not a useful theoretical concept to analyze development strategies in less-developed regions – instead they perceived the concept of territorial patterns of innovation as more promising.

Undoubtedly, the innovation potential of companies located in less-developed regions is largely dependent on their collaboration patterns and the availability of external knowledge. Grillitsch and Nilsson (2015), who studied collaboration patterns of innovative enterprises in Sweden, showed that companies located in periphery regions tend to collaborate more than their counterparts in developed regions to compensate for weak

<sup>5</sup> For instance, a serious challenge for sparsely populated regions is the limited availability of human capital and the lack of agglomeration effects regarding economic growth (Sörvik et al., 2018).

opportunities to access the local knowledge base. Moreover, the efficiency of this compensation mechanism is driven by the “in-house capabilities” of the enterprises – those with strong capability take advantage of inter-regional, national or even international collaboration, while those with a weaker capability (usually small ones) are more dependent on regional knowledge infrastructure. Wassmann, Schiller, and Thomsen (2016) revealed that the innovativeness of companies in a low-technology region (they focused on Lower Bavaria) is dependent on the scale and scope of cooperation in spatial terms: cooperating with regional partners led to low-innovation outcomes, while companies cooperating with distant partners were capable of introducing product innovations. This implies that intra-regional cooperation may be not sufficient for enterprises from less-developed regions to innovate, or it may lead to technological lock-in (Santoalha, 2018).

Bearing in mind that contemporary approaches to innovation policy at the regional level (RIS, and more recently S3) put a lot of attention on the role of the institutional milieu in innovation creation at the company level, and that studies analyzing innovativeness in less-developed regions point to the important role of knowledge transfer within and between regions – in both cases, these are factors which may be classified as external drivers of innovation. The main research hypothesis to be tested in this study is as follows: *regional (external) factors are more important to enhance the innovativeness of SMEs in less-developed regions in Poland<sup>6</sup> than firm-level (internal) drivers.*

## RESEARCH METHODS

The Regional Innovation Scoreboard is a widely used synthetic measure to analyze innovation performance at the regional (NUTS 2) level in the European Union. It classifies all regions into four broad groups, from the best performing Innovation Leaders, through Strong Innovators and Moderate Innovators to the worst performing Modest Innovators. Each group is additionally split into a top one-third (with “+”), a middle one-third and a bottom one-third (with “-”).

In this study, we constructed a new synthetic index measuring regional innovation capabilities – we named it RIC. It was derived from the concept of studies on national technological capabilities. RIC incorporates both categories defined by Bell and Pavitt (1992) – productive capacity and technological capability. The first one relies on the availability of resources required to produce goods and services while the other is related to the availability of skills, knowledge, and experience acquired by individuals and organizations. RIC may also be treated as another version of the Revealed

<sup>6</sup> 15 out of 16 Polish NUTS 2 regions are classified as less-developed in terms of the EU's cohesion policy.

Comparative Advantage (RCA) index (see D’Adda et al., 2018). It takes into account the following categories<sup>7</sup>:

- the number of patents granted by the Patent Office of the Republic of Poland per person in 2015;
- the ratio of the number of graduates of universities to the population in the years 2010-2015;
- the cumulative dynamics of employment in R&D in the years 2002-2015;
- in-house R&D expenditure per capita in 2015;
- the ratio of expenditure on innovation to the gross value of fixed assets in 2015;
- the percentage of enterprises with foreign capital in 2015.

The number of patents reflects the creation of technology. The ratio of university graduates to population and the dynamics of employment in R&D provide information about the skills availability in a region. Variables associated with R&D expenditure and innovation expenditures reflect technological effort (Archibugi & Coco, 2004), while the percentage of enterprises with foreign capital reflects openness and technology transfer (Fagerberg & Srholec, 2008). The values of these variables are taken from the Local Data Bank of the Polish Central Statistical Office. The values of all six variables are calculated for 16 Polish regions. If  $RC_{lj}$  denotes the value of the  $l$ -th regional variable ( $l=1, \dots, 6$ ) for the  $j$ -th region ( $j=1, 2, \dots, 16$ ), the measure of a region’s innovation capability may be calculated in the following way:

$$RIC_j = \frac{1}{6} \sum_{l=1}^6 \frac{(RC_{lj} - \min(RC_{lj}))}{(\max(RC_{lj}) - \min(RC_{lj}))} \quad (1)$$

This normalized measure takes values between 0 and 1.

In order to identify the impact of firm-level factors and regional innovation capabilities on innovativeness in Polish small and medium-sized enterprises, the parameters of a multilevel probit model are estimated. The following mixed effects models are considered:

$$INNOV\_k_i^* = \mathbf{x}_i \boldsymbol{\beta}_k + RIC_{ij} \theta + \mathbf{z}_i \boldsymbol{\gamma}_k + \varepsilon_i^k, \quad (2.a)$$

$$INNOV\_k_i = I\{INNOV\_k_i^* > 0\}, \quad (2.b)$$

<sup>7</sup> The reference year to calculate RIC is 2015, when primary data in the companies was collected.

where  $k=PROD, PROC, ORG, MARKET$ . It means that  $INNOV\_PROD_i, INNOV\_PROC_i, INNOV\_ORG_i$  and  $INNOV\_MARKET_i$  are binary variables taking value 1 for firms which introduced a product, process, organizational and marketing innovation respectively.

These types of innovations refer to the categories defined in the Oslo Manual (OECD, 2005).  $x_i$  is a vector of explanatory variables associated with firms. Firm-level data was collected in the first half of 2015 in 820 SMEs located in all Polish NUTS 2 regions. A random sampling approach with additional stratification by company size (micro, small and medium entities – in line with the definition of SMEs in force in the European Union), sector (manufacturing, services), and region (NUTS 2) was used. Data collection was done using face-to-face interviews, with the use of the PAPI technique. Interviews were processed by a professional research agency to assure the high quality of data, and they provided information on the companies' performance in the areas of ICT utilization, innovativeness, organizational change, and human capital development.  $\beta_k$  and  $\theta$  are parameters for consecutive variables. In order to take into account the similarity of the innovation performance of enterprises located in the same region, as well as random differences in the impact of firms' features on innovation performance among regions, a random part  $z_i \gamma_k$  is included.  $\varepsilon_i^k$  is the error term, which follows standard normal distribution. Table 1 presents a list of potential determinants of enterprise innovativeness used in econometric modelling<sup>8</sup>. Expectations regarding the direction of the impact of consecutive variables and literature references are also discussed.

These determinants may be grouped, according to previously presented categorization, into firm-level/internal factors (*RD, UNIV\_MAN, UNIV\_WORK, INVEST\_ICT, MOT\_PAY, ICT\_USE, ORG\_CHANGE, sectoral variables*)<sup>9</sup> and external (mainly regional) factors (*RIC, INT\_COV, ICT\_SKILLS*).

The parameters of all four multilevel probit models are estimated using adaptive Gaussian-Hermite quadrature (Pinheiro & Chao, 2006). The choice of a probit model is due to the fact that an enterprise will or will not decide to introduce innovation. Since enterprises located in the same region may compete or cooperate, the choice of a multilevel approach enables the identification of innovation diffusion, technology spillover, or competition among enterprises.

8 Summary statistics of the dependent variables and regressors are presented in the Appendix.

9 Most of these factors are categorized as co-innovative sources of firm productivity.

**Table 1.** List of potential determinants of innovativeness of enterprises

Name of variable	Definition of variable	Expectation about the impact of the variable on innovativeness
<b>Binary variables</b>		
<i>RD</i>	1 for firms with their own R&D department	When a firm has its own R&D department, the probability of introducing innovation should increase, which is in line with the standard CDM model (Crepon, Duguet, & Mairesse, 1998)
<i>UNIV_MAN</i>	1 if the majority of the management of the company possess a university degree	The level of education of entrepreneurs should be positively correlated with the level of knowledge in management and the probability of having a development strategy (Grabowski & Stawasz, 2017; Stawasz, 2019). As a result, the awareness that innovativeness brings benefits is higher.
<i>UNIV_WORK</i>	1 if the majority of line-workers in the company possess a university degree	A positive relationship between human capital at the firm level and innovation performance was found by, among others, D'Amore, Iorio, and Lubrano Lavadera (2017)
<i>ICT_SKILLS</i>	1 for firms which require ICT skills from all new employees	An increase in ICT skills of workers is associated with an increase in their human capital. As a result, the innovativeness of a company should improve.
<i>ICT_TUT</i>	1 for firms which organize ICT training	Investing in employees' skills by organizing training (Torrent-Sellens & Ficapal-Cusi, 2010) plays an important role in enhancing the innovativeness of enterprises
<i>INVEST_ICT</i>	1 for firms investing in ICT in the last 24 months	The positive relationship between investing in ICT and innovation performance of enterprises was identified by Arendt and Grabowski (2017).
<i>MOT_PAY</i>	1 for companies which introduced a motivation pay system	A motivation pay system could improve the creativity of workers and encourage them to find innovative solutions (Rynes, Gerhart, & Minette, 2004)
<i>INT_COV</i>	1 for firms which have national or international market coverage	Firms, which are active not only on the local or regional market, should increase their competitiveness. The introduction of innovations could be treated as a method of increasing competitiveness (Despotovic, Cvetanovic, & Nedic, 2014)

Name of variable	Definition of variable	Expectation about the impact of the variable on innovativeness
<i>MANUFACTURING</i>	1 for firms from the manufacturing sector	Sectoral differences in innovativeness were identified by, among others, Dahl Fitjar and Rodríguez-Pose (2015), Forsman and Temel (2016), Malerba (2005)
<i>CONSTRUCTION</i>	1 for firms from the construction sector	
<i>SERVICES</i>	1 for firms from the services sector	
<i>MTF<sup>10</sup></i>	1 for firms from the MTF sector	
<b>Other variables</b>		
<i>ICT_USE<sup>11</sup></i>	Firms reported on ICT use in the following business processes: office management, accountancy, production management, supply management, HR management, ERP software, CRM software, CNC systems, and CAD/CAM systems. If <i>NBP</i> denotes the number of business processes, in which a firm operates, then variable <i>ICT_USE</i> is constructed as follows: $ICT\_USE = \frac{NBP-2}{7}$ .	The results obtained by, among others, Polder, van Leeuwen, Mohnen and Raymond (2009) indicate that ICT use has a positive impact on all types of innovations.
<i>ORG_CHANGE</i>	Synthetic measure of the readiness of a given company to make an organizational change. Greater values of this variable reflect a greater readiness to make an organizational change. A detailed description of the definition and construction of this variable is provided by Arendt & Grabowski (2017)	According to the complementarity hypothesis (Milgrom & Roberts, 1990), using the potential of new technologies requires changes in work organization.
<i>Size</i>	Logarithm of the number of workers within a firm	According to Schumpeter's (1994) theoretical idea, firm size (and monopoly power) may have a positive effect on innovation.

Using a multilevel model is justified if random differences in innovation performance, as well as random differences in the relationship between the features of firms and their decisions, are valid. It means that the feasibility of a multilevel probit model should be verified. Therefore, in the first step, parameters of the most general mixed effects model (2.a)-(2.b) are estimated, and hypothesis  $\gamma_k = 0$  is verified using the likelihood ratio test. If hypothesis  $H_0$  is not rejected, then a binary choice model without random effects is considered. In the next step, the adequacy of region-specific variables is tested (hypothesis  $\theta = 0$  is verified). If the  $H_0$  hypothesis is not rejected, the parameters of the specific standard binary choice model should be estimated. The logit/probit model is appropriate if the error term follows symmetric distribution. Therefore, the symmetry of the distribution of the error term is verified using Stukel's (1988) test. In the case of asymmetry, the parameters of the (multilevel) complementary log-log model are estimated.

10 A class of Manufacturing-Trade and Services enterprises was distinguished. These enterprises conduct a vast array of activities and therefore cannot be classified into one type of business. The trade sector is used as a reference category.

11 As already mentioned, the surveyed sample covered only those SMEs which used ICT tools (firms which reported the use of at least 2 out of 9 business processes included in the survey questionnaire). However, as the variable *ICT\_USE* is not a binary type and measures the scale of ICT use, it may be incorporated into the econometric modelling as the explanatory variable.

---

## STUDY RESULTS

---

The RIC approach utilized in this study revealed the dominant position of the Mazowieckie region (Table 2), which is in line with the results of other studies, including the Regional Innovation Scoreboard, which is used to evaluate the innovativeness of regions in the European Union (RIS, 2014<sup>12</sup>). Plawgo, Klimczak, Czyz, Boguszewski, and Kowalczyk (2013) argued that the Mazowieckie region is so far ahead of the other Polish regions in terms of innovative potential that it would be hard to identify any similarity between them. They also confirmed a statistically significant relationship between innovative potential and regional development measured by GDP in the Polish regions. It seems that the opposite relationship also holds – Rozanski and Socha (2017), using taxonomy methods, proved that development potential at the regional level has a positive impact on the scale of innovation activities undertaken by companies.

The use of the RIC framework brought similar results to the Regional Innovation Scoreboard 2014. Mazowieckie, Dolnoslaskie, and Malopolskie appeared to be the best-performing regions with respect to RIC. The worst performing regions include Podlaskie, Swietokrzyskie, Lubuskie, and Warminsko-Mazurskie. Though the level of correlation between the wealth of the regions and innovativeness is quite high, it should be stressed that the Podkarpackie region seems to be an outlier. Though this region is among the poorest in Poland, its innovation capability is much better than the performance of many other richer (than Podkarpackie) regions (Table 2).

Nevertheless, research studies usually point out that eastern Polish regions are lagging behind regarding innovation potential. Dziemianowicz and Peszat (2016), who analyzed the innovative capacity of Polish peripheral NUTS 2 regions in the east of the country in the light of smart specializations and EU co-funded innovative projects in the period 2007-2013, came to three disturbing conclusions: an increase in innovation inputs will not necessarily enhance economic growth in these regions; the development gap between these regions and the best developed Polish regions may broaden not decline; positive changes may occur in small groups of companies.

This study revealed that innovativeness at the firm-level is indeed dependent on the regional innovation performance measured by RIC – the propensity to introduce product, process, organizational and marketing innovations is higher for regions characterized by higher levels of innovation capabilities (Table 2; columns 3-5). A high percentage of firms from

---

12 Research within the Regional Innovation Scoreboard was conducted in 2014, 2016 and 2017, among other years.

Dolnoslaskie, Malopolskie, and Pomorskie declared that they had introduced product, process, organizational, or marketing innovations.

Interestingly, the highest percentage of innovative enterprises was reported in the Zachodniopomorskie region, which is located in the middle of the ranking of innovation capacity. At the same time, the percentage of innovative enterprises in the Mazowieckie region turned out to be lower than expected. There may be a few explanations for this phenomenon.

The first is related to the way in which the innovation in companies was measured – during the survey, managers were asked if their companies had introduced different types of innovation within the 12 months prior to the interview<sup>13</sup>. The collected data did not contain information on the value of sales from innovative products or whether the innovation was new to the firm or new to the market. Therefore, it was difficult to distinguish between radical or incremental innovations.

**Table 2.** Innovativeness of Polish regions – RIC measure. The share of companies introducing product, process, organizational and marketing innovations in different Polish regions (in %)

Region	Value of RIC (1)	Product innovation	Process innovation	Organizational innovation	Marketing innovation
Dolnoslaskie	0.538	29	18	43	15
Kujawsko-Pomorskie	0.171	10	22	24	12
Lubelskie	0.303	8	10	27	8
Lubuskie	0.088	19	12	12	5
Lodzkie	0.330	15	13	20	10
Malopolskie	0.473	24	23	19	16
Mazowieckie	0.827	19	26	25	9
Opolskie	0.180	14	3	3	0
Podkarpackie	0.447	3	36	28	19
Podlaskie	0.136	12	15	17	9
Pomorskie	0.382	20	11	24	17
Slaskie	0.335	18	9	9	5
Swietokrzyskie	0.112	21	14	14	4
Warminsko-Mazurskie	0.086	14	15	10	6
Wielkopolskie	0.362	10	10	12	11
Zachodniopomorskie	0.322	76	8	20	29

13 In this way we were able to “identify” innovation processes taking place in SMEs over a longer period, not only at the time the survey was processed.



However, as we surveyed SMEs, we should remember that in the case of small companies, innovations do not have to be linked to “formal” R&D, but may be a result of their “daily” business activities (Santamaria, Nieto, & Barge-Gil, 2009). In such an approach, innovation is defined by the token of development and implementation of new/improved product or service, or the way in which these products/services are manufactured and delivered (Forsman & Temel, 2016). As a consequence, small companies are more likely to develop incremental innovations rather than radical ones.

Nevertheless, the subjective evaluation of a company’s innovativeness seems to be an acceptable approach, since knowledge about innovations and innovative potential is tacit – researchers from the University of Warsaw showed that official data and international rankings of innovativeness may significantly underestimate the potential of Polish firms, as many Polish companies undertake innovative actions but do not report them in their financial statements as R&D expenditures for tax reasons (Bialek-Jaworska, Ziembinski, & Zieba, 2016). Thus, the very high percentage of companies introducing product innovations in the Zachodniopomorskie region may be a result of the assessment of managers who treated solutions as innovative, even if they would not be considered innovative by the managers of enterprises from other regions. Secondly, the analysis of the innovation performance of regions in the period 2005-2015 indicates the Zachodniopomorskie region belongs to the group which made very strong progress in terms of innovativeness. Consequently, we may expect dynamic innovation activity in this region. Thirdly, it should be emphasized that we model innovations in small and medium-sized enterprises, while the Regional Innovation Scoreboard and RIC take into account the overall innovative potential of the region, including input generated by large companies. This may explain the relatively low level of SMEs innovativeness recorded in our study in the Mazowieckie region, which hosts many large national and international corporations.

The results presented in Table 3 indicate that enterprises which have their own R&D department, with well-educated managers and skilled line-workers, which invest in ICT, introduce a motivation pay system, and are active on the national or international markets, are characterized by a greater propensity to introduce innovations. It seems that the stock of human capital of line-workers, proxied by completion of a university degree, is the least important driver of innovation among the factors listed in Table 3.

Table 4 presents the results of the estimation of the parameters of the multilevel binary choice model<sup>14</sup>. For the binary explanatory variables, their

---

14 As a robustness check, the RIC variable was replaced by a synthetic measure from the Regional Innovation Scoreboard 2014. The results of the estimation turned out to be very similar. These results are available upon request.

effects on the probability that the dependent variable equals 1 are provided. The relationship between the probability of introducing innovation and the size of an enterprise appeared to be ambiguous. Larger SMEs are better at introducing process, organizational and marketing innovations than smaller ones. This result is in line with Schumpeter's (1994) idea that the large size of a firm (and monopoly power) may positively affect innovativeness.

On the other hand, the size of a firm turned out to be insignificant in the equation explaining propensity to introduce product innovations.

This result is, however, in line with the conclusions obtained by Symeonidis (1996), who did not empirically confirm the positive relationship between size and innovativeness. The ambiguity of this result may be explained by the fact that small and large companies have different innovation strategies. As Plehn-Dujowich (2009) and Vaona and Pianta (2008) argued, large companies focus more on process innovation and market expansion, while small companies introduce such innovations rarely. Product innovations are, however, introduced by all firms regardless of their size (Table 4).

**Table 3.** Companies introducing product, process, organizational and marketing innovations for firms with different values of binary explanatory variables (in %)

Binary variable and its value	Product innovation	Process innovation	Organizational innovation	Marketing innovation
<i>RD=0</i>	12	9	13	8
<i>RD=1</i>	68	37	41	35
<i>UNIV_MAN=0</i>	8	7	10	6
<i>UNIV_MAN=1</i>	25	19	23	14
<i>UNIV_WORK=0</i>	19	15	19	12
<i>UNIV_WORK=1</i>	21	19	22	12
<i>ICT_SKILLS=0</i>	14	15	19	4
<i>ICT_SKILLS=1</i>	21	16	21	13
<i>INVEST_ICT=0</i>	12	8	13	6
<i>INVEST_ICT=1</i>	31	23	26	18
<i>MOT_PAY=0</i>	11	9	12	7
<i>MOT_PAY=1</i>	27	19	25	15
<i>INT_COV=0</i>	8	6	13	9
<i>INT_COV=1</i>	29	21	24	13

There is a higher probability of a company introducing each type of innovation if it has its own R&D department. However, the estimates of parameters and marginal effects are different in all four equations. Internal R&D has a stronger impact on the probability of introducing product innovations than process,

organizational, or marketing innovations. This result is in line with Lee, Olson and Trimi's (2012) finding that the link between the R&D department and innovation capacity was especially important in the closed innovation framework.

The results show a positive relationship between the human capital of managers and line-workers and the probability of introducing innovations; however, this relationship is statistically significant, but not for all types of innovation. If the majority of managers had a university diploma, then the probability of product innovation being introduced was greater by 0.26 than in the case of companies with less educated managers. When the majority of line-workers had a university diploma, then the probability of a marketing innovation being introduced was greater by 0.02 in comparison to an enterprise with less educated line-workers.

**Table 4.** Results of the estimation of the parameters of multilevel binary choice models<sup>15</sup>

Variable	Product innovation	Process innovation	Organizational innovation	Marketing innovation
<i>Constant</i>	-2.514***	-2.668***	-2.583***	-2.625***
<i>RIC</i>	-	-	0.745*(0.44)	0.834*(0.07)
<i>RD</i>	0.929*** (0.55)	0.579***(0.07)	0.427***(0.13)	0.634***(0.29)
<i>UNIV_MAN</i>	0.418*** (0.26)	-	-	-
<i>UNIV_WORK</i>	-	0.345***(0.07)	0.300**(0.12)	0.118*(0.02)
<i>ICT_USE</i>	0.885***	0.554**(0.14)	0.476**(0.24)	-
<i>ICT_SKILLS</i>	-	-	-	0.324***(0.06)
<i>ICT_TUT</i>	-	0.251**(0.04)	-	-
<i>INVEST_ICT</i>	0.381*** (0.25)	-	-	0.225**(0.14)
<i>MOT_PAY</i>	0.309** (0.23)	-	-	-
<i>INT_COV</i>	0.347*** (0.30)	-	-	-
<i>ORG_CHANGE</i>	-	0.488***(0.08)	0.600***(0.11)	0.268**
<i>Log(SIZE)</i>	-	0.183***(0.03)	0.193***(0.04)	0.216***
<i>MANUFACTURING</i>	0.417**(0.38)	-	-	-0.336*(-0.04)
<i>CONSTRUCTION</i>	0.375*(0.13)	-	-	-0.350*(-0.03)
<i>SERVICES</i>	0.047(0.05)	-	-	-0.217(-0.02)
<i>MTF</i>	0.501***(0.28)	-	-	0.011(0.00)
Model	Mixed-effects probit. Random coefficient with <i>RD</i> , <i>ICT_USE</i> and <i>INVEST_ICT</i>	Mixed-effects probit Random intercept	Mixed-effects probit Random intercept	Mixed-effects probit. Random intercept

15 We used Vuong's (1989) test for non-nested models in order to check whether the random effects model outperforms the fixed effects model. In all four cases, the results indicate that a multilevel model (a model assuming the presence of random effects) provides better results.

The human capital of line workers also had a positive impact on the probability of process and organizational innovations being introduced. Moreover, the estimated marginal effect for the *ICT\_SKILLS* variable shows that the probability of a marketing innovation being introduced is larger by 0.06 for firms in which all new employees were required to possess sufficient ICT skills, compared to firms with less skilled candidates (Table 4). These findings are in line with the argument present in the empirical literature pointing to human capital as being one of the principal factors of innovation capacity of enterprises (Smith, Courvisanos, Tuck, & McEachern, 2011; Van Uden, Knobens, & Vermeulen, 2017).

The results of the estimates indicate that sector dummies are significant in equations explaining the propensity to introduce product and marketing innovations. Enterprises from the manufacturing sector are characterized by a higher propensity to introduce product innovations, while companies from the Trade and MTF sector report a higher propensity to introduce marketing innovations. These results confirm that innovation drivers differ across the industries (Dahl Fitjar & Rodríguez-Pose, 2015; Malerba, 2005) and that there are significant discrepancies between manufacturing and service SMEs in terms of innovation (Forsman & Temel, 2016).

The *INVEST\_ICT* variable turned out to be significant in the equations, explaining the propensity to introduce product and marketing innovations, which proves that investing in ICT raises the innovation potential of enterprises (Spiezia, 2011). Moreover, the readiness of a company to make an organizational change has a positive impact on the probability of introducing process, organizational, and marketing innovations. This result is in line with the complementarity hypothesis (Milgrom & Roberts, 1990). It indicates that in Poland, using the potential of new technologies requires changes in work organization, too. This result also confirms the conclusions from the empirical research conducted by Arendt and Grabowski (2017), who found that the organizational change in Polish enterprises moderates the role of ICT in stimulating innovativeness.

The *INT\_COV* variable turned out to be significant only in the equation explaining the propensity to introduce product innovations (Table 4). It may imply that inter-regional knowledge transfer is an important driver for SMEs in Poland to enhance innovativeness only in one dimension – while entering external markets, Polish SMEs try to build their competitive advantage by extending their product offer, not relying so much on organizational, process and marketing capacities. This finding contradicts the results of Lewandowska and Golebiowski's (2014) study, which pointed out that process innovations were more strongly linked to internationalization than product innovations. However, differences in the results may be due to different periods of analysis.

Lewandowska and Golebiowski (2014) used data covering the period shortly after Poland's accession to the EU when Polish enterprises had to restructure and introduce process innovations in order to be competitive. In 2015, introducing product innovations was treated as a method of competing in international markets.

Finally, it appeared that innovation potential measured by RIC influences positively only organizational and marketing innovations introduced by SMEs, while it does not have an impact on product or process innovations. This may be due to the fact that enterprises introduce standardized products in all markets where they are present. Moreover, firms compete with enterprises from other regions and introduce process innovations in order to reduce costs and to be more competitive than other enterprises from the same industry. As a result, regional innovation capabilities do not have any impact on the probability of introducing product and process innovations.

Table 5 presents the random effects for an intercept and the parameters measuring the impact of variables *RD*, *ICT\_USE* and *INVEST\_ICT* in the equation which explains propensity to introduce product innovation. The random effects for equations of the process, organizational and marketing innovations are given in Table 6. By calculating random effects, we capture the impact of the regional institutional milieu on the differences in the innovative potential of the surveyed SMEs.

The results indicate that the propensity to introduce a product innovation in SMEs is, *ceteris paribus*, highest in the Dolnoslaskie, Malopolskie and Zachodniopomorskie regions. It does not contradict expectations since these regions are characterized by a very high concentration of firms within small areas. The probability of introducing product innovation in regions characterized by a lower concentration of firms and lower academic potential (e.g., Lubuskie, Podlaskie, and Warminsko-Mazurskie) is, *ceteris paribus*, lower. This result is in line with the finding of Brouwer, Budil-Nadvornikova, and Kleinknecht (1999), who noticed that firms in urban agglomerations, compared to firms in rural regions, use a greater share of their R&D for product development. This confirms the finding of Gonzalez-Lopez, Dileo, and Losurdo (2014), who noticed that cooperation with universities positively affects innovativeness of enterprises. It is also in line with the New Economic Geography approach, which indicates that proximity plays an important role in increasing innovativeness (Benos, Karagiannis, & Karkalakos, 2015). As Fujita and Thisse (2003) argued, firms in densely populated areas learn from the co-presence of similar firms in related activities, thus implementing new technologies efficiently.

**Table 5.** Random effects for intercepts and coefficients for the equation explaining the propensity to introduce product innovation

Region	Product innovation (random intercept)	Product innovation (RD)	Product innovation (ICT_USE)	Product innovation (INVEST_ICT)
Dolnoslaskie	0.305	-0.138	1.428	-0.133
Kujawsko-Pomorskie	-0.074	-0.366	-0.520	0.000
Lubelskie	-0.195	-0.098	-0.034	-0.059
Lubuskie	-0.139	0.041	-0.094	0.020
Lodzkie	-0.060	0.045	0.630	0.000
Malopolskie	0.247	-0.210	-0.524	-0.030
Mazowieckie	-0.241	0.327	0.052	0.069
Opolskie	0.078	-0.035	0.018	0.025
Podkarpackie	-0.052	0.084	0.035	-0.030
Podlaskie	0.004	0.202	-0.218	-0.065
Pomorskie	-0.116	0.293	-0.189	0.020
Slaskie	-0.018	-0.471	-0.702	0.069
Swietokrzyskie	-0.115	-0.032	0.187	-0.026
Warminsko-Mazurskie	0.057	0.100	-0.167	0.071
Wielkopolskie	-0.087	-0.017	-0.495	0.050
Zachodniopomorskie	0.406	0.276	0.593	0.019

Interestingly, the propensity to introduce product innovation appeared to be lower than average in the Mazowieckie region. However, the SMEs in the Mazowieckie region are characterized by a stronger relationship between having an R&D department and introducing product innovation, which means that in this region, R&D departments are used most effectively for introducing product innovations. The efficient use of R&D is also found for the Podlaskie, Pomorskie, and Zachodniopomorskie regions. The impact of the use of ICT on the probability of introducing product innovation proved to be the highest in Dolnoslaskie, Lodzkie and Zachodniopomorskie regions, while the weakest role of ICT use in product innovations is found for the Slaskie region. Investments in ICT translate into product innovations most intensely in the case of enterprises located in the Warminsko-Mazurskie, Mazowieckie, and Slaskie regions (Table 5).

The propensity to introduce process innovations is, *ceteris paribus*, higher for SMEs located in the Kujawsko-Pomorskie, Malopolskie and Podkarpackie regions, and is perceptibly lower in the Lodzkie, Swietokrzyskie, and Zachodniopomorskie regions. Relatively strong negative regional effects

discouraging companies from introducing organizational innovations are reported in the Mazowieckie, Opolskie, and Slaskie regions, while the group of leaders includes Dolnoslaskie, Kujawsko-Pomorskie, and Lubelskie regions. Regional milieu has a positive impact on the probability of introducing marketing innovation for enterprises from the Dolnoslaskie, Podlaskie and Podkarpackie regions. On the other hand, a propensity to introduce this kind of innovation is, *ceteris paribus*, lower for enterprises from the Opolskie and Slaskie regions (Table 6).

**Table 6.** Random effects for the intercept in the equation explaining the propensity to introduce process, organizational and marketing innovations

Region	Process innovation (random intercept)	Organizational innovation (random intercept)	Marketing innovation (random intercept)
Dolnoslaskie	0.198	0.649	0.445
Kujawsko-Pomorskie	0.450	0.485	0.113
Lubelskie	-0.116	0.380	0.173
Lubuskie	-0.112	-0.084	-0.016
Lodzkie	-0.348	-0.225	-0.254
Malopolskie	0.365	-0.015	0.094
Mazowieckie	0.214	-0.324	-0.297
Opolskie	-0.288	-0.326	-0.388
Podkarpackie	0.573	0.117	0.221
Podlaskie	0.233	0.237	0.278
Pomorskie	-0.135	0.151	0.083
Slaskie	-0.282	-0.419	-0.335
Swietokrzyskie	-0.354	-0.315	-0.218
Warminsko-Mazurskie	-0.197	-0.024	0.059
Wielkopolskie	-0.065	-0.102	-0.119
Zachodniopomorskie	-0.531	-0.185	0.160

It should be noticed that the positive impact of location in a specific region on innovativeness is strongly visible in the case of enterprises from the Dolnoslaskie region, and to a lesser extent in the Kujawsko-Pomorskie and Podkarpackie regions.

This result can be justified by more intensive cooperation among enterprises from these regions. In particular, enterprises located in the Podkarpackie region cooperate very often with others in comparison with firms from other parts of Poland. It confirms the findings obtained by Grillitsch and Nilsson (2015) and Wassmann, Schiller and Thomsen (2016), who found that the innovation

potential of enterprises located in less-developed regions is largely dependent on their collaboration patterns. In “Marshallian” terms, linkages among firms reduce transaction costs due to the geographical, social, and organizational proximity of innovation agents (Bengoa, Martinez-San Roman, & Perez, 2017).

In order to evaluate the goodness of fit of the multilevel probit model as well as the importance of firm-level (internal) and regional variables for enhancing innovations, the percentage of correctly predicted zeros and ones were calculated for three models:

- the full model;
- a standard probit model without the RIC variable;
- a multilevel model without firm-level variables.

The results presented in Table 7 indicate that the full model (with regional and firm-level variables) provides the best prediction; the predictive powers of the models at about 80% means that the selected explanatory variables are important drivers of innovativeness in Polish enterprises. Excluding regional variables brought a slight decrease in explanatory power while excluding firm-specific variables resulted in a substantial drop. This confirms that both groups of variables are significant; however, firm-specific variables seem to be more important than regional ones in enhancing innovations.

**Table 7.** The percentage of correctly predicted values for the full model and models without internal and regional innovation drivers

	Product innovation	Process innovation	Organizational innovation	Marketing innovation
Full model	82%	75%	77%	77%
Model without regional variables and regional random effects	78%	72%	73%	73%
Model without firm-level variables	67%	55%	56%	60%

In order to verify whether a firm located in an unfavorable environment may be a successful innovator, ranges of probabilities of introducing different types of innovations were calculated for regions with the lowest innovation potential. In order to check, whether the reverse is true, analogous ranges were calculated for firms from the least innovative sectors, assuming that firm-specific stimulants of innovativeness (the variables *RD*, *UNIV\_MAN*, *UNIV\_WORK*, *ICT\_USE*, *ICT\_SKILLS*, *ICT\_TUT*, *INVEST\_ICT*, *MOT\_PAY*, *INT\_COV*) are equal to 0.



**Table 8.** Ranges of probabilities of introducing different types of innovation for low-performing regions and firms with low values of innovation drivers

	Product innovation	Process innovation	Organizational innovation	Marketing innovation
Low innovativeness of region	between 0.01 and 0.86	between 0.01 and 0.76	between 0.01 and 0.74	between 0.00 and 0.26
Low innovativeness of firm	between 0.00 and 0.02	between 0.01 and 0.25	between 0.01 and 0.27	between 0.01 and 0.08

The results from Table 8 indicate that an SME with favorable “in-house capabilities” can have good innovation performance even if the region exerts less favorable conditions. Firms from less innovative regions may work actively and successfully to develop strategies in order to overcome regional constraints – they may acquire so much market intelligence that they outstrip counterparts in more innovative locations. The greater importance of firm-level variables in comparison to regional ones in enhancing innovations is in line with the findings of Keeble and Vaessen (1995) or Sternberg and Arndt (2001).

## DISCUSSION AND CONCLUSIONS

The research study presented in this paper was aimed at identifying firm-level (internal) and external (regional) drivers of innovation in the regional dimension in Polish Small and Medium-Sized Enterprises which had undergone ICT upgrading and used modern technologies in their day-to-day operations. As almost all NUTS 2 regions in Poland (except Mazowieckie) are classified as less-developed regions in the context of the EU’s cohesion policy, this study has brought new insight to the discussion on enhancing the innovation potential of companies located in disfavored regions in a Central and Eastern Europe country.

Firstly, the results confirmed that having an R&D department, the quality of labor employed in enterprises, investments in and the use of ICT, organizational change, and motivation systems are key firm-level drivers of the innovativeness of Polish SMEs – most of these drivers are classified as co-innovative sources of productivity (Torrent-Sellens & Ficapal-Cusi, 2010). Secondly, the study revealed that regional factors influence, to a different degree, SMEs’ innovativeness – knowledge transfer and spillover effects stemming from the inter-regional presence of enterprises enhance only the introduction of product innovations, while the institutional milieu, proxied by the RIC measure, drives organizational and marketing innovations. Thus, we proved that the innovative behavior of Polish small and medium-sized enterprises operating in less-developed regions (by European Union standards)

is dependent on the regional innovation policy and companies' collaboration patterns (Isaksen & Trippl, 2014a; Grillitsch & Nilsson, 2015; Sörvik et al., 2018). Thirdly, this study demonstrated which drivers are more important in enhancing SMEs' innovativeness. Interestingly, the main research hypothesis was verified negatively – even though we might assume that enterprises located in less-developed regions would rely more on regional innovation drivers, it appeared that firm-level factors are more significant for enhancing innovation than external ones. At the same time, the mixed effects model, which reflects the importance of technology spillovers among enterprises located in the same region, proved that firm-level and regional innovation drivers are reinforcing themselves. Taking advantage of the regional random effects approach made it possible to assess indirectly the effectiveness of innovation policies conducted in Polish NUTS 2 regions within RIS and then the S3 framework – by this token, Dolnoslaskie, Podkarpackie and Kujawsko-Pomorskie may be perceived as leaders.

Finally, though regional innovation potential influences the innovative behavior of SMEs, the innovation patterns of companies in regions do not always reflect the regional potential measured by the Regional Innovation Scoreboard or RIC index. In other words, SMEs in some regions (e.g., Podkarpackie or Zachodniopomorskie) report a bigger scale of innovation activities than would be expected from the level of regional innovation potential, while in other regions (e.g., Mazowieckie) this situation is reversed. It should be emphasized that the Mazowieckie region is an interesting example – on the one hand, it is the best developed Polish NUTS 2 region in terms of economic and innovation potential; on the other hand, SMEs' propensity to introduce all types of innovations analyzed in the paper is, *ceteris paribus*, lower than expected. At the same time, SMEs in the Mazowieckie region are more effective than average in translating R&D effort, ICT use, and ICT investments into product innovations.

The practical conclusion stemming from this research study posits that regional policies (within the framework of the Smart Specialisation Strategy) in less-developed regions should focus more on linking firm-level factors and regional innovation systems to enhance companies' innovation capacity (Hauge, Kyllingstad, Maehle, & Schulze-Krogh, 2017). Since SMEs rely more on in-house innovation capacity and, at the same time, firm-level and regional innovation drivers are reinforcing themselves (still not too much), strengthening this mechanism should be beneficial to companies (and regions) in terms of creating innovative potential. This leads to implications for further research – meaning the development of a framework (within the S3 concept) of more effective interdependence between the internal (companies) and regional innovation potential in less-developed regions.

In most cases, the obtained results confirm the conclusions from other studies devoted to the analysis of determinants of firm-level innovativeness of Polish enterprises (Arendt & Grabowski, 2017, 2018; Szczygielski & Grabowski, 2014; Szczygielski et al., 2017; Lewandowska & Kowalski, 2015; Lewandowska, 2016). Moreover, the results are consistent with the conclusions from studies devoted to regional differences in innovativeness (Golejewska, 2018). It should be stressed that the conclusions from this paper significantly expand the existing knowledge concerning firm-level and regional-level determinants of innovativeness. The novelty of the approach presented in this paper relies on combining, within one framework, firm-level data with meso data describing the innovative potential of the regional environment, and using multilevel random-effects models to test the hypothesis about the relevance of firm-level and regional drivers of SMEs' innovativeness. Thanks to the use of such an approach, we can evaluate interregional differences in the impact of consecutive factors on the probability of introducing different types of innovation. These conclusions should be treated as an original contribution in comparison with the results of other studies. Moreover, we were able to evaluate the relative significance of firm-level and regional factors on innovativeness, and the former turned out to be more important.

However, this study has some limitations. The most important one is related to the mode of firm-level data collection – survey research is not easily replicable. Moreover, as our data contains information about the innovation behavior of enterprises covering only one year before the survey, there is no possibility to use dynamic models or to analyze companies' innovation patterns in time. In addition, as the survey covered only SMEs, which are relatively advanced in ICT utilization, the results might differ if other, less ICT-ready SMEs had been surveyed as well.

## Appendix - Summary statistics of dependent variables and regressors

**Table A.1.** Summary statistics of the dependent variable and regressors

Variable	Binary variables
	Percentage of "ones" (%)
<i>INNOV_PROD</i>	28
<i>INNOV_PROC</i>	16
<i>INNOV_ORG</i>	20
<i>INNOV_MARKET</i>	16
<i>RD</i>	23
<i>UNIV_MAN</i>	74
<i>UNIV_WORK</i>	26

<b>Binary variables</b>				
<b>Variable</b>	<b>Percentage of “ones” (%)</b>			
<i>ICT_SKILLS</i>	28			
<i>ICT_TUT</i>	40			
<i>INVEST_ICT</i>	50			
<i>MOT_PAY</i>	62			
<i>INT_COV</i>	63			
<i>MANUFACTURING</i>	15			
<i>CONSTRUCTION</i>	11			
<i>SERVICES</i>	31			
<i>MTF</i>	21			
<b>Non-binary variables</b>				
<b>Variable</b>	<b>Mean</b>	<b>Standard deviation</b>	<b>Maximum</b>	<b>Minimum</b>
<i>ICT_USE</i>	0.36	0.27	1	0
ORG	0.34	0.48	1	0
Size	38.93	53.54	249	2

## Acknowledgments

We are grateful to the two anonymous referees for providing helpful comments and suggestions. Any remaining errors are the responsibility of the authors. This paper was prepared within the framework of the research project “Impact of Information and Communication Technologies on productivity – macro and micro analysis” at the Department of Economic Policy, the University of Lodz, financed by the National Science Centre (contract number DEC-2013/11/B/HS4/00661).

## References

- Almeida, A., Figueiredo, A., & Rui Silva, M. (2011). From concept to policy: Building Regional Innovation Systems in follower regions. *European Planning Studies*, 19(7), 1331-1356. <https://doi.org/10.1080/09654313.2011.573140>
- Archibugi, D. & Coco, A. (2004). A new indicator of technological capabilities for developed and developing countries (ArCo). *World Development*, 32(4), 629-654. <https://doi.org/10.1016/j.worlddev.2003.10.008>
- Arendt, L. & Grabowski, W. (2018). Impact of ICT utilization on innovations and on labor productivity: Micro-level analysis for Poland. In A. Dias, B. Salmelin, D. Pereira, & M. Sales Dias (Eds.), *Modeling Innovation*

- Sustainability and Technologies. Economic and Policy Perspectives* (pp. 225-247). Switzerland (Cham): Springer.
- Arendt, L. & Grabowski, W. (2017). Innovations, ICT, and ICT-driven labour productivity in Poland. A firm-level approach. *Economics of Transition*, 25(4), 723-758. <https://doi.org/10.1111/ecot.12135>
- Bakovic, T. (2010). Managing innovation systems in transition economies (University of Zagreb Faculty of Economics and Business Working Paper No. 10-01). Retrieved from <https://pdfs.semanticscholar.org/ac11/4db6a82d1af8017c5523233b41772f7b0b06.pdf>
- Bengoa, M., Martinez-San Roman, V., & Perez, P. (2017). Do R&D activities matter for productivity? A regional spatial approach assessing the role of human and social capital. *Economic Modelling*, 60, 448-461. <https://doi.org/10.1016/j.econmod.2016.09.005>
- Benos, N., Karagiannis, S., & Karkalakos, S. (2015). Proximity and growth spillovers in European regions: The role of geographical, economic and technological linkages, *Journal of Macroeconomics*, 43, 124-139. <https://doi.org/10.1016/j.jmacro.2014.10.003>
- Bialek-Jaworska, A., Ziembinski, M., & Zieba, D. (2016). *Innowacyjność Polskich Przedsiębiorstw. Działalność Badawczo-rozwojowa i Współpraca Nauki z Biznesem*. Warszawa: DELab UW.
- Boermans, M. A., & Roelfsema, H. (2012). The effects of internationalization on innovation: Firm-level evidence for transition economies. *Open Economies Review*, 26(2), 333-350. <https://doi.org/10.1007/s11079-014-9334-8>
- Broekel, T., & Boschma, R. (2016). The cognitive and geographical structure of knowledge links and how they influence firms' innovation performance. *Regional Statistics*, 6(2), 3-26. <https://doi.org/10.15196/RS06201>
- Brouwer, E., Budil-Nadvornikova, H., & Kleinknecht, A. (1999). Are urban agglomerations a better breeding place for product innovation? An analysis of new product announcements. *Regional Studies*, 33, 541-550. <https://doi.org/10.1080/00343409950078233>
- Burcher, S., Habersetzer, A., & Mayer, H. (2015). Entrepreneurship in peripheral regions: A relational perspective (CRED Research Paper No. 6). Retrieved from <https://pdfs.semanticscholar.org/e007/8399ab04e98b686e3190102bbb0faa6aaa6e.pdf>
- Capello, R., & Lenzi, C. (2015). Knowledge, innovation and productivity gains across European regions. *Regional Studies*, 49(11), 1788-1804. <https://doi.org/10.1080/00343404.2014.917167>
- Crepon, B., Duguet, E., & Mairesse, J. (1998). Research, innovation and productivity: An econometric analysis at the firm level. *Economics of Innovation and New Technology*, 7(2), 115-158. <https://doi.org/10.1080/10438599800000031>
- D'Adda, D., Guzzini, E., Iacobucci, D., & Palloni, R. (2018). Is Smart Specialisation Strategy coherent with regional innovative capabilities? *Regional Studies*, 53(7), 1004-1016. <https://doi.org/10.1080/00343404.2018.1523542>

- D'Amore, R., Iorio, R., & Lubrano Lavadera, G. (2017). Exploring the relationship between human capital and innovation at the firm level: A study on a sample of European firms (CELPE Discussion Paper No. 144). Retrieved from [http://www.unisa.it/uploads/2551/dp\\_144.pdf](http://www.unisa.it/uploads/2551/dp_144.pdf)
- Dahl Fitjar, R., & Rodríguez-Pose, A. (2015). Interaction and innovation across different sectors: Findings from Norwegian city-regions. *Regional Studies*, 49(5), 818-833. <https://doi.org/10.1080/00343404.2015.1016415>
- Dahl Fitjar, R., & Rodríguez-Pose, A. (2011). Innovating in the periphery: Firms, values and innovation in southwest Norway. *European Planning Studies*, 19(4), 555-574. <https://doi.org/10.1080/09654313.2011.548467>
- Despotovic, D., Cvetanovic, S., & Nedic, V. (2014). Innovativeness and competitiveness of the Western Balkan countries and selected EU Member States. *Industrija*, 42(1), 27-45. <https://doi.org/10.5937/industrija42-4602>
- Dziemianowicz, W., & Peszat, K. (2016). Inteligentne specjalizacje w polskich regionach peryferyjnych w świetle dotychczasowej regionalnej polityki wspierania innowacyjności. *Studia KPZK*, 170, 278-291.
- EBRD (2014). Transition report 2014. Innovation in transition (European Bank for Reconstruction and Development Transition Report 2014). Retrieved from <https://www.ebrd.com/news/publications/transition-report/transition-report-2014.html>
- Fagerberg, J., & Srholec, M. (2008). National innovation systems, capabilities and economic development. *Research Policy*, 37(9), 1417-1435. <https://doi.org/10.1016/j.respol.2008.06.003>
- Forsman, H., & Temel, S. (2016). From a non-innovator to a high-innovation performer: Networking as a driver. *Regional Studies*, 50(7), 1140-1153. <https://doi.org/10.1080/00343404.2014.968120>
- Fujita, M., & Thisse, J-F. (2003). Does geographical agglomeration foster economic growth? And who gains and losses from it? *The Japanese Economic Review*, 54, 121-145. <https://doi.org/10.1111/1468-5876.00250>
- Ghinararu, C. (2017). The people are always right. A conceptual political economy essay into why countries in Central and Eastern Europe persistently remain at the periphery of socio-economic development. *Osztyn Economic Journal*, 12(4), 427-450.
- Golejewska, A. (2018). Innovativeness of enterprises in Poland in a regional context. *Journal of Entrepreneurship, Management and Innovation*, 14(1), 29-44. <https://doi.org/10.7341/20181412>
- Gonzalez-Lopez, M., Dileo, I., & Losurdo, F. (2014). University-industry collaboration in the European regional context: The cases of Galicia and Apulia Region. *Journal of Entrepreneurship, Management and Innovation*, 10(3), 57-87. <https://doi.org/10.7341/20141033>
- Grabowski, W., & Stawasz, E. (2017). The role of business consulting in creating knowledge and formulating a strategy of development in Polish microenterprises. *Journal for East European Management Studies*, 22(3), 374-396. <https://doi.org/10.5771/0949-6181-2017-3-374>

- Griffith, R., Huergo, E., Mairesse, J., & Peters, B. (2006). Innovation and productivity across four European countries. *Oxford Review of Economic Policy*, 22(4), 483-498. <https://doi.org/10.1093/oxrep/grj028>
- Grillitsch, M., & Nilsson, M. (2015). Innovation in peripheral regions: Do collaborations compensate for a lack of local knowledge spillovers? *Annals of Regional Science*, 54(1), 299-321. <https://doi.org/10.1007/s00168-014-0655-8>
- Hall, H., & Donald, B. (2009). Innovation and creativity on the periphery: Challenges and opportunities in Northern Ontario (Martin Prosperity Institute Working Paper Series No. 2009-WPONT-002). Retrieved from <http://www.ruralontarioinstitute.ca/file.aspx?id=eaddc08f-e3b2-4608-a871-09858c361deb>
- Hall, B. H., Lotti, F., & Mairesse, J. (2013). Evidence on the impact of R&D and ICT investments on innovation and productivity in Italian firms. *Economics of Innovation and New Technology*, 22(3), 300-328. <https://doi.org/10.1080/10438599.2012.708134>
- Hauge, E. S., Kyllingstad, N., Maehle, N., & Schulze-Krogh, A. C. (2017). Developing cross-industry innovation capability: Regional drivers and indicators within firms. *European Planning Studies*, 25(3), 388-405. [10.1080/09654313.2016.1276158](https://doi.org/10.1080/09654313.2016.1276158)
- Isaksen, A., & Trippl, M. (2017). Exogenously led and policy-supported new path development in peripheral regions: Analytical and synthetic routes. *Economic Geography*, 93(5), 436-457. <https://doi.org/10.1080/00130095.2016.1154443>
- Isaksen, A., & Trippl, M. (2014a). New path development in the periphery (Lund University Papers in Innovation Studies No. 2014/31). Retrieved from [http://wp.circle.lu.se/upload/CIRCLE/workingpapers/201431\\_Isaksen\\_Trippl.pdf](http://wp.circle.lu.se/upload/CIRCLE/workingpapers/201431_Isaksen_Trippl.pdf)
- Isaksen, A., & Trippl, M. (2014b). Regional industrial path development in different regional innovation systems: A conceptual analysis (Papers in Innovation Studies No. 2014/17). Retrieved from <https://www.lunduniversity.lu.se/lup/publication/cae32681-41dc-4e66-a64d-204098f502d8>
- Jensen, M. B., Johnson, B., Lorenz, E., & Lundvall, B.-Å. (2007). Forms of knowledge and modes of innovation, *Research Policy*, 36, 680-693. <https://doi.org/10.1016/j.respol.2007.01.006>
- Keeble, D., & Vaessen, P. (1995). Growth-orientated SMEs in unfavorable regional environments. *Regional Studies*, 29, 489-505. <https://doi.org/10.1080/00343409512331349133>
- Kleibrink, A., Laredo, P., & Phillip, S. (2017). Promoting innovation in transition countries: A trajectory for smart specialization (Working Paper No. EUR 28638 EN). Retrieved from [http://publications.jrc.ec.europa.eu/repository/bitstream/JRC106260/jrc106260\\_jrc\\_science4policy\\_s3-trajectory\\_transition-countries\\_2017\\_final\\_proof-read\\_online.pdf](http://publications.jrc.ec.europa.eu/repository/bitstream/JRC106260/jrc106260_jrc_science4policy_s3-trajectory_transition-countries_2017_final_proof-read_online.pdf)

- Kosala, M., & Wach, K. (2011). Regionalne determinanty rozwoju innowacyjności przedsiębiorstw. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie*, 866, 19-36.
- Lee, S. M., Olson, D. L., & Trimi, S. (2012). Co-innovation: Convergenomics, collaboration and co-creation for organizational values. *Management Decision*, 50(5), 817-831. <https://doi.org/10.1108/00251741211227528>
- Lewandowska, M. S., & Golebiowski, T. (2014). Innovation and international competitiveness of manufacturing firms: Evidence from Bulgaria, Czech Republic, Hungary and Romania. In A. Zhuplev & K. Liuhto (Eds.), *Geographical Competitiveness in Central and Eastern Europe, the Baltic Countries, and Russia* (pp. 57-82). Hershey, PA: IGI Global.
- Lewandowska, M. S., & Kowalski, A. M. (2015). Współpraca polskich przedsiębiorstw w sferze innowacji a wsparcie z funduszy unijnych. *Gospodarka Narodowa*, 4(278), 69-89. <https://doi.org/10.33119/GN/100826>
- Lewandowska, M. S. (2016). Do government policies foster environmental performance of enterprises from CEE region? *Comparative Economic Research*, 19(3), 45-67. <https://doi.org/10.1515/cer-2016-0020>
- Malerba, F. (2005). Sectoral systems: How and why innovation differs across sectors. In J. Fagerberg, D. Mowery, & R. Nelson (Eds.), *The Oxford Handbook of Innovation* (pp. 380-406). Oxford: Oxford University Press.
- Martinez-Roman, J. A., & Romero, I. (2017). Determinants of innovativeness in SMEs: Disentangling core innovation and technology adoption capabilities. *Review of Managerial Science*, 11(3), 543-569. <https://doi.org/10.1007/s11846-016-0196-x>
- Masso, J., & Vahter, P. (2008). Technological innovation and productivity in late-transition Estonia: Econometric evidence from innovation surveys. *European Journal of Development Research*, 20(2), 240-261. <https://doi.org/10.1080/09578810802060751>
- McCann, P., & Ortega-Argilés, R. (2015). Smart specialization, regional growth and applications to European Union Cohesion Policy. *Regional Studies*, 49, 1291-1302. <https://doi.org/10.1080/00343404.2013.799769>
- Milgrom, P., & Roberts, J. (1990). The economics of modern manufacturing: Technology, strategy and organization. *American Economic Review*, 80(3), 511-528. <https://www.jstor.org/stable/2006681>
- Nguyen Thi, T. U., & Martin, L. (2015). The relationship between innovation and productivity conditional to R&D and ICT use. An empirical analysis for firms in Luxembourg. *Revue Economique*, 66(6), 1105-1130. <https://www.cairn.info/revue-economique-2015-6-page-1105.htm>
- OECD. (2005). *Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data* (OECD iLibrary). Retrieved from [https://www.oecd-ilibrary.org/science-and-technology/oslo-manual\\_9789264013100-en](https://www.oecd-ilibrary.org/science-and-technology/oslo-manual_9789264013100-en)
- Oughton, C., Landabaso, M., & Morgan, K. (2002). The regional innovation paradox: Innovation policy and industrial policy. *Journal of Technology Transfer*, 27(1), 97-110. <https://doi.org/10.1023/A:1013104805703>



- Pinheiro, J. C., & Chao, E. C. (2006). Efficient Laplacian and adaptive Gaussian quadrature algorithms for multilevel generalized linear mixed models. *Journal of Computational and Graphical Statistics*, 15(1), 58-81. <https://doi.org/10.1198/106186006X96962>
- Plawgo, B., Klimczak, T., Czyz, P., Boguszewski, R., & Kowalczyk, A. (2013). Regionalne Systemy Innowacji w Polsce (Raport z Badań). Retrieved from <https://www.parp.gov.pl/files/74/81/626/15705.pdf>
- Plehn-Dujowich, J. M. (2009). Firm size and types of innovation. *Economics of Innovation and New Technology*, 18(3), 205-223. <https://doi.org/10.1080/10438590701785850>
- Polder, M., van Leeuwen, G., Mohnen, P., & Raymond, W. (2009). Productivity effects of innovation modes (MPRA Paper No. 18893). Retrieved from <https://mpra.ub.uni-muenchen.de/18893/1/200933x10pub.pdf>
- Raffo, J., Lhuillery, S., & Miotti, L. (2008). Northern and Southern innovativity: A comparison across European and Latin American countries. *European Journal of Development Research*, 20(2), 219-239. <https://doi.org/10.1080/09578810802060777>
- Rodriguez-Pose, A. (2014). Leveraging research, science and innovation to strengthen social and regional cohesion (Policy paper by the Research, Innovation, and Science Policy Experts (RISE)). Retrieved from [https://ec.europa.eu/info/sites/info/files/research\\_and\\_innovation/groups/rise/rodriguez-pose-leveraging\\_science.pdf](https://ec.europa.eu/info/sites/info/files/research_and_innovation/groups/rise/rodriguez-pose-leveraging_science.pdf)
- Rodriguez-Pose, A., & Comptour, F. (2012). Do clusters generate greater innovation and growth? An analysis of European regions. *The Professional Geographer*, 64(2), 211-231. <https://doi.org/10.1080/00330124.2011.583591>
- Rozanski, J., & Socha, B. (2017). Potencjał rozwojowy regionu a działalność inwestycyjna przedsiębiorstw. *Studia i Prace WNEiZ US*, 48(3), 229-241.
- Rynes, S. C., Gerhart, B., & Minette, K. A. (2004). The importance of pay in employee motivation: Discrepancies between what people say and what they do. *Human Resource Management*, 43(4), 381-394. <https://doi.org/10.1002/hrm.20031>
- Santamaria, L., Nieto, M. J., & Barge-Gil, A. (2009). Beyond formal R&D: Taking advantage of other sources of innovation in low- and medium-technology industries. *Research Policy*, 38(3), 507-517. <https://doi.org/10.1016/j.respol.2008.10.004>
- Santoalha, A. (2018). Technological diversification and smart specialisation: The role of cooperation. *Regional Studies*. <https://doi.org/10.1080/00343404.2018.1530753>
- Schumpeter, J. (1994). *Capitalism, Socialism and Democracy*. London: Routledge.
- Smith, A., Courvisanos, J., Tuck, J., & McEachern, S. (2011). Building innovation capacity: The role of human capital formation in enterprises – a review of the literature (NCVER Occasional Paper). Retrieved from <https://files.eric.ed.gov/fulltext/ED517803.pdf>

- Sörvik, J., Teräs, J., Dubois, A., & Pertoldi, M. (2018). Smart specialisation in sparsely populated areas: Challenges, opportunities and new openings. *Regional Studies*, 53(7), 1070-1080. <https://doi.org/10.1080/00343404.2018.1530752>
- Spiezia, V. (2011). Are ICT users more innovative? *OECD Journal: Economic Studies*, 1, 1-21. <https://doi.org/10.1787/19952856>
- Stawasz, E. (2019). Factors that shape the competitiveness of small innovative companies operating in international markets with a particular focus on business advice. *Journal of Entrepreneurship, Management and Innovation*, 15(1), 61-82. <https://doi.org/10.7341/20191513>
- Stukel, T.A. (1988). Generalized logistic models. *Journal of the American Statistical Association*, 83, 426-431. <https://doi.org/10.2307/2288858>
- Symeonidis, G. (1996). Innovation, firm size and market structure: Schumpeterian hypotheses and some new themes (OECD Economics Department Working Paper No. 161). Retrieved from [https://www.oecd-ilibrary.org/economics/innovation-firm-size-and-market-structure\\_603802238336](https://www.oecd-ilibrary.org/economics/innovation-firm-size-and-market-structure_603802238336)
- Szczygielski, K., & Grabowski, W. (2014). Innovation strategies and productivity in the Polish services sector. *Post-Communist Economies*, 26(1), 17–38. <https://doi.org/10.1080/14631377.2014.874226>
- Szczygielski, K., Grabowski, W., & Woodward, R. (2017). Innovation and the growth of service companies: The variety of firm activities and industry effects. *Industry and Innovation*, 24(3), 249–262. <https://doi.org/10.1080/13662716.2016.1232191>
- Sternberg, R., & Arndt, O. (2001). The firm or the region: What determines the innovation behavior of European firms? *Economic Geography*, 77(4), 364-382. <https://doi.org/10.1111/j.1944-8287.2001.tb00170.x>
- Torrent-Sellens, J., & Ficapal-Cusi, P. (2010). New co-innovating sources of business productivity? *Innovar*, 20(38), 111-124.
- Uyarra, E., Marzocchi, C., & Sorvik, J. (2018). How outward looking is smart specialisation? Rationales, drivers and barriers. *European Planning Studies*, 26(12), 2344-2363. <https://doi.org/10.1080/09654313.2018.1529146>
- Van Leeuwen, G., & Klomp, L. (2006). On the contribution of innovation to multifactor productivity growth. *Economics of Innovation and New Technology*, 15(4-5), 367-390. <https://doi.org/10.1080/10438590500512927>
- Van Uden, A., Knobens, J., & Vermeulen, P. (2017). Human capital and innovation in Sub-Saharan countries: A firm-level study. *Innovation. Organization & Management*, 19(2), 103–124. <https://doi.org/10.1080/14479338.2016.1237303>
- Vaona, A., & Pianta, M. (2008). Firm size and innovation in European manufacturing. *Small Business Economics*, 30(3), 283-299. <https://doi.org/10.1007/s11187-006-9043-9>
- Varga, A., Sebestyén, T., Szabó N., & Szerb, L. (2018). Estimating the economic impacts of knowledge network and entrepreneurship development in

- smart specialization policy. *Regional Studies* (forthcoming). <https://doi.org/10.1080/00343404.2018.1527026>
- Vuong, Q. H. (1989). Likelihood ratio tests for model selection and non-nested hypotheses. *Econometrica*, 57(2), 307-333. <https://doi.org/10.2307/1912557>
- Wassmann, P., Schiller, D., & Thomsen, S. L. (2016). Spatial cooperation patterns and their impact on innovation outcomes: Lessons from firms in a low-technology region. *European Planning Studies*, 24(5), 833-864. <https://doi.org/10.1080/09654313.2016.1140721>

### Abstrakt

Artykuł podejmuje problematykę innowacyjności małych i średnich przedsiębiorstw w ujęciu regionalnym w gospodarce, która przeszła proces transformacji systemowej. Analiza empiryczna bazuje na danych zgromadzonych w 820 polskich MŚP, które aktywnie wykorzystują ICT w swojej działalności. Celem głównym badania była identyfikacja wewnętrznych (na poziomie przedsiębiorstwa) i zewnętrznych (regionalnych) determinant innowacyjności małych i średnich przedsiębiorstw. Oryginalnym elementem badania było zastosowanie podejścia, w którym sięgnięto równocześnie po dane mikro i mezo opisujące potencjał innowacyjny firm i regionów, i użycie wielopoziomowego modelu efektów losowych do określenia, które z czynników – wewnętrzne czy regionalne – mają istotniejszy wpływ na innowacyjność MŚP. Dzięki wykorzystaniu regionalnych efektów losowych oceniono, w sposób pośredni, skuteczność polityki innowacyjnej prowadzonej w polskich województwach w ramach strategii RIS oraz inteligentnych specjalizacji. Nieoczekiwanie, hipoteza badawcza mówiąca o tym, że czynniki regionalne mają większy wpływ na innowacyjność MŚP niż wewnętrzne (firmowe) determinanty, nie została potwierdzona. Badanie wykazało, że dla innowacyjności MŚP ze słabiej rozwiniętych regionów kraju, który przeszedł transformację systemową gospodarki, bardziej istotny jest potencjał wewnętrzny przedsiębiorstwa niż potencjał innowacyjny regionu. Sugeruje to, że strategia inteligentnych specjalizacji w słabiej rozwiniętych regionach powinna koncentrować się w większym zakresie na kreowaniu efektu synergii między czynnikami wewnętrznymi i regionalnymi systemami innowacji w celu zwiększenia zdolności innowacyjnych przedsiębiorstw.

**Słowa kluczowe:** MŚP, innowacje, słabo rozwinięte regiony, wielopoziomowy model probitowy

### Biographical notes

**Lukasz Arendt**, Ph.D., the Director of the Institute of Labour and Social Studies in Warsaw, and Assistant Professor in the Department of Economic Policy at the University of Lodz, Poland. He has been involved in international research projects, including those within the PROGRESS programme, commissioned by DG EAC, and CEDEFOP. His research experience covers the evaluation of PES capabilities, delivering a proposal on the Polish flexicurity model, consultancy activities for the Polish Ministry of Family, Labour and Social Policy, and the

Ministry of Regional Development. Research interests: the emergence of the information society, enhancing SME growth through the wider utilization of ICT, labor market polarization, education, training, and lifelong learning schemes.

**Wojciech Grabowski**, Ph.D., an assistant professor in the Department of Econometric Models and Forecasts at the University of Lodz. He specializes in limited dependent and qualitative variables models and applies these methods in the economics of innovation and entrepreneurship as well as in modeling macroeconomic phenomena (currency crises, foreign exchange interventions). He has published several papers in high-quality international and Polish journals, co-authored a number of books and participated in many prestigious economic conferences.

# The uneven regional distribution of projects funded by the EU Framework Programmes

**Pedro Varela-Vázquez<sup>1</sup>** , **Manuel González-López<sup>2</sup>**   
**María del Carmen Sánchez-Carreira<sup>3</sup>** 

## Abstract

*The Framework Programmes (FPs) represent one key supply-side instrument in the innovation policy mix implemented directly by the European Union (EU). Since its final goal is fostering innovation and competitiveness, it is advisable to analyze the spatial distribution of this instrument across EU regions. The main aim of this paper is to analyze the regional allocation of the coordination and participation in projects under the 6<sup>th</sup> and the 7<sup>th</sup> FPs, as well as the distribution of funds from Horizon 2020 (the 8<sup>th</sup> FP). For this purpose, a comprehensive database regionalized at NUTS 2 level was elaborated based on the data supplied by CORDIS and the Smart Specialisation Platform. Moreover, in order to tackle the relationship between FPs and regional development, NUTS 2 regions were classified into three groups: less developed regions, middle-income regions and developed regions. Our empirical evidence underlines different trends in this tool of the innovation policy mix. The general trend points to a positive correlation between the level of development and the capacity to attract FPs projects and funds. Therefore, FPs might contribute to reinforcing pre-existing innovation hubs and long-term growth disparities. Thus, coordination and participation in projects, as well as the funds allocated in the FPs are heavily concentrated in the developed regions. Middle-income regions attract more projects on average than less developed regions, although the disparities among them are not particularly high. Concerning less developed regions, there are two*

1 Pedro Varela-Vázquez, Ph.D., Lecturer at the Department of Business Management and ICEDE Research Group. Faculty of Economics and Business. Universidade de Santiago de Compostela, Avenida do Burgo s/n, 15782 Santiago de Compostela, Galicia, Spain, e-mail: [pedro.varela.vazquez@usc.es](mailto:pedro.varela.vazquez@usc.es) (ORCID ID: 0000-0002-9276-669X), corresponding author.

2 Manuel González-López, Ph.D., Associate Professor at the Department of Applied Economics and ICEDE Research Group. Faculty of Economics and Business. Universidade de Santiago de Compostela, Avenida do Burgo s/n, 15782 Santiago de Compostela, Galicia, Spain, e-mail: [manuel.gonzalez.lopez@usc.es](mailto:manuel.gonzalez.lopez@usc.es) (ORCID ID: 0000-0002-2645-011X).

3 María del Carmen Sánchez-Carreira, Ph.D., Assistant Professor at the Department of Applied Economics and ICEDE Research Group. Faculty of Economics and Business. Universidade de Santiago de Compostela. Avenida do Burgo s/n, 15782 Santiago de Compostela, Galicia, Spain, e-mail: [carmela.sanchez@usc.es](mailto:carmela.sanchez@usc.es) (ORCID ID: 0000-0001-9265-2521).

Received 30 October 2018; Revised 6 February 2019; Accepted 15 February 2019

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

---

*different groups of regions. One of them is characterized by a remarkable number of project coordinations that attract funds, even higher than some middle-income regions; while the other group shows a low number of coordinations or participations in projects. Comparing the 6<sup>th</sup> and the 7<sup>th</sup> FPs, we observe a slight reduction of the disparities, particularly due to the higher participation of regions from Spain, Portugal and Italy, which were among the hardest hit by the economic recession in Europe. This trend could be explained by the need to compensate the reduction of regional and national funds by means of being more active in capturing EU funds.*

**Keywords:** Framework Programmes, innovation policies, cohesion policy, regional development, less developed regions

---

## INTRODUCTION

---

The Framework Programmes stand out as one of the main instruments to foster research and innovation in the European Research Area since their launching in 1984 (Guzzetti, 1995; Dávid, 2016; Reillon, 2017). Likewise, several studies pointed out the spillover effects of the EU Framework Programmes (Vence, Guntín, & Rodil, 2000; Boldrin & Canova, 2001; Hudson, 2007; Reid, 2007; Rodil, Vence, & Sánchez, 2014). This instrument is aimed at promoting research, technological development and innovation across Europe by means of funding international consortia (European Commission, 2016; Dávid, 2016; Reillon, 2017). In this regard, its allocation rationality is mainly based on scientific excellence and industrial leadership and, therefore, it does not consider regional cohesion criteria. Given their increasing relevance in terms of financial support in the European budget (European Commission, 2018), it should be key to analyze the geographical distribution of projects and funds, as well as its recent trends. In other words, we are wondering which regions are the main beneficiaries of this instrument. This issue was mainly addressed from a historical and theoretical point of view, as well as at national levels (Vence, 1998; Vence et al., 2000; Dávid, 2016; Reillon, 2017; Izsák & Radošević, 2017; Özbolat & Harrap, 2018). Therefore, it might be valuable to shed light on the main recent dynamics of this instrument at the regional level.

The main aim of this paper is to analyze the spatial distribution of the coordination and participation in projects under the 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes, as well as regarding the current Horizon 2020 (8<sup>th</sup> FP) funding. For this purpose, NUTS 2 regions are classified into three groups according to their economic development level in terms of GDP per capita. The methodology is based on a descriptive analysis of a database which contains information about coordination and participation in these projects. This comprehensive database was built by the authors from the CORDIS dataset, as well as regionalized at NUTS 2 level. Concerning the Horizon 2020, this study is based on the data

from the Smart Specialisation Platform (European Commission, 2018). Given all these characteristics, this methodology represents a step ahead from previous analyses, which have hardly considered the geographical allocation of projects and funds regarding the level of regional economic development (Dávid, 2016; Izsák & Radošević, 2017).

The paper is structured in four sections. The first section deals with the dilemma between place-based and place-neutral policies pointed out by the literature on regional development policies. The following section introduces the spatial dimension of the EU research and innovation policy. In this regard, this section briefly describes the origin and evolution of the research and innovation policy in the EU and, later, it focuses on the Framework Programmes from the regional dimension. The third section shows the main results concerning the regional distribution of projects and funds from the 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes and Horizon 2020. Finally, the last section approaches the discussion and the policy implications from the main results of this paper.

### **Place-based vs. place-neutral policies**

One of the key debates within the field of regional development refers to the existence of two different approaches for public intervention: the so-called place-based and place-neutral perspectives. On the one hand, place-neutral approach argues that policies should target development problems with the same recipes regardless of the region characteristics. Promoting spatially-blind institutions (e.g., those defending property-rights), connectivity infrastructure and factors mobility would be the most effective way of generating growth and welfare for individuals. The fact that such measures might reinforce agglomerations does not constitute a real issue. Thus, the focus of these policies is increasing the welfare of individuals, regardless of which region they live in (Barca, McCann, & Rodríguez-Pose, 2012). This perspective, which is also coherent with a sectoral approach to policies, rests mainly on two studies: the so-called Sapir Report (Sapir et al., 2014) and the World Development Report Reshaping Economic Geography (World Bank, 2009).

On the other hand, the place-based approach assumes that the territorial context, understood in terms of social, cultural and institutional characteristics, matters for policy intervention. Moreover, it considers that policy design and implementation should involve local stakeholders for being effective. This view rests largely on the work *An Agenda for a Reformed Cohesion Policy* made by Barca (2009) for the European Commission, as well as on two OECD reports that highlight the relevance of regions in economic development (OECD, 2009a, 2009b). From a policy perspective, the particularities of regions make ineffective the “one-size-fits-all” approach

and, for this reason, the place-based argument suggests that development strategies should focus on mechanisms that build on local capabilities and promote innovative ideas. Such ideas would come through the interaction of local and exogenous actors, sharing different knowledge basis, with the aim of overcoming local failures (González-López, Dileo, & Losurdo, 2014).

The place-based approach is used by the current EU cohesion policy (2014-2020) and particularly in the smart specialization strategies (S3), which are the theoretical foundation of this policy. In this way, EU regions must design and implement a S3 in order to receive structural funds. The S3 are based on a bottom-up process, where the main regional stakeholders participate, taking into account the specific characteristics of each region. Nevertheless, other EU policies do not follow a place-based approach, but they are rather sectorial and place-neutral. It is the case of the research and technology policy, and it is partially the case of the agricultural policy, which after recent reforms, shares both place-based and place-neutral approaches. In this regard, this paper analyzes the geographical distribution of the main instrument of the EU research and technological policy, the Framework Programmes (FPs) for research and innovation, which are an example of a space-blinded policy.

Our analysis links also with one of the on-going debates about EU policies, which regards the need for coordination between different policies and instruments and, particularly, their alignment with the cohesion objective of the EU (Begg, 2008; Rodríguez-Pose & Novak, 2013; Rodil, et al., 2014; Crescenzi, De Filippis, & Pierangeli, 2015; Foray, Morgan, & Radošević, 2018a, 2018b). In this way and referring to the EU RTD policy, Reillon (2017) points out that the need for spreading the benefits of the EU Framework Programmes to all regions remains a pending issue. Thus, the main criterion for selecting projects in the FPs has been excellent science, which would lead to the concentration of research and innovation capacities in some areas or regions.

## **The spatial dimension of the research and innovation policy**

### **a) The EU R&I policy: Origin and evolution**

The research and innovation (R&I) policy in the European Union comes back to the mid-eighties when it was explicitly included in the title VI of the Single European Act (dedicated to “Research and Technological Development”). From that moment, research and technological policy becomes one of the formal community policies. Its aim is to strengthen the scientific and technological basis of European industry and to encourage it to become more competitive at international level (Guzzetti, 1995; Vence, 1998; Reillon, 2015, 2017). The EU R&I policy is based on a multilevel model because powers to implement



policies are distributed among the different levels of government. Besides the national powers, some authors underline the increasing role played by the regional level (Landabaso, 2000; De Brujin & Lagendijk, 2005; Tödtling & Trippl, 2005; Fernández, Castro, & Zabala, 2007; Fernández, Mas-Verdu, & Tortosa, 2010). The interventions of the European Union in this field are based on the subsidiarity principle, supplementing the national and regional actions. In contrast to many other EU policies, which are implemented and executed by national governments, the majority of the EU innovation actions are directly implemented by the European Commission. They tend to consist of funding for research and innovation, additional to the regional and national budgets.

The Directorate General R&I is the Department of the Commission in charge of the EU policy on research, science, and innovation. However, due to the cross-cutting nature of innovation, other departments (also Directorates General) manage some innovation issues.

## **b) The R&D Framework Programmes**

The main instrument of the EU to foster research and technological development has been the multiannual R&D Framework Programmes (FPs). These programmes set the thematic priority areas for science and technology in a certain period. Since the Treaty of Maastricht, the FPs are not only a programming tool but also a financial tool (Guzzetti, 1995; Vence, 1998; Reillon, 2017). The 1<sup>st</sup> FP was launched in 1984 and focused on research in biotechnology, telecommunications and industrial fields. In this regard, fostering collaborative research arose at that moment as one of the main aims of this research and innovation instrument. The 4<sup>th</sup> FP 1994-1998 is the first one after the Maastricht Treaty and joins all the different and fragmented R&D community actuations in order to improve efficiency and coordination (Vence, 1998; European Commission, 2016). From the 5<sup>th</sup> FP onwards, proposals had to be submitted through an international consortium, and they had to prove a European-level impact (Dávid, 2016). These programmes continued until the 7<sup>th</sup> FP (2007-2013) (European Union, 2016), when they are ongoing through Horizon 2020 (also called the 8<sup>th</sup> Framework Programme for the period 2014-2020), with a budget of 77 billion euros. They have focused on funding research and innovation projects, promoting cooperation among disciplines, countries, and partners.

The evolution of the FPs (Table 1) shows an increasing budget, mainly from the 7<sup>th</sup> Framework Programme. These higher budgets highlight the growing relevance of research and innovation for the EU. Thus, the EU allocated less than 2% of its budget to research in 1981, while nowadays, it is roughly 7.5% (Reillon, 2017). Despite their main focus on research, it is noticed increasing

attention to innovation issues in the EU policy. The increasing focus on the SMEs is another feature of this shift, as it is shown by the 7<sup>th</sup> FP, which is complemented by the Competitiveness and Innovation Programme (€3.6 billion) (Rodil, 2007). Concerning the agents involved, universities accounted for the bulk of the funding from the 7<sup>th</sup> FP, reaching 44% of the total. Other relevant actors are research and technology organizations, SMEs and large private firms, which mean 27%, 13% and 11% of the total funds, respectively (Dávid, 2016).

**Table 1.** Timeline of FPs and their budgets

Framework Programme	Period	Budget (€ Billion)
1 <sup>st</sup> Framework Programme	1984-1987	3,74
2 <sup>nd</sup> Framework Programme	1987-1991	5,36
3 <sup>rd</sup> Framework Programme	1990-1994	6,60
4 <sup>th</sup> Framework Programme	1994-1998	13,12
5 <sup>th</sup> Framework Programme	1998-2002	14,96
6 <sup>th</sup> Framework Programme	2002-2006	17,50
7 <sup>th</sup> Framework Programme	2007-2013	53,20
8 <sup>th</sup> Framework Programme	2014-2020	74,80

(Horizon 2020)

Source: own elaboration based on European Commission.

The current EU FP is called Horizon 2020, and it corresponds to the 8<sup>th</sup> FP. It is launched in the context of the Europe 2020 Strategy, addressing three main issues: excellent science, industrial leadership, and tackling societal challenges. Horizon 2020 gathers all its R&I funding from the EU, including the European Institute of Innovation & Technology (EIT) initiatives. Its scope is broad, because it provides funding from the idea to the market, covering research and innovation. This programme is not only structured by thematic areas, but also by challenges. In this regard, the main challenges are social ones, such as health, clean energy or transport. Finally, Horizon 2020 attempts to simplify the procedures and rules of the funding, making it easier to apply for and access grants for all participants, as well as reducing bureaucracy and time.

### c) The regional dimension in the EU Framework Programmes

As pointed out above, the FPs are mainly based on excellent science and industrial leadership. Although there were some attempts to introduce a criterion concerning greater cohesion in the selection criteria, mainly based

on the idea of leveraging synergies between these programmes and the structural funds (Corpakis, 2016; De Carli, 2017; Reillon, 2017), this is still a pending issue. This situation led to the creation of instruments under Horizon 2020, whose objectives are to ‘spread excellence’ and ‘widen participation,’ but with a very limited budget (less than 2% of the Horizon 2020 budget) (Reillon, 2017). As pointed by this author, there is a conflict between the excellence and the cohesion criteria, as the application of the excellence criterion tends to lead to a concentration of research and innovation capacities in some areas or regions. Some studies have shown that well-developed regions attract a large share of such funds (Commission of the European Communities, 1993, 1994; Vence, 1998; Özbolat & Harrap, 2018).

Moreover, most of the cases show a positive relationship between participation and returns with the level of R&D expenditure, both at national/regional levels and agent level. This implies that this kind of policies might have an important feedback effect on pre-existing regional disparities. Therefore, the uneven regional distribution of EU innovation policy has not only effects in the short term, but also in the long term, due to the cumulative character of innovation. Likewise, there is feedback between the participation in R&I activities and the building of regional innovation capacities and learning (Vence, 1998; Rodil, 2007). In any case, Rodríguez-Pose (2018) argues that if policy intervention is place-sensitive through considering specific regional development strategies, it could balance excellence criteria as well as regional cohesion aims.

## **Spatial analysis of the Framework Programmes**

European integration aims to achieve sustained growth based on higher levels of competitiveness. Likewise, it also considers social and territorial cohesion as one of its main targets. Even though these aims may be compatible (Rodríguez-Pose, 2018), it would be complex to reach them simultaneously (Rodil et al., 2014). A divergent path might lead to an increase in competitiveness, but at the cost of the cohesion and regional development (Begg, 2008; Cornett & Sørensen, 2008; Rodríguez-Pose & Novak, 2013; Rodil et al., 2014; Foray et al., 2018a, 2018b; Özbolat & Harrap, 2018). Thus, it is advisable to wonder whether the current dynamics of the spatial distributions of the FPs foster both innovation and territorial cohesion.

This section addresses the geographical distribution of the participation and coordination of research and technological development projects under the 6<sup>th</sup> and 7<sup>th</sup> FPs (2002-2013). Likewise, current geographical trends of the investments allocated under Horizon 2020 (2014-May 2017) are analyzed in the second subsection. This study considers useful to differentiate between

coordination and participation in projects because coordination usually requires more capabilities than participation.

## METHODOLOGY

The methodological framework is based on the descriptive analysis of a comprehensive database elaborated by the authors from the CORDIS dataset. It includes a wide array of information regarding the research and technological development projects funded by the European Union under the 6<sup>th</sup> and 7<sup>th</sup> FPs. In this regard, projects are classified regarding the role played by the different agents involved, that is coordination and participation. The authors regionalized these data at NUTS 2 level and later organized them into the analyzed FPs and regions. Likewise, the NUTS 2 breakdown was harmonized in order to maintain geographical coherence over time. Complementarily to CORDIS, the database used in this study is also based on information from Eurostat regarding regional economic development. Concerning the Horizon 2020 programmes, data are gathered from the Smart Specialisation Platform (European Commission). The elaborated comprehensive database makes easier the analysis of the geographical distribution of the different instruments addressed in this paper at NUTS 2 level, as well as enlightening the main insights of these tools regarding regional economic development.

The database used in this study regionalizes data from more than 140,000 projects under the 6<sup>th</sup> and 7<sup>th</sup> FPs. Moreover, all the projects are classified into 276 regions, following the NUTS 2013 classification at level 2. It should be noted that the CORDIS dataset did not provide NUTS 2 codes. Therefore, it was required to regionalize each project based on the available geographical information in that dataset. As a result, the database is filtered in order to quantify the number of coordinations and participations in projects under both FPs per each NUTS 2 region. In this regard, Table 2 summarizes the number of projects, as well as the number of regions analyzed in each FP. As it is shown, the total number of projects increased sharply to 42.7% between the 6<sup>th</sup> and 7<sup>th</sup> FPs.

**Table 2.** Summary statistics of the granted projects in the 6<sup>th</sup> and 7<sup>th</sup> FPs

	Number of projects	Number of regions (NUTS2)
6 <sup>th</sup> FP	57,984	276
7 <sup>th</sup> FP	82,770	276

Source: own elaboration based on CORDIS.

### a) Regional participation in the 6th and 7th Framework Programmes

Concerning the total breakdown between the coordination (Cfp) and participation (Pfp) in the FPs, Table 3 depicts descriptive statistics regarding the total and the average number of coordinations and participations in projects per region, as well as the standard deviation and the minimum and maximum values. As a first approximation, it should be pointed out that projects under both FPs are unevenly distributed geographically. Furthermore, this uneven distribution is higher in the coordination than in the participation in projects. However, there is a slight reduction in the geographical concentration between the 6<sup>th</sup> and the 7<sup>th</sup> FPs.

**Table 3.** Summary statistics of coordination and participation in projects in the 6<sup>th</sup> and 7<sup>th</sup> FPs

	Sum	Mean	Std. Dev.	Min	Max.
Cfp6	8,540	30.94	66.27	0	848
Pfp6	49,444	62.52	129.85	0	1,534
Cfp7	17,255	179.14	322.08	0	3,717
Pfp7	65,515	237.37	419.78	0	4,547

Note: Cfp6 and Cfp7 mean coordination of projects under 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes, respectively. Pfp6 and Pfp7 mean participation in projects under 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes, respectively.

**Source:** own elaboration based on CORDIS.

One complimentary way to analyze the concentration of the coordination and participation in the different projects under the analyzed FPs could be the Herfindahl index. An index value close to 1 means heavy concentration and 0, otherwise. Equation 1 shows it in mathematical terms

$$H = \sum_{i=1}^n s_i^2; \quad (1)$$

where  $s_i$  is the share of region  $i$  in the total of coordination and participation in projects. As Table 4 shows, coordination and participation in the sum of the two FPs show a moderate concentration (0.019 and 0.015; respectively), but the concentration is higher in the case of the coordination in projects. Moreover, the concentration of the coordination in projects slightly reduces between the sixth (0.020) and seventh FPs (0.019). The same trend is described in the participation in projects: from 0.0153 to 0.0149.

**Table 4.** Geographical concentration of coordination and participation in projects through the Herfindahl index

	Cfp6	Cfp7	Pfp6	Pfp7	Cfp6-Cfp7	Pfp6-Pfp7
H index	0.02018	0.01920	0.01529	0.01491	0.01933	0.01502

Note: Cfp6 and Cfp7 mean coordination of projects under 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes, respectively. Pfp6 and Pfp7 mean participation in projects under 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes, respectively.

Source: own elaboration based on CORDIS.

Tables 5 and 6 highlight some descriptive statistics of the coordination and participation in FP projects, in terms of the regional economic development and the population. For this purpose, all the regions were classified into three different groups regarding their regional GDP per capita in PPS in comparison with the EU-28 average. The first group, called “less developed regions” (LDR) includes all the regions below 75% of the EU average. The next category called “middle-income regions” (MIR), encompasses those regions between 75 and 100% of the EU average. Finally, “developed regions” (DR) includes all the regions above the EU average. In this way, this differentiation regarding regional economic development makes easier to analyze spatial singularities. In addition, Tables 5 and 6 show the level of regional economic development in 2000, 2009 and 2015; given that these years represent two years before the starting of the 6<sup>th</sup> FP, one year after the beginning of the economic recession and two years after the end of the 7<sup>th</sup> FP, respectively. Likewise, the number of coordinations and participations in projects is expressed per million of inhabitants.

According to Tables 5 and 6, some patterns can be drawn from the geographical distribution of the coordination and participation in projects, in terms of the regional economic development. Firstly, the coordination and participation in the FPs, per million of inhabitants, go hand in hand with the level of regional economic development during the whole period analyzed. As it is shown in these tables, developed regions outperform the other in terms of the average number of coordinated and participated projects. This phenomenon is expected because the ability of coordinating or participating in international projects is a function of long-term research and innovation (R&I) capabilities, which are the foundations of long-term economic growth. The same occurs between middle income and less developed regions, except for the 7<sup>th</sup> FP.

Secondly, less developed regions show higher levels of disparities in the coordination and participation in projects in comparison with the other two groups of regions, which are more homogenous, especially the developed regions. In this regard, R&I capabilities and infrastructure, as well as the effect of previous support policies and expertise, might explain these two different

patterns. This pattern may resemble the Mathew's effect in which success breeds success (Merton, 1968). As the virtuous circles of the Mathew's effect, Myrdal (1957) asserts that more developed regions are more able to attract investment, employment, and new activities than less developed regions. In this regard, regional partners face difficulties and barriers to apply and participate in FPs, at least for the first time. This fact could be linked with the absorption capacity, which tends to be low in less developed regions (Tesfaye & Kitaw, 2018; Pelikánová, 2019). Therefore, it is needed to build these capabilities. However, it should be noted that many less developed regions coordinated or participated in more projects per million of inhabitants, than many middle-income regions, especially in the 7th FP. This interesting issue needs further research that is beyond the aim of this paper.

Moreover, there can be other qualitative criteria (even not formal), which are considered in the evaluation of applications (such as a broad geographical consortium, the composition of the network, former collaborations). Balland and Ravet (2018) analyze the networks involved in the FPs from the 6th FP until the ongoing Horizon 2020, from a dynamic perspective. They show that different factors, such as cultural and geographical proximity, play an important role in shaping the structure of the network. Moreover, they find a high dynamic and relatively open network of partners over time, although there are some persistently peripheral countries (Balland & Ravet, 2018).

Despite some authors underline the negative effects of the 2008 financial crisis on R&I funds and policies in Southern and, to a lesser extent, Central-Eastern Europe (Izsák & Radošević, 2017), there is no global evidence regarding the FPs. In this way, there are negative and statistically significant correlations between the variation of GDP per capita in 2009-2015 and the coordination and participation in projects per million of inhabitants. However, it would also be advisable to analyze this evolution in more detail with the specific data of these geographical areas.

Going into detail of the specific regional data at NUTS 2 level, Figure 1 describes the sum of the coordinated projects under the 6<sup>th</sup> and 7<sup>th</sup> FPs per million of inhabitants in each region. It should be noted that the number of regions in each category appears in brackets in the legend. Firstly, this figure emphasizes the concentration of coordinated projects around a few hubs. Most of them are identified with the highest per capita income regions, such as Bavaria (DE21), Ile-de-France (FR10), Brussels (BE10), Wien (AT13), Copenhagen (DK01), Greater London (UKI) or Vlaams-Brabant (BE24). Despite their income per capita below the average, there are some unexpected results regarding some regions in Greece (EL41, EL43, EL53, EL54), which show a high number of coordinated projects per million of inhabitants. With a GDP per capita between 49% and 67% of the European average, they

**Table 5.** Summary statistics of coordination and participation in projects per million of inhabitants regarding the regional economic development

Sum	Cfp6/POP				Pfp6/POP				Cfp7/POP				Pfp7/POP							
	Mean	Std. Dev.	Min.	Max.	Sum	Mean	Std. Dev.	Min.	Max.	Sum	Mean	Std. Dev.	Min.	Max.	Sum	Mean	Std. Dev.	Min.	Max.	
LDR	503	7	13	0	64	3,491	45	66	0	344	1,376	18	49	0	294	5,760	75	141	0	787
MIR	687	10	16	0	117	3,989	59	76	0	473	1,377	20	32	0	208	5,453	80	102	0	553
DR	3,183	24	26	0	187	18,572	142	142	0	1,040	6,186	47	46	0	208	23,534	180	179	4	1,393
LDR	458	6	12	0	64	3,026	41	63	0	344	1,201	16	44	0	294	4,893	66	128	0	787
MIR	919	10	17	0	117	4,591	52	52	0	289	1,935	22	40	0	227	6,456	73	96	0	619
DR	2,996	27	26	0	187	18,434	163	149	0	1,040	5,802	51	45	0	208	23,398	207	185	10	1,393
LDR	673	8	18	0	117	3,654	44	68	0	344	1,813	22	53	0	294	6,473	77	147	0	787
MIR	835	9	12	0	81	5,128	58	65	0	473	1,574	18	25	0	176	6,254	71	76	0	553
DR	2,866	28	27	0	187	17,269	166	149	0	1,040	5,552	53	46	0	208	22,020	212	187	10	1,393

Source: own elaboration based on CORDIS.

**Table 6.** Summary statistics of the total coordination and participation in projects per million of inhabitants regarding the regional economic development

Sum	Cfp6_7/POP				Pfp6_7/POP					
	Mean	Std. Dev.	Min.	Max.	Sum	Mean	Std. Dev.	Min.	Max.	
LDR	1,879	24	62	0	358	9,250	120	202	0	1,037
MIR	2,064	30	47	0	324	9,442	139	175	0	1,026
DR	9,369	72	70	0	395	42,106	321	319	17	1,273
LDR	1,660	22	56	0	358	7,919	107	186	0	1,037
MIR	2,854	32	56	0	324	11,047	124	143	0	835
DR	8,798	78	69	0	395	41,832	370	331	17	2,415
LDR	2,486	30	69	0	358	10,127	121	210	0	1,037
MIR	2,409	27	37	0	257	11,382	129	138	0	1,026
DR	8,418	81	71	0	395	39,289	378	333	17	2,432

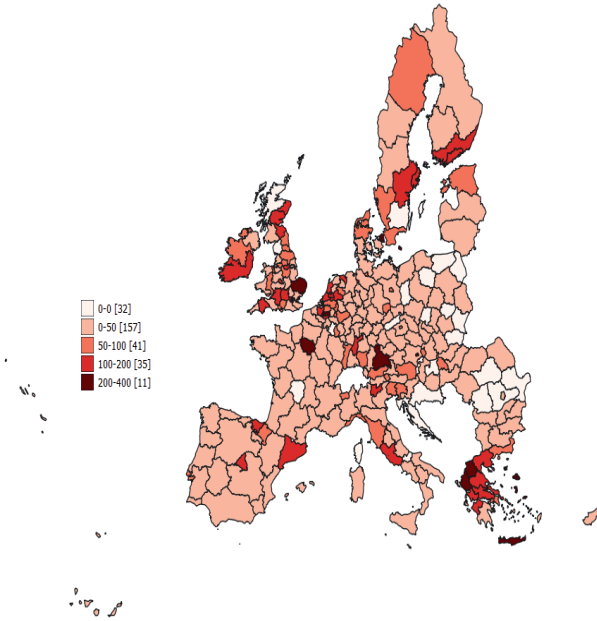
Source: own elaboration based on CORDIS.



represent a good example of the aforementioned group of regions with an outstanding performance in the coordination of projects. Concerning regions in the European GDP per capita average, East Anglia (UKH1) stands out as one of the leaders in terms of coordinated projects. These results are in line with previous studies, which pointed out that the bulk of the projects are allocated in the three main regions in each country (Commission of the European Communities, 1993, 1994; Vence, 1998).

In addition, many less developed regions stand out in the second level of hubs in terms of coordinated projects (between 100 and 200 projects per million of inhabitants). Once again, some Greek regions (EL52, EL61, EL63) show very acceptable performance in comparison with their economic performance. Moreover, the case of South Yorkshire (UK3) should be noted, which coordinated more than 108 projects per million of inhabitants in the 6<sup>th</sup> and 7<sup>th</sup> FPs, but its GDP per capita was below 75% of the EU average in 2015. The third level of regions from the top (between 50 and 100 projects per million) constitutes the “middle class.” In the same way, as in the first and second level, the developed, or middle-income regions take the lion’s share. However, few less developed regions were able to enter in this level, such as the case of Estonia (EE00), North East England (UKC1) or Eastern Macedonia and Thrace (EL51). Finally, there is a large group of developed and middle-income regions with a weak performance, due to these regions coordinate less than 50 projects per million of inhabitants.

Figure 2 depicts the number of participations in projects in both FPs per million of inhabitants. As mentioned above in the summary statistics in Table 3, this figure shows less concentration than the coordinated projects. In this regard, this map paints a uniform color across the EU. In any case, there are also some important hubs with a high concentration of participation in projects in both FPs, such as Wien (AT13), Brussels (BE10), Valle d’Aosta (ITC2) and Ljubljana (SI04). All of them are developed or middle-income regions as in the last case. However, the Greek region of Epirus (EL54) also stands out as one of the main hubs with 1,037 participations in projects per million of inhabitants in the 6<sup>th</sup> and 7<sup>th</sup> FPs. Figure 1, and to a lesser extent Figure 2, demonstrate the high concentration of projects around capital states and other relevant economic cities. This is the case in France, Hungary, Romania, Spain, Portugal and Germany.



**Figure 1.** Number of coordinated projects under the 6<sup>th</sup> and 7<sup>th</sup> FPs per million of inhabitants

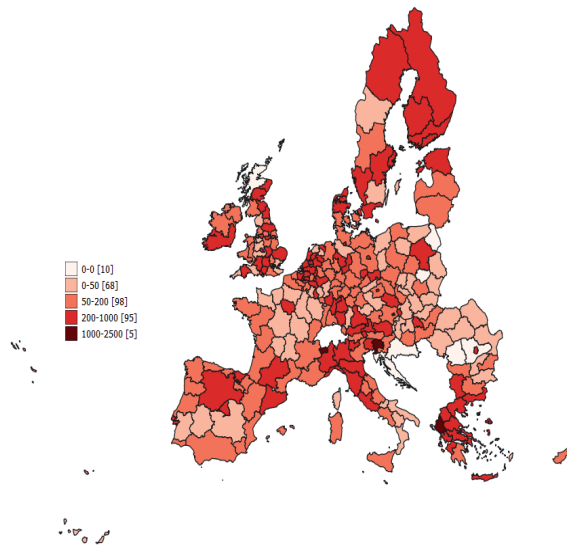
**Note:** Hereinafter, the number of regions is in brackets.

**Source:** own elaboration based on CORDIS.

Developed and middle-income regions represent the bulk of the second level (regions between 200 and 1000 participations in projects per million of inhabitants). Some less developed regions highlight, such as the capital city Sofia (BG41), Estonia (EE00) and South Yorkshire (UK3). Moreover, eight Greek regions also stand out to this respect (EL41, EL43, EL51, EL52, EL53, EL61, EL63, EL64). It is advisable to underline that many of these Greek regions underwent a severe downgrading in their levels of GDP per capita between 2009 and 2015. Despite the effects of the economic recession, these regions might have partially kept previous R&I capabilities in order to participate and coordinate European projects.

Regarding the coordinated projects, it could be useful to analyze the geographical distribution of the 6<sup>th</sup> and 7<sup>th</sup> FPs, as well as its evolution. Comparing Figures 3 and 4 makes this task easier, especially concerning different regional patterns. At a glance, there was a general reduction of the polarization of the coordinated projects between the two FPs. In this way, a moderate reduction takes place in the regions with projects between 0 and 10, and 10-50. Furthermore, there was a slight reduction in the regions

without projects. Likewise, the number of regions with more than 50 projects per million of inhabitants increased sharply. In any case, this general trend should be nuanced, because the general budget and the number of projects have also increased between the two FPs.

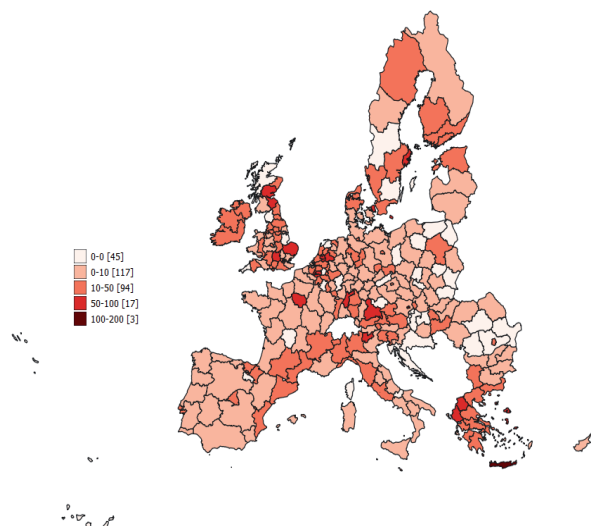


**Figure 2.** Number of participations in projects under the 6<sup>th</sup> and 7<sup>th</sup> FPs per million of inhabitants

Source: own elaboration based on CORDIS.

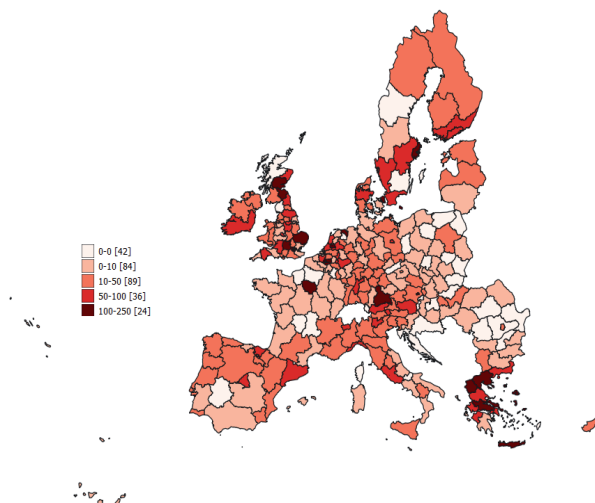
Spain, Portugal and Germany show a more well-balanced distribution at regional level of coordinated projects in the 7<sup>th</sup> FP in comparison with the previous one. These countries could upgrade several regions and reduce the differences with the capital state or the most dynamics economic hubs. France and Sweden are clear exception of this trend, in which the polarization in the coordinated projects remains stable or even increased in the 7<sup>th</sup> FP.

Regarding the participation in projects, Figures 5 and 6 enlighten the evolution of the geographical distribution of the participation in projects, which makes the identification of different patterns easier. These figures show a slight reduction in the concentration of the participation in projects between the 6<sup>th</sup> and 7<sup>th</sup> FPs. Looking into detail, the number of regions at first and second bottom levels (between 0 and 100 participated projects per million of inhabitants) moderately reduces. This trend is combined with a proportional increase in the regions included in the next two levels, remaining unchanged those regions above 800 projects per million of inhabitants.



**Figure 3.** Number of coordinated projects under the 6<sup>th</sup> FP per million of inhabitants

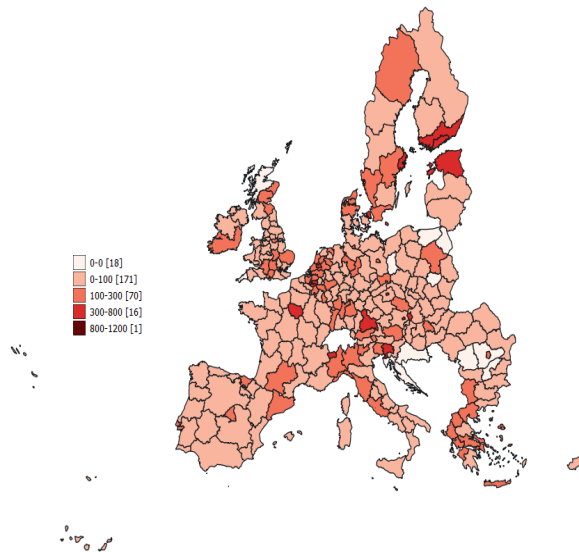
Source: own elaboration based on CORDIS.



**Figure 4.** Number of coordinated projects under the 7<sup>th</sup> FP per million of inhabitants

Source: own elaboration based on CORDIS.

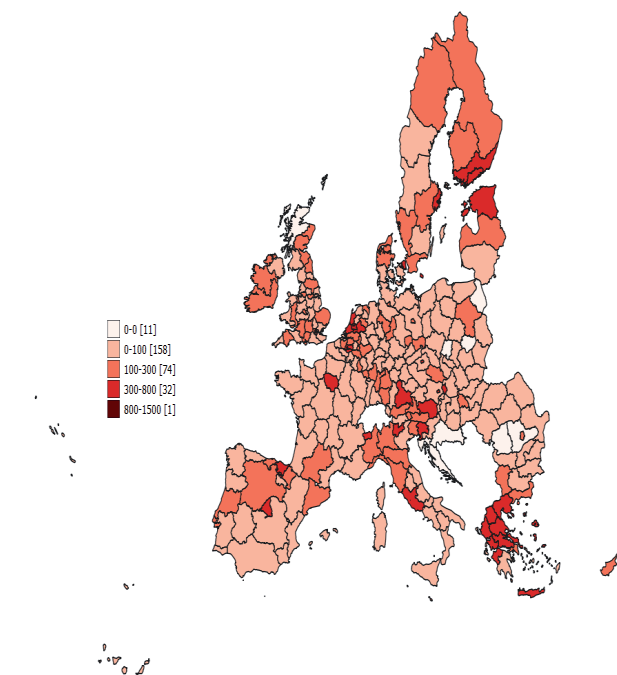
Concerning specific national patterns, Southern Europe is characterized by a reduction in the concentration of the participation in projects and the upgrading process of their less developed regions. This phenomenon is evident in Spain, Portugal, Italy and Greece. In this regard, there is no evidence of a negative impact of the economic recession in the participation of these countries during the 7<sup>th</sup> FP. In addition, the same trend is evident in Northern Europe, such as in the case of Finland, Ireland, the United Kingdom and Latvia. However, France and many areas in Central-Eastern Europe tend to maintain their geographical distribution of the participation in projects over time.



**Figure 5.** Number of participations in projects under the 6<sup>th</sup> FP per million of inhabitants

Source: own elaboration based on CORDIS.

The descriptive analysis carried out in this subsection enables us to shed light on the main geographical features and trends of the 6<sup>th</sup> and 7<sup>th</sup> FPs. In order to complement this overview, it would be advisable to examine the ongoing FP: the 8<sup>th</sup> FP also called Horizon 2020. This last task makes easier a comprehensive comparison of these competitive-oriented R&I European policies.



**Figure 6.** Number of participations in projects under the 7<sup>th</sup> FP per million of inhabitants

Source: Own elaboration based on CORDIS.

#### a) Regional funds from Horizon 2020

Horizon 2020 (H2020) is the ongoing FP, which provides support for R&I initiatives during the period 2014-2020. It accounts for 77 billion euros, being one of the main instruments to foster the European Research Area (European Commission, 2018). The main aim of this subsection is to analyze the main geographical features of the funds allocated by H2020 through the last available data (May 2017) in terms of regional economic development. As H2020 is the ongoing FP, final data is not available regarding the geographical distribution of coordination or participation in projects.

Table 7 shows the summary statistics related to the total H2020 funding per capita regarding regional economic development in 2015. Firstly, it should be noted that these funds are more concentrated in the DRs in comparison with MIRs and LDRs. On average, DRs have received almost five times more financial resources than LDRs and more than three times than MIRs. This expected feature of H2020 supports the pattern described in the 6<sup>th</sup> and 7<sup>th</sup> FPs. Comparing the dispersion of values among the three levels of economic

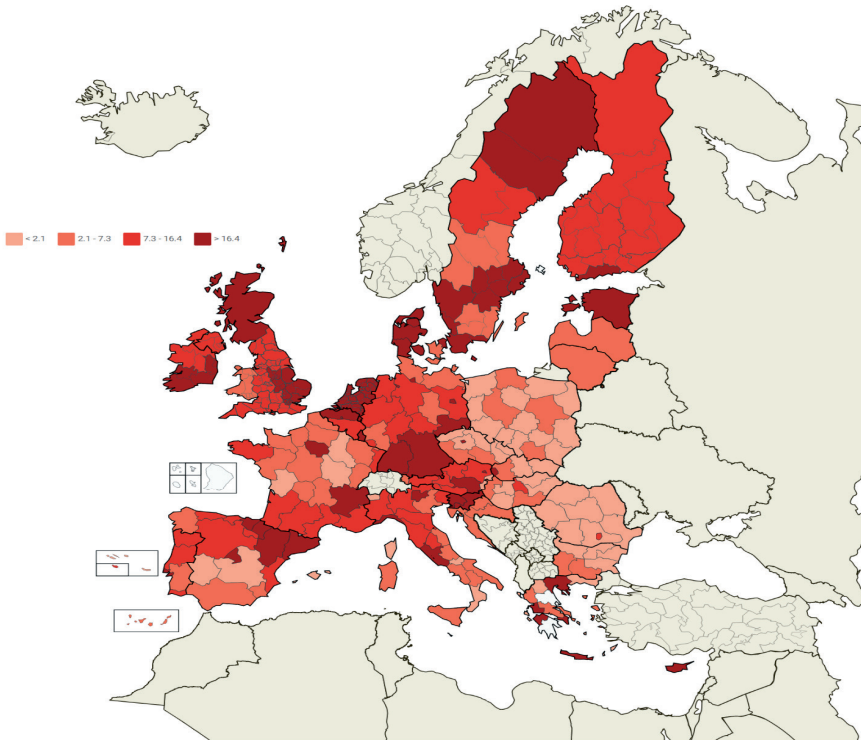
development, LDRs are more heterogeneous than the other two groups. In fact, dispersion is inversely proportional to GDP per capita. It is advisable to underline that LDRs have captured more funds than MIRs because of the former accounts for 92 regions and the latter for 36.

**Table 7.** Summary statistics of H2020 funding in euros per capita per year allocated until May 2017 regarding regional economic development in 2015

	<b>Sum</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min.</b>	<b>Max.</b>
LDR	416.69	4.79	6.97	0.06	35.16
MIR	285.08	7.92	6.83	0.87	26.40
DR	1,644.19	22.22	17.21	1.28	106.59

**Source:** own elaboration based on the Smart Specialisation Platform (European Commission).

The dispersion of the allocated funds in LDRs can be mainly explained again by the performance of some Greek regions. In order to unveil this geographical feature, Figure 7 shows the spatial allocation of this funding. These data were gathered from the Smart Specialisation Platform (European Commission). It should be noted that there are some missing values from two Greek regions because they are not available in the official dataset. Regardless of this deficiency, this map sheds light on the different geographical patterns. In this way, the lion's share of the regions with more funds per capita (above 16.4 €) are classified as DRs. This is supported by previous analyses of the 6th and 7th FPs, more focused on the distribution across countries (Commission of the European Communities, 1993, 1994; Vence, 1998; Vence et al., 2000; Dávid, 2016; Reillon, 2017; Izsak & Radošević, 2017; Özbolat & Harrap, 2018), as well as for the sources of long-term economic growth. Some regions constitute exceptions to this rule, such as the case of Central Macedonia (EL52), Western Greece (EL63), Crete (EL43), Estonia (EE00) and Slovenia (SI). These cases are in line with the trends mentioned above in the 6th and 7th FPs. Furthermore, there is a group of DRs with relatively low performance in the attraction of funds in H2020. They are below 7.3 euros per capita, which means that their performance is more in line with LDRs or MIRs. This is the case in Vorarlberg (AT34), Rhineland-Palatinate (DEB), Schleswig-Holstein (DEF), Sjælland (DK02), Valle d'Aosta (ITC2), Veneto (ITH3), Småland med öarna (SE21) and Norra Mellansverige (SE31).



**Figure 7.** Total H2020 funding per capita per year allocated until May 2017

Source: Smart Specialisation Platform (European Commission).

## DISCUSSION AND POLICY IMPLICATIONS

The Framework Programmes stand out as the main supranational instruments to foster R&D and innovation within the European Research Area. Given that Horizon 2020 currently accounts for roughly 6.9% of the total EU budget (European Commission, 2018), it plays a relevant role in supporting the foundations for long-term regional economic growth. Its relative importance might be even more crucial in a situation of a general decrease of national support in many areas due to the financial crisis (Izsák, Markianidou, & Radošević, 2013; Izsák & Radošević, 2017) and an increasingly fierce international competition for funds (Dávid, 2016). For this reason, regional distribution of projects and funds are key to upgrade regional innovation capabilities and long-term economic growth.

The results of analyzing the geographical allocation patterns of coordination and participation in projects under the 6<sup>th</sup> and 7<sup>th</sup> FPs, as well as



Horizon 2020 funds, underline that the main beneficiaries are the developed regions. Thus, the number of projects per million of inhabitants under the 6<sup>th</sup> and 7<sup>th</sup> FPs in those regions is practically triple the figures of the rest of regions. In the same vein, the funds per inhabitant coming from H2020 until May 2017 managed by developed regions were more than four times greater than the ones managed by less developed regions.

It is expected that if the lion's share of the projects and funds are allocated in those areas, the FPs are boosting pre-existing innovation hubs and, therefore, enhancing long-term growth disparities. This outcome is a direct consequence of the design of this supply-side instrument, which aims at fostering excellent science and industrial leadership with a spatially blinded criterion. Such unequal allocation of projects and funds could hinder regional cohesion and even long-term growth. Thus, as pointed out by Rodríguez-Pose (2018), a structurally uneven regional economic growth could be self-defeating, in terms of well-being, inequality and even social peace. And although some authors have highlighted the role of spillover effects from big agglomerations to less developed regions, empirical evidence is not unanimous at all and, therefore, agglomeration could hardly sustain economic growth and prosperity in the long-term (Tomaney, Pike, & Rodríguez-Pose, 2010; McCann, 2016).

Moreover, concerning the impact of the economic recession of 2008 on the allocation of projects and funds from the FPs, empirical evidence indicates that it has not had an apparent negative effect on the attraction capacity of those regions more hit by the crisis. Many Southern economies, such as Spain, Portugal or Italy, shows a more well-balanced interregional portfolio between the 6<sup>th</sup> and the 7<sup>th</sup> FPs. The explanations could be, on the one hand, that the regional innovation systems of these economies might have overcome the negative hits from the aforementioned crisis. According to this, these regions still have enough technological capabilities in order to coordinate and participate in projects under the FPs. Nevertheless, the negative effects of the 2008 crisis on innovation systems may be seen in the long term, instead of in the short term, mainly in some critical areas such as human resources, technological facilities or the critical mass of agents.

On the other hand, the general decline in national financial support could lead to an increase in the participation of these less developed regions in the FPs; therefore, it is just a matter of necessity and searching for alternative sources of funding. This last hypothesis is in line with some trends described by Izsák et al. (2013), Dávid (2016), or Izsák and Radošević (2017). However, it is vital to ask if European funding from FPs might compensate for the reduction of national support in less developed regions, especially, when these areas are not able to attract the same number of projects and funds

than the developed ones. This issue is crucial in order to close the regional gap regarding disparities in terms of innovation capabilities.

In any case, and despite the relatively better performance of some southern regions, an enormous concentration of resources coming from the EU RTD policy in highly developed regions remains. This issue raises the debate about redesigning this policy with an alternative rationale. In this regard, we agree with authors like Reillon (2017), who recommends increasing the relevance of place-sensitive criteria in the EU innovation policy in order to foster regional cohesion aims. From our point of view, it is advisable to shift the focus from place-blinded policies to other kinds of policies that take into account regional potentialities and capabilities, in order to develop new opportunities (Rodríguez-Pose, 2018).

In particular, FPs could be an instrument that balances efficiency and cohesion by means of supporting innovation and the development of new related activities also in less developed regions. FPs should be redesigned in order to consider interregional disparities in terms of economic development and innovation capabilities, as well as the long-term accumulation effects that stem from the FPs. Combining the excellence criteria with the cohesion criteria, i.e., favoring the participation of less developed regions in the projects and networks funded, could be a good option that might also facilitate spillover effects. This could also be achieved by designing the general challenges of the FPs, as well as the project thematic according to a European portfolio of regional smart specialization strategies. As a result, there could be more synergies between FPs and European Structural Investment Funds (ESIFs), which are more dependent on income per capita levels. In this hypothetical scenario, there would be more opportunities for a homogenous geographical distribution of projects, because FPs would balance innovation and industrial leadership criteria, well-being measures and the regional untapped potential.

## CONCLUSION

---

Framework Programmes stand out as one of the main supply-side instruments aimed at fostering research and innovation in the European Research Area. Given their relevance in terms of financial support in the European budget, as well as in the innovation capabilities and long-term growth, it is advisable to know the geographical distribution in the EU, especially regarding regional economic development. This paper has addressed this issue by means of a comprehensive analysis of the regional allocation of coordination and participation in projects under the 6<sup>th</sup> and 7<sup>th</sup> FPs, as well as of the funds allocated in the ongoing Horizon 2020.

Empirical evidence underlines that developed regions account for the bulk of the coordination and participation in projects and the funds from the FPs instrument. In this way, such unevenly geographical distribution of projects and funds leads to the reinforcement of pre-existing industrial and innovation hubs. In this regard, enhancing research and innovation networks and capabilities in well-established hubs can only trigger the maintenance or the increase of regional disparities. This is the result of a place-blinded intervention, which does not consider any regional singularity. This issue raises the debate about the redesign of such policy with an alternative rationale, giving more relevance to place-sensitive criteria in order to foster regional cohesion aims.

Moreover, there is a slight trend towards the reduction of the concentration in the participation in projects and the attraction of funds. This remarkable feature mainly takes place in many areas in Southern Europe and Germany and, to a lesser extent, in some regions in Northern and Central-Eastern Europe. In the case of Southern Europe, this trend might be paradigmatic due to Spain, Portugal and Italy having undergone a wide array of economic restrictions since the 2008 economic recession. As pointed out by other authors, the increasing participation could be a result of a special effort aimed at compensating the reduction in national financial support.

Regarding further research, firstly it is important to improve the comparison among the 6<sup>th</sup> and 7<sup>th</sup> FPs with the ongoing Horizon 2020 by means of building a whole database with the regionalized data of the coordination and participation in projects. It makes a more homogenous comparison among them easier. Given that Horizon 2020 is ongoing, it is currently a complex task to unify all the data from the three FPs. Secondly, future extensions of this study should also address the impact of FPs on innovation capabilities at the regional level. This issue is crucial to shed light on the policy assessment dimension and enrich the debate regarding the geographical distribution of the support provided by the FPs. Moreover, it is necessary to enlighten the reasons behind the over-performance of the Greek regions under the 6<sup>th</sup> and 7<sup>th</sup> FPs.

## **Acknowledgments**

The Erasmus+ Programme of the European Union Project EURIPER (EU Regional Innovation Policies and Peripheral Regions), under grant number 587410-EPP-1-2017-1-ES-EPPJMO-PROJECT, supported this work.

## References

- Balland, P.A., & Ravet, J. (2018). Dynamic Network Analysis of the EU R&I Framework Programme. Brussels: European Commission. <https://doi.org/10.2777/651302>
- Barca, F. (2009). An agenda for cohesion policy: A place-based approach to meeting Europe Union challenges and expectations (Independent Report prepared at the request of Danuta Hübner, Commissioner of Regional Policy). Retrieved from [http://www.europarl.europa.eu/meetdocs/2009\\_2014/documents/regi/dv/barca\\_report\\_/barca\\_report\\_en.pdf](http://www.europarl.europa.eu/meetdocs/2009_2014/documents/regi/dv/barca_report_/barca_report_en.pdf)
- Barca, F., McCann, P., & Rodríguez-Pose, A. (2012). The case for regional development intervention: Place-based versus place-neutral approaches. *Journal of Regional Science*, 52(1), 134-152. <https://doi.org/10.1111/j.1467-9787.2011.00756.x>
- Begg, I. (2008). Structural policy and economic convergence. *CESifo Forum*, 9(1), 3-9.
- Boldrin, L., & Canova, F. (2001). Inequality and convergence in Europe's regions. Reconsidering European regional policies. *Economic Policy*, 16(32), 207-253.
- Commission of the European Communities. (1993). Cohesion and RTD Policy. Synergies between research and technological development policy and economic and social cohesion policy. Communication from the Commission to the Council and the European Parliament, COM (1993) 203 final. Brussels: European Commission.
- Commission of the European Communities. (1994). The European Report on Science and Technology Indicators 1994 (ERSTI). Brussels: European Commission.
- CORDIS. European Commission. (2018, June). EU research projects under FP6 and FP7. Retrieved from [https://cordis.europa.eu/projects/home\\_en.html](https://cordis.europa.eu/projects/home_en.html)
- Cornett, A.P., & Sørensen, N.K. (2008). International vs. intra-national convergence in Europe – An assessment of causes and evidence. *Investigaciones Regionales*, 13, 35-53.
- Corpakis, D. (2016). Fostering synergies between Horizon 2020 and Cohesion policy. Retrieved from <https://www.kpk.gov.pl/wp-content/uploads/2016/07/synergie-2016-03-17.pdf>
- Crescenzi, R., De Filippis, F., & Pierangeli, F. (2015). In tandem for cohesion? Synergies and conflicts between regional and agricultural policies of the European Union. *Regional Studies*, 49(4), 681-704. <https://doi.org/10.1080/00343404.2014.946401>
- Dávid, Á. (2016). The participation of Austria and Hungary in the Framework Programmes for research and technological development of the European Union. A comparative analysis. *Romanian Journal of European Affairs*, 16(4), 48-67.
- De Bruijn, P., & Lagendijk, A. (2005). Regional innovation systems in the Lisbon strategy. *European Planning Studies*, 13(8), 1153-1172. <https://doi.org/10.1080/09654310500336519>

- De Carli, M. (2017). SEWP and Seal of excellence: Fostering synergies. Retrieved from <http://s3platform.jrc.ec.europa.eu/documents/20182/205894/2.+M+de+CARLI.pdf/0fda6eb5-85ee-4a6c-b4b5-8cbbf4678117>
- European Commission. (2016). The EU explained: Research and innovation. Luxembourg: Publications Office of the European Union.
- European Commission. (2018, October). Horizon 2020. Retrieved from <https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>
- European Commission. (2018, July). Smart Specialisation Platform. Retrieved from <http://s3platform.jrc.ec.europa.eu/synergies-tool>
- Fernández, I., Castro, E., & Zabala, M. (2007). Estrategias regionales de innovación: El caso de regiones europeas periféricas. In X. Vence (Ed.), *Crecimiento y políticas de innovación. Nuevas tendencias y experiencias comparadas* (pp. 157-189). Madrid: Pirámide.
- Fernández, I., Mas-Verdu, F., & Tortosa, E. (2010). Regional innovation policies: The persistence of the linear model in Spain. *The Service Industries Journal*, 30(5), 749-762. <https://doi.org/10.1080/02642060802398093>
- Foray, D., Morgan, K., & Radošević, S. (2018a). The role of smart specialization in the EU research and innovation policy landscape. Retrieved from [https://ec.europa.eu/regional\\_policy/sources/docgener/brochure/smart/role\\_smartspecialisation\\_ri.pdf](https://ec.europa.eu/regional_policy/sources/docgener/brochure/smart/role_smartspecialisation_ri.pdf)
- Foray, D., Morgan, K., & Radošević, S. (2018b). From rivalry to synergy: R&I policy and cohesion policy. Retrieved from [https://ec.europa.eu/regional\\_policy/sources/docgener/brochure/smart/rivalry\\_synergies.pdf](https://ec.europa.eu/regional_policy/sources/docgener/brochure/smart/rivalry_synergies.pdf)
- González-López, M., Dileo, I., & Losurdo, F. (2014). University-industry collaboration in the European regional context: The cases of Galicia and Apulia region. *Journal of Entrepreneurship, Management and Innovation*, 10(3), 57-88. <https://doi.org/10.7341/20141033>
- Guzzetti, L. (1995). *A Brief History of European Union Research Policy*. Luxembourg: Office for the Official Publication of the European Communities.
- Hudson, R. (2007). Regions and regional uneven development forever? Some reflective comments upon theory and practice. *Regional Studies*, 41(9), 1149-1160. doi: 10.1080/00343400701291617
- Izsák, K., & Radošević, S. (2017). EU research and innovation policies as factors of convergence or divergence after the crisis. *Science and Public Policy*, 44(2), 274-283. <https://doi.org/10.1093/scipol/scw063>
- Izsák, K., Markianidou, P.M., & Radošević, S. (2013). *Lessons from a Decade of Innovation Policy. What can be learnt from the INNO Policy TrendChart and The Innovation Union Scoreboard*. Luxembourg: Office for the Official Publication of the European Communities.
- Landabaso, M. (2000). Las nuevas políticas regionales de promoción de la innovación en la Unión Europea. *Economía Industrial*, 335-336, 51-66.
- McCann, P. (2016). *The UK Regional-national Economic Problem. Geography, Globalisation and Governance*. London: Routledge.
- Merton, R. K. (1968). The Matthew effect in science. *Science*, 159, 56-63. <https://doi.org/10.1126/science.159.3810.56>

- Myrdal, G. (1957). *Economic Theory and Underdeveloped Regions*. London: Duckworth.
- OECD. 2009a. *How Regions Grow*. Paris: Organisation for Economic Growth and Development.
- OECD. 2009b. *Regions Matter: Economic Recovery, Innovation and Sustainable Growth*. Paris: Organisation for Economic Growth and Development.
- Özboilat, N.K., & Harrap, N. (2018). *Addressing the innovation gap: Lessons from the Stairway to Excellence (S2E) project*. Luxembourg: Publications Office of the European Union.
- Pelikánová, R.M. (2019). R&D expenditure and innovation in the EU and selected member states. *Journal of Entrepreneurship, Management and Innovation*, 15(1), 9-30. <https://doi.org/10.7341/20191511>
- Reid, A. (2007). Innovation and regional development, do European structural funds make a difference? *European Planning Studies*, 15(7), 961-983. <https://doi.org/10.1080/09654310701356696>
- Reillon, V. (2015). Overview of EU funds for research and innovation. Retrieved from [http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568327/EPRS\\_BRI%282015%29568327\\_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568327/EPRS_BRI%282015%29568327_EN.pdf)
- Reillon, V. (2017). *EU Framework Programmes for Research and Innovation. Evolution and Key Data from FP1 to Horizon 2020 in view of FP9*. Brussels: European Parliamentary Research Service.
- Rodil, Ó. (2007). Innovación y competitividad en la Unión Europea: Las nuevas políticas europeas en el período 2007-2013. In X. Vence, *Crecimiento y políticas de innovación. Nuevas tendencias y experiencias comparadas* (pp. 101-124). Madrid: Pirámide.
- Rodil, Ó.; Vence, X., & Sánchez, M.C. (2014): Disparidades en la Eurozona: El debate de la convergencia regional a la luz de las asimetrías en la estructura productiva. *Ekonomiaz: Revista Vasca de Economía*, 86, 274-305.
- Rodríguez-Pose, A. (2018). The revenge of the places that don't matter. *Cambridge Journal of Regions, Economy and Society*, 11(1), 189-209. <https://doi.org/10.1093/cjres/rsx024>
- Rodríguez-Pose, A., & Novak, K. (2013). Learning processes and economic returns in European cohesion policy. *Investigaciones Regionales*, 25, 7-26.
- Sapir, A., Aghion, P., Bertola, G., Hellwig, M., Pisani-Ferry, J., Rosati, Viñals, J., Wallace, H., Buti, M., Nava, M., & Smith, P.M. (2004). *An Agenda for a Growing Europe: The Sapir Report*. Oxford: Oxford Scholarship.
- Tesfaye, G., & Kitaw, D. (2018). An innovation capability development process for firms in developing countries: A theoretical conceptual model. *Journal of Entrepreneurship, Management and Innovation*, 14(3), 87-110. <https://doi.org/10.7341/20181434>
- Tödtling, F., & Trippl, M. (2005). One size fits all? Towards a differentiated regional innovation policy approach. *Research Policy*, 34(8), 1203-1219. <https://doi.org/10.1016/j.respol.2005.01.018>

- Tomaney, J., Pike, A., & Rodríguez-Pose, A. (2010). Local and regional development in time of crisis. *Environment and Planning A*, 42, 771-779. <https://doi.org/10.1068/a43101>
- Vence, X. (1998). *La política tecnológica comunitaria y la cohesión regional. Los retos de los sistemas de innovación periféricos*. Madrid: Civitas.
- Vence, X., Guntín, X., Rodil, Ó. (2000). Determinants of the uneven regional participation of firms in European Technology Programmes. The "Low R&D Trap". *European Planning Studies*, 8(1), 29-42. <https://doi.org/10.1080/096543100110910>
- World Bank (2009). *World Development Report 2009: Reshaping economic geography*. Washington DC: World Bank.

### **Abstrakt**

*Programy Ramowe (PR) stanowią jeden z kluczowych instrumentów po stronie podaży w zestawie polityki innowacji wdrażanych bezpośrednio przez Unię Europejską (UE). Ponieważ jej ostatecznym celem jest wspieranie innowacji i konkurencyjności, wskazane jest przeanalizowanie rozmieszczenia przestrzennego tego instrumentu w regionach UE. Głównym celem tego artykułu jest analiza regionalnej alokacji koordynacji i udziału w projektach w ramach 6-ego i 7-ego PR, a także podział środków z programu „Horyzont 2020” (8 PR). W tym celu opracowano obszerną bazę danych regionalizowaną na poziomie NUTS 2 na podstawie danych dostarczonych przez CORDIS i Platformę Inteligentnej Specjalizacji. Ponadto, w celu rozwiązania problemu relacji między programami ramowymi a rozwojem regionalnym, regiony NUTS 2 podzielono na trzy grupy: regiony słabiej rozwinięte, regiony o średnich dochodach i regiony rozwinięte. Nasze dowody empiryczne podkreślają różne trendy w tym narzędziu (zestawie) polityki innowacyjnej. Ogólna tendencja wskazuje na pozytywną korelację między poziomem rozwoju a zdolnością przyciągania projektów i funduszy. Dlatego też PR mogą przyczynić się do wzmocnienia wcześniej istniejących ośrodków innowacji i długoterminowych dysproporcji wzrostu. Tak więc koordynacja i uczestnictwo w projektach, a także środki przydzielone w ramach PR są silnie skoncentrowane w regionach rozwiniętych. Regiony o średnich dochodach przyciągają średnio więcej projektów niż mniej rozwijające się regiony, chociaż różnice między nimi nie są szczególnie wysokie. Jeśli chodzi o regiony słabiej rozwinięte, istnieją dwie różne grupy regionów. Jedna z nich charakteryzuje się znaczną liczbą koordynacji projektów, które przyciągają fundusze, nawet wyższe niż niektóre regiony o średnich dochodach; podczas gdy druga grupa wykazuje małą liczbę koordynacji lub udziału w projektach. Porównując 6-ty i 7-my PR, obserwujemy niewielkie zmniejszenie dysproporcji, w szczególności ze względu na większy udział regionów z Hiszpanii, Portugalii i Włoch, które były jednymi z najbardziej dotkniętych recesją gospodarczą w Europie. Tendencję tę można wytłumaczyć potrzebą zrekompensowania zmniejszenia funduszy regionalnych i krajowych poprzez większą aktywność w pozyskiwaniu funduszy UE.*

**Słowa kluczowe:** *Programy Ramowe, polityka innowacji, polityka spójności, rozwój regionalny, regiony słabiej rozwinięte*

## Biographical notes

**Pedro Varela-Vázquez** is a researcher and lecturer at the Department of Business Management of the University of Santiago de Compostela and a member of the ICEDE Research Group. His research focuses on wind sectoral policies, the socio-economic impact of renewable energies and their market diffusion. In this regard, he has led a research project to quantify the potential economic effects of offshore wind on the Spanish economy. Moreover, his research topics are also related to public procurement for innovation, as well as innovation policies in peripheral areas.

**Manuel González-López** is a researcher and Associate Professor at the Department of Applied Economics of the University of Santiago de Compostela and a member of the ICEDE Research Group. He has published many papers in national and international journals in the field of regional development and innovation with a particular focus on the EU regions. He has also participated in several national and EU projects about innovation policies, regional innovation systems and other similar topics. His academic and research activity shows a high international profile as he completed his post-graduate studies in the UK, participated as a visitor researcher in France and Denmark and has collaborated in a large number of international (EU) projects.

**María del Carmen Sánchez-Carreira** is a researcher and Assistant Professor at the Department of Applied Economics, University of Santiago de Compostela and a member of the ICEDE Research Group. Her main research topics are state-owned enterprises, privatization, innovation policies and public procurement. Apart from academic publications, she has participated in several international and national projects.



# Family management and Industry 4.0: Different effects in different geographical areas? An analysis of the less developed regions in Italy

*Marco Pini*<sup>1</sup>

---

## **Abstract**

*This paper tests the impact of different types of management within family businesses on digital innovation related to Industry 4.0 investments, from a geographical perspective. The data set consists of 3,000 Italian manufacturing small- and medium-sized enterprises. Using probit models, the results show that while in the more advanced area (center-north) external management affects the propensity for innovation significantly, in the less developed area (Southern Italy) external management requires an additional and simultaneous investment in R&D to drive a firm's innovation. This suggests that innovation policy should define incentives that also help enhance new management business models and take into account behavioral features of different firms in relation to the level of the development of the geographical areas in which they operate.*

**Keywords:** *family businesses, Industry 4.0, manufacturing, regions*

---

## **INTRODUCTION**

---

Since the first studies on entrepreneurship (Schumpeter, 1934) and the business cycle and economic performance (Freeman, 1987), innovation has been a subject of investigation. Innovation has been examined in relation to the society, through the concept of the National Innovation System (Lundvall, 1992; Nelson & Rosenberg, 1993; Niosi, Saviotti, Bellon, & Crown, 1993; OECD, 1999; Edquist, 2005; Asheim, Isaksen, Nauwelaers, & Tödling, 2003). The subject has also been addressed from a territorial point of view (Acs, 2000;

---

<sup>1</sup> Marco Pini, Senior Economist, Unioncamere-Si.Camera, via Nerva, 1, 00199 Rome, Italy, e-mail: [m.pini@sicamera.camcom.it](mailto:m.pini@sicamera.camcom.it)

*Received 30 October 2018; Revised 10 February 2019, 25 February 2019; Accepted 27 February 2019*

*This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).*

---

Autio, 1998; Bathelt & Depner, 2003; Braczyk, Cooke, & Heidenreich, 1998; Cooke, Boekholt, & Tödling, 2000; de la Mothe & Paquet, 1998; Doloreux, 2002; Fornhal & Brenner, 2003; Howells, 1999; Mytelka, 2000; Moolaert & Sekia, 2003) through the introduction of the Regional Innovation System approach (Autio, 1998; Braczyk et al., 1998; Cooke et al., 2000), which focused on innovation clusters (Audretsch & Feldman, 1996), interdependencies among regions, innovation networks (Boschma & Frenken, 2009) and other themes related to spatial analysis. These new developments in addressing innovation have taken territorial and microeconomic perspectives, highlighting the importance of the absorption capacity of a firm (Tödtling & Trippl, 2005) and the ability to adapt to the structural changes in less-developed, compared to more advanced, regions.

The behavioral characteristics linked to the management and organization of enterprises, also based on innovation capabilities (Aas & Breunig, 2017), particularly for SMEs, were not considered until the 1990s (Lagendijk, 2000): the main innovation factors taken into account were primarily R&D, infrastructure, financial support, and technology transfer. It has become increasingly clear that there is no “best practice” in innovation policy (see also Cooke et al., 2000; Isaksen, 2001; Nauwelaers & Wintjes, 2003), but only policies considering macroeconomic features of the regions and microeconomic features at a firm level. Nauwelaers and Wintjes (2003) divide policy instruments into two: firm-oriented and regional system-oriented.

Stimulating innovation only through the transfer of financial resources may be unsuccessful if the firms lack managerial and organizational competencies (Cobbenhagen, 1999). Many studies view management as one of the main subjects of regional innovation policies (Smallbone, North, Roper & Vickers, 2003; Cooke, 2001; Nauwelaers & Wintjes, 2003; Tödtling & Trippl, 2005). Focusing on the firm level, Family Businesses (FBs) play an important role across all economies (Aronoff & Ward, 1995; La Porta, Lopez-de-Silanes, & Shleifer, 1999; Neubauer & Lank, 1998). According to Mandl (2008), in the EU countries, FBs represent at least two-thirds of the total number of enterprises, while in Italy the share is over 90% (Ferri, Pini, & Scaccabarozzi, 2014).

Within a company the different levels of family involvement in ownership and management may affect the technological innovation process arising from diverse resource management and deployment methods (Sirmon & Hitt, 2003), risk aversion (Gómez-Mejía, Haynes, Núñez-Nickel, Jacobson, & Moyano-Fuentes, 2007; Cucculelli, Mannarino, Pupo, & Ricotta, 2014; Le Breton-Miller & Miller, 2006; Naldi, Nordqvist, Sjöberg, & Wiklund, 2007; Bianco, Bontempi, Golinelli, & Parigi, 2013; Chrisman, Chua, De Massis, Frattini, & Wright, 2015), and long-term vision (Le Breton-Miller & Miller, 2006; Manso, 2011).

In Italy, FBs are characterized by a stronger presence of family members in their management than in other countries (Bank of Italy, 2009; Giacomelli & Trento, 2005; Bianchi, Bianco, Giacomelli, Paccès, & Trento, 2005; Bloom, Sadun, & van Reenen, 2008), and there is a reluctance to outsource management (Bloom et al., 2008). Few empirical studies on the role of management within FBs in terms of technological innovation have been conducted (Craig & Moores, 2006; Kotlar, De Massis, Frattini, Bianchi, & Fang, 2013; Matzler, Veider, Hautz, & Stadler, 2015), particularly from a territorial perspective, which is relevant in a country such as Italy where there are wide socio-economic disparities between the Centre-North and the South.

Finally, most studies on FB management in Italy specifically focus only on product or process innovation (Cucculelli, Le Breton-Miller, & Miller, 2016; Minetti, Murro, & Paiella, 2015). Digitalization (Xu, Xu, & Li, 2018) has become the new technology framework in the current technological age (or Fourth industrial revolution, Schwab, 2016). Many advanced countries and supranational institutions have adopted innovation policies – defined as Industry 4.0 – based on digital technological innovation development, with particular regard to small- and medium-sized enterprises (SMEs) (Crnjac, Veža, & Banduka, 2017; Geissbauer, Vedso, & Schrauf, 2016; European Commission, 2017; Cassetta & Pini, 2018; Dileo & Pini 2018; Pini, Dileo, & Cassetta, 2018). Industry 4.0 is already at the forefront of the strategic agenda of many companies (PWC, 2016) as a push factor to ensure their competitive edge.

Industry 4.0 is, therefore, an important topic from a regional perspective (Ciffolilli & Muscio, 2018) and represents an opportunity to relaunch a firm's competitiveness in less developed areas. It can thus, potentially contribute to reducing territorial gaps. Many scholars suggest that Industry 4.0 requires not only ICT investments but also new business models and business process management, and a high level of expertise (Xu et al., 2018; Liao, Deschamps, Loures, & Ramos, 2017; Lorenz, Ruessmann, Strack, Lueth, & Bolle, 2015; Schneider, 2018; Almada-Lobo, 2016), so the subject of management within FBs becomes even more relevant. Only a few analyses focus on Industry 4.0 (for a review see Liao et al., 2017; Moeuf, Pellerin, Lamouri, Tamayo-Giraldo, & Barbaray, 2018) and particularly within Italy, but only at a country level (Cassetta & Pini, 2018; Dileo & Pini 2018).

Therefore, due to this lack of research, the current study focuses on innovation related to Industry 4.0 and associated with entrepreneurial models within FBs from a territorial perspective. The study investigates whether in less developed regions FBs run by outside managers show a higher propensity to innovate (investing in Industry 4.0) than those where the managers are family members. The study also highlights the differences in more developed areas. We consider Southern Italy as our less-developed

region because the competitiveness gap of this area is evident in the GDP per capita, which is 44% lower than that of the Centre-North. The analysis uses a survey conducted in 2018 on a sample of 3,000 Italian manufacturing SMEs with between 5 and 249 employees.

## LITERATURE REVIEW

---

Family businesses are important for the economic production of all countries (Aronoff & Ward, 1995; La Porta et al., 1999; Neubauer & Lank, 1998). According to the literature (Le Breton-Miller, Miller, & Lester, 2011), FBs are divided into the two categories of firms managed by family members (included the owner) and by external managers. This distinction is very important as family involvement in ownership and management can affect innovation propensity in different ways, such as the methods of resource management and deployment (Sirmon & Hitt, 2003); risk aversion degree (Gómez-Mejía et al., 2007; Cucculelli et al., 2014; Miller & Le Breton-Miller, 2006; Naldi et al., 2007; Bianco et al., 2013; Chrisman et al., 2015); debt financing and new ventures investments (Miller and Le Breton-Miller, 2006; Cabrera-Suárez, De Saá-Pérez, & García-Almeida, 2001; Carney, 2005; Naldi et al. 2007; Villalonga & Amit, 2006); entrenchment and personalism level (Gómez-Mejía, Núñez-Nickel, & Gutierrez, 2001; Schulz, Lubatkin & Dino, 2003; Chrisman, Chua, & Litz, 2004; De Massi, Frattini, Pizzurno, & Cassia, 2015); short- and long-term company interests (Davi, Schoorman, Mayer, & Tan 2000; Miller & Le Breton-Miller, 2006; Manso, 2011); and various incentives (Ang, Cole, & Lin, 2000; Demsetz, 1988; Fama & Jensen, 1983a, 1983b).

This view relates to the acknowledged importance of management within regional policies. Smallbone et al. (2003) consider the distinct organizational culture linked to the proximity between ownership and management, which is one of the three SME characteristics for innovation policies. Cooke (2001) identifies among the innovation factors superstructural elements linked to the governance of firms, in addition to the infrastructural elements such as finance, telecom, and transport infrastructures. Nauwelaers and Wintjes (2003) identify the subsidy for hiring innovation managers in SMEs and the innovation management training and advice among the policy innovations at a firm level. Tödtling and Trippel (2005) point out the need for management schools, which can raise the education/skill level of a region (Leon, 2017).

The effect of inside vs. outside managers within the family businesses on performance has been variously analyzed, with mixed results. In Agency theory (Schulze, Lubatkin, Dino, & Buchholtz, 2001), it is assumed that when there is an alignment between owners and managers there is no information

asymmetry (Chrisman et al., 2004; Gómez-Mejía et al., 2001; Jensen & Meckling, 1976; Fama & Jensen, 1983a, 1983b) or different incentives (Ang et al., 2000; Demsetz, 1988; Fama & Jensen, 1983a, 1983b): so agency costs can be advantageously low (for a measure of agency cost, see Ang et al., 2000).

Non-family managers can have short-run interests and, as agents, pursue their own personal goals rather than those of their principals (Fama & Jensen, 1983b; Jensen & Meckling, 1976): this generates free-ride problems. The owner-manager instead has the incentive and the knowledge to run the business well and has a far-sighted vision that can generate superior performance (Hoopes & Miller, 2006; Jayaraman, Khorana, Nelling, & Covin, 2000).

Nevertheless, non-family managers can avoid problems of excessive entrenchment, altruism, and personalism (Schulze et al., 2003; Chrisman et al., 2004) that can be associated with the family-manager case. In fact, family managers can pursue goals different from profit or firm value maximization (Chrisman, Chua, Pearson, & Barnett, 2012), which can lead to mismanagement or under-management of the business (Schulze et al., 2003; Westhead & Howorth, 2007), and conflicts of interests within the family (Gómez-Mejía et al., 2001; Schulze et al., 2003). Thus, personalism and particularism may negatively affect the innovation process (De Massis et al., 2015). In addition, the close connection between family and firm assets means that the owner-manager may have greater risk aversion, which may hinder innovation activities (Cucculelli et al., 2014; Chrisman et al., 2015).

Second, the stewardship theory is linked to the concepts of “familiness” (Habbershon & Williams, 1999), and family capital (Hoffman, Hoelscher, & Sorenson, 2006), and focuses more on social capital than on financial or economic aspects. This theory states that when managers are family members or emotionally linked to the family, there is more stimulus to pursue long-term interests (Davis, Schoorman, Mayer, & Tan, 2000; Miller & Le Breton-Miller, 2005; Miller & Le Breton-Miller, 2006), which are essential to supporting innovation productivity (Manso, 2011; Bratnicka-Myśliwiec, Wronka-Pośpiech, & Ingram, 2019). The family managers act with altruism to achieve the best for the company, its stakeholders and the organizational collective (Davis, Schoorman, & Donaldson, 1997; Donaldson & Davis, 1991; Fox & Hamilton, 1994; Miller & Le Breton-Miller, 2005), devoting attention to job security, social contribution, belonging and standing within the family (Gómez-Mejía et al., 2007; Miller, Le Breton-Miller, & Scholnick, 2008). However, family managers may tend to preserve their power and authority even at the cost of hindering the firm’s potential economic benefits (Kotlar et al., 2013), which can also involve the innovative process (Matzler et al., 2015).

The third theory includes the resource-based view and the knowledge-based view and focuses on the competitive edge of family businesses due

to the nature and transfer of knowledge within the family (Barney, 1991; Grant, 1991; Peteraf, 1993). Specifically, the interaction between family unit, business unit, and individual family members generates a unique system of distinctive and inimitable resources and capabilities (Chua, Chrisman, & Sharma, 1999; Zahra, Hayton, & Salvato, 2004), which represents an advantage for the business. These resources and capabilities relate to tacit knowledge: commitment, trust, reputation, know-how, valuable relationships, innovation talents, corporate culture and organization (Cabrera-Suárez et al., 2001; Barney & Hansen, 1994). This harmony also allows for more efficient communication, information sharing (Tagiuri & Davis, 1996) and decision-making (Gersick, Davis, Hampton, & Lansberg, 1997). Thus, management run by family members may have a positive effect on innovation (Matzler et al., 2015). Family managers also have a greater knowledge of their firms and networks, positively supporting innovation decisions (Johannisson & Huse, 2000); but non-family managers can provide new expertise, objectivity and alternative perspectives that may be overlooked by family members, and they can improve resource-allocation decisions by avoiding possible expropriation of a firm's wealth by family members (Anderson & Reeb, 2004; Dalton, Daily, Ellstrand, & Johnson, 1998).

In the literature, the effects of different types of management within FBs on firm performance are still unclear (Cucculelli et al., 2014). More generally, some studies suggest that FBs are more innovative than non-FBs, as highlighted by Craig and Dibrell (2006) with reference to US firms, and Llach and Nordqvist (2010) for Spanish firms.

In terms of management, Matzler et al. (2015) found a positive relationship in Germany between family-managers and innovation output (patent counts and the forward citation of patents) but a negative relationship in terms of innovation input (R&D). Hansson, Liljebloom, and Martikainen (2011) found a positive effect of Family CEO on performances (ROA and ROI) in Finland, particularly when the CEO is the founder. Focusing on FBs where family members are involved in management, Nieto, Santamaria, and Fernandez (2015) found for Spanish firms a greater propensity for incremental innovation instead of radical innovation.

In the case of Italy, the issue has been analyzed from a different point of view. Sciascia and Mazzola (2008) used numerous indicators to measure performance (sales growth, revenue growth, net profit growth, return on net asset growth, reduction of debt/equity ratio, return on equity growth, and dividends growth) and found that family businesses run by family-managers perform worse. Caselli and Di Giuli (2010), using ROA and ROI, confirm this finding. Amore, Minichilli, and Corbetta (2011) found that non-family managers foster investments through an increase in debt. Regarding

---

productivity, Bloom et al. (2008) and Bandiera, Guiso, Prat, and Sadun (2008) identified a negative effect associated with the presence of family managers. Cucculelli et al. (2014) pointed out that when considering only family-owned businesses, there is no difference - in terms of productivity - between FBs run by family managers and those run by outside managers.

In terms of innovation, Cucculelli et al. (2016) found that family management can limit the renewal of technological capabilities in products. Minetti et al. (2015) highlighted a negative relationship between product innovation and shares of external managers, as possible consequence of conflicts between shareholders and managers (for an analysis on family business and innovation from a conceptual point of view, see De Massis et al. (2015); for a systematic international review of empirical analyses, see Duran, Kammerlander, Van Essen, & Zellweger (2016). Overall, studies generally focus on product innovation without territorial considerations. Digitalization increasingly affects innovation (Evangelista, Guerrieri, & Meliciani, 2014), and policies in advanced countries are based on Industry 4.0 platforms, which promote the digital technological innovation of SMEs (Crnjac et al., 2017; Geissbauer et al., 2015; European Commission, 2017). Thus, two insights emerge from the literature: the role of management within family businesses to develop innovation activities in less developed regions, and the innovation framework of Industry 4.0 (Pickering & Byrne, 2014; for a review see Liao et al., 2017; Moeuf et al., 2018).

## RESEARCH METHODS

---

### Data

The data source is a survey carried out by Unioncamere (Italian Union of Chambers of Commerce) in early 2018. The data refer to a statistically representative sample of 3,000 small- and medium-sized Italian manufacturing firms with between 5 and 249 employees.

The dataset was enriched with structural characteristics of the firms (age, economic activities, etc.) through a record linkage to an administrative archive. The questionnaire submitted to the firms includes information about the issues of ownership and management, workforce characteristics, innovation and R&D, Industry 4.0, internationalization, and relationships.

## Variables description

### *Dependent variable*

The dependent variable concerns the innovation related to the Industry 4.0 program. Industry 4.0 can be defined as an in-depth transformation of business models involving digitalization, automation, and robotics (Gotz & Jankowska, 2017). Italy's Industry 4.0 plan (Ministry of Economic Development, 2017) identifies nine topics: advanced manufacturing solutions; additive manufacturing; augmented reality; simulation; horizontal/vertical integration; industrial Internet; cloud; cyber security; and big data and analytics. The dependent variable (dummy) used in the regressions takes the value of 1 if the firm invested in at least one topic of Italy's Industry 4.0 plan during the period 2017 to mid-2018. Table 1 displays the variable description.

**Table 1.** Variables description

Variables	Type	Description
<i>Dependent variable</i>		
Industry 4.0	Dummy	whether the firm has invested in Industry 4.0 during the period 2017 to mid-2018 (yes = 1. no = 0)
<i>Independent variables: firm's behavior</i>		
External Management	Dummy	whether the firm run by external manager (yes = 1. no = 0)
R&D	Dummy	whether the firm invested in R&D during the period 2015-17 (yes = 1. no = 0)
Export	Dummy	whether the firm exports (yes = 1. no = 0)
IPP last	Dummy	whether the firm introduced some type of innovation (process/product) in 2014-2016 (yes = 1. no = 0)
Green	Dummy	whether the firm invested in circular economy (energy efficiency, raw materials reuse and renewables, remanufacturing, reverse logistic, recycling and waste reduction) (yes = 1. no = 0)
Stakehold	Dummy	whether the firm is no-profit maximization (si = 1. no = 0)
Bank R	Dummy	whether the firm strengthened relationships with the banking system (yes = 1. no = 0)
University R	Dummy	whether the firm strengthened relationships with the research centers and University (yes = 1. no = 0)
Firm R	Dummy	whether the firm strengthened relationships with other firms (yes = 1. no = 0)
HC	Dummy	whether the firm has employees with tertiary degrees (yes = 1. no = 0)
<i>Independent variables: firm's structural characteristics</i>		
Age	Continuous	Number of years since inception (logarithm)
Size	Continuous	Number of employees (logarithm)
Pavitt sectors	Categorical	Sectoral Pavitt industry classification (Suppliers dominated = 1, Scale intensive = 2, Specialized suppliers = 3, Science based = 4)



---

## ***Family businesses and management***

Family businesses are variously defined in the literature (Astrachan & Shanker, 2003; Chua et al., 1999; Miller, Le Breton-Miller, Lester, & Cannella, 2007). Chua et al. (1999) define family businesses as businesses “governed and/or managed with the intention to shape and pursue the vision of the business held by a dominant coalition controlled by members of the same family or a small number of families in a manner that is potentially sustainable across generations of the family or families”. Three criteria have been used to measure a family’s influence in a firm (López-Gracia & Sánchez-Andújar, 2007): capital ownership (Donckels & Lambrecht, 1999); management decision (Filbeck & Lee, 2000); and resources monitoring and provision through presence on the board (Anderson & Reeb, 2004). In this study, FBs are regarded as firms where the founder and/or family members (regardless of the generation) are the owners. From the management perspective, FBs are divided into the two categories of FBs managed by the founder and/or family members (*Family management*) and those managed by non-family members (*External management*).

### ***Control variables: Determinants of innovation and firm’s characteristics***

We consider different variables related to innovation determinants. We include R&D investments (Cuccullelli et al., 2016; Guerrieri, Luciani, & Meliciani, 2011) (a dummy variable that takes the value 1 if the firm invested in R&D and 0 otherwise) as R&D is recognized as a reasonable indicator of innovation input (Adams, Bessant, & Phelps, 2006; Barker & Mueller, 2002; Block, 2009; Chen & Hsu, 2009; O’Brien, 2003; Spithoven, Frantzen, & Clarysse, 2010). The firm accumulates essential technological and market capabilities enabling them to develop innovations through R&D.

Regional innovation policies identify the importance of internationalization. Nauwelaers and Wintjes (2003) and Tödling and Trippel (2005) highlight the need to support firms in linking to international input and output markets, achieving synergies and global visibility. Studies on FBs and innovation also consider internationalization as an important push factor for innovation (Nieto et al., 2015) because it requires continued innovation to remain competitive (Galende & De La Fuente, 2003; Veugelers & Cassiman, 1999). We, therefore, considered a dummy variable that takes the value 1 if the firm exports.

Within regional innovation systems, economic growth also depends on the integration of research into industry (Muscio, 2006) and on relationships

between actors, in addition to investments in R&D (Camagni & Capello, 2013). Another aspect highlighted by the regional innovation framework (Nauwelaers & Wintjes, 2003; Tödling & Tripl, 2005; González-López, Dileo, & Losurdo, 2014; Dileo & Divella, 2016) considers the relationships of the firm with technological resources (R&D centers). Thus, we include a variable that considers whether the firm has relationships with universities and research centers. Moreover, we used another variable to capture whether the firm has relationships with other firms.

The regional innovation policy framework addresses two other themes: financial, highlighting the importance of the firm's relationships with external resources; and human capital, highlighting the relevance of attracting and retaining highly skilled workers (Nauwelaers & Wintjes, 2003). Thus, we add into the analyses two variables: the first identifies whether the firm strengthened the relationships with the banking system, and the second indicates if the firm has employees with tertiary degrees.

A connection between Industry 4.0 and sustainable manufacturing has been identified (Stock & Seliger, 2016), so we consider whether the firm made green investments. We also control for a firm's innovation propensity, identifying the businesses that innovated in the years before the introduction of the Industry 4.0 program. Social aspects may also affect innovation. Studies have found a positive relationship between social capital (trust, relational equity, etc.) and innovation at a firm level (Landry, Amara, & Lamari, 2000; Cook & Clifton, 2004; Cook, Clifton, & Oleaga, 2005; Cook, 2007). To capture this, we use a variable that identifies firms pursuing social sustainability (e.g., stakeholder interests) (Freeman, 1984) instead of only profit maximization.

We also controlled for different firm characteristics. In the empirical studies on innovation, age is used to take into account the firm's level of experience and learning (Kumar & Saqib 1996). The variable used refers to years since establishment (Cucculelli et al., 2014, 2016; Matzler et al., 2015; Nieto et al., 2015). The size may be an important determinant of innovation activities (Becheikh, Landry, & Amara, 2006), although this issue is still controversial (Tsai & Wang, 2005). We thus include the number of employees as a variable (Cucculelli et al., 2014, 2016; Nieto et al., 2015; Minetti et al., 2015).

Finally, we also control for sectoral characteristics related to the technological regime (Nieto et al., 2015): we distinguish the firms by Pavitt sectoral classification (Cucculelli et al., 2016; Minetti et al., 2015) using the 2-digit activities Nace rev.2 Classification (Bogliacino & Pianta, 2016).

## Descriptive statistics

The descriptive statistics are reported in Table 2. Family businesses make up 80% of the total sample. Around 15% of the FBs (referred to as “firms” here) are located in Southern Italy. In this area, almost 10% of businesses invested in Industry 4.0. Regarding family management, over 10% of FBs are managed by non-family members. Investments in R&D involved about one third (35.5%) of the firms, as did the exporters’ share (34.1%). Innovation activities in the past (before the introduction of Industry 4.0) were carried out by just over half of the firms (54.9%). Green investment propensity is less intensive and was relevant to 11.6% of the firms. Relationships with banks and with universities are more widespread (respectively 28.0% and 20.2%) than those between firms (9.5%). About one third (32.7%) of the firms employ graduate personnel. In almost all these cases in Southern Italy, the percentages are lower than those in the Centre-North, confirming the competitiveness gap between the two areas. The firm’s size is in general lower in Southern Italy, where the average number of employees is 22, versus 31 in the Centre-North. From the Pavitt sectors perspective, there are no significant territorial differences. The correlation matrix between independent variables (with the exception of age, sectoral, and size control variables) is reported in Tables 3 and 4. We also calculated the Variance Inflation Factor to test for multicollinearity. Values greater than 10 indicate a multicollinearity problem (Yoo et al., 2014). As all values are lower than this threshold, this is not a concern.

**Table 2.** Descriptive statistics

	Southern		Centre-North	
	Mean	S.D.	Mean	S.D.
Industry 4.0	0.092 (0.016)	0.290	0.127 (0.007)	0.333
External Management	0.127 (0.018)	0.334	0.109 (0.007)	0.312
R&D	0.355 (0.026)	0.479	0.437 (0.011)	0.496
Export	0.341 (0.026)	0.475	0.490 (0.011)	0.500
IPP last	0.549 (0.027)	0.498	0.569 (0.011)	0.495
Green	0.116 (0.017)	0.320	0.132 (0.008)	0.339
Stakehold	0.630 (0.026)	0.483	0.718 (0.010)	0.450
Bank R	0.280 (0.024)	0.450	0.312 (0.010)	0.463
University R	0.202 (0.022)	0.402	0.214 (0.009)	0.410
Firm R	0.095 (0.016)	0.294	0.124 (0.007)	0.330
HC	0.327 (0.025)	0.470	0.412 (0.011)	0.492
Age	32.312 (0.613)	11.402	36.075 (0.283)	12.672

	Southern		Centre-North	
	Mean	S.D.	Mean	S.D.
Size	22.291 (1.802)	33.516	31.010 (0.946)	42.406
Supplier dominated	0.627 (0.026)	0.484	0.572 (0.011)	0.495
Scale intensive	0.251 (0.023)	0.434	0.215 (0.009)	0.411
Specialized suppliers	0.090 (0.015)	0.286	0.168 (0.008)	0.374
Science based	0.032 (0.094)	0.176	0.045 (0.004)	0.208

Note: standard error in parenthesis.

**Table 3.** Correlation matrix: Southern

	1	2	3	4	5	6	7	8	9	10	VIF
1.External Management	1.000										1.03
2.R&D	0.097	1.000									1.29
3.Export	0.110	0.319	1.000								1.33
4.IPP last	-0.020	0.248	0.113	1.000							1.14
5.Green	0.052	0.298	0.198	0.201	1.000						1.28
6.Stakehold	0.041	0.119	0.059	0.076	0.109	1.000					1.06
7.Bank R	0.013	0.088	0.108	0.178	0.076	-0.122	1.000				1.07
8.University R	0.013	0.287	0.245	0.153	0.290	0.043	0.070	1.000			1.21
9.Firm R	0.024	0.149	0.140	-0.022	0.313	0.004	0.082	0.204	1.000		1.15
10. HC	0.012	0.268	0.422	0.123	0.192	0.151	0.018	0.217	0.131		1.29
										1.000 Mean VIF	1.19

**Table 4.** Correlation matrix: Centre-North

	1	2	3	4	5	6	7	8	9	10	VIF
1.External Management	1.000										1.02
2.R&D	0.034	1.000									1.25
3.Export	0.024	0.203	1.000								1.24
4.IPP last	-0.005	0.324	0.136	1.000							1.19
5.Green	0.071	0.183	0.081	0.153	1.000						1.14
6.Stakehold	0.099	-0.012	0.075	-0.059	0.069	1.000					1.04
7.Bank R	0.012	0.128	0.074	0.205	0.089	-0.105	1.000				1.09
8.University R	0.055	0.233	0.192	0.109	0.265	0.017	0.204	1.000			1.23
9.Firm R	0.096	0.181	0.172	0.129	0.227	0.085	0.063	0.286	1.000		1.16
10. HC	0.035	0.303	0.413	0.229	0.132	0.044	0.078	0.209	0.158		1.32
										1.000 Mean VIF	1.17

## Empirical model

The aim of this study is to assess the impact of different types of management within family firms on the investments in Industry 4.0 in a less-developed Italian area (Southern Italy); and if there are differences with the Centre-North. As the dependent variable is binary, taking only values 1 and 0, we use probit models. Binary response models allow one to overcome the two most important disadvantages of the linear probability models: the fitted probabilities can be less than zero or greater than one; the partial effect of any independent variable is constant (Wooldridge, 2016). Our probit model is as follows:

$$P(Y_i = 1 | EM_i, S_i) = P(\beta_0 + \beta_1 EM_i + \beta_2 S_i + \varepsilon_i > 0) = \Phi(\beta_0 + \beta_1 EM_i + \beta_2 S_i + \varepsilon_i) \quad (1)$$

where  $Y_i$  represents the probability that the firm  $i$  invests in Industry 4.0 (Industry 4.0).

The independent variables are  $EM_i$  that indicates if the family firm is run by external managers, and  $S_i$  is a vector including the other independent variables relating to firm's behaviour and characteristics. All variables are binary except for age and size.  $\Phi$  is a standard normal cumulative distribution function, taking only values strictly between zero and one for all values of the parameters and the independent variables. Thus, this ensures that the estimated response probabilities are between zero and one  $0 < \Phi(z) < 1$ . Finally,  $\varepsilon_i$  is the normally distributed random error with zero mean and constant variance  $N(0, \sigma^2)$ , that captures other any unknown factors.

As probit is a non-linear model, the coefficients do not correspond to marginal effects (they indicate the change of z-values, whose effects on the probability are not linear), as in linear regressions. Thus, after estimating the probit model, we calculate marginal effects (reported in Table 5): they indicate «the effect on conditional mean of Y of a change in one regressor, say,  $x_j$ » (Cameron & Trivedi 2010, p. 343). Specifically, for binary independent variables, marginal effects show how  $P(Y=1)$  changes as the independent variable changes from 0 to 1, after controlling for the other variables in the model. For categorical variables with more than two possible values, marginal effects show how  $P(Y=1)$  changes for cases in one category relative to the reference category. For continuous independent variables, marginal effects show how  $P(Y=1)$  changes as the independent variable changes by a 1-unit (Cameron & Trivedi, 2010; Williams, 2012). We used average marginal effects (AME).

Any conclusion regarding causality is limited when working on a cross-section analysis. Stata version 13 was used for all the estimates.

## RESULTS

---

Table 5 reports the results. All regressions are based on the sample related to only family businesses by differentiating between FBs run by outside managers (*External management*) and those run by owner/family-members. To study the innovation factors in less-developed regions, all models focus separately on Southern Italy and on the Centre-North. We would point out that the results for the South might be less reliable than those for the Centre-North due to the much fewer observations for the former group.

After controlling for various firm characteristics and behavior, we find that external management affects the probability to invest in Industry 4.0 less significantly in Southern Italy ( $p < 0.10$ ) than in the Centre-North ( $p < 0.01$ ) (Models 1 and 2). This finding suggests that in less-developed regions family businesses require additional factors to invest in digital innovation. We, therefore, control for R&D as this is acknowledged as the main innovation input. This variable is not significant in Southern Italy, while it is significant in the Centre-North.

When we combine these two variables (Model 3), we find that in Southern Italy, the FBs run by outside managers that invest in R&D are more likely to innovate in Industry 4.0. The marginal effect of the variable *External management*\*R&D is more significant ( $p < 0.05$ ; Model 3) than that related to only *External management* in Model 1. In Model 3, the variable *External management* also loses significance. This suggests that in less-developed regions family businesses require a strong injection of know-how that only an external manager can bring, as in the more developed areas. A possible lower level of management skill in Southern Italy could explain this. Furthermore, human capital has a positive and significant impact ( $p < 0.05$ ) on the propensity to invest in Industry 4.0 regardless of the development level of the territory.

For a robustness check, we replicate the model with the interaction (*External management*\*R&D) for the Centre-North (Model 4) and do not find the same evidence as in the Southern case. Indeed, in the Centre-North the variable *External management*\*R&D does not influence the likelihood to invest in Industry 4.0, while *External management* and R&D when considered separately confirm significant and positive marginal effects ( $p < 0.05$  in both cases).

Regarding other variables, we find that the firms that innovated in the past are significantly more likely to invest in Industry 4.0 in both areas. This may contribute to a possible increase in the innovation divide between the innovative firms that have continued to invest in innovation (in this case, digital innovation) and the non-innovative firms.

**Table 5.** Results

	Southern (1)	Centre- North (2)	Southern (3)	Centre- North (4)
External Management	0.066* (0.034)	0.070*** (0.019)	-0.039 (0.065)	0.064** (0.030)
External Management*R&D			0.172** (0.081)	0.011 (0.039)
R&D	0.027 (0.032)	0.039*** (0.015)	-0.007 (0.035)	0.038** (0.016)
Export	0.029 (0.033)	0.049*** (0.016)	0.023 (0.033)	0.049*** (0.016)
IPP last	0.077** (0.033)	0.040** (0.016)	0.083** (0.033)	0.040** (0.016)
Green	0.073** (0.036)	0.064*** (0.018)	0.078** (0.036)	0.064*** (0.018)
Stakehold	0.126*** (0.044)	0.029* (0.017)	0.132*** (0.044)	0.030* (0.017)
Bank R	0.006 (0.033)	-0.005 (0.015)	0.005 (0.033)	-0.005 (0.015)
University R	-0.045 (0.037)	0.047*** (0.016)	-0.049 (0.037)	0.047*** (0.016)
Firm R	0.031 (0.044)	0.038** (0.019)	0.034 (0.044)	0.037** (0.019)
HC	0.063** (0.031)	0.041** (0.017)	0.075** (0.031)	0.041** (0.017)
Age	-0.096 (0.077)	0.023 (0.036)	-0.090 (0.074)	0.022 (0.036)
Size	0.013 (0.038)	0.031* (0.017)	0.001 (0.037)	0.031* (0.017)
Pavitt sectors	Y	Y	Y	Y
Observations	346	2,009	346	2,009
Pseudo R <sup>2</sup>	0.292	0.156	0.316	0.156

Note: (a) Dependent variable: Industry 4.0. (b) The regressions are estimated by probit. (c) The table reports regressions marginal effects. (d) Standard errors are in parentheses. (e) \*\*\* p<0.01; \*\* p<0.05; \* p<0.10.

## DISCUSSION AND CONCLUSION

In this study, we analyze the effects of different types of management within family businesses on digital innovation - related to investments in Industry 4.0 - in less-developed Italian regions (Southern) in comparison to more developed regions (the Centre-North). Following the literature (Le Breton-

Miller et al., 2011), we differentiated FBs run by family-members and those run by external managers.

The results show that in Southern Italy FBs are significantly more likely to invest in Industry 4.0 when the firm is run by an external manager and simultaneously invests in R&D. External management and R&D, when considered separately, do not affect digital innovation, as in the Centre-North. Thus, this study contributes to the literature by providing empirical evidence that the effects of external management on innovation (for the Italian case, e.g., Cucculelli et al., 2016; Minetti et al., 2015) may change according to the areas' development levels.

Several policy implications can be drawn from our findings. Since there are different results between less and more advanced regions, innovation policies should be based on specific "innovation patterns" defined within individual regions. In line with the recent literature, policies should not just be "embedded" in the local reality, assets and skill base but also in "connectedness," thereby guaranteeing the connection to the external environment (Camagni & Capello, 2013; Capello, 2017; McCann & Ortega-Argilés, 2015). Detailed analyses of local areas are thus very important in increasing the success of innovation policies (Hughes, 2012), because there is no single "best practice" innovation policy approach (see also Cooke et al., 2000; Isaksen, 2001; Nauwelaers & Wintjes, 2003).

Our findings also show that policies should be developed in at least two different directions: not only in terms of R&D incentives but also encouraging management openness, hence stimulating management innovation (Kraśnicka, Głód, & Wronka-Pośpiech, 2016), within family businesses. Such openness can lead to an important change in mentality in terms of firm's innovation aimed at leveraging their full potential.

In the Industry 4.0 revolution, firms increasingly need professionals who combine organizational capabilities and digital skills in order to gain a competitive edge. Indeed, our results show that in less developed regions, R&D requires new competencies and capabilities, which may be provided by the external management, in increasing digital innovation. As highlighted in the literature, this confirms the innovation effect produced by the relationship between R&D and skills endowment (Magro, Aranguren, & Navarro, 2010; Marino & Parrotta, 2010), in self-reinforcing feedback between innovation and knowledge (Camagni & Capello, 2013). Only financial transfers, e.g., incentives for R&D, may be unsuccessful (Cobbenhagen, 1999).

All these implications confirm the importance of the "policy mix" approach (Nauwelaers, Boekholt, Mostert, Cunningham, Guy, Hofer, & Rammer, 2009; Flanagan, Uyarra, & Laranaja, 2011; OECD, 2010), hence overcoming the "linear approach" that is entirely based on R&D and technology issues.



---

Innovation has evolved from considering science and technology as the unique drivers of innovation to also considering the organizational and social aspects, as the determinants of innovation (Magro & Wilson, 2013).

The limitations of the study have been addressed in other papers (Cucculelli et al., 2014, 2016; Matzler et al., 2015; Nieto et al., 2015; Minetti et al., 2015). The study does not distinguish management run by founders from that run by other family members, nor does it differentiate the first generation from the second or later. It does not take into account the degree of involvement of family in the management or the ownership concentration, or the foreign equity share, or if the firm is listed on the stock market. Data were not available for these factors. Balance sheet indicators were not considered as control variables (leverage, capital intensity). However, as a large proportion of the sample consists of micro and small firms, we can state that many of the abovementioned points may be less relevant. In terms of budgetary indicators, data for micro and small businesses was not available.

Integrative research could be conducted in this domain from a territorial perspective. For example, the intensity of investments in Industry 4.0, which overcomes the limitation related to the binary variable, can be investigated. Investigating whether intergenerational transfer problems may hinder innovation activities could also be of benefit.

## Acknowledgments

I wish to thank Alessandro Rinaldi, who provided me the possibility to realize this article. I am grateful to Valentina Meliciani for her valuable suggestions on the analysis. Thanks also to Giacomo Giusti for the assistance in the construction of the database. All remaining errors are mine.

## Disclaimer

The views expressed in the article are those of the author and not of the institution he is affiliated with.

## References

- Aas, T. H., & Breunig, K. J. (2017). Conceptualizing innovation capabilities: A contingency perspective. *Journal of Entrepreneurship, Management and Innovation*, 13(1), 7-24. <https://doi.org/10.7341/20171311>
- Acs, Z. (Ed.). (2000). *Regional Innovation, Knowledge and Global Change*. London, United Kingdom: Pinter.

- Adams, R., Bessant, J., & Phelps, R. (2006). Innovation management measurement: A review. *International Journal of Management Reviews*, 8(1), 21-47. <https://doi.org/10.1111/j.1468-2370.2006.00119.x>
- Almada-Lobo, F. (2016). The Industry 4.0 revolution and the future of Manufacturing Execution Systems (MES). *Journal of Innovation Management*, 3(4), 16-21. [https://doi.org/10.24840/2183-0606\\_003.004\\_0003](https://doi.org/10.24840/2183-0606_003.004_0003)
- Amore, M. D., Minichilli, A., & Corbetta, G. (2011). How do managerial successions shape corporate financial policies in family firms?. *Journal of Corporate Finance*, 17(4), 1016-1027. <https://doi.org/10.1016/j.jcorpfin.2011.05.002>
- Anderson, R. C., & Reeb, D. M. (2004). Board composition: Balancing family influence in S&P 500 firms. *Administrative Science Quarterly*, 49(2), 209-237. <https://doi.org/10.2307/4131472>
- Ang, J. S., Cole, R. A., & Lin, J. W. (2000). Agency costs and ownership structure. *The Journal of Finance*, 55(1), 81-106. <https://doi.org/10.1111/0022-1082.00201>
- Aronoff, C. E., & Ward, J. L. (1995). Family-owned businesses: A thing of the past or a model for the future?. *Family Business Review*, 8(2), 121-130. <https://doi.org/10.1111/j.1741-6248.1995.00121.x>
- Asheim, B. T., Isaksen, A., Nauwelaers, C., & Tödtling, F. (Eds.). (2003). *Regional Innovation Policy for Small-Medium Enterprises*. Cheltenham, UK: Edward Elgar Publishing.
- Astrachan, J. H., & Shanker, M. C. (2003). Family businesses' contribution to the US economy: A closer look. *Family Business Review*, 16(3), 211-219. <https://doi.org/10.1177/08944865030160030601>
- Audretsch, D. B., & Feldman, M. P. (1996). Innovative clusters and the industry life cycle. *Review of Industrial Organization*, 11(2), 253-273. <https://doi.org/10.1007/BF00157670>
- Autio, E. (1998). Evaluation of RTD in regional systems of innovation. *European Planning Studies*, 6(2), 131-140. <https://doi.org/10.1080/09654319808720451>
- Bandiera, O., Guiso, L., Prat, A., & Sadun, R. (2008). *Italian managers: Fidelity or performance*. London, UK: mimeo, London School of Economics.
- Bank of Italy (2009). *Rapporto sulle tendenze nel sistema produttivo italiano* (Questioni di Economia e Finanza No. 45). Retrieved from [https://www.bancaditalia.it/pubblicazioni/qef/2009-0045/QEF\\_45.pdf](https://www.bancaditalia.it/pubblicazioni/qef/2009-0045/QEF_45.pdf)
- Barker III, V. L., & Mueller, G. C. (2002). CEO characteristics and firm R&D spending. *Management Science*, 48(6), 782-801. <https://doi.org/10.1287/mnsc.48.6.782.187>
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120. <https://doi.org/10.1177/014920639101700108>

- Barney, J. B., & Hansen, M. H. (1994). Trustworthiness as a source of competitive advantage. *Strategic Management Journal*, *15*(S1), 175-190. <https://doi.org/10.1002/smj.4250150912>
- Bathelt, H., & Depner, H. (2003). Innovation, Institution und Region: Zur Diskussion über nationale und regionale Innovationsysteme (Innovation, institution and region: a commentary on the discussion of national and regional innovation systems). *Erdkunde*, *57*(2), 126-143.
- Becheikh, N., Landry, R., & Amara, N. (2006). Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003. *Technovation*, *26*(5-6), 644-664. <https://doi.org/10.1016/j.technovation.2005.06.016>
- Bianchi, M., Bianco, M., Giacomelli, S., Paccas, A. M., & Trento, S. (2005). *Proprietà e controllo delle imprese in Italia*. Bologna: Il Mulino.
- Bianco, M., Bontempi, M. E., Golinelli, R., & Parigi, G. (2013). Family firms' investments, uncertainty and opacity. *Small Business Economics*, *40*(4), 1035-1058. <https://doi.org/10.1007/s11187-012-9414-3>
- Block, J. (2009). *Long-term Orientation of Family Firms: An Investigation of R&D Investments, Downsizing Practices, and Executive Pay*. Wiesbaden, Germany: Gabler Verlag. <https://doi.org/10.1007/978-3-8349-8412-8>
- Bloom, N., Sadun, R., & Van Reenen, J. (2008). Measuring and explaining management practices in Italy. *Rivista di Politica Economica*, *98*(2), 15-56.
- Bogliacino, F., & Pianta, M. (2016). The Pavitt Taxonomy, revisited: Patterns of innovation in manufacturing and services. *Economia Politica*, *33*(2), 153-180. <https://doi.org/10.1007/s40888-016-0035-1>
- Boschma, R., & Frenken, K. (2009). Some notes on institutions in evolutionary economic geography. *Economic Geography*, *85*(2), 151-158. <https://doi.org/10.1111/j.1944-8287.2009.01018.x>
- Braczyk, H. J., Cooke, P. N., & Heidenreich, M. (Eds.). (1998). *Regional innovation systems: the role of governances in a globalized world*. London, UK: UCL Press.
- Bratnicka-Mysłiewicz, K., Wronka-Pośpiech, M., & Ingram, T. (2019). Does socioemotional wealth matter for competitive advantage? A case of Polish family businesses. *Journal of Entrepreneurship, Management and Innovation*, *15*(1), 123-146. <https://doi.org/10.7341/20191515>
- Cabrera-Suárez, K., De Saá-Pérez, P., & García-Almeida, D. (2001). The succession process from a resource-and knowledge-based view of the family firm. *Family Business Review*, *14*(1), 37-48. <https://doi.org/10.1111/j.1741-6248.2001.00037.x>
- Camagni, R., & Capello, R. (2013). Regional innovation patterns and the EU regional policy reform: Toward smart innovation policies. *Growth and Change*, *44*(2), 355-389. <https://doi.org/10.1111/grow.12012>
- Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics Using Stata*. College Station, TX: Stata Press.
- Capello, R. (2017). Toward a New Conceptualization of Innovation in Space: Territorial Patterns of Innovation. *International Journal of Urban and*

- Regional Research*, 41(6), 976-999. <https://doi.org/10.1111/1468-2427.12556>
- Carney, M. (2005). Corporate governance and competitive advantage in family-controlled firms. *Entrepreneurship Theory and Practice*, 29(3), 249-265. <https://doi.org/10.1111/j.1540-6520.2005.00081.x>
- Caselli, S., & Di Giuli, A. (2010). Does the CFO matter in family firms? Evidence from Italy. *The European Journal of Finance*, 16(5), 381-411. <https://doi.org/10.1080/13518470903211657>
- Cassetta, E. & Pini, M. (2018). Impresa 4.0 e competitività delle medie imprese manifatturiere: Una prima analisi firm-level. *Economia Marche-Journal of Applied Economics*, 37(1), 35-63.
- Chen, H. L., & Hsu, W. T. (2009). Family ownership, board independence, and R&D investment. *Family Business Review*, 22(4), 347-362. <https://doi.org/10.1177/0894486509341062>
- Chrisman, J. J., Chua, J. H., De Massis, A., Frattini, F., & Wright, M. (2015). The ability and willingness paradox in family firm innovation. *Journal of Product Innovation Management*, 32(3), 310-318. <https://doi.org/10.1111/jpim.12207>
- Chrisman, J. J., Chua, J. H., Pearson, A. W., & Barnett, T. (2012). Family involvement, family influence, and family-centered non-economic goals in small firms. *Entrepreneurship Theory and Practice*, 36(2), 267-293. <https://doi.org/10.1111/j.1540-6520.2010.00407.x>
- Chrisman, J. J., Chua, J. H., & Litz, R. A. (2004). Comparing the agency costs of family and non-family firms: Conceptual issues and exploratory evidence. *Entrepreneurship Theory and Practice*, 28(4), 335-354. <https://doi.org/10.1111/j.1540-6520.2004.00049.x>
- Chua, J. H., Chrisman, J. J., & Sharma, P. (1999). Defining the family business by behavior. *Entrepreneurship Theory and Practice*, 23(4), 19-39. <https://doi.org/10.1177/104225879902300402>
- Ciffolilli, A., & Muscio, A. (2018). Industry 4.0: National and regional comparative advantages in key enabling technologies. *European Planning Studies*, 26(12), 2323-2343. <https://doi.org/10.1080/09654313.2018.1529145>
- Cobbenhagen, J. (1999). *Managing innovation at the company level: A study on non-sector-specific success factors*. Maastricht, Netherlands: Maastricht University. Retrieved from <https://cris.maastrichtuniversity.nl/portal/files/1580911/guid-c9c6cdfc-a848-461a-94a8-d579ebceb038-ASSET2.0>
- Cooke, P. (2007). Social capital, embeddedness, and market interactions: An analysis of firm performance in UK regions. *Review of Social Economy*, 65(1), 79-106. <https://doi.org/10.1080/00346760601132170>
- Cook, P., & Clifton, N. (2004). Spatial variation in social capital among UK small and medium sized enterprises. *Entrepreneurship and Regional Economic Development: A Spatial Perspective*. Cheltenham, UK: Edward Elgar Publishing,.

- Cooke, P., Clifton, N., & Oleaga, M. (2005). Social capital, firm embeddedness and regional development. *Regional Studies*, 39(8), 1065-1077. <https://doi.org/10.1080/00343400500328065>
- Cooke, P. (2001). Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10(4), 945-974. <https://doi.org/10.1093/icc/10.4.945>
- Cooke, P. N., Boekholt, P., & Tödtling, F. (2000). *The governance of innovation in Europe: regional perspectives on global competitiveness*. London, UK: Pinter.
- Craig, J., & Dibrell, C. (2006). The natural environment, innovation, and firm performance: A comparative study. *Family Business Review*, 19(4), 275-288. <https://doi.org/10.1111/j.1741-6248.2006.00075.x>
- Craig, J. B., & Moores, K. (2006). A 10-year longitudinal investigation of strategy, systems, and environment on innovation in family firms. *Family Business Review*, 19(1), 1-10. <https://doi.org/10.1111/j.1741-6248.2006.00056.x>
- Crnjac, M., Veža, I., & Banduka, N. (2017). From concept to the introduction of Industry 4.0. *International Journal of Industrial Engineering and Management*, 8(1), 21-30.
- Cucculelli, M., Le Breton-Miller, I., & Miller, D. (2016). Product innovation, firm renewal and family governance. *Journal of Family Business Strategy*, 7(2), 90-104. <https://doi.org/10.1016/j.jfbs.2016.02.001>
- Cucculelli, M., Mannarino, L., Pupo, V., & Ricotta, F. (2014). Owner-management, firm age, and productivity in Italian family firms. *Journal of Small Business Management*, 52(2), 325-343. <https://doi.org/10.1111/jsbm.12103>
- Dalton, D. R., Daily, C. M., Ellstrand, A. E., & Johnson, J. L. (1998). Meta-analytic reviews of board composition, leadership structure, and financial performance. *Strategic Management Journal*, 19(3), 269-290. [https://doi.org/10.1002/\(SICI\)1097-0266\(199803\)19:3<269::AID-SMJ950>3.0.CO;2-K](https://doi.org/10.1002/(SICI)1097-0266(199803)19:3<269::AID-SMJ950>3.0.CO;2-K)
- Davis, J. H., Schoorman, F. D., Mayer, R. C., & Tan, H. H. (2000). The trusted general manager and business unit performance: Empirical evidence of a competitive advantage. *Strategic Management Journal*, 21(5), 563-576. [https://doi.org/10.1002/\(SICI\)1097-0266\(200005\)21:5<563::AID-SMJ99>3.0.CO;2-0](https://doi.org/10.1002/(SICI)1097-0266(200005)21:5<563::AID-SMJ99>3.0.CO;2-0)
- Davis, J. H., Schoorman, F. D., & Donaldson, L. (1997). Toward a stewardship theory of management. *Academy of Management Review*, 22(1), 20-47. <https://doi.org/10.5465/amr.1997.9707180258>
- De la Mothe, J., & Paquet, G. (1998). Local and regional systems of innovation as learning socio-economies. In *Local and Regional Systems of Innovation* (pp. 1-16). Boston, MA: Springer. [https://doi.org/10.1007/978-1-4615-5551-3\\_1](https://doi.org/10.1007/978-1-4615-5551-3_1)
- De Massis, A., Frattini, F., Pizzurno, E., & Cassia, L. (2015). Product innovation in family versus nonfamily firms: An exploratory analysis. *Journal of Small Business Management*, 53(1), 1-36. <https://doi.org/10.1111/jsbm.12068>

- Demsetz, H. (1988). *Ownership, Control and the Firm: The Organization of Economic Activity*. Oxford, UK: Basil Blackwell.
- Dileo, I., & Divella, M. (2016). Heterogeneity in cooperation for innovation and technological capabilities of firms in Italy. *L'industria*, 37(3), 493-514. <https://doi.org/10.1430/85408>
- Dileo, I., & Pini, M. (2018). Management, digital innovation and Industry 4.0. The case of family businesses in Italy. *Journal of Knowledge Management, Economics and Information Technology*, VIII(6), 22-52.
- Doloreux, D. (2002). What we should know about regional systems of innovation. *Technology in Society*, 24(3), 243-263. [https://doi.org/10.1016/S0160-791X\(02\)00007-6](https://doi.org/10.1016/S0160-791X(02)00007-6)
- Donaldson, L., & Davis, J. H. (1991). Stewardship theory or agency theory: CEO governance and shareholder returns. *Australian Journal of Management*, 16(1), 49-64. <https://doi.org/10.1177/031289629101600103>
- Donckels, R., & Lambrecht, J. (1999). The re-emergence of family-based enterprises in east-central Europe: What can be learned from family business research in the Western world?. *Family Business Review*, 12(2), 171-188. <https://doi.org/10.1111/j.1741-6248.1999.00171.x>
- Duran, P., Kammerlander, N., Van Essen, M., & Zellweger, T. (2016). Doing more with less: Innovation input and output in family firms. *Academy of Management Journal*, 59(4), 1224-1264. <https://doi.org/10.5465/amj.2014.0424>
- Edquist, C., (2005). *Systems of Innovation—Perspectives and Challenges*. In J. Fagerberg, D. Mowery, & R. Nelson (Eds.), *The Oxford Handbook of Innovation* (pp. 181-208). Oxford: Oxford University Press.
- European Commission (2017), *Key lessons from national industry 4.0 policy initiatives in Europe*. Retrieved from [https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM\\_Policy%20initiative%20comparison%20v1.pdf](https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_Policy%20initiative%20comparison%20v1.pdf)
- Evangelista, R., Guerrieri, P., & Meliciani, V. (2014). The economic impact of digital technologies in Europe. *Economics of Innovation and New Technology*, 23(8), 802-824. <https://doi.org/10.1080/10438599.2014.918438>
- Fama, E. F., & Jensen, M. C. (1983a). Separation of ownership and control. *The Journal of Law and Economics*, 26(2), 301-325. <https://doi.org/10.1086/467037>
- Fama, E. F., & Jensen, M. C. (1983b). Agency problems and residual claims. *The Journal of Law and Economics*, 26(2), 327-349. <https://doi.org/10.1086/467038>
- Ferri, G., Pini, M., & Scaccabarozzi, S. (2014). Le imprese familiari nel tessuto produttivo italiano: caratteristiche, dimensioni, territorialità. *Rivista di Economia e Statistica del Territorio*, 2, 48-77. <https://doi.org/10.3280/REST2014-002003>

- Filbeck, G., & Lee, S. (2000). Financial management techniques in family businesses. *Family Business Review*, 13(3), 201-216. <https://doi.org/10.1111/j.1741-6248.2000.00201.x>
- Flanagan, K., Uyarra, E., & Laranja, M. (2011). Reconceptualising the 'policy mix' for innovation. *Research Policy*, 40(5), 702-713. <https://doi.org/10.1016/j.respol.2011.02.005>
- Fornahl, D., & Brenner, T. (2003). *Cooperation, Networks and Institutions in Regional Innovation Systems*. Cheltenham, UK: Edward Elgar Publishing
- Fox, M. A., & Hamilton, R. T. (1994). Ownership and diversification: Agency theory or stewardship theory. *Journal of Management Studies*, 31(1), 69-81. <https://doi.org/10.1111/j.1467-6486.1994.tb00333.x>
- Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Marshfield, MA: Pitman Publishing.
- Freeman, C. (1987). *Technology and Economic Performance: Lessons from Japan*. London: Printer.
- Galende, J., & de la Fuente, J. M. (2003). Internal factors determining a firm's innovative behaviour. *Research Policy*, 32(5), 715-736. [https://doi.org/10.1016/S0048-7333\(02\)00082-3](https://doi.org/10.1016/S0048-7333(02)00082-3)
- Gersick, K. E., Davis, J. A., Hampton, M. M., & Lansberg, I. (1997). *Generation to Generation: Life Cycles of the Family Business*. Harvard: Harvard Business Press.
- Giacomelli, S., & Trento, S. (2005). *Proprietà, controllo e trasferimenti nelle imprese italiane: Cosa è cambiato nel decennio 1993-2003?* (Bank of Italy Working Papers No. 550). Retrieved from [https://www.bancaditalia.it/pubblicazioni/temi-discussione/2005/2005-0550/tema\\_550.pdf](https://www.bancaditalia.it/pubblicazioni/temi-discussione/2005/2005-0550/tema_550.pdf)
- Geissbauer, R., Vedso, J., & Schrauf, S. (2016). *Industry 4.0: Building the digital enterprise*. Retrieved from <https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf>
- Gómez-Mejía, L. R., Haynes, K. T., Núñez-Nickel, M., Jacobson, K. J., & Moyano-Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. *Administrative Science Quarterly*, 52(1), 106-137. <https://doi.org/10.2189/asqu.52.1.106>
- Gómez-Mejía, L. R., Núñez-Nickel, M., & Gutierrez, I. (2001). The role of family ties in agency contracts. *Academy of Management Journal*, 44(1), 81-95. <https://doi.org/10.5465/3069338>
- González-López, M., Dileo, I., & Losurdo, F. (2014). University-industry collaboration in the European regional context: The cases of Galicia and Apulia region. *Journal of Entrepreneurship, Management and Innovation*, 10(3), 57-87. <https://doi.org/10.7341/20141033>
- Götz, M., & Jankowska, B. (2017). Clusters and Industry 4.0—do they fit together?. *European Planning Studies*, 25(9), 1633-1653. <https://doi.org/10.1080/09654313.2017.1327037>

- Grant, R. M. (1991). The resource-based theory of competitive advantage: Implications for strategy formulation. *California Management Review*, 33(3), 114-135. <https://doi.org/10.2307/41166664>
- Guerrieri, P., Luciani, M., & Meliciani, V. (2011). The determinants of investment in information and communication technologies. *Economics of Innovation and New Technology*, 20(4), 387-403. <https://doi.org/10.1080/10438599.2010.526313>
- Habbershon, T. G., & Williams, M. L. (1999). A resource-based framework for assessing the strategic advantages of family firms. *Family Business Review*, 12(1), 1-25. <https://doi.org/10.1111/j.1741-6248.1999.00001.x>
- Hansson, M., Liljeblom, E., & Martikainen, M. (2011). Corporate governance and profitability in family SMEs. *The European Journal of Finance*, 17(5-6), 391-408. <https://doi.org/10.1080/1351847X.2010.543842>
- Hoffman, J., Hoelscher, M., & Sorenson, R. (2006). Achieving sustained competitive advantage: A family capital theory. *Family Business Review*, 19(2), 135-145. <https://doi.org/10.1111/j.1741-6248.2006.00065.x>
- Hoopes, D. G., & Miller, D. (2006). Ownership preferences, competitive heterogeneity, and family-controlled businesses. *Family Business Review*, 19(2), 89-101. <https://doi.org/10.1111/j.1741-6248.2006.00064.x>
- Howells, J. (1999). Regional systems of innovation? In D. Archibugi, J. Howells, & J. Michie (Eds.), *Innovation Policy in a Global Economy* (pp. 67-93). Cambridge, UK: Cambridge University Press.
- Hughes, A. (2012). Choosing races and placing bets: UK national innovation policy and the globalisation of innovation systems. In D. Greenaway (Ed.), *The UK in a Global World* (pp. 37-70). London, UK: CEPR.
- Isaksen, A. (2001). Building regional innovation systems: Is endogenous industrial development possible in the global economy?. *Canadian Journal of Regional Science*, 24(1), 101-120.
- Jayaraman, N., Khorana, A., Nelling, E., & Covin, J. (2000). CEO founder status and firm financial performance. *Strategic Management Journal*, 21(12), 1215-1224. [https://doi.org/10.1002/1097-0266\(200012\)21:12<1215::AID-SMJ146>3.0.CO;2-0](https://doi.org/10.1002/1097-0266(200012)21:12<1215::AID-SMJ146>3.0.CO;2-0)
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305-360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X)
- Johannisson, B., & Huse, M. (2000). Recruiting outside board members in the small family business: An ideological challenge. *Entrepreneurship & Regional Development*, 12(4), 353-378. <https://doi.org/10.1080/08985620050177958>
- Kotlar, J., De Massis, A., Frattini, F., Bianchi, M., & Fang, H. (2013). Technology acquisition in family and nonfamily firms: A longitudinal analysis of Spanish manufacturing firms. *Journal of Product Innovation Management*, 30(6), 1073-1088. <https://doi.org/10.1111/jpim.12046>



- Kraśnicka, T., Głód, W., & Wronka-Pośpiech, M. (2016). Management innovation and its measurement. *Journal of Entrepreneurship, Management and Innovation*, 12(2), 95-122. <https://doi.org/10.7341/20161225>
- Kumar, N., & Saqib, M. (1996). Firm size, opportunities for adaptation and in-house R&D activity in developing countries: The case of Indian manufacturing. *Research Policy*, 25(5), 713-722. [https://doi.org/10.1016/0048-7333\(95\)00854-3](https://doi.org/10.1016/0048-7333(95)00854-3)
- Llach, J., & Nordqvist, M. (2010). Innovation in family and non-family businesses: A resource perspective. *International Journal of Entrepreneurial Venturing*, 2(3-4), 381-399.
- Legendijk, A. (2000). Learning in non-core regions: Towards' intelligent clusters' addressing business and regional needs. In F. Boekema, K. Morgan, S. Bakkers (Eds.), *Knowledge, Innovation and Economic Growth: The Theory and Practice of Learning Regions* (pp. 165-191). Aldershot, UK: Edward Elgar
- Landry, R., Amara, N., & Lamari, M. (2002). Does social capital determine innovation? To what extent?. *Technological Forecasting and Social Change*, 69(7), 681-701. [https://doi.org/10.1016/S0040-1625\(01\)00170-6](https://doi.org/10.1016/S0040-1625(01)00170-6)
- La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (1999). Corporate ownership around the world. *The Journal of Finance*, 54(2), 471-517. <https://doi.org/10.1111/0022-1082.00115>
- Le Breton-Miller, I., Miller, D., & Lester, R. H. (2011). Stewardship or agency? A social embeddedness reconciliation of conduct and performance in public family businesses. *Organization Science*, 22(3), 704-721. <https://doi.org/10.1287/orsc.1100.0541>
- Le Breton-Miller, I., & Miller, D. (2006). Why do some family businesses out-compete? Governance, long-term orientations, and sustainable capability. *Entrepreneurship Theory and Practice*, 30(6), 731-746. <https://doi.org/10.1111/j.1540-6520.2006.00147.x>
- Leon, R. D. (2017). Developing entrepreneurial skills. An educational and intercultural perspective. *Journal of Entrepreneurship, Management and Innovation*, 13(4), 97-121. <https://doi.org/10.7341/20171346>
- Liao, Y., Deschamps, F., Loures, E. D. F. R., & Ramos, L. F. P. (2017). Past, present and future of Industry 4.0-a systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12), 3609-3629. <https://doi.org/10.1080/00207543.2017.1308576>
- López-Gracia, J., & Sánchez-Andújar, S. (2007). Financial structure of the family business: Evidence from a group of small Spanish firms. *Family Business Review*, 20(4), 269-287. <https://doi.org/10.1111/j.1741-6248.2007.00094.x>
- Lorenz, M., Ruessmann, M., Strack, R., Lueth, K. L., & Bolle, M. (2015). Man and machine in industry 4.0: How will technology transform the industrial workforce through 2025. Retrieved from <https://www.bcg.com/publications/2015/technology-business-transformation-engineered-products-infrastructure-man-machine-industry-4.aspx>

- Lundvall, B. A. (1992). *National Innovation System: Towards a Theory of Innovation and Interactive Learning*. London, UK: Pinter.
- Magro, E., Aranguren, M., & Navarro, M. (2010, May). Does regional S&T policy affect firms' behaviour. Paper presented at the *Regional Studies Association annual international conference*. Retrieved from <http://www.regional-studies-assoc.ac.uk/events/2010/may-pecs-papers.asp>
- Magro, E., & Wilson, J. R. (2013). Complex innovation policy systems: Towards an evaluation mix. *Research Policy*, 42(9), 1647-1656. <https://doi.org/10.1016/j.respol.2013.06.005>
- Mandl, I. (2008). *Overview of family business relevant issues*. Retrieved from <https://ec.europa.eu/docsroom/documents/10389/attachments/1/translations/en/renditions/pdf>
- Manso, G. (2011). Motivating innovation. *The Journal of Finance*, 66(5), 1823-1860. <https://doi.org/10.1111/j.1540-6261.2011.01688.x>
- Marino, M., & Parrotta, P. (2010, June). Impacts of public funding to R&D: Evidences from Denmark. In *DRUID summer conference*. Retrieved from <https://www.imperial.ac.uk/business-school/research/innovation-and-entrepreneurship/events/conferences/druid-summer-conference-2010/>
- Matzler, K., Veider, V., Hautz, J., & Stadler, C. (2015). The impact of family ownership, management, and governance on innovation. *Journal of Product Innovation Management*, 32(3), 319-333. <https://doi.org/10.1111/jpim.12202>
- McCann, P., & Ortega-Argilés, R. (2015). Smart specialisation, regional growth and applications to EU cohesion policy. *Regional Studies*, 49(8), 1291-1302. <https://doi.org/10.1080/00343404.2013.799769>
- Miller, D., & Le Breton-Miller, I. (2006). Family governance and firm performance: Agency, stewardship, and capabilities. *Family Business Review*, 19(1), 73-87. <https://doi.org/10.1111/j.1741-6248.2006.00063.x>
- Miller, D., & Le Breton-Miller, I. (2005). *Managing for the Long Run: Lessons in Competitive Advantage from Great Family Businesses*. Harvard: Harvard Business Press.
- Miller, D., Le Breton-Miller, I., Lester, R. H., & Cannella Jr, A. A. (2007). Are family firms really superior performers?. *Journal of Corporate Finance*, 13(5), 829-858. <https://doi.org/10.1016/j.jcorpfin.2007.03.004>
- Miller, D., Le Breton-Miller, I., & Scholnick, B. (2008). Stewardship vs. stagnation: An empirical comparison of small family and non-family businesses. *Journal of Management Studies*, 45(1), 51-78. <https://doi.org/10.1111/j.1467-6486.2007.00718.x>
- Minetti, R., Murro, P., & Paiella, M. (2015). Ownership structure, governance, and innovation. *European Economic Review*, 80, 165-193. <https://doi.org/10.1016/j.euroecorev.2015.09.007>
- Ministry of Economic Development. (2017). *Italy's plan: Industria 4.0*. Retrieved from [https://www.mise.gov.it/images/stories/documenti/2017\\_01\\_16-Industria\\_40\\_English.pdf](https://www.mise.gov.it/images/stories/documenti/2017_01_16-Industria_40_English.pdf)

- Moeuf, A., Pellerin, R., Lamouri, S., Tamayo-Giraldo, S., & Barbaray, R. (2018). The industrial management of SMEs in the era of Industry 4.0. *International Journal of Production Research*, 56(3), 1118-1136. <https://doi.org/10.1080/00207543.2017.1372647>
- Moulaert, F., & Sekia, F. (2003). Territorial innovation models: A critical survey. *Regional Studies*, 37(3), 289-302. <https://doi.org/10.1080/0034340032000065442>
- Muscio, A. (2006). From regional innovation systems to local innovation systems: Evidence from Italian industrial districts. *European Planning Studies*, 14(6), 773-789. <https://doi.org/10.1080/09654310500496073>
- Mytelka, L. K. (2000). Local systems of innovation in a globalized world economy. *Industry and Innovation*, 7(1), 15-32. <https://doi.org/10.1080/713670244>
- Naldi, L., Nordqvist, M., Sjöberg, K., & Wiklund, J. (2007). Entrepreneurial orientation, risk taking, and performance in family firms. *Family Business Review*, 20(1), 33-47. <https://doi.org/10.1111/j.1741-6248.2007.00082.x>
- Nauwelaers, C., Boekholt, P., Mostert, B., Cunningham, P., Guy, K., Hofer, R., & Rammer, C. (2009). Policy mixes for R&D in Europe. Retrieved from [http://www.eurosfaire.prd.fr/7pc/doc/1249471847\\_policy\\_mixes\\_rd\\_ue\\_2009.pdf](http://www.eurosfaire.prd.fr/7pc/doc/1249471847_policy_mixes_rd_ue_2009.pdf)
- Nauwelaers, C., & Wintjes, R. (2003). Towards a new paradigm for innovation policy. In B. T. Asheim, A. Isaksen, C. Nauwelaers, & F. Tödling (Eds.), *Regional Innovation Policy for Small-medium Enterprises* (pp. 193-220). Cheltenham, UK: Edward Elgar.
- Nelson, R. R., & Rosenberg, N. (1993). Technical innovation and national systems. In R. R. Nelson (Ed.), *National Innovation Systems: A Comparative Analysis* (pp. 3-22). Oxford, UK: Oxford University Press.
- Neubauer, F., & Lank A. G. (1998). *The Family Business: Its Governance for Sustainability*. New York: Routledge.
- Nieto, M. J., Santamaria, L., & Fernandez, Z. (2015). Understanding the innovation behavior of family firms. *Journal of Small Business Management*, 53(2), 382-399. <https://doi.org/10.1111/jsbm.12075>
- Niosi, J., Saviotti, P., Bellon, B., & Crow, M. (1993). National systems of innovation: In search of a workable concept. *Technology in Society*, 15(2), 207-227. [https://doi.org/10.1016/0160-791X\(93\)90003-7](https://doi.org/10.1016/0160-791X(93)90003-7)
- O'Brien, J. P. (2003). The capital structure implications of pursuing a strategy of innovation. *Strategic Management Journal*, 24(5), 415-431. <https://doi.org/10.1002/smj.308>
- OECD (2010). *OECD science, technology and industry outlook 2010*. Paris, France: OECD Publishing. Retrieved from [https://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2010\\_sti\\_outlook-2010-en](https://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2010_sti_outlook-2010-en)
- OECD (1999). *Managing National Innovation Systems*. Paris, France: OECD Publishing. Retrieved from [https://www.oecd-ilibrary.org/industry-and-services/managing-national-innovation-systems\\_9789264189416-en](https://www.oecd-ilibrary.org/industry-and-services/managing-national-innovation-systems_9789264189416-en)

- Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 179-191. <https://doi.org/10.1002/smj.4250140303>
- Pickering, C., & Byrne, J. (2014). The benefits of publishing systematic quantitative literature reviews for PhD candidates and other early-career researchers. *Higher Education Research & Development*, 33(3), 534-548. <https://doi.org/10.1080/07294360.2013.841651>
- Pini, M., Dileo, I., & Cassetta, E., (2018). Digital reorganization as a driver of the export growth of Italian manufacturing small and medium sized enterprises. *Journal of Applied Economic Sciences*, 5(59), 1373-1385.
- PWC. (2016). *Industry 4.0: Building the Digital Enterprise*. Retrieved from <https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf>
- Schneider, P. (2018). Managerial challenges of Industry 4.0: An empirically backed research agenda for a nascent field. *Review of Managerial Science*, 12(3), 803-848. <https://doi.org/10.1007/s11846-018-0283-2>
- Schulze, W. S., Lubatkin, M. H., & Dino, R. N. (2003). Toward a theory of agency and altruism in family firms. *Journal of Business Venturing*, 18(4), 473-490. [https://doi.org/10.1016/S0883-9026\(03\)00054-5](https://doi.org/10.1016/S0883-9026(03)00054-5)
- Schulze, W. S., Lubatkin, M. H., Dino, R. N., & Buchholtz, A. K. (2001). Agency relationships in family firms: Theory and evidence. *Organization Science*, 12(2), 99-116. <https://doi.org/10.1287/orsc.12.2.99.10114>
- Schumpeter, J. A. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
- Schwab, K. (2016). The 4th industrial revolution. In *World Economic Forum*. New York: Crown Business.
- Sciascia, S., & Mazzola, P. (2008). Family involvement in ownership and management: Exploring nonlinear effects on performance. *Family Business Review*, 21(4), 331-345. <https://doi.org/10.1177/08944865080210040105>
- Sirmon, D. G., & Hitt, M. A. (2003). Managing resources: Linking unique resources, management, and wealth creation in family firms. *Entrepreneurship Theory and Practice*, 27(4), 339-358. <https://doi.org/10.1111/1540-8520.t01-1-00013>
- Smallbone, D., North, D., Roper, S., & Vickers, I. (2003). Innovation and the use of technology in manufacturing plants and SMEs: An interregional comparison. *Environment and Planning C: Government and Policy*, 21(1), 37-52. <https://doi.org/10.1068/c0218>
- Spithoven, A., Frantzen, D., & Clarysse, B. (2010). Heterogeneous firm-level effects of knowledge exchanges on product innovation: Differences between dynamic and lagging product innovators. *Journal of Product Innovation Management*, 27(3), 362-381. <https://doi.org/10.1111/j.1540-5885.2010.00722.x>

- Stock, T., & Seliger, G. (2016). Opportunities of sustainable manufacturing in industry 4.0. *Procedia Cirp*, 40, 536-541. <https://doi.org/10.1016/j.procir.2016.01.129>
- Tagiuri, R., & Davis, J. (1996). Bivalent attributes of the family firm. *Family Business Review*, 9(2), 199-208. <https://doi.org/10.1111/j.1741-6248.1996.00199.x>
- Tödtling, F., & Trippel, M. (2005). One size fits all?: Towards a differentiated regional innovation policy approach. *Research Policy*, 34(8), 1203-1219. <https://doi.org/10.1016/j.respol.2005.01.018>
- Tsai, K. H., & Wang, J. C. (2005). Does R&D performance decline with firm size?—A re-examination in terms of elasticity. *Research Policy*, 34(6), 966-976. <https://doi.org/10.1016/j.respol.2005.05.017>
- Veugelers, R., & Cassiman, B. (1999). Make and buy in innovation strategies: Evidence from Belgian manufacturing firms. *Research Policy*, 28(1), 63-80. [https://doi.org/10.1016/S0048-7333\(98\)00106-1](https://doi.org/10.1016/S0048-7333(98)00106-1)
- Villalonga, B., & Amit, R. (2006). How do family ownership, control and management affect firm value?. *Journal of Financial Economics*, 80(2), 385-417. <https://doi.org/10.1016/j.jfineco.2004.12.005>
- Xu, L. D., Xu, E. L., & Li, L. (2018). Industry 4.0: State of the art and future trends. *International Journal of Production Research*, 56(8), 2941-2962. <https://doi.org/10.1080/00207543.2018.1444806>
- Westhead, P., & Howorth, C. (2007). 'Types' of private family firms: An exploratory conceptual and empirical analysis. *Entrepreneurship and Regional Development*, 19(5), 405-431. <https://doi.org/10.1080/08985620701552405>
- Williams, R. (2012). Using the margins command to estimate and interpret adjusted predictions and marginal effects. *Stata Journal*, 12(2), 308-331. <https://doi.org/10.1177/1536867X1201200209>
- Wooldridge, J. M. (2016). *Introductory Econometrics: A Modern Approach*. Boston, MA: Cengage Learning.
- Yoo, W., Mayberry, R., Bae, S., Singh, K., He, Q. P., & Lillard Jr, J. W. (2014). A study of effects of multicollinearity in the multivariable analysis. *International Journal of Applied Science and Technology*, 4(5), 9-19.
- Zahra, S. A., Hayton, J. C., & Salvato, C. (2004). Entrepreneurship in family vs. non-family firms: A resource-based analysis of the effect of organizational culture. *Entrepreneurship Theory and Practice*, 28(4), 363-381. <https://doi.org/10.1111/j.1540-6520.2004.00051.x>

### Abstrakt

W niniejszym artykule zbadano wpływ różnych rodzajów zarządzania w firmach rodzinnych na innowacje cyfrowe związane z inwestycjami w Przemysł 4.0 z perspektywy geograficznej. Zestaw danych obejmuje 3000 włoskich małych i średnich przedsiębiorstw produkcyjnych. Wykorzystując modele probitowe, wyniki pokazują, że podczas gdy w bardziej zaawansowanym obszarze (centrum-północ) zarządzanie

*zewnętrzne wpływa znacząco na skłonność do innowacji, w mniej rozwiniętym obszarze (południowe Włochy), zarządzanie zewnętrzne wymaga dodatkowych inwestycji w badania i rozwój w celu wprowadzenia innowacji. Sugeruje to, że polityka innowacyjna powinna określać zachęty, które również pomagają ulepszać nowe modele biznesowe zarządzania i uwzględniać cechy behawioralne różnych firm w odniesieniu do poziomu rozwoju obszarów geograficznych, w których działają.*

**Słowa kluczowe:** *firmy rodzinne, przemysł 4.0, produkcja, regiony*

## **Biographical note**

**Marco Pini** is an economist at Unioncamere-Si.Camera, Italian Union of Chambers of Commerce. Previously, he served at the Institute for Studies and Economic Analyses (ISAE, Rome, Italy) and at G. Tagliacarne Institute (Foundation of Unioncamere, Rome, Italy). He is also a member of Italian Society of Economics Demography and Statistics (SIEDS) and of Italian Society of Industrial Economics and Policy (SIEPI). His research interests include entrepreneurship, family business, industrial economics, the labor market, innovation, digitalization, the green economy, and social economy.

# An innovation policy framework for upgrading firm absorptive capacities in the context of catching-up economies

*Agnė Paliokaitė*<sup>1</sup>

---

## **Abstract**

*The paper addresses the 'regional innovation paradox' referring to the lower capacity to absorb public funds earmarked for the promotion of innovation in the peripheral regions. The key aim is thus to propose and test a conceptual framework of tailored innovation policy routes that aim at stimulating absorptive capacities of firms. Literature analysis helps to distill determinants of absorptive capacity at firm and system levels. Analysis of innovation policies applied by the Central and Eastern European (CEE) countries in 2007-2013 is used to determine the gap between mainstream innovation policies and business capacity building needs. The paper presents an integrative conceptual 'stairway of competence' framework, mapping four innovator types with alternative policy routes. An assessment of innovation policies in the selected CEE countries is provided. We find that mainstream innovation policies in the selected countries mainly focused on two routes: strengthening the capacities of mature innovators and the uptake of existing technology. There is little evidence that this approach had any clear effects on structural change in the CEE economies. These findings suggest that a more tailor-made approach to innovation capacity building is needed, taking into account the current capacity levels within the target groups. These findings are especially relevant to the use of European Union cohesion policy funds and the implementation of the smart specialization strategies. Although the CEE is the main context for the framework, its implications are applicable to other catching-up and peripheral regions more widely.*

**Keywords:** *peripheral and catching-up regions, technological upgrading, regional innovation paradox, absorptive capacities, innovation policies*

---

1 Agnė Paliokaitė, Visionary Analytics, M. Valančiaus St. 1A, 03155 Vilnius, Lithuania, e-mail: [agne@visionary.lt](mailto:agne@visionary.lt)

Received 30 July 2018; Revised 31 March 2019, 17 May 2019; Accepted 21 May 2019

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

## INTRODUCTION

---

Despite significant investments in R&D and innovation (RDI), upgrading the Central and Eastern European (CEE) countries towards knowledge-based economies is a slow and complex process. Many deficiencies in policy frameworks and institutional capacities emerge at the CEE level (Bachtler, Mendez, & Oraže, 2014). The CEE region, or at least most of the countries in this part of Europe, is classified as ‘peripheral’ or ‘lagging-behind’, and suffers from a lack of skilled human capital, differences in the structural and sectoral composition of the ‘economic fabric’, making them less prone to innovation, the phenomenon of brain drain and deficient institutional settings (Rodriguez-Pose, 2015).

The rationale behind the European Union (EU) cohesion policy-funded interventions in the region was to alleviate these disparities and help the CEE countries catch-up with Western Europe. It is estimated that between 2007 and 2015, the CEE countries spent around 22 percent of their total cohesion policy allocations on enterprise and R&D policies (Serbanica & Constantin, 2018). By the end of 2014, the CEE countries provided direct support to approximately 70,000 SMEs across the region, helped more than 5,500 new businesses and funded more than 3,000 business-academia collaborations (European Commission [EC], 2016). Some evaluation reports indicate that such policies helped modernize production processes and purchase both tangible and intangible assets (new equipment, machinery, etc.). This, in turn, increased the value-added of SME economic activities, increased turnover, profitability and exports, and, in a number of cases, also led to behavioral changes, with SMEs becoming more willing to take risks, to innovate and to develop new products (EC, 2016). However, other evaluation reports claim that innovation policies have not led to higher innovation capacities (Muscio, Rivera Leon, & Reid, 2015; Clar, Boekholt, Nauwelaers, Saublens, & Tiits, 2015), the structural change of the CEE economies, or any related long-term benefits (Rodriguez-Pose, 2015). Indeed, the CEE countries still lag behind in innovation performance. According to the European Innovation Scoreboard 2018, all countries within the CEE region, with the exception of Slovenia, are moderate or modest innovators. This means that, despite some positive impact on territorial convergence, so far, mainstream innovation policies did not succeed in alleviating regional differences (Gorzela, 2017).

Unless RDI policies are granted sufficient attention, a continued ‘lagging-behind’ with respect to the aspirations of the CEE countries’ knowledge economy may lead to a Europe with a two-tier or multi-tier economy creating potentially negative economic and political consequences for the EU as a whole. Although some CEE countries have demonstrated high rates of



---

economic growth, the European Bank for Reconstruction and Development (2017) still sees the CEE region as caught in the middle-income trap. Escaping this trap requires a restructuring of the economy towards higher value-added activities. In that case, the region's economic model would transition towards productivity-led growth rather than remain factor-driven. Although reorientation is possible, many countries in the CEE region encounter the so-called 'regional innovation paradox' (Muscio et al., 2015), which limits their capabilities to rapidly increase productivity. Firms in such regions are likely to fail in fully exploiting existing innovation opportunities. Muscio et al., (2015) claim that the CEE innovation systems have reached a limit in terms of their capacity to absorb public financial investments in research and innovation, which are notably due to the limited human and financial capacities of local firms and research institutes. Hence, pumping more investment in without changing the current strategy is unlikely to bring the expected returns.

Building on the claims above, this paper argues that innovation policies would be more effective if they depended on the structural characteristics of national economies and the resulting absorptive capacities of firms. Tailored policies, especially directed at stimulating the absorptive capacities of firms, would thus be necessary to promote effective structural changes. Izsak, Markianidou, and Radošević (2014) found a high homogeneity amongst policy mixes despite the relatively large differences between the CEE countries in technological and economic development, and the differences with respect to the role of knowledge generation vs. knowledge absorption in their growth. Innovation and absorption can work together to create a virtuous circle. Some interpretative mechanisms have been identified. However, the conceptual links between policy interventions and absorptive capacity building, especially in the contexts of catching-up and pre-frontier stages, as well as empirical testing, still require further investigation. The 2014–2020 period may be time of make-or-break for the CEE countries if they are to achieve significant structural change and break out of the 'middle-income trap' (Muscio et al., 2015). With the EU's smart specialization strategies underway, the question is how could innovation policies benefit firms in building absorptive capacities to leverage innovation performance, restructuring traditional sectors, and transitioning them to new knowledge-based activities overall.

In view of the issues raised, the key aim of this paper is to discuss and test a conceptual framework of tailored innovation policy routes, which aim at stimulating absorptive capacities of firms. The study contains four parts. First of all, the paper reviews extant literature to set out alternative perspectives on explaining the upgrading process and measuring the determinants of absorptive capacities. This allows us to distinguish determinants of capacity

building in firms that have differing capacity building needs (mature, emerging, and potential innovators). Secondly, we match determinants of absorptive capacity relevant to firms that have differing capacity building needs with relevant policy instruments and alternative policy routes. Thirdly, based on a database of innovation policy instruments implemented by selected CEE countries (Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, Slovenia, Estonia, Latvia, and Lithuania) during 2007-2013, the paper provides a comparative analysis of preferred policy routes. Finally, the last section discusses the results and provides implications for theory and practice.

## LITERATURE REVIEW

---

The 'regional innovation paradox' refers to the apparent contradiction between the comparatively greater need to spend on innovation in lagging regions and their relatively lower capacity to absorb public funds that have been specifically allocated to innovation and related activities (Oughton, Landabaso, & Morgan, 2002). There are a few theoretical arguments as to why the regional innovation paradox exists. Moncada-Paternò-Castello, Ciupagea, Smith, Tübke, and Tubbs (2010) claim that the differences in R&D are determined more by structural differences of economies rather than other factors. This could be the case in the CEE countries, where most R&D-intensive industries are insufficiently developed. In most CEE countries, much of the manufacturing production is at the low end of advanced manufacturing and global value chains. Furthermore, a low share of knowledge-intensive business services in manufacturing intermediate consumption goods undermines the potential to differentiate products and increase the value added of the manufacturing sector. However, even if low innovation capacities are driven by economic structure, the need to transform economies towards productivity-oriented growth remains relevant, and the means of overcoming this issue should still be identified.

In general terms, upgrading refers to a country's ability to reduce the gap in productivity and income in relation to leading world economies (Fagerberg & Godinho, 2005). According to the endogenous growth theory (Romer, 1990), economic development significantly depends on a country's income gap in relation to advanced economies (i.e., the distance to the 'global technological frontier'). So long as the gap remains wide, economic growth may be driven by adopting existing technology. The closer a country gets to the global technological frontier, the smaller the returns of adoption become

and, instead, innovation has to take over as the main driver for productivity and economic growth (Table 1).

**Table 1.** Development stages and related capabilities

Development stage	<b>Pre-catching-up stage:</b> natural, resource-based, commodity exports. Limited technological capabilities.	<b>Catching-up stage:</b> basic infrastructure, growing capacity to imitate. Engaged in low-value-adding-manufacturing, often as OEM supplier.	<b>Pre-frontier stage:</b> increasingly specialized knowledge. Decline in potential to imitate and adapt. Increasing integration into efficiency-based global production networks. Strong domestic industry. Increasing use of networking to achieve modularity. Rising inward-outward FDI.	<b>Frontier-sharing stage:</b> Technological opportunities primarily rest on long-term innovation and collaboration. Pushing back frontiers of knowledge. Considerable in-house R&D activity by both domestic and foreign MNEs. Outward FDI. Growing use of R&D alliances and networking. Strong knowledge infrastructure.
Economy structure	Primary sector, reliance on labor-intensive technology	Manufacturing sector increasing. Shift to knowledge-intensive industries	Service sector increasing. Growth increasingly comes from knowledge-intensive industries	Growth comes from inter-sectoral shifts. High investment in creating new industries and shutting down sunset sectors
Relevant capabilities		Technology imitation Production capability Engineering innovation	Technology diversification From engineering innovation to advanced development From production capability to technology capability	Technology frontier activities From engineering innovation and advanced development to exploratory development

Source: Narula (2004); Radošević and Yoruk (2015).

Understanding the specificities of the relevant sectoral and innovation systems is fundamental in order to identify the source of innovation in development. According to Muscio et al. (2015) attempts to promote advanced industries in economies that are further from the technological frontier will result in enterprises which become dysfunctional in open, competitive markets. The alternative is to adopt a strategy which follows comparative advantage and enables firms to follow the economy's comparative advantage in choosing technologies and markets only if the relative prices reflect latent comparative advantages. From a dynamic perspective, economic development depends on upgrading industrial structures, endowments, and improving infrastructure. Catching-up is thus closely linked to the processes of technology and industry upgrading. Upgrading is usually defined as a process of a gradual shift from lower to higher value-added activities. As noted by Radošević and Yoruk (2015), the recent push in our understanding of technology upgrading came from exploring the upgrading that takes place through global value chains. Gereffi (1999) defines it as a process of improving the ability of a firm or an economy to move to more profitable and/or technologically sophisticated capital and skill-intensive economic niches. Upgrading is a multi-level process that takes place at firm, industry, inter-industry, and country levels. Ongoing developments in literature have recently grown to recognize that countries' advancement of their firm-level upgrading is increasingly dependent on 'industry linkages' (Ernst, 2008).

Radošević and Yoruk (2015) suggest an index of upgrading, based on several propositions listed below. First of all, when countries are far from technology distance, their growth is based on imitative technology. As they move from middle to high income, imitative technology efforts do not suffice, so countries need to find alternative paths through technology diversification rather than imitation. Once they reach the post-catch-up stage, they need to embark upon activities at the technology frontier. Secondly, technology upgrading is a multidimensional process that goes well beyond R&D and consists of the following three major dimensions:

- *Technology upgrading capabilities*: production capability, technology capability, R&D, and knowledge intensity are present in all economies but to different degrees. Kravtsova and Radošević (2011) and Radošević (2015) have shown that for many middle-income countries (esp. Eastern Europe) production capability is a significant determinant of productivity growth, both at micro and macro levels.
- *Structural change* driven by technology transforms the boundaries as well as the nature of industries. Empirical results do not support the idea that growth correlates with shares of the high-tech sectors

---

(Sandven, Smith & Kaloudis, 2005). Furthermore, catching-up countries are becoming increasingly involved in high tech industries but remain at their low value-added segments. Instead, we observe the changing nature of industries and services and their convergence. This is being captured by knowledge-intensive business services which are especially important in this development. Instead of focusing on structural changes at the level of industries, Radošević and Yoruk (2015), as well as Havas (2014), suggest a shift in our attention to the following trends with regard to technological change:

- increasing importance of ICT in all sectors and activities within the economy;
- increasing importance of convergence between manufacturing and (knowledge intensive) services;
- increasing knowledge intensity within all sectors of the economy;
- increasing technology diversification as countries upgrade their technologies;
- infrastructural upgrading, human capital (input into technology upgrading), and firm structure (large firms vs. SMEs).
- *Interaction with the global economy*, which means that technology upgrading is also an outcome of interaction between global actors and local technology accumulation activities (pursued by host country firms and governments). Technology transfer happens through capital equipment import, and is embedded in modes like FDI, networks, and subcontracting or is disembodied (licenses). Technology (embodied) imports, knowledge imports (licenses), and knowledge cooperation (R&D cooperation) are taken as components of interaction within the dimensions of the global economy.

Extrapolating from the endogenous growth theory (Romer, 1990) as a starting point, this paper proposes an alternative explanation that relates to productive use of knowledge. Catching-up also entails a process through which emerging economies learn and accumulate knowledge to develop products, processes, and technologies that may differ more or less from the ones of advanced countries. Countries that undergo a restructuring of their economies towards productivity-based growth face two main problems. First of all, firms must be able to exploit existing knowledge and turn it into commercial outputs. And secondly, firms must obtain new knowledge to remain competitive, expanding the scope rather than the scale of their production. One potential explanation of why the CEE region lags behind is that despite innovation-friendly developments, economic entities are not ready to exploit new opportunities. Although financial resources are available and the environment is suitable, the firms themselves possibly lack capacities that are needed to absorb knowledge and transform it into commercially viable innovations.

In order to produce and successfully commercialize innovation, firms must synthesize a wide variety of expertise and knowledge coming from different complementary sources. Firms learn from both internal sources of knowledge such as R&D activity and from a wide variety of external sources of innovation systems (Malerba, 1992; Malerba & Nelson, 2011). In the last two decades, this aspect of learning has become increasingly targeted and widely studied. More recently, the discussion on absorptive capacity has crossed that on the governance of the innovation process, the open-innovation mode (Chesbrough, 2003), and the role of technology transfer and innovation networks. Open innovation and knowledge transfer, including from high technology to low technology sectors, and from innovative to previously non-innovative firms, is also at the forefront of the EU's national, and regional innovation policies. Simply put, reaching the frontier becomes easier, once countries have 'learned-to-learn' (Criscuolo & Narula, 2002) – i.e., absorb knowledge and transform it into higher-value added economic activities. The present paper is set within this particular context of research.

Studies define the absorptive capacity of firms (Zahra & George, 2002, p. 198) either as, 'a firm's ability to value, assimilate and apply information toward commercial ends,' or as '[an] emphasis on acquiring and exploiting externally generated knowledge.' Zahra and George (2002, p. 198) go further to update these definitions by including 'organizational routines and strategic processes,' as well as 'exploit[ing] new knowledge by transforming acquired knowledge.' Thus, absorptive capacity reflects the inner capabilities of a firm to seek new knowledge and adapt it according to its needs. It reflects many aspects of the firm, such as routines, knowledge sources, etc..

Absorptive capacities are seen as an explanation of competitive advantage (Cohen & Levinthal, 1990), innovation (Stock, Greis, & Fischer, 2001), and firm performance (Lane, Salk, & Lyles, 2001). While most studies have focused on the tangible outcomes, absorptive capacities also seem to result in intangible outcomes, such as intraorganizational transfer of knowledge (Gupta & Govindarajan, 2000), inter-organizational learning (Lane, Salk, & Lyles, 2001), and knowledge search (Shenkar & Li, 1999).

The main determinants of absorptive capacities at a *micro (firm) level* were identified in the meta-analysis provided by, e.g. Van den Bosch, Volberda, and de Boer (1999) and Volberda, Foss, and Lyles (2010) and are listed below:

- *Prior related knowledge stock.* This refers to the direction, scope, and breadth of knowledge as well as the firm's prior knowledge and experiences.

- *Managerial and strategic aspects.* They are defined as a firm's managerial competencies, mental models and cognition power, related to different areas that influence the firm's ability to use external knowledge (e.g., R&D investment strategy, facilitating knowledge sharing and internal communication).
- *Inter-firm relationships.* They are defined as relationships with business partners to acquire new knowledge or to access business networks and obtain new knowledge.
- *Intra-firm relationships.* They are defined as various aspects of a firm's internal communication and social mechanisms such as organizational form, communication systems and processes, connectedness, cross-functional communication, informal networks, information exchange, knowledge sharing, and coordination mechanisms.
- *Environmental conditions.* This refers to the characteristics such as competitiveness, dynamics of appropriability regime, and knowledge characteristics within the firms' environment. In a stable knowledge environment, which is often found in a mature single industry, existing firms have a strong focus on the exploitation of knowledge. Over time, an efficiency focus on knowledge absorption is likely to result in a low diversity of knowledge structures, few cross-functional relationships, and low absorptive capacity. Firms operating in stable knowledge environments, therefore, are likely to become more reactive. Firms in turbulent knowledge environments, however, are likely to dedicate efforts exclusively to increase their absorptive capacity. In such environments, knowledge absorption is likely to be more focused on exploration.

Absorptive capacities are cumulative, and past dependent and its current accrument allows for future higher increasing rates. However, the *national absorption capacity* is not a simple sum of the absorptive capacities of national firms or industries. There are synergic effects, inter-firm and inter-industries influences, due to systemic and institutional elements that facilitate absorption (Crisculo & Narula, 2002). The following key factors which have definite impacts on the magnitude and dynamics of AC at the system-level are discussed in the literature at length (Effelsberg, 2011):

- *National potential of highly educated people with relevant social capabilities* (Fagerberg & Godinho, 2004). Technology in the form of new machinery and equipment will not lead to increased productivity unless accompanied by sufficient skills that are needed to use it effectively. To improve the knowledge base of the industrial and education/research system, investment in basic research and training are needed.

- *Organizational learning capabilities and skills*, including managerial innovations and new organizational forms, such as mass production in the US in the first part of the 20<sup>th</sup> century and the Kanban system in Japan in the 1970s (Malerba, 2006). General skills, unless converted into firm-specific skills, will not suffice for upgrading. Eastern Europe is a good example of a region where the labor force has relatively high education levels but also low firm-specific skills.
- *Creation of structural conditions*, the aim of which is to improve infrastructure and entrepreneurship. A high share of young start-up companies and university spin-offs is an indication of low barriers to entry of a market and thus for a higher intensity of competition whereas a short time-to-market indicates a high ability to benefit from ideas.
- *R&D spillovers and institutional intermediates for knowledge transfer* that support interactions between companies, as well as between different components of the national innovation system. The capacity to absorb research results that universities and research institutes deliver is particularly dependent on the factors that are specific, intrinsic to the potential receiver. A common scientific language with knowledge providers would improve the ability to acknowledge, absorb, and exploit the results of scientific research (Schmidt, 2010).
- *International interconnectedness*. Globalization of technology exploitation and collaboration but also technology generation through globalization of R&D process has further increased the importance of international linkages for industrial upgrading (Radošević & Yoruk, 2015). In countries that are behind the technology frontier, growth is mainly driven by diffusion and absorption of technologies that are new to the firm or country but are not new in the world as such. The task of economic policy is to create framework conditions which would eliminate barriers to international cooperation. Collaborations could fail in cases where bureaucratic rules complicate the enforcement of patents, basic information about legal conditions is lacking, or a partner of a joint innovation project is not found. Providing contact- or information platforms is a possible form of support to avoid these types of failures.
- *Effective governance*. The potential of innovation policies to foster 'innovation-driven growth' is seriously constrained by weak governance capacities in the CEE countries (Muscio et al., 2015). This constraint is present at both the strategic (priority setting) level and especially the program implementation level. Resolving this will require the ministries and agencies to strengthen their strategic management capacities (notably a shift from direct financial aid to demand-side policies), as well as to foster the emergence



of partnerships to manage ‘innovation platforms’ and structure fragmented business capacities.

- *Demand for innovation and R&D inputs.* Malerba (2006) suggests that in addition to the size of domestic or international markets, one has to add another role of demand related to the specificities of different sectoral systems: here specialization in product groups, demand segments or niches, or stages of the global value chain indeed fostered the catch-up process.
- Finally, *mobility of people* is one of the most effective channels of knowledge transfer and technology upgrading. This is the key mechanism for conveying tacit knowledge as well as initiating learning.

Muscio et al. (2015) suggest that the mismatch between regional supply and demand for innovation (e.g., lack of private demand for R&D and other innovation inputs, weak embedding of the regional research and technological infrastructure, etc.) and regional governance capacity are the main causes of the ‘regional innovation paradox.’ Lundvall (1999) suggests that an innovation systems approach requires institutional change through coordinating actors from the supply and demand sides so that a demand-driven perspective is adopted. Similarly, science, education and innovation, and industrial policies need to be complementary to each other. Most importantly, solving the ‘innovation paradox’ requires policies that increase the regional capacity to absorb public investment funds for innovation (Muscio, Rivera Leon & Reid, 2015). In response, the paper proposes the research framework below.

## RESEARCH FRAMEWORK

---

The literature review above provides a variety of determinants of absorptive capacity that specific policies may tackle. Following the classification of policy instruments proposed by Izsak, Markianidou, and Radošević (2014) and Paliokaitė and Martinaitis (2016), an integrative ‘stairway of competence’ model is proposed (Table 2), which matches four innovator types with tailor-made innovation policy routes, each of which further aim at strengthening specific capacities. The proposed model focuses on all types of absorptive capacity determinants. The model is based on a suggestion made by Havas (2015) and Radošević and Yoruk (2015), that innovation policies could be more effective if their goals were set and the tools are selected by following the broad approach of innovation, taking into account various types, forms and sources of knowledge used by all sorts of actors in all economic sectors for innovation purposes. It would mean that innovation policies should reflect different capabilities and needs of firms and sectors, from technology

upgrading to imitation, diversification, and technology frontier activities. Finally, the model responds to the critique voiced by Izsak, Markianidou, and Radošević (2014) that the convergence of national innovation policy mixes in Europe has gone too far insofar as current innovation policies in the CEE countries are not appropriate to their income levels and distance to the technological frontier. These policies are much more reflective of 'the best practice,' but not the country-specific technological positions and constraints. Such policies are unable to contribute to convergence across the EU but could be a factor of further divergence. The exclusive focus on policy transfer and the diffusion of the 'best practice' de facto precludes a critical understanding of the factors that influence a country's technology upgrading (Izsak, Markianidou & Radošević, 2014).

Key assumptions of the proposed framework are listed below. First, in the proposed model, firms with only basic innovation and absorptive capacities (*technology consumers*) start climbing the 'competence stairway' by strengthening their technological capabilities, upgrading production systems and managerial knowledge, attracting skilled specialists and strengthening cooperation with innovative companies in order to foster technology diffusion.

Second, the model implies that innovation promotion services, innovation brokering/scouting, and pipeline facilitation via technical assistance and support are necessary preconditions for higher absorptive capacities of *potential innovators*. Such capacity building is an important aspect of improving RDI performance in terms of excellence. Buying a new production line improves efficiency and quality, but the business function remains the same. To move up the value chain means leaving the previous function and starting a new one. This requires different capacities than an understanding of the production line (like design, engineering, marketing, service development, etc.). The decision to move up the value chain emerges when a business can no longer stay competitive in its customary position. Many of the companies in traditional industries are facing a decline in low cost based competitive strategies and are looking for new business fields. Despite their limited R&D capacities, they are nonetheless potential innovators. One of the reasons why these potential innovators are less engaged in R&D activities and partnerships is their lack of competencies linked to acknowledgment of the value of innovation, and/or capabilities related to the management of innovation processes. Precisely, this failure justifies State intervention and the need for facilitation and acceleration services with respect to innovative ideas. Hence, the policy mix should focus on the pro-active incentives which encourage companies to get involved in discovering the following opportunities of diversification and experimentation:

- 
- mechanisms (e.g., vouchers) to boost the number of experiments and inventions while simultaneously encouraging connections among economic agents;
  - industry, technology and market foresights, studies on long-term future trends and likely development of technologies that could improve forward-looking capabilities and agility;
  - innovation scouting/brokerage, technical assistance and other innovation support services aimed at emphasizing the value of innovation and linking the activities of different actors in the innovation system (businesses and research institutions);
  - more focus on experimental development and engineering.

Third, innovation policies need to be open to *emerging innovators* – newcomers in the form of start-ups and spin-offs. A number of policy instruments are relevant for this purpose. In addition to technology transfer through IP commercialization, other forms of knowledge transfer could be more, or just as, relevant such as collaborative projects with industry, industry PhDs, joint study programs with industry, etc. In addition, the spin-off policy can be extended to encourage business spin-outs from mature innovators as a possible source for greater variety and knowledge spill-over. The role of foreign direct investments as a possible source of new and more varied activities should not be underestimated.

The final group concerns *mature innovators*. It is assumed that absorptive capacities of such firms both in terms of their ability to use knowledge and their ability to use dedicated R&D funds productively are the highest. Therefore, these firms are the main recipients of R&D grants and similar policy instruments. Also, they serve as a source of knowledge transfer from high technology to low technology sectors.

The next objective of our study is to test the research framework within the context of the CEE countries. To test the hypothesized gap between innovation policies and absorptive capacities, the paper analyses policy instruments implemented during 2007-2013, which were meant to facilitate business innovation and growth. The scope of the study is eleven CEE countries, all of which are the EU Member States, i.e., Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, Slovenia, Estonia, Latvia, and Lithuania.

**Table 2.** 'Competence stairway' and the different needs of existing and potential innovators

	<b>Technology consumers</b>	<b>Potential innovators</b>	<b>Emerging innovators</b>	<b>Mature innovators</b>
<i>Typical firms</i>	Manufacturing companies and services providers (including public sector) that lack modern technological and managerial capacity and productivity.	Generally large manufacturing companies or services providers in the traditional sectors ('the cornerstones of economy' facing the loss of competitiveness and thus feeling the pressure to move to new business fields and products).	Generally young and/or small companies, export-oriented, fast growing. Include both emerging indigenous companies (start-ups, university spin-offs) and foreign direct investors.	Generally R&D-based medium-large, long time in the market, operating mainly in the high technology sectors, export-oriented, having well-developed networks with the research institutions and business partners in the country and beyond.
<i>Challenges</i>	Modernization and strengthening of technology and absorptive capacities (including human resources).	Diversification and technology transfer, new innovative activities and new business models.	Acceleration of innovative activities, including spin-off creation, attraction of risk capital and other financial resources (incl. FDI) to increase the critical mass, strengthening of capacities (including R&D infrastructure).	Moving to higher impact innovations, large scale R&D projects, new international markets, spin-outs.

	<b>Technology consumers</b>	<b>Potential innovators</b>	<b>Emerging innovators</b>	<b>Mature innovators</b>
<i>Focus of the policy mix</i>	<ul style="list-style-type: none"> <li>• Demand-side incentives (innovative public procurement, pre-commercial procurement, other market incentives, e.g., facilitation of ICT in all sectors).</li> <li>• Capacity development (attracting highly qualified specialists, learning, technology upgrading – grants or tax incentives for production of new technology)</li> </ul>	<ul style="list-style-type: none"> <li>• Incentives for transformation (support for networking - technology platforms, clusters, foresight);</li> <li>• Support for experimentation</li> <li>• Various innovation support services encouraging moving to new products and new business models, such as ‘soft’ idea development support, brokerage, technology services at the science parks;</li> <li>• R&amp;D subcontracts fostering linkages with research institutions, innovation vouchers</li> </ul>	<ul style="list-style-type: none"> <li>• Start-up acceleration (mentors, seed and risk capital, business plan competitions, prizes for young entrepreneurs, business incubation, etc.).</li> <li>• Targeted FDI attraction.</li> </ul>	<ul style="list-style-type: none"> <li>• Grants for R&amp;D projects;</li> <li>• Grants for international R&amp;D projects – FP7, Horizon 2020 and other international initiatives;</li> <li>• R&amp;D infrastructure support (for companies, not universities).</li> <li>• Promotion of technology diffusion and transfer from high-tech to low-tech industries.</li> </ul>
<i>Horizontal</i>	Availability of high-quality labor force (ensuring high quality of education). Favorable framework conditions (entrepreneurship policies, flexible labor market, tax policy, RDI regulations, talent attraction policies, standardization, favorable conditions for research careers, etc.)			

**Source:** developed by the author based on Iszak, Markianidou, and Radošević (2014) and Paliokaitė, Martinaitis, and Sarpong (2016).

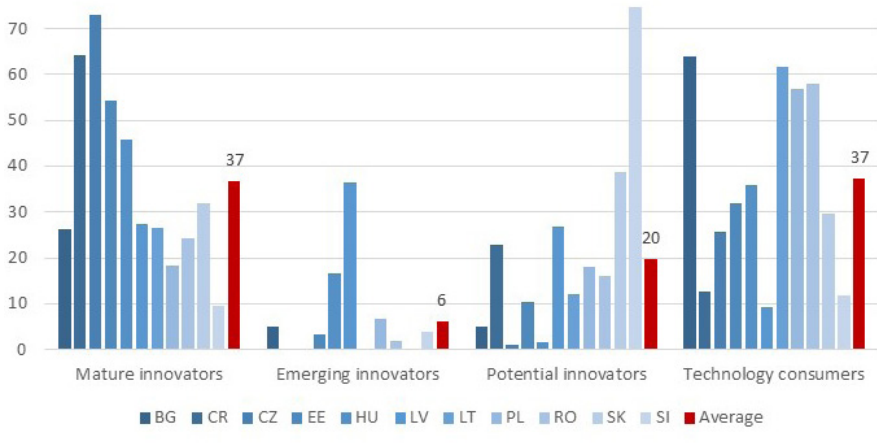
The analysis was performed in the following steps. First, a database of implemented innovation policy instruments was constructed. The data on policy instruments was collected from the Research and Innovation Observatory (RIO) (<https://rio.jrc.ec.europa.eu/>), which contains information on all the RDI policy instruments implemented in the 28 EU Member States. All the policy instruments that were aimed at developing the public or private sector’s RDI capacities in the selected countries were included in the database. To cross-validate the findings from the RIO database, the author reviewed existing policy evaluations (EC, 2015) and publicly available national databases of policy instruments (the websites of national innovation agencies).

A total of 144 instruments were identified and reviewed. Each policy instrument and its budget for the period 2007-2015 in each selected country was assigned to a specific category (technology consumers, mature, emerging, or potential innovators) as per the research framework above. Only

the financial instruments implemented throughout 2007-2015 and targeted at business growth and innovation were analyzed. R&D tax incentives and funding by the international R&D programmes (FP7, Horizon 2020 and others) were not included in the calculations of budget share. In the next step, the calculations of financial allocations per innovator category allowed us to determine the gap between mainstream innovation policies and business capacity building needs, leading to this paper’s conclusions.

## ANALYSIS AND DISCUSSION

To test the hypothesized gap between innovation policies and absorptive capacities, the study analyses policy instruments implemented throughout 2007-2013 in the selected countries to facilitate business innovation and growth. Based on the analysis of data collected we find that within the 2007-2013 business innovation policy mix in the CEE region there was a strong emphasis on science-driven innovation and technology uptake, targeting current R&D performers (‘mature innovators’) and, to a lower extent, technology consumers (Figure 1).



**Figure 1** Share of budget (%) allocated to policy instruments per innovator category, per country

**Source:** calculated by the author based on several data sources, such as Research and Innovation Observatory, DG REGIO evaluations (EC, 2015) and publicly available national databases of policy instruments.

The most typical policy instruments included grants for technology upgrading, grants for business R&D, and R&D subcontracts, which aimed at fostering

linkages with research institutions through such schemes as innovation vouchers (Table 3).

**Table 3.** Policy instruments available to firms and entrepreneurs during 2007-2013, per innovator category

	Policy instruments	BG	CR	CZ	EE	HU	LV	LT	PL	RO	SK	SI
Mature innovators	R&D tax incentives		+	+		+	+	+	+	+	+	+
	Business R&D grants	+	+	+	+	+	+	+	+	+	+	+
	Grants for business R&D infrastructure				+			+	+	+		
	Grants/support for participation in the international R&D programs (FP7, Horizon 2020, etc.) and other international collaborations					+	+	+	+		+	+
	+											
	Promotion of technology diffusion and transfer from high-tech to low-tech industries			+		+			+			
Emerging innovators	Entrepreneurship promotion (awareness raising, business plan competitions, trainings)				+		+	+				
	Pre-seed and/or seed capital								+			
	Grants for start-ups	+				+	+		+	+		+
	Risk/venture capital							+	+			
	Facilitation of private business angels				+							
	Business incubation and related services			+			+	+		+		
	'Soft' innovation support services and business acceleration (scouting, mentoring, technology foresight, etc.)				+	+	+		+			
	'Hard' tech services, e.g., prototype testing											
Potential innovators	Support for transformative networking (technology platforms, clusters, foresight)			+	+	+	+	+	+		+	
	Support for experimentation (prototype development, validation, pilot manufacturing).		+		+							+
	'Soft' innovation support services (technology consultants, mentors, scouts, brokers) encouraging facilitation of new technology ideas, new products, business models.	+					+		+			+
	R&D subcontracts fostering linkages with research institutions, and technology transfer, including innovation vouchers		+	+	+			+	+	+	+	+
	Provision of technology services (prototype testing, etc.)				+		+					

Policy instruments		BG	CR	CZ	EE	HU	LV	LT	PL	RO	SK	SI
Technology consumers	Demand-side instruments (innovative public procurement, pre-commercial procurement, other market incentives)											
	Grants for attracting highly qualified specialists							+				
	Technology upgrading – grants for acquisition of new technology	+	+	+	+	+	+	+	+	+	+	+
	Grants for organizational/ marketing/managerial upgrading	+				+		+			+	

**Source:** calculated by the author based on several data sources, such as Research and Innovation Observatory, DG REGIO evaluations (EC, 2015) and national databases. ‘+’ means that specific policy instruments were implemented in a given country. Empty cells mean that corresponding policy instruments were not identified.

This paper has its roots in the endogenous growth theory, which assumes that economic growth is strongly influenced by human capital and the rate of technological innovation (Romer, 1990). Policies for technological and industrial development may be regarded as a result of the interplay between innovative opportunities, the incentives to exploit those opportunities, the capabilities of the agents to achieve success (further conditioned on their perception of both opportunities and incentives), and the organizational arrangements and mechanisms through which technological advances are implemented and searched for (Dosi, 1997). The capabilities of firms and the role of absorptive capacities are crucial in the process of upgrading towards the technology frontier. Thus, the specific context of accumulated productive, technology and R&D capabilities cannot be ignored within industrial and innovation policy design (Radošević & Yoruk, 2015; Andreoni, 2011; Chang, Andreoni, & Kuan, 2013).

The technology upgrading rankings developed by Radošević and Yoruk (2015) provide some contextual data. First, compared to other European regions, the CEE countries have the weakest absorptive capacities, and therefore, the catching-up opportunities are not sufficiently exploited. According to the index of structural change, which measures the diversification of technological knowledge and changes in demand and supply of technology, the CEE countries are amongst the lowest ranked. This is quite an important feature of the CEE countries because it shows that they are not structurally dynamic economies. They are well behind frontier economies in terms of technology capability and firm-level organizational capabilities. The CEE countries rank best in terms of human capital and physical infrastructure and are well placed in terms of schooling years, but not so well in the quality of education in the areas of maths and science (except Estonia and Slovenia). These suggest that the ‘quantity’ of education is much less of an issue when compared to its ‘quality.’



Second, the CEE countries are widely positioned along with the index of technology upgrading, reflecting the differentiated potential for further growth. The Czech Republic and Estonia are leading economies amongst other CEE countries. The CEE countries are quite divided in terms of their capabilities. Radošević and Yoruk (2015) show that the lagging of Eastern Europe is quite substantial in terms of intensity of technology upgrading (47% of Central Europe, consisting of Estonia, Czech Republic, Hungary, Slovenia), firm-level organizational capabilities (33%), R&D capability (34%), technology capability (42%) and production capability (65%).

R&D capability is especially important for designing innovation policy measures that aim at direct investments in business RDI or joint projects with public research institutions. Countries with very limited business R&D capabilities will struggle to absorb such investments. For example, business R&D investments taken as a share of GDP in Lithuania and Latvia are more than 5 times below the EU average (1.3% of GDP). The number of existing RDI performers is rather limited and mainly consists of several top-tier research groups and few knowledge-based companies. Moreover, these performers are small and lack critical mass. In this case the countries' efforts should be based on increasing the number of innovators by focusing on (i) newcomers, such as start-ups, spin-offs, knowledge-based FDI, and (ii) encouraging previously non-innovative companies (potential innovators) to transform their businesses towards more innovative activities (EC, 2015).

From this perspective, the analyzed 2007-2013 policy mixes have some evident gaps. First, in a majority of countries (with some exceptions) emerging innovators are granted the least policy attention. To facilitate structural change, innovation policies ought to foster the process of creation, financing, support, organization, and growth of new firms. Second, considering that the majority of companies in the CEE countries lack R&D capabilities, there is high demand for technology upgrading to help them increase efficiency in the context of decreasing labor-cost competitiveness and to upgrade competences required for moving up the value chain. This need is met by providing grants for technology upgrading in all the researched countries (see Table 3). However, there is still insufficient attention given to the diversification and restructuring of potential innovators, such as traditional industries that form the backbone of respective CEE economies.

Structural change, especially diversification of key economic sectors, is one of the major factors in upgrading from middle- to high-income status. The idea of smart specialization is based on this line of thinking (Radošević & Yoruk, 2015). Furthermore, the function of 'collective research centers' in building absorptive capacity at the inter-organizational level is mainly relevant in the case of SMEs or firms from traditional sectors. The

number and qualification of their human resources may not be sufficient to properly engage in open innovation activities. There is a lack of 'soft' capacity building targeted at companies not active in RDI yet. Related existing instruments include support for technology-push oriented feasibility studies and innovation support services, mainly targeting knowledge-intensive companies. Incentives for transformation and experimentation are still a missing link between technology absorption measures and direct support for business R&D. Furthermore, there is a lack of demand-side policy measures, and little recognition of organizational or service innovation (with some exceptions implemented in LT, BG, HU, and SK).

To sum up, a balanced policy mix needs to acknowledge the different maturity of existing RDI performers and potential innovators, especially those active in traditional industries. Evidence points towards the implementation of tailored policy interventions. The targeted types could include 'emerging' and 'potential' innovators from a variety of economy sectors, as opposed to a 'narrow' approach which focuses mainly on R&D-based sectors. First, dealing with RDI pipeline creation through capacity building is an important target in the new period. Relevant examples include incentives for transformation, such as technology platforms, foresight, future technology, consumer, skills and market trends, support for experimentation filling the gap between small innovation vouchers and larger R&D grants, mobility of researchers between science and industry, use of external innovation services (e.g. idea facilitation), scouting, mentoring, and matchmaking, which would especially target companies not performing RDI. To attract currently non-performing but potential innovators, these incentive schemes could be low-barrier, industry, and demand-driven, and also include non-technological innovation.

Second, Radošević, and Yoruk (2015) point out that the CEE economies have significantly lower levels of buyer sophistication and lower availability of state-of-the-art technologies. The period of 2008-2013 saw a large decline in the levels of buyers' sophistication due to faltering growth caused by the global financial crisis. Developing demand-side RDI policies and instruments, such as pre-commercial and innovative public procurement, ideas competitions for solving societal challenges, etc. should help fill this gap.

Third, an important structural feature of the CEE technology upgrading is their openness in terms of technology and knowledge flows (Radošević & Yoruk, 2015). For example, the literature on global value chains (GVC) provides rich empirical evidence about how firms, clusters, and regions learn and innovate because of their involvement in GVCs (De Marchi, Giuliani, & Rabellotti, 2016; Fagerberg, Lundvall, & Srholec, 2018). Diffusion of knowledge and know-how can be achieved by targeting FDI attraction and establishing a framework for wider national participation in new types of EU

---

level RDI collaboration, as well as extending and strengthening instruments aimed at international networking.

## CONCLUSIONS AND IMPLICATIONS

---

The present paper has several implications for theory and practice. It enriches the current body of knowledge with findings on the links between innovation policies and firm absorptive capacities. First, based on the works of Volberda, Foss, and Lyles (2010) and Effelsberg (2011), among others, this study proposes that tailor-made innovation policies should take into account the structural characteristics of their economies and absorptive capacities of firms, or lack thereof, by facilitating organizational learning capabilities and skills, including managerial innovations, R&D spill-overs and institutional intermediates for knowledge transfer. In mapping, the determinants of absorptive capacities in different types of firms, a 'stairway of competence' model is proposed that matches four innovator types (technology consumers, potential innovators, emerging innovators, and mature innovators) with tailor-made innovation policy routes, each aiming to strengthen their respective capacities.

Second, we found that the 2007-2013 innovation policies in the selected CEE countries mainly focused on two routes: strengthening the capacities of mature innovators and facilitating technology upgrading, with a very limited focus on the creation and growth of new knowledge-intensive firms ('emerging innovators'), or encouraging the restructuring of 'potential innovators' in the traditional industries. There is little evidence that this approach had clear effects on economy transformation. According to the European Innovation Scoreboard (2018), the CEE country innovation impact indicators remain below the EU average, for example, exports of medium and high technology products as a share of total product exports (49.9% vs. 56.7%), knowledge-intensive services exports as % of total services exports (39.0% vs. 69.2%).

The findings of this paper can contribute to a better understanding of how to speed up the restructuring and innovation processes in peripheral regions specialized in labor-intensive traditional industries that face the need for upgrading. The suggested policy routes may help identify more adequate public policies and instruments, which aim at stimulating the absorptive capacities of local firms. A more tailor-made approach to R&D and innovation capacity building is needed, especially taking into account that current capacity levels and the potential to move up the value-added chain largely differ within the structure of mature, emerging and potential innovators. First, innovation policies need to open for newcomers through start-ups, spin-offs acceleration, mentoring, and start-up/seed funding as well as targeted

FDI attraction. Second, the findings suggest that raising the allocations for business R&D grants without simultaneously dealing with pipeline creation through capacity building results in problems with the absorption of available funding. While the current RDI performers would need the boost to expand their RDI activities and engage in different collaborations and alliances, those with the RDI potential, but only modest or no RDI activity at present, would mostly benefit from 'soft' capacity building measures such as innovation and technology audits, vouchers, clusters, foresights innovation brokering/scouting, mentoring and pipeline facilitation via technical assistance and support, etc. Third, addressing skills and talent shortage for RDI is an emerging challenge for capacity development in the CEE (Paliokaitė, Petraitė, & Gonzalez Verdesoto, 2018). The issue is twofold: a rapid decrease in the young population as a result of the demographic trends and migration. Therefore, education and skills development policies are relevant to all innovator types, ensuring supply of relevant capabilities into the economy, thus strengthening the national absorptive capacity (Effelsberg, 2011). These findings are especially relevant to the use of European Structural and Investment Funds and implementation of the smart specialization strategies.

There are limitations implied by the chosen design. First and foremost, while a more balanced policy mix is proposed, the paper did not take into account the structural differences of the analyzed CEE countries. There could be significant differences, for example, between Visegrad or Baltic countries. Promising avenues for future research could be to study the role of industrial structure, regional or national specializations, or even global value chains' participation in the interaction between absorptive capacities and innovation policies.

## Acknowledgments

The author gratefully acknowledges the support provided by the Research Council of Lithuania (Grant no. S-MIP-17-116). The author would like to thank Ovidijus Stauskas, Eglė Jasonaitė, and Pijus Krūminas for their contribution and helpful suggestions.

## References

- Andreoni, A. (2011). Productive Capabilities Indicators for Industrial Policy Design (UNIDO Working Paper 17). Retrieved from <https://eprints.soas.ac.uk/19235/1/2011%20Productive%20Capabilities%20Indicators%20UNIDO.pdf>
- Bachtler, J., Mendez, C., & Oraže, H. (2014). From conditionality to Europeanization in Central and Eastern Europe: Administrative

- performance and capacity in cohesion policy. *European Planning Studies*, 22(4), 735–757. <https://doi.org/10.1080/09654313.2013.772744>
- Chang, H.-J., Andreoni, A., & Kuan, M.L. (2014). International industrial policy experiences and the lessons for the UK. In A. Hughes (Ed.), *The Future of UK Manufacturing: Scenario Analysis, Financial Markets and Industrial Policy* (pp. 451-555). Retrieved from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/277162/ep4-international-industrial-policy-experiences.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/277162/ep4-international-industrial-policy-experiences.pdf)
- Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston, Massachusetts: Harvard Business School Press.
- Clar, G., Boekholt, P., Nauwelaers, C., Saublens C., & Tiits, M. (2015). Perspectives for research and innovation strategies for smart specialisation (RIS3) in the wider context of the Europe 2020 – growth strategy. Retrieved from [https://ec.europa.eu/research/regions/pdf/publications/ris3\\_report-082015.pdf](https://ec.europa.eu/research/regions/pdf/publications/ris3_report-082015.pdf)
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128-152. <https://doi.org/10.2307/2393553>
- Crisuolo, P., & Narula, R. (2002). A novel approach to national technological accumulation and absorptive capacity: Aggregating Cohen and Levinthal. *European Journal of development Research*, 20, 56-73.
- De Marchi, V., Giuliani, E., & Rabellotti, R. (2016). Local innovation and global value chains in developing countries. UNIDO/UNU-MERIT background papers for the UNIDO, Industrial Development Report 2016: IDR 2016 WP 1. Retrieved from <https://www.unido.org/api/opentext/documents/download/9928076/unido-file-9928076>
- Dosi, G. (1997). Opportunities, incentives and the collective patterns of technological change. *Economic Journal* 107(444), 1530–1547. <https://doi.org/10.1111/j.1468-0297.1997.tb00064.x>
- Effelsberg, M. (2011). Measuring absorptive capacity of national innovation systems. Discourses in Social Market Economy, OrdnungsPolitisches Portal (OPO). Retrieved from <https://ideas.repec.org/p/zbw/opodis/201104.html>
- Ernst, D. (2008). Can Chinese IT firms develop innovative capabilities within global knowledge networks? In M.G. Hancock, H.S. Rowen, & W.F. Miller W.F. (Eds), *China's Quest for Independent Innovation* (pp. 197–216). Stanford, CA: Shorenstein Asia Pacific Research Center and Brookings Institution Press.
- European Bank for Reconstruction and Development. (2017). Transition Report 2017-18: Sustaining Growth. Retrieved from <http://2017.tr-ebrd.com/>
- European Commission. (2015). Support to SMEs – increasing research and innovation in SMEs and SME development, third intermediate report, work package 2. Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Fund (ERDF) and the Cohesion Fund (CF). Retrieved from [http://ec.europa.eu/regional\\_](http://ec.europa.eu/regional_)

- policy/sources/docgener/evaluation/pdf/expost2013/wp2\_3rd\_intermediate\_report\_1.pdf.pdf
- European Commission. (2016). Ex post evaluation of the ERDF and Cohesion Fund 2007–13. Commission Staff Working Document, SWD(2016) 318 final. Brussels. Retrieved from [https://ec.europa.eu/regional\\_policy/en/information/publications/evaluations/2016/commission-staff-working-document-ex-post-evaluation-of-the-erdf-and-cohesion-fund-2007-13](https://ec.europa.eu/regional_policy/en/information/publications/evaluations/2016/commission-staff-working-document-ex-post-evaluation-of-the-erdf-and-cohesion-fund-2007-13)
- European Innovation Scoreboard. (2018). Indicators database. Retrieved from <https://ec.europa.eu/docsroom/documents/30282>
- Fagerberg, J., & Godinho, M. (2005). Innovation and catching up. In J. Fagerberg, D. Mowery, & R. Nelson (Eds.), *The Oxford Handbook of Innovation* (pp. 514-542). Oxford: Oxford University Press.
- Fagerberg, J., Lundvall, B.Å., & Srholec, M. (2018). Global value chains, national innovation systems and economic development. *European Journal of Development Research*, 30(3), 533-556. <https://doi.org/10.1057/s41287-018-0147-2>
- Gerrefi, G. (1999). International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics*, 48(1), 37-70. [https://doi.org/10.1016/S0022-1996\(98\)00075-0](https://doi.org/10.1016/S0022-1996(98)00075-0)
- Gorzela, G. (2017). Cohesion policy and regional development. In J. Bachtler, P. Berkowitz, S. Hardy, & T. Muravska (Eds.), *EU Cohesion Policy: Reassessing Performance and Direction*, (pp. 33–54). Abingdon–New York: Routledge.
- Gupta, A.K., & Govindarajan, V. (2000). Knowledge flows within the multinational corporation. *Strategic Management Journal*, 21(4), 473-496. [https://doi.org/10.1002/\(SICI\)1097-0266\(200004\)21:4<473::AID-SMJ84>3.0.CO;2-I](https://doi.org/10.1002/(SICI)1097-0266(200004)21:4<473::AID-SMJ84>3.0.CO;2-I)
- Havas, A. (2015). The persistent high-tech myth and its implications for the EU10 countries. GRINCOH Working Paper. Retrieved from <http://www.grincoh.eu/working-papers?get=dbb6580c6f4ec73b638828ccc0717245>
- Izsak, K., Markianidou, P., & Radošević, S. (2014). Convergence of national innovation policy mixes in Europe – has it gone too far? An analysis of research and innovation policy measures in the period 2004–12. *Journal of Common Market Studies*, 53(4), 786-802. <https://doi.org/10.1111/jcms.12221>
- Kravtsova, V., & Radošević, S. (2011). Are systems of innovation in Eastern Europe efficient? *Economic Systems*, 36(1), 109-126.
- Lane, P.J., Salk, J.E., & Lyles, M.A. (2001). Absorptive capacity, learning and performance in international joint ventures. *Strategic Management Journal* 22(12), 1139- 1161. <https://doi.org/10.1002/smj.206>
- Lundvall, B. (1999). *Technology Policy in the Learning Economy. Innovation Policy in a Global Economy*. Cambridge: Cambridge University Press.
- Malerba, F. (1992). Learning by enterprises and incremental technical change. *Economic Journal*, 102(4), 845–859.
- Malerba, F. (2006). Catch up in different sectoral systems: Some introductory remarks. Innovation systems for competitiveness and shared prosperity

- in developing countries. Paper presented at Globelics Conference India. Retrieved from <https://smartech.gatech.edu/bitstream/handle/1853/35245/MalerbaGlobelicsIndia.pdf>
- Malerba, F., & Nelson, R. (2011). Learning and catching up in different sectoral systems: Evidence from six industries. *Industrial and Corporate Change*, 20(6), 1645-1675. <https://doi.org/10.1093/icc/dtr062>
- Moncada-Paternò-Castello, P., Ciupagea, C., Smith, K., Tübke, A., & Tubbs, M. (2010). Does Europe perform too little corporate R&D? A comparison of EU and non-EU corporate R&D performance. *Research Policy*, 39(4), 523-536. <https://doi.org/10.1016/j.respol.2010.02.012>
- Muscio, A., Rivera Leon, L., & Reid, A. (2015). An empirical test of the Regional Innovation Paradox: Can smart specialisation overcome the paradox in the central and Eastern European countries? *Journal of Economic Policy Reform*, 18(2), 153-171. <https://doi.org/10.1080/17487870.2015.1013545>.
- Narula, R. (2004). Understanding absorptive capacities in an innovation systems context: Consequences for economic and employment growth (MERIT Research Memorandum 2004-003). Retrieved from [https://pdfs.semanticscholar.org/e910/ffaa71d4c8eb7b4f93d4b2e35f5b7f526c9c.pdf?\\_ga=2.107006603.846032450.1561639837-256785477.1561639837](https://pdfs.semanticscholar.org/e910/ffaa71d4c8eb7b4f93d4b2e35f5b7f526c9c.pdf?_ga=2.107006603.846032450.1561639837-256785477.1561639837)
- Oughton, C., Landabaso, M., & Morgan, K. (2002). The regional innovation paradox: Innovation policy and industrial policy. *Journal of Technology Transfer* 27(1), 97–110. <https://doi.org/10.1023/A:1013104805703>
- Paliokaitė, A., Martinaitis, Ž., Sarpong, D. (2016). Implementing Smart Specialisation roadmaps in Lithuania: Lost in translation? *Technological Forecasting & Social Change* 110, 143-152. <https://doi.org/10.1016/j.techfore.2016.01.005>
- Paliokaitė, A., Petraitė, M., & Gonzalez Verdesoto, E. (2018). *RIO Country Report 2017: Lithuania*. doi:10.2760/11127.
- Radošević S. & Yoruk E. (2015). A new metrics of technology upgrading: The Central and East European countries in a comparative perspective (GRINCOH Working Paper series. Working paper 3.04). Retrieved from University College London website: [http://www.grincoh.eu/media/serie\\_3\\_knowledge\\_\\_innovation\\_\\_technolog/grincoh\\_wp\\_3.04\\_radosevic\\_yoruk.pdf](http://www.grincoh.eu/media/serie_3_knowledge__innovation__technolog/grincoh_wp_3.04_radosevic_yoruk.pdf)
- Radošević, S. (Ed.). (2015). Synthesis report: WP3. Innovation, entrepreneurship and industrial dynamics. Technology upgrading and innovation policy in Central and Eastern Europe (GRINCOH Working Paper Series, Paper No. 3). Retrieved from [http://www.grincoh.eu/media/syhtnesis\\_reports/grincoh\\_wp3\\_synthesis\\_report\\_radosevic.pdf](http://www.grincoh.eu/media/syhtnesis_reports/grincoh_wp3_synthesis_report_radosevic.pdf)
- Rodriguez-Pose, A. (2015). Leveraging research, science and innovation to strengthen social and regional cohesion (policy paper by the Research, Innovation, and Science Policy Experts, RISE). Retrieved from [https://ec.europa.eu/info/sites/info/files/research\\_and\\_innovation/groups/rise/rodriguez-pose-leveraging\\_science.pdf](https://ec.europa.eu/info/sites/info/files/research_and_innovation/groups/rise/rodriguez-pose-leveraging_science.pdf)

- Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5, Part 2), S71-S102.
- Sandven, T., Smith, K., & Kaloudis, A. (2005). Structural change, growth and innovation: The roles of medium and low-tech industries, 1980-2000. In H. Hirsch-Kreinsen, D. Jacobson, & S. Laestadius (Eds.), *Low-tech Innovation in the Knowledge Economy* (pp. 31-59). Peter Lang Publishing Group. Retrieved from [https://eprints.utas.edu.au/1424/1/Structural\\_change%2C\\_growth\\_and\\_technological\\_upgrading.pdf](https://eprints.utas.edu.au/1424/1/Structural_change%2C_growth_and_technological_upgrading.pdf)
- Serbanica, S., & Constantin, D. L. (2018). EU cohesion policy and innovation support in Central and Eastern Europe: A critical review (CESifo Forum, Volume 19, 01/2018). Retrieved from <https://www.ifo.de/DocDL/CESifo-Forum-2018-1-Serbanica-Constantin-EU-Cohesion-Policy-march.pdf>
- Shenkar, O., & Li, J. (1999). Knowledge search in international cooperative ventures. *Organization Science*, 10(2), 134-143. <https://doi.org/10.1287/orsc.10.2.134>
- Schmidt, T. (2010). Absorptive capacity – one size fits all? *Managerial and Decision Economics*, 31(1), 1-18.
- Stock, G., Greis, N.P., & Fischer, W.A. (2001). Absorptive capacity and new product development. *Journal of High Technology Management Research*, 12(1), 77-91. [https://doi.org/10.1016/S1047-8310\(00\)00040-7](https://doi.org/10.1016/S1047-8310(00)00040-7)
- Van den Bosch, F.A.J., Volberda, H.W., & de Boer, M. (1999). Coevolution of enterprise absorptive capacity and knowledge environment: Organisational forms and combinative capabilities. *Organization Science*, 10(5), 551-568.
- Volberda, H.W., Foss, N.J., & Lyles, M.A. (2010). Absorbing the concept of absorptive capacity: How to realize its potential in the organization field. *Organization Science* 21(4), 931-951. <https://doi.org/10.1287/orsc.1090.0503>
- Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27(2), 185-203. <https://doi.org/10.5465/AMR.2002.6587995>

### **Abstrakt**

Artykuł dotyczy „regionalnego paradoksu innowacji”, który odnosi się do niższej zdolności do absorpcji środków publicznych przeznaczonych na promocję innowacji w regionach peryferyjnych. Kluczowym celem jest zatem zaproponowanie i przetestowanie ram koncepcyjnych dostosowanych ścieżek polityki innowacji, które mają na celu stymulowanie zdolności absorpcyjnych firm. Analiza literatury pomaga destrylować determinanty zdolności absorpcyjnej na poziomie firmy i systemu. Analiza polityki innowacyjnej stosowanej przez kraje Europy Środkowej i Wschodniej w latach 2007-2013 jest wykorzystywana do określenia luki między głównymi politykami innowacji a potrzebami w zakresie budowania potencjału biznesowego. Artykuł przedstawia integracyjną koncepcję „schodów kompetencji”, odwzorowującą cztery typy innowatorów z alternatywnymi ścieżkami polityki. Podano ocenę polityki innowacji



---

w wybranych krajach Europy Środkowej i Wschodniej. Uważamy, że główny nurt polityki innowacji w wybranych krajach skupiał się głównie na dwóch: wzmocnieniu zdolności dojrzałych innowatorów i wykorzystaniu istniejących technologii. Niewiele jest dowodów na to, że takie podejście miało wyraźny wpływ na zmiany strukturalne w gospodarkach EŚW. Wyniki te sugerują, że potrzebne jest bardziej dostosowane do potrzeb podejście do budowania potencjału innowacyjnego, biorąc pod uwagę obecne poziomy zdolności w grupach docelowych. Wyniki te są szczególnie istotne dla wykorzystania funduszy polityki spójności Unii Europejskiej i wdrożenia strategii inteligentnej specjalizacji. Chociaż Europa Środkowo-Wschodnia jest głównym kontekstem, jej implikacje mają szersze zastosowanie do innych regionów nadrabiających zaległości i peryferyjnych.

**Słowa kluczowe:** regiony peryferyjne, regiony nadrabiające zaległości, modernizacja technologiczna, regionalny paradoks innowacji, zdolności absorpcyjne, polityka innowacji

### Biographical note

**Agnė Paliokaitė** is a founding partner and director of a private research institute Visionary Analytics, based in Lithuania. She has a Ph.D. degree in strategic management awarded by the ISM University of Management and Economics. Her research interests focus on: innovation systems, technology and innovation policies, RDI collaboration networks, and innovation dynamics in business, foresight, and long-term strategies.



# How local resources shape innovation and path development in rural regions. Insights from rural Estonia

Merli Reidolf<sup>1</sup> , Martin Graffenberger<sup>2</sup> 

## Abstract

*This paper examines the role of local resources (physical, human, immaterial, social and community, and financial) in shaping firm innovation and path development in rural areas. Existing research in spatially informed innovation studies has largely overlooked the place-specific resources of rural regions as innovation facilitating qualities. This paper addresses the following research questions: (i) what is the role of local rural resources in a firm's innovation activities, and (ii) how do these resources shape regional development paths? We propose a framework that takes a holistic view of rural resources and their role in shaping innovation and regional development paths. The empirical analyses suggest that rural resources offer valuable and diverse opportunities for firm innovation, providing that firms (pro-)actively mobilize and purposefully exploit these resources as part of their innovation endeavors. We find that rural resources have the potential to extend and upgrade regional development paths and operate as ingredients to enrich existing paths with additional functions and, thereby, to make them more future-oriented. However, merely relying on rural resources does not suffice to facilitate substantial changes in regional paths. Our analyses are based on semi-structured interviews with representatives of firms located in rural Estonia, active in different manufacturing and service industries. This paper contributes to the emerging, but still fragmented, literature on rural innovation and offers a contextually grounded micro-level framework on the role of local rural resources for firm innovation in rural areas. Furthermore, the study adds an empirical contribution from a rarely studied Central and Eastern European regional context.*

**Keywords:** local resources, rural regions, innovation, development path, resources, Estonia

1 Merli Reidolf, M.A., Tallinn University of Technology, Department of Business Administration, Ehitajate tee 5, 19086 Tallinn, Estonia, e-mail: merli.reidolf@taltech.ee (ORCID ID 0000-0002-0541-14).

2 Martin Graffenberger, M.A., Leibniz Institute for Regional Geography, Schongauerstr. 9, 04328 Leipzig, Germany, e-mail: M\_Graffenberger@ifl.leipzig.de (ORCID ID: 0000-0001-5373-5826).

Received 30 October 2018; Revised 21 March 2019, 24 April 2019; Accepted 24 April 2019

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

## INTRODUCTION

---

A central assumption in economic geography is that innovation is largely influenced by local and regional conditions (Isaksen & Karlsen, 2016; Müller & Korsgaard, 2018). While firm innovation is generally assigned a key function in regional development (Torre & Wallet, 2016), the discourse on innovation and space can be linked to a distinct urban bias in both theoretical and empirical accounts (Shearmur, 2017; Solesvik & Gulbrandsen, 2014; Torre, 2015). As urban qualities such as density, proximity and diversity support interactive processes of knowledge creation and diffusion, city regions are widely considered the centers of the innovation machine (Florida, Adler, & Mellander, 2017). Consequently, the innovation capacities of rural and peripheral regions, as well as their actors, remain substantially understated (Eder, 2019; Graffenberger & Vonnahme, 2019).

In this paper, we define innovation as an interactive process which results in products or processes that are at least new on the firm level (OECD/Eurostat, 2005). Due to prevailing high-tech perceptions of innovation (Hansen & Winther, 2011), specific qualities of rural regions, such as historically embedded knowledge and physical or social resources (Ring, Peredo, & Chrisman, 2010; Spyridakis & Dima, 2016; Stathopoulou, Psaltopoulos, & Skuras, 2004), are commonly considered irrelevant and, consequently, largely neglected in theoretical debates and empirical studies. However, it is increasingly stressed that rural regions and their distinct physical, social and economic milieus can act as productive environments for innovation and entrepreneurship (Fitjar & Rodríguez-Pose, 2011; Korsgaard, Ferguson, & Gaddefors, 2015; Mayer & Baumgartner, 2014). Notwithstanding, the extent to which local resources in rural regions facilitate innovation and how firms exploit these resources and shape regional trajectories have so far received only minor attention (Eder & Trippel, 2019; Pylak, 2015; Shearmur, Carrincazeaux, & Doloreux, 2016). By applying a holistic view on the role of rural resources in firm innovation, this paper addresses these gaps.

Evolutionary perspectives suggest that regional industrial trajectories follow path-dependent developments, i.e., present and future economic action is directed by past activities, contexts, and events (Martin & Sunley, 2006). Path development processes operate along a continuum ranging from rather continuity-driven and incremental developments to considerable change and novelty (Garud & Karnøe, 2001; Grillitsch, Asheim, & Trippel, 2018; Isaksen, Jakobsen, Njøs, & Normann, 2019). Consequently, current exploitation practices of resources in rural (and urban) regions have partly been shaped by past economic cycles. In turn, local resources, as determinants of firm innovation, directly and indirectly condition future paths. Nevertheless, path development

---

does not constitute a fully deterministic process but points to an open-ended nature (Martin & Sunley, 2006), highlighting the importance of agency (Huggins & Thompson, 2019; Isaksen et al., 2019; Sotarauta & Suvinen, 2018).

Agency, broadly defined as the capacity to do certain things (and not others) to produce particular effects (Emirbayer & Mische, 1998; Garud, Kumaraswamy, & Karnøe, 2010; Sotarauta & Suvinen, 2018), can be understood as a process through which opportunities are consciously recognized, mobilized and exploited (Garud, Kumaraswamy, & Karnøe, 2010; Huggins & Thompson, 2019). In rural regions, such opportunities might relate to specific endowments with physical, human, social, and immaterial resources. A common message from different agency conceptions is that it operates as an essential enabler for regional development (Grillitsch & Sotarauta, 2018; Huggins & Thompson, 2019). In particular, it has been argued that its facilitating function is potentially more significant in rural than in institutionally thick regions (Isaksen et al., 2019; Plüschke-Altöf & Grootens, 2019). In this paper, the notion of agency is used as a lens that allows one to understand more comprehensively how firms construct and exploit local resources.

Along these lines, this paper aims at providing contextually grounded micro-level understandings on the use of local rural resources for innovation. It addresses the following research questions: (i) what is the role of local rural resources in a firm's innovation activities, and (ii) how do these resources shape regional development paths? Our results suggest that rural resources provide valuable and diverse opportunities for firm innovation, which, however, have to be recognized and actively exploited. We also find that rural resources have the potential to extend and upgrade regional development paths and, thereby, operate as valuable ingredients to renew regional paths and to make them more future-oriented. Nonetheless, the exploitation of rural resources alone does not suffice to facilitate substantial changes in regional development paths but needs coupling with extra-local (re)sources.

Methodologically, this study adopts an exploratory, qualitative case design and is based on interviews with owners/managers of innovating firms. Due to its conceptual and methodological orientations, this paper contributes to emerging discussions and expands existing literature on innovation in rural regions, in particular on the role of rural resources in shaping innovation and regional development paths. It analyses five distinct resource categories and proposes a model on the role of local resources in innovation. Furthermore, it broadens the scope of existing research in regional innovation studies, as we provide rather rare empirical insights from Central and Eastern Europe and the north-eastern fringe of the European Union (Eder, 2019; Golejewska, 2018; Květoň & Blažek, 2018).

The remainder of the paper is structured as follows: The second section presents the theoretical framework, illustrating the function of rural resources in innovation processes and how innovations that build on these resources might shape regional development paths along continuity and change. The third part provides a contextual description of the study area and presents the methodological approach to data collection and analysis. The fourth section presents and details the central findings. The results are further discussed, reflected upon, and linked to the outlined theoretical perspectives in the fifth section. The paper finishes with concluding remarks and reflections regarding policy implications.

## LITERATURE REVIEW

---

### Rural resources and firm innovation

Both urban and rural regions are highly heterogeneous spatial units which offer particular, yet distinct, resources for innovation and regional development. Features such as human resources, knowledge bases, institutional arrangements, and networks are emphasized as innovation supporting elements (Isaksen & Karlsen, 2016). Rather than adopting mainstream perspectives that frame rural conditions foremost as constraints, place-specific features of rural regions such as embedded knowledge, preserved routines and physical resources as well as cultural and historical landscapes can, and should be, more broadly perceived as valuable resources for entrepreneurship and innovation (Eder & Trippel, 2019; Golejewska, 2018; Müller & Korsgaard, 2018; Korsgaard, Ferguson, & Gaddefors, 2015). However, it should not be supposed that innovation based on resources locally available to rural firms lead to similar (i.e., high-tech and science-based) outcomes that can be frequently observed in urban areas.

The value of local rural resources, and in particular their purposive exploitation, is not fully determined but can be shaped by local firms. In this sense, the capacity to identify, access and construct specific meaning(s) from these resources reflects the agency of firms and actors in rural regions (Garud, Kumaraswamy, & Karnøe, 2010; Huggins & Thompson, 2019; Ray, 2001). To successfully utilize and exploit local resources, firms need to have basic understandings – which might relate to single individuals, firms and organizations (individual agency) or be exercised through interdependent action, coordinated for example by local and extra-local groups/networks (collective agency) (Emirbayer & Mische, 1998; Sotarauta & Suvinen, 2018). Furthermore, as the value of these resources is subjective, there will be

differences in the extent to which firms mobilize and exploit rural resources. In the following sections, we conceptualize the resources of rural regions along with a heuristic developed by Müller and Korsgaard (2018), differentiating five interrelated dimensions: physical resources, human resources, immaterial resources, social and community resources, and financial resources.

### **Physical resources**

Many rural firms, especially when active in traditional sectors such as food, agriculture and fishery, timber, energy, etc., intensively use physical resources which continue to be important factors for rural economies (Ring, Peredo, & Chrisman, 2010). Physical resources comprise, e.g. natural resources, raw materials, infrastructure, (immaterial) landscapes or vacant buildings (Müller & Korsgaard, 2018). Physical resources have a vital position in generating recreational opportunities and link to tourism activities (Mayer & Baumgartner, 2014; Torre, 2015). The remoteness of rural regions, coupled with low population densities, has allowed the preservation of unique scenery, which favors the leverage of environmental features (Stathopoulou, Psaltopoulos, & Skuras, 2004). Exploiting physical resources in contemporary and non-traditional ways can help to create new value. In addition, distance, perceived as a physical resource, might prevent knowledge and technology diffusion and, consequently, induce the emergence of specific local niche developments (Eder & Trippl, 2019).

### **Human resources**

Human resources refer to the capacities of employees as well as regionally distinct local knowledge and practical expertise embedded in firms' processes and products (Müller & Korsgaard, 2018). While rural human resources are often characterized in negative terms such as brain-drain, productivity deficiencies, etc. (Kalantaridis, 2009; Ring, Peredo, & Chrisman, 2010; Ward & Brown, 2009), it can be observed that traditional knowledge and practical experience have been sustained precisely because of a certain state of remoteness (Gibson, 2016; Spyridakis & Dima, 2016; Stathopoulou, Psaltopoulos, & Skuras, 2004). Such embedded practices and techniques offer opportunities for innovation, especially when coupled with contemporary marketing approaches (Dinis, 2006) and/or scientific research (Cannarella & Piccioni, 2011). Accordingly, this knowledge might lead to innovations not possible elsewhere.

Moreover, the implementation of innovation also relates to the individual level. As the workforce of rural firms is often loyal (Isaksen & Karlsen, 2016; Kalantaridis, 2009) and less receptive to labor poaching (Eder & Trippl, 2019),

firms can draw on rich sets of human resources which, accumulated over time, might substantially contribute to a firm's internal capacities. Furthermore, collaboration with local/regional research institutions and professional schools can offer additional advantages by supporting human resource development and regional innovation capacity (Huggins & Johnston, 2009). Such institutions also act as brokers for accessing external networks (Virkkala, 2007).

### **Immaterial resources**

Immaterial resources such as traditions, cultural amenities and heritage, historic buildings, distinct images and specific local identities can be transformed into place-specific outcomes and brands (Dinis, 2006; Müller & Korsgaard, 2018). The interpretation and deliberate exploitation of immaterial resources can add regionally distinct value to a firm's innovation activities (Anderson, 2000). It has been highlighted that in particular, the food and tourism industries benefit from place-specific marketing that draws upon immaterial resources (Stathopoulou, Psaltopoulos & Skuras, 2004). Immaterial resources are directly and indirectly coupled with other sets of rural resources, such as human resources: new opportunities are identified and mobilized by existing knowledge bases and experiences of actors (Garud, Kumaraswamy, & Karnøe, 2010). In this sense, locally embedded knowledge and specific traditions can be treated as essential parts of local images which, if proactively and strategically exploited as part of agentic action, can operate as effective marketing instruments (Dinis, 2006; Plüschke-Altöf & Grootens, 2019).

It has also been mentioned that the entrepreneurial intentions of firms in rural regions are not always purely economic, efficiency seeking and pecuniary. Rather, a firm's intentions also relate to specific motivations to creatively mobilize local resources, images, and associations to expose localities to broader visibility (Huggins & Thompson, 2019; Lafuente, Vaillant, & Serarols, 2010). Furthermore, reputations for a high-quality of life and good living environments might operate as benefits and help to attract talented individuals to rural regions (Eder & Tripl, 2019; Shearmur, 2017).

### **Social and community resources**

Collective action, which emerges from interactive connections and surfaces as social networks, firm networks, partnerships and cooperatives (Müller & Korsgaard, 2018) is widely considered an essential innovation enabler (Camps & Marques, 2014). As for supplements to limited internal resources, it is particularly important for small firms (van Hemert, Nijkamp, & Masurel, 2012). In rural regions, collective action can be effectively facilitated through



institutional arrangements such as common understandings, coordinated goals, or shared identity and, thereby, become a place-specific quality (Isaksen & Karlsen, 2016). Sharing information, knowledge and skills expresses collective agency and assists the constructing of (individual and collective) meanings regarding local resources (Sotarauta & Suvinen, 2018). In this sense, social and community resources provide access to capacities located both within and outside a given locality (Ratajczak-Mrozek, 2014; Šumane et al., 2018). Moreover, it has been highlighted that the low actor densities of rural regions encourage interactions between rather dissimilar actors, inducing potentially productive diversity into social ties and firm networks (Mcpherson, Smith-Lovin, & Cook, 2001).

Family and friendship ties are important elements of business networks in rural regions (Siemens, 2010; Stathopoulou, Psaltopoulos, & Skuras, 2004). Family members and friends provide emotional support and are frequently recruited as employees. Thus, family and friendship ties are expanded into the business sphere and blur the boundaries between social and economic relations. Furthermore, connections between local actors favor the exploitation of embedded skills and knowledge (Cannarella & Piccioni, 2011). In this regard, Petrov (2011) concludes that social and community resources take on a central function for firm innovation in rural regions – providing that innovators actively involve communities and their diverse resources (e.g., human, financial, etc.). In addition, relations with local and regional decision takers, based on personal acquaintance, can facilitate extended support and equip governance processes with specific qualities (Eder & Trippel, 2019). However, it has also been highlighted that network relations that are socially too tightly knit are at risk of becoming over-embedded and hamper innovative potential (Atterton, 2007; Boschma, 2005).

### **Financial resources**

Innovation activities typically require upfront investments. Due to their rather small size, firms in rural areas lack internal financial resources and require access to external finance (van Hemert, Nijkamp, & Masurel, 2012). These can be grants, loans or special support and subsidy schemes available to rural firms on local (e.g., locally administered LEADER funds), national (e.g., funds from ministries) and EU levels. Conversely, it has been found that venture capital or angel funding sources are less important to rural firms (Müller & Korsgaard, 2018). Furthermore, rural firms appreciate support from location-specific funding schemes as these are associated with a broader recognition of innovative ideas – even though financial support is typically rather small (Müller & Korsgaard, 2018; Reidolf, 2016). Additionally, it can be highlighted

that rural areas account for cost advantages, as wages and land prices are lower compared to those in agglomerations.

Although firms from rural areas can access generic funding schemes, small and inexperienced firms especially, face distinct problems applying for and administering external funds and, thus, might choose not to apply for external finance (Korsgaard, Ferguson, & Gaddefors, 2015; Mayer & Baumgartner, 2014; Müller & Korsgaard, 2018). Consequently, these firms rely on self-financing, using savings or smaller sums acquired via informal channels (e.g., friends, family, acquaintances) (OECD, 2014; Siemens, 2010).

The previous sections provided a discussion on rural resources as innovation inputs. It should be pointed out that these resources are not strictly separated from each other but should rather be understood as interlinked. As an illustration, an empty house itself can be regarded as a rural physical resource, but in combination with immaterial resources (e.g., historical legend) it has greater value for marketing. Similarly, jam from local berries is assigned additional value if it is made according to a traditional regional recipe (Dinis, 2006). Moreover, local social networks can facilitate access to further resources and opportunities (Šumane et al., 2018), and amplify outcomes when local actors act jointly.

### **Path development between continuity and change**

The central understanding of path development processes is that present, current and future economic action is, to varying degrees, directed by past events and economic cycles (Martin & Sunley, 2006). In this evolutionary perspective, new information is interpreted through the lens of existing knowledge. Hence, path development processes emphasize the role of local and regional resources and the function of place-specific features and actors in shaping regional development paths.

However, path development is not a fully deterministic concept that generates predictable outcomes. Its directions are, in fact, open-ended and contingent (Martin & Sunley, 2006; Strambach & Halkier, 2013). Path development processes can be understood along a continuum ranging from rather continuity-driven developments to processes that induce substantial change and novelty and genuinely new futures (Asheim, Grillitsch, & Trippl, 2017; Garud & Karnøe, 2001; Martin & Sunley, 2006). Linked to its frequent mobilization in evolutionary economic geography, the path development notion has been extended and nuanced in a number of ways. This contribution adopts the typology recently outlined by Isaksen et al. (2019), who differentiate between *path extension*, *path upgrading*, *path diversification* and *path creation*.

Path extension processes represent continuity and consist mostly of incremental, step-wise innovations in existing industries and along prevailing economic and technological orientations (Isaksen, 2015). Path upgrading processes relate to more substantial degrees of change and move existing regional paths in new directions. Upgrading processes are for instance induced through the mobilization of new technologies, substantive organizational changes, the accumulation and development of specialized skills, the identification of industrial niches or novel use of symbolic knowledge (Grillitsch, Asheim & Trippl, 2018). Both path extension and path upgrading represent rather incremental changes through which existing organizational and regional competencies are strengthened. As a result, existing processes operate more efficiently and contribute to sustaining regional competitiveness (Isaksen, 2015; Isaksen et al., 2019). In cases where existing capabilities are combined with related or unrelated knowledge from local and/or extra-local sources, available paths might be diversified (Neffke, Hartog, Boschma, & Henning, 2018) and new knowledge accumulated. Innovations exploited through these processes allow firms and regions to access new markets (Isaksen et al., 2019). At the end of the spectrum are path creation processes, which imply high degrees of change and, consequently, represent a comprehensive mode of regional industrial change (Martin & Sunley, 2006; Simmie, 2012). Path creation relates to the emergence of new industries and technologies, scientific discoveries, or business models in a region (Isaksen, 2015; Hassink, Isaksen, & Trippl, 2019). It has been debated that the resources underlying path diversification and path creation are more likely to be found in metropolitan regions, whereas extension and upgrading processes might also be facilitated in rural regions and rather traditional resources – despite a state of organizational thinness (Isaksen, 2015).

These nuanced path development processes link to the notion of path plasticity. Path plasticity supposes that the direction of paths can be actively shaped and molded by actors (Strambach, 2008), indicating that opportunities for innovation are available within existing paths – which has also been highlighted for rural regions (Atterton, Newbery, Bosworth, & Affleck, 2011; Ray, 2001). Consequently, the effective use of local resources provides an effective means for shaping regional development trajectories (Isaksen, 2015; Mitchell, 2013; Petrov, 2011). This, however, requires comprehensive knowledge about embedded resources to generate new options out of them. In this regard, recent studies highlight the pivotal role of agency in path development processes (e.g., Garud, Kumaraswamy, & Karnøe, 2010; Huggins & Thompson, 2019; Isaksen et al., 2019; Sotarauta & Suvinen, 2018). Essentially, it is supposed that the initial conditions for path development are not entirely exogenously given but constructed by actors, for example through mobilizing their agency (Garud, Kumaraswamy, & Karnøe, 2010;

Sotarauta & Suvinen, 2018) or by acquiring knowledge via multi-scalar social action (Hassink, Isaksen, & Trippel, 2019; Simmie, 2012). In this sense, agency itself becomes an endogenous resource for regional development (Ray, 2001; Sotarauta & Beer, 2017). Moreover, it has been argued that collective agency, i.e., the coordinated and orchestrated action of multiple and diverse actors, is especially important for rather radical processes of path diversification and creation (Isaksen et al., 2019).

However, it might also happen that self-reinforcing stabilization mechanisms lock regional systems into existing trajectories. Actors and regions become insensitive to change, and potential future opportunities are overlooked (Martin, 2010; Strambach & Halkier, 2013). As a consequence, innovation potentials are substantially limited as influxes of novelty are not sufficiently recognized or even blocked (Martin & Sunley, 2006). Rural regions can be regarded to be particularly exposed to the latent danger of lock-in as they provide only for rather limited opportunities to alter existing development paths (Pylak, 2015). Again, these arguments bring to the fore, the potential function of agency to prevent, moderate, or even exploit lock-in situations.

While lock-in situations have mainly been discussed in negative terms, Gibson (2016) illustrates how traditional skills, embedded knowledge, technologies, production methods, etc. are transformed into distinct qualities – precisely because modernization pressures were resisted and traditional practices maintained. Likewise, Anderson (2000) illustrates that actors in rural regions nurse and transform obsolete and out-dated technologies and values into economically viable outcomes which, if coupled with suitable marketing instruments, become articulations of place, traditions, and cultural landscapes. Thus, adhering to historical economic legacies should not be merely perceived a constraint as long as actors proactively and continuously search for feasible extensions within existing paths. Along these lines, Garud, Kumaraswamy, and Karnøe, (2010) perceive lock-in as temporary, provisional and inevitable stabilization mechanisms of evolving paths.

## RESEARCH METHODS

---

### Regional context

We follow a general definition of rurality according to which the population density is less than 150 inhabitants per km<sup>2</sup> and the majority of the population lives in settlements with less than 10,000 inhabitants (OECD, 2006). Despite such characterizing features, it must be highlighted that rural regions themselves are highly heterogeneous spatial units. The firms

(cases) investigated as part of this study are located in rural Estonian regions. Estonia is situated in the north-eastern part of Europe, on the Baltic Sea. It has a population of 1.3 million and an average population density of about 30 inhabitants per km<sup>2</sup>. The firms investigated are located in the counties of Lääne, Järva, Viljandi, and Võru (see Figure 1).



**Figure 1.** Location of cases

Source: Leibniz Institute for Regional Geography (IfL) (2018).

In addition to their relative distance to the main national agglomerations of Tallinn and Tartu, the counties that constitute the study area share a number of socio-structural characteristics. All the counties exhibit low population densities, have experienced a decline in population, which exceeds the national average and account for rather low levels of GDP per

capita (see Table 1). In terms of economic structure, the regional economy of the study area can be described as “typically rural.” The contribution of agriculture and forestry to total value added is relatively high and exceeds 10% for the counties of Viljandi and Võru. Additionally, manufacturing and industrial production, especially in low- and medium-tech activities, such as metal, wood and food, are significant contributors to regional value added.

Conversely, compared to the national average, the service sector is substantially less important. However, Lääne county can be seen as a particular exception in this regard. The tourism industry has traditionally been a backbone of the regional economy and continues to play a major role, especially in the well-known spa town and county capital Haapsalu (see Table 1). Viljandimaa and Võrumaa have a long tradition in manufacturing, with wood, metal and furniture manufacturing being particularly important. Järvamaa is a traditional Estonian agricultural area.

**Table 1.** Characteristics of counties in the study area

	Population			GDP		GDP (share in value added, 2016)		
	Total population 2017	Density	Change in population 2000-2017	Per capita 2017	Relative to Estonian average	Agriculture, forestry and fishing	Industry and construction	Services
Estonia	1 315 635	30,3	-6%	17,925	100%	2,6	26,9	70,5
Järvamaa	30 378	12,4	-20%	10,877	61%	9,4	37,2	53,4
Läänemaa	24 301	10,1	-17%	12,024	67%	7,4	28,3	64,2
Viljandimaa	47 288	13,8	-20%	11,222	63%	14,1	37,7	48,2
Võrumaa	33 505	14,5	-16%	8,729	49%	11,6	39,8	48,6

Source: authors, based on data from Statistics Estonia.

## Data collection and analysis

A qualitative approach was chosen to provide contextually grounded and micro-level perspectives, which allow for interpretations through the understandings of research participants (Creswell, 2013). Interviews with management representatives of 20 firms were conducted in several waves from 2014 to 2016 (see Table 2). These were complemented by interviews with individuals from the regional development arena. Interviews focused on the firms’ innovation activities and followed a semi-structured approach, including substantial narrative sections. This interview approach enabled interviewers to cover intended topics while leaving freedom for the interviewees to elaborate on and prioritize their own ideas and perspectives (Gomm, 2004).

**Table 2.** Characteristics of interviewed firms

Interview ID	No. of employees	Year established	Industry	Interview respondent	Date of interview
E1	150	1991	Manufacturing (doors, windows)	Manager	12.03.14
E2	120	1994	Manufacturing (e.g. life jackets)	Owner	21.03.14
E3	60	1991	Manufacturing (wire products)	Manager	06.03.14
E4	80	2005	Tourism (spa hotel)	Manager	12.02.14
E5	65	1994	Manufacturing	Manager	16.04.14
E6	80	1997	Tourism (spa hotel)	Owner/manager	12.03.14
E7	5	2007	Information Technology	Owner/manager	09.05.14
E8	138	1958/2003	Medical Treatments	Manager	12.03.14
E9	3	2003	Tourism	Owner/manager	16.04.14
E10	2	2014	Manufacturing (modular houses)	Owner	03.06.14
E11	50	1996	Manufacturing (furniture)	Manager	15.04.15
E12	100	1992	Manufacturing (furniture)	Manager	15.04.15
E13	-	1992	Handicraft	Manager	16.04.14
E14	75	2005	Manufacturing (furniture)	Production Manager	14.01.16
E15	3	2014	Manufacturing (food)	Owner	15.01.16
E16	7	2014	Manufacturing (saunas)	Owner	05.02.16 & 07.11.16
E17	5	2011	Farming/Manufacturing	Owner	22.03.16
E18	106	1910	Manufacturing (food)	Manager	13.04.16
E19	11	2002	Manufacturing (food)	Owner	02.02.16 & 02.11.16
E20	9	1992	Manufacturing/Wholesale (food)	Owner	21.03.16

Most of the interviews took place at the company/institution of the interviewees. The interviews were conducted in both Estonian and English. The interviews lasted between 40 and 90 minutes and were tape recorded and transcribed. Partly software supported, these transcripts were analyzed through coding and categorization processes (Kvale, 2007). The relevant aspects were extracted from the interview material and organized along with coding categories reflecting the topics of interest (e.g., innovation activities, mobilization of local resources, coupling of existing resources). Coding was organized in several steps. First, the resource types, following a typology similar to that of Müller and Korsgaard (2018) were used as a basis to sort the data. The data in these groups were re-reviewed using *in vivo* coding (Creswell, 2013) to systematically and inductively develop new codes. Finally, these codes were thematically categorized.

Table 2 provides an overview of the firm selection of this research. Case selection for this study reflects activities that are of economic importance in the counties that constitute the study area (see Table 1). Most of the manufacturing firms exhibit a clear orientation towards export markets, and the service firms target domestic as well as international clients, mostly from neighboring countries. The firms that were selected have all innovated in the past. Furthermore, case selection was aimed at covering firms of different size and with activities within low- and medium-tech manufacturing (e.g., food and wood) as well as service industries (e.g., tourism and IT). Accordingly, the selection strategy relates to purposive and variation sampling (Gummesson, 2000), partly guided by snowballing techniques. Data from secondary sources such as company websites and social media accounts, official documents, newspaper articles, etc., complemented the interview material.

## FINDINGS

---

### The function of rural resources for innovation

The focus of this part is to provide an overview of how the investigated case firms mobilized local resources for innovation. Based on our empirical analysis, we suggest that place-specific rural resources play a substantial role when it comes to inducing novelty and change into the local economy. However, we also find that these resources facilitate mostly incremental innovation processes along existing trajectories.

### Physical resources

Our data highlight that physical resources such as landscape, natural assets, vacant buildings, etc. are frequently mobilized by firms from rural regions in the innovation context. These resources have place-specific features and allow firms involved in diverse economic activities to create regionally distinct products that satisfy existing, and generate new, demand. Tourism, health and recreational firms stress the importance of landscape as a general resource, referring to the sea and forests not only as a particular aspect of scenery but also concerning the health and rehabilitation services offered. Specifically, we find, for instance, that in the health and spa sector, traditional treatments using local mineral mud are widespread and that firms seek to widen these traditional applications through consultations with local research organizations.

*[...] The Centre of Excellence does research about curative mineral mud to find new applications. Today, we [in the spa] use mineral mud in a traditional*



*way, which means that we heat it and use it only once. The Centre of Excellence has ideas how to make mineral powder that could be used for massages and other treatments. [...](Spa hotel manager)*

Accordingly, these natural resources are featured prominently in marketing activities, and health and spa firms have added nature-related services to their existing portfolios, such as guided walking tours. Further examples of the proactive and contemporary use of physical resources are observed within food manufacturing. For instance, a dairy began to harvest birch sap, a traditional Baltic beverage, on a larger scale to meet increasing demands from international health and organic food markets, thereby generating new value from the abundantly available birch forests:

*There is clearly a new trend in [international food] markets. We have received several export requests for birch sap. [...]. We have also developed new birch sap products like lemonade. (Food manufacturer)*

Additionally, it has been mentioned that vacant buildings are considered a specific resource in rural areas and have been used to establish additional service/production sites or even to start new businesses. Thus, there might be situations in which firms can benefit from real estate vacancies, which are typically considered liabilities for rural communities. Furthermore, the state of the buildings themselves could push firms to be creative and to innovate in order to be able to use and maintain the buildings in the long run. As pointed out by one spa firm, there are no ready-made solutions available for these activities. Thus, renovations rely heavily on developing and testing creative solutions that could potentially be re-applied in future projects.

## **Human resources**

Human resources are an important local resource through which innovation is facilitated and implemented. Innovation and entrepreneurship are supported by historically embedded knowledge, giving rise to the continuation of the specific skills and competencies of both the available workforce and local firms. For instance, Viljandi is reported to be the (former) center of furniture production in Estonia. Accordingly, the county provides an experienced workforce with specific practical knowledge of furniture production. Similarly, the availability of a skilled workforce, especially with experience and knowledge in the sewing industry and other light industries, has been mentioned as attracting related firms to Haapsalu. Our data reveal that such a specialized workforce is not only appreciated for its loyalty but also that

its specific knowledge facilitates the emergence of (incremental) innovation regarding proposed changes and improvements of products and processes.

Furthermore, knowledge about old handicraft techniques is a particular example of how embedded human resources continue to be economically relevant and unique. Lääne county is well-known for its specific lace shawl. Knowledge about related production techniques is typically passed down the generations or shared within local handicraft circles. More recently, this embedded knowledge has been mobilized to create additional demand by directly engaging customers in the production process, offering, for instance, extended workshops during which experienced handicrafters and customers jointly co-create items – rather than merely offering traditionally made handicraft products through classical sales channels.

However, the lack of a qualified workforce, coupled with rising wages, has frequently been mentioned as an innovation barrier across industries. Consequently, the response of firms in addressing labor shortages might facilitate innovation. In particular, manufacturing firms are considering the reorganization of production routines through technological modernization and by rationalizing production to implement new production processes. However, employees continue to be a critical factor when it comes to operating highly specialized machinery:

*One thing is to buy a machine [...] another is to train employees and change their mindset. The latter is more complicated [...] at least in the beginning. When we bought our first 'smarter' machines [...] people did not get near them. [...] Today, nobody is afraid anymore. We use some machines [...] as practical tools for training and experimentation. (Wire manufacturer)*

Moreover, firms also facilitate knowledge exchange between experienced and new staff and try to secure the existing employees to further build and expand their internal capacity and thus compensate for the shortage of available workforce.

*We use a lot internal training. [...] We don't let employees who are trained according to our [firm] values and needs leave. This region is not large enough to find new employees. (Spa hotel manager)*

Furthermore, all organizations located in the area benefit from human capital. For example, the Centre of Excellence in Health Promotion and Rehabilitation is located in Läänemaa. It connects wellness and treatment firms and other regional actors in this field and, thus, diffuses knowledge regionally. Thus, these local organizations can be seen as not only providing

relevant knowledge to local actors but also as brokers through which local firms can mediate access to extra-local competences. Multiple health and spa firms have expressed expectations that these research capacities and transfer activities might eventually facilitate product and process innovations.

### Immaterial resources

In combination with other resources, immaterial resources provide complementary qualities that allow firms to mobilize additional value. Immaterial aspects emerge as articulations of place attachment, emotional engagement, relations to cultural heritage, embedded traditions and the mobilization of rural images and associations. For instance, when establishing a new sauna manufacturing business, the owner, based in Tallinn, highlighted that the locational choice was substantially driven by his personal attachment to the area:

*My roots are from here, my grandparents live here, and I have a big summer house nearby. (Sauna manufacturer)*

Likewise, regional development actors indicated that the owners of summer houses in rural areas are considered potential facilitators for local innovation. Such actors potentially couple their emotional and local attachment with distinct experiences and external networks. Multiple cases reflect that local cultural heritage is actively mobilized as part of the innovation activities, for instance, for marketing purposes. We observe that relations to cultural heritage and traditions help firms to differentiate themselves and their products from competitors. For instance, a food manufacturer activates the local Estonian Mulgi heritage<sup>3</sup> as part of its brand identity – transported, for instance, through marketing and packaging:

*My entire family has been living in Mulgimaa. I am Mulgi, too. Mulgi is my identity. And this is why we have Mulgi chips [...]. The logo of the business is a traditional Mulgi motive. (Food manufacturer)*

Tourism businesses in Haapsalu mobilize tales about the Russian Tsar family's visits to the town and enjoyment of mineral mud treatments hundreds of years ago. Similarly, the fact that local mineral mud is used instead of generic powder is actively promoted. These practices illustrate a certain place attachment referred to as 'local patriotism' and signal to

<sup>3</sup> Until the end of the 19th century, Mulgimaa was a distinct ethnographic and linguistic area within south Estonia. Five historical parishes (Halliste, Paistu, Karksi, Helme and Tarvastu) constituted the Mulgi area. Its population used to speak, and a small part still speaks, Mulgi dialect.

customers that local traditions are maintained. Furthermore, firms were found to actively mobilize images and associations of rural and idyllic landscapes. Thereby, places and rural spaces are purposefully commodified, for example, as part of packaging, online activities, and social media. A rural location allows firms to authentically mobilize such images. By highlighting that landscape and scenery support relaxation and healing, such practices are adopted in the health and spa sector but also beyond (craft-based food production, sauna manufacturing). Furthermore, firms from the food sector use particular food labels awarded by public institutions (e.g., indicating sources of origin, quality aspects, etc.) to support rural associations and to position themselves accordingly.

### **Social and community resources**

We find that local social resources and firm innovation are linked in multiple dimensions, such as mobilizing local/regional supply chains, mitigating access to other resources, the coupling of social and business ties and governance aspects. Our data suggest that social ties and business practices are interwoven and constituted by an underlying social fabric that builds upon mutual trust and common understanding. It has been frequently mentioned that, if possible, firms seek to source goods and services from local and regional suppliers. Motivations for local and regional cooperation relate to intentions to strengthen local economic structures and to build authenticity for handcrafted local products, but also to speed up processes:

*For changing fittings, we have a really good local welding guy at hand, a good friend of mine. The first thing we try is to do everything locally. [...]. If you have some local guy, you just drive there. It takes 20 minutes. He makes it right away. (Furniture manufacturer)*

Firms expand personal relationships with friends, family members, and acquaintances to specific business intentions. This coupling ranges from the provision of emotional support and critical feedback to the establishment of formal business relations and even co-ownership of newly established firms. Furthermore, joint production initiatives and sales/marketing cooperatives have emerged based on the established trust and shared values between the partners involved. Generally, the investigated cases reflect high levels of trust and mutual understanding of local expertise and matters. Consequently, it has been highlighted that familiarity within small communities facilitates the activation of social ties for economic purposes:

---

*We stick together. [...] If everyone knows everyone, then there is a lot of trust. [...] you don't have to start explaining yourself if you need something and contact people. (Spa hotel manager)*

Further aspects from the social and community dimension relate to local and regional governance. Some firms highlight that, despite being small companies, they experience a high level of appreciation and practical support, for instance, when it comes to licensing and building permit procedures. Local governance structures can operate as a productive and supportive resource in small and non-anonymous communities:

*I even feel that if you are located in a really small place, the local government treats you differently. It is much easier to negotiate because you are important. In Tallinn, a company like us is nobody, because we are so small. (Sauna manufacturer)*

However, social connections that are too tight might lead to the lock-in of existing networks, and some areas of potential may thus be left unattended. For instance, disharmony was identified in local governments' support for new ideas and interest in general business development. It was explained that not all persons who know each other and occasionally meet during other events discuss business-related issues and the support that local government could offer. Interestingly, an actor from the regional development arena mentioned that second-home owners, by mobilizing their diverse networks, can be considered a kind of gatekeeper who might potentially mediate and moderate connections between rural and metropolitan actors such as universities. Thus, these actors extend the spatial scope of the local social resources. Thereby, the difficulties small firms in rural areas tend to have in attracting the interest of high-level scientific partners, and consequently in obtaining input for their development activities, could be moderated.

## **Financial resources**

For most of the innovation projects investigated as part of this study, internal financial resources were mobilized. Nevertheless, firms also used a number of different external finance opportunities to facilitate processes. Although access to formal and, specifically, rural funding schemes does not seem to have a substantial function, some firms accessed such schemes, for example, via the LEADER program or the national agricultural ministry. A few firms pointed out that their engagement with local research partners could provide opportunities to access additional science-related finance, which is often administered by scientific

partners. Although financial support is directly linked to the implementation of innovation, this is not the only aspect. Many of the interviewees acknowledged that receiving competition-based funding is perceived as approval of an idea, which is a vital aspect, especially for small firms.

In addition to the use of public funding schemes, it can be observed that entrepreneurs, throughout the process of establishing new ventures, frequently mobilize financial resources from within their social networks. Thereby, family members, friends, and acquaintances who live locally and have an interest in the venture's wellbeing not only become investors but potentially also co-owners. These indications illustrate how social ties are expanded into the business sphere.

---

## DISCUSSION

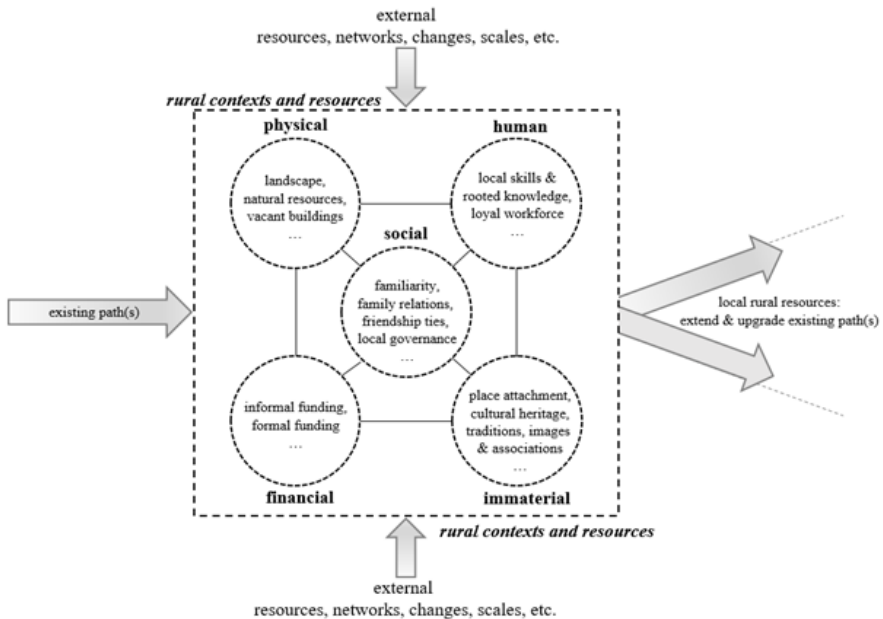
### Local resources shaping economic paths

In the previous sections, we illustrated the various ways in which firms from rural Estonian regions mobilized local resources as part of their innovation activities. Our empirical analyses highlight that the particular physical, human, social, immaterial, and financial resources of rural regions provide diverse and valuable opportunities for regionally distinct innovations. Based on these analyses we propose an empirically grounded model (see Figure 2) that helps to understand the role of rural resources for firm innovation, the various dimensions of these resources and their role in shaping regional development paths.

Even though we find a highly diverse picture across cases, it is important to note that the individual resources analyzed should not be perceived separately. Rather, we suggest that these resources are interlinked and operate as complements. A large number of the investigated firms strategically couple multiple local resources to drive their innovation activities. For instance, firms from food and tourism as well as wood-related manufacturing construct particular marketing images that draw upon the existence of specific physical resources which are not ubiquitously available (e.g., birch sap, mineral mud, idyllic landscape).

Furthermore, our findings suggest that in particular social and community resources, such as local business networks, family and friendship ties, operate as essential facilitators – for instance by providing access to resources such as embedded knowledge and finance or by mobilizing wider cultural heritage. In this regard, social and community resources provide a pivotal ground to mobilize collective agency based on shared understandings and, consequently, to construct value and meaning of resources and common goals beyond

individual firms. A particular example to be mentioned is the initiative of one case firm to coordinate the activities of multiple regional birch sap collectors under the umbrella of a joint cooperative.



**Figure 2.** Model on the role of local rural resources in firm innovation and path development

However, this particular enabling function presupposes that local firms are prepared and willing to engage with local communities. Only then do local social resources induce synergies which have been found to considerably shape entrepreneurial processes and innovation activities in rural areas (e.g., Korsgaard, Ferguson, & Gaddefors, 2015; Petrov, 2011; Šumane et al., 2018). As Petrov (2011, p. 168) highlights, 'innovation [...] in the periphery relies on social capital and community efforts as much as on other traditional factors of successful innovation'. Furthermore, it has been suggested that collective action based on mutual understanding and shared goals can induce more fundamental processes of regional change (Isaksen et al., 2019; Sotarauta & Suvinen, 2018).

Even though our empirical analyses indicate that, if proactively and purposefully mobilized, local rural resources provide productive assets for firm innovation, we find that these resources mainly facilitate the emergence of incremental innovation. According to the typology outlined by Isaksen

et al. (2019), local rural resources primarily stimulate continuity driven processes of regional change, i.e., path extension and path upgrading. Our empirics do not suggest that regional economic structures are drastically diversified or genuinely new paths are created. Consequently, we suggest that rural resources alone, typically, do not suffice to activate genuinely new trajectories. The results are confirmed in a recent study on regional contexts in Czechia and Poland (Květoň & Blažek, 2018).

However, such continuity-driven extensions of existing paths must not be perceived as simply reproducing and creating more of the same. Rather, available paths are enriched with additional opportunities, functions and economic values and, consequently, existing structures are renewed and strengthened. It has been highlighted that these moderate change processes are of substantial value to rural economies: 'Innovation in the periphery can have a stronger impact on a community's economic path, and can be more pivotal [...] for a given remote locality' (Petrov, 2011, p. 186). The impact of incremental innovation for regional development in rural regions derives from its cumulative effects. Especially if incremental innovation occurs across a diverse range of economic activities relevant for rural economies, such as the ones investigated in the study, overall economic structures and practices are upgraded and, collectively, might facilitate the emergence of more heterogeneous and resilient regional economies. Future-oriented economic practices, as well as viable path extensions and upgrades, require agency through which the continuous search for change and activation of alternatives to shape and mold existing paths in rural regions is supported.

However, modest ambitions to change and a mere focus on local resources such as local employees, static social and community relations or local educational organizations, coupled with only a few external knowledge-oriented network linkages in rural regions (Reidolf, 2016) might, in the long run, exhaust existing opportunities, eventually resulting in actors, practices and regions becoming locked-in. However, it has also been suggested that the maintenance of established knowledge/routines does not necessarily preclude positive change (Anderson, 2000; Gibson, 2016). If attuned to contemporary consumer preferences and coupled with modern marketing methods, the retention of these practices allows firms to build distinctive features and to set themselves apart. For example, teaching traditional local handicraft techniques helps to open new tourist and sales segments, and customs related to the consumption of fermented birch sap provide a base to develop soft drinks corresponding to international market preferences.

As the aim of this paper is to assess the role of local rural resources in firm innovation, its analytical focus is deliberately inward looking. Consequently, more substantial path development processes, such as diversification and



path creation, might have been excluded. However, we acknowledge the central position of external and outward-looking dimensions in spatially informed innovation research – evidence from our cases also sheds light on their importance. It has been corroborated that the integration of external resources through multi-scalar network linkages plays a significant and productive role in the innovation activities of firms from rural regions (e.g., Fitjar & Rodríguez-Pose, 2011; Reidolf, 2016; Strambach & Halkier, 2013). The activation of non-local resources and linkages provides for the influx of new ideas and knowledge which complement endogenous rural resources and support the capacity of firms and regions to adapt to change. It is precisely this duality of mobilizing local resources and recognizing extra-local factors and resources which is at the core of the wider debate on neo-endogenous (rural) development (Atterton et al., 2011; Ray, 2001; Ward & Brown, 2009). The effective coupling of local and extra-local resources might prevent regional lock-in and give rise to more substantial regional change – potentially leading to processes of path diversification and path creation (Isaksen, 2015; Isaksen et al., 2019). Thus, for future research, we suggest complementing this inward-looking perspective with an exogenous dimension and, thereby, assess the interplay between local and extra-local resources, and their collective, and potentially more substantive, impact on regional path development processes.

---

## CONCLUSION

This exploratory, contextually grounded and micro-level study examined the role of local resources (physical, human, immaterial, social and community, and financial) in shaping firm innovation and path development processes in rural areas. The empirical analyses suggest that rural resources can play an important role in the innovation activities of firms in rural regions. Local rural resources provide valuable and diverse assets that can be proactively exploited by firms. However, the value and meaning of these resources have to be recognized by firms, a stage in which individual and collective agency takes on a pivotal function.

The results of the study were synthesized as part of a model. This model illustrates the multiple dimensions and mobilization mechanisms of rural resources and outlines that rural regions account for endogenous resources which, when mobilized separately or in concert, provide opportunities for extensions and upgrades of existing paths and, thereby, increase the opportunities for both firm progress and regional development. Within this diverse set of rural resources, we find a particularly pivotal role of social

and community resources. They have a central function for mobilizing further resources and for facilitating collective action and sense-making. Furthermore, social ties constitute central mechanisms to mediate relations to extra-local actors and resources.

However, rural resources were mainly found to provide a base for incremental innovations and, consequently, tend to impact rather modestly on existing regional development paths. Hence, it seems that the mere exploitation of rural resources alone does not suffice to facilitate substantial changes in these paths. Moreover, our research reveals examples in which the deliberate continuation of existing development paths and local resources, such as locally embedded knowledge or customs, were used as specific qualities in firms' innovation endeavors, often in combination with certain modernization elements, such as marketing. Overall, these reflections indicate that local resources in rural areas should be considered valuable ingredients to extend, upgrade, and renew existing paths, thereby, inducing additional functions and elements which make them more future-oriented. Such extension and upgrading processes relate to the plasticity of paths and highlight that possibilities for innovation are endogenously available. Interpreted in such a way, our findings confirm existing scholarship on the complementary function of rural resources (e.g., Eder & Trippl, 2019; Korsgaard, Ferguson, & Gaddefors, 2015; Mitchell, 2013). The cumulative effects of moderate change processes support the emergence of more heterogeneous and resilient regional economies, especially in rural areas. However, merely relying on (modified) endogenous factors might eventually exhaust the opportunities of existing paths and pose the long-term risk of lock-in.

This study expands the debate on the role of local rural resources for innovation by proposing an empirically grounded model on the role of rural resources in shaping regional development paths. For analytical purposes, our study deliberately excluded firm relations to external actors – precisely because its focus is on the underexplored issue of local rural resources. So far, the productive properties and qualities of urban areas, such as actor density or localized knowledge spill-overs, are assigned a key role in conventional, i.e. agglomeration-oriented, narratives on regional innovation. This study illustrates that rural contexts, typically portrayed in the existing innovation literature from a problem-centered perspective (Graffenberger & Vonnahme, 2019), offer place-specific, yet often hidden, opportunities for innovation which firms need to recognize and proactively exploit. Thereby, this paper supplements emerging studies (e.g., Anderson, 2000; Eder & Trippl, 2019; Gibson, 2016; Müller & Korsgaard, 2018) that also discuss the role and productive properties of rural resources. However, we have to be cautious when making conclusions, as one cannot conclude from our study that all firms in rural Estonia have the

---

possibility to (equally) mobilize local resources for innovation, or that firms who do so operate per se more successfully. Furthermore, our empirical focus on rural Estonia complements existing studies in the field with a rather rare contextual setting from Central and Eastern Europe.

Finally, the results of this paper allow us to reflect on the implications for regional and innovation policy targeting rural areas. A central question to be posed is how innovation policy can effectively support processes of building, mobilizing and exploiting rural resources to facilitate innovation. One option for policymakers is to support regional capacity and resource building in organizations such as regional development centers, vocational schools, or research centers to assist firms in the process of generating value from rural resources. Furthermore, actors in rural regions might benefit from initiatives that provide financial support and advisory services to local bottom-up initiatives and firms to facilitate the emergence of regionally distinct (incremental) innovation. Related to our finding on the importance of social and community resources, the importance of support measures that target overall networking activities should be emphasized. Networking activities can be framed along with Faulconbridge's reflections on relational policy approaches (2017) and be understood as mechanisms to supplement the individual agency of firms with coordinated and collective action – found to support more substantial change processes (Isaksen et al., 2019). Policy initiatives that provide opportunities for firms to build regional, as well as extra-regional linkages, can effectively support the emergence of collective action. Furthermore, collective agency and coordinated action might also be facilitated through the initiation of joint regional marketing strategies. The direction of such regional marketing and branding initiatives should be to emphasize place-based resources as distinct local/regional qualities and assets that cannot easily be found and imitated elsewhere.

## **Acknowledgments**

The work presented in this paper was performed within the framework of the EU 7th Framework Programme, the International Research Staff Exchange Scheme (IRSES): Crossing Boundaries: Knowledge and Technology Transfer and Innovation and the RegPol2 project which has received funding from the EU 7th Framework Programme, People Programme (Marie Curie Actions) (Grant Agreement no.: 607022). The authors were also supported by the Doctoral School of Economics and Innovation, supported by the EU Regional Development Fund (Tallinn University of Technology ASTRA project "TTÜ arenguprogramm aastateks 2016-2022"; project code: 2014-2020.4.01.16-

0032). The authors thank Urve Venesaar and the two anonymous reviewers for constructive comments that helped to improve the paper.

## References

- Anderson, A. R. (2000). Paradox in the periphery: An entrepreneurial reconstruction? *Entrepreneurship and Regional Development*, 12(2), 91–109. <https://doi.org/10.1080/089856200283027>
- Asheim, B., Grillitsch, M., & Trippl, M. (2017). Introduction: Combinatorial knowledge bases, regional innovation, and development dynamics. *Economic Geography*, 93(5), 429–435. <https://doi.org/10.1080/00130095.2017.1380775>
- Atterton, J. (2007). The “Strength of Weak Ties”: Social networking by business owners in the Highlands and Islands of Scotland. *Sociologia Ruralis*, 47(3), 228–245. <https://doi.org/10.1111/j.1467-9523.2007.00435.x>
- Atterton, J., Newbery, R., Bosworth, G., & Affleck, A. (2011). Rural enterprise and neo-endogenous development. In G. Alsos, S. Carter, E. Ljunggren, & F. Welter (Eds.), *Handbook of Research on Entrepreneurship in Agriculture and Rural Development* (pp. 256–280). Cheltenham, UK: Edward Elgar.
- Boschma, R. (2005). Proximity and Innovation: A critical assessment. *Regional Studies*, 39(1), 61–74. <https://doi.org/10.1080/0034340052000320887>
- Camps, S., & Marques, P. (2014). Exploring how social capital facilitates innovation: The role of innovation enablers. *Technological Forecasting and Social Change*, 88, 325–348. <https://doi.org/10.1016/j.techfore.2013.10.008>
- Cannarella, C., & Piccioni, V. (2011). Traditiovations: Creating innovation from the past and antique techniques for rural areas. *Technovation*, 31(12), 689–699. <https://doi.org/10.1016/j.technovation.2011.07.005>
- Creswell, J. W. (2013). *Qualitative Inquiry & Research Design: Choosing Among Five Approaches* (3rd ed.). Los Angeles: Sage Publications.
- Dinis, A. (2006). Marketing and innovation: Useful tools for competitiveness in rural and peripheral areas. *European Planning Studies*, 14(1), 9–22. <https://doi.org/10.1080/09654310500339083>
- Eder, J. (2019). Innovation in the periphery. *International Regional Science Review*, 42(2), 119–146. <https://doi.org/10.1177/0160017618764279>
- Eder, J., & Trippl, M. (2019). Innovation in the periphery: Compensation and exploitation strategies. *Papers in Economic Geography and Innovation Studies*, 07, 1–17.
- Emirbayer, M., & Mische, A. (1998). What is agency? *American Journal of Sociology*, 103(4), 962–1023. <https://doi.org/10.1086/231294>
- Faulconbridge, J. R. (2017). Relational geographies of knowledge and innovation. In H. Bathelt, P. Cohendet, S. Henn, & L. Simon (Eds.), *The Elgar Companion to Innovation and Knowledge Creation* (pp. 671–684). Cheltenham, UK: Edward Elgar Publishing.

- Fitjar, R. D., & Rodríguez-Pose, A. (2011). Innovating in the periphery: Firms, values and innovation in Southwest Norway. *European Planning Studies*, 19(4), 555–574. <https://doi.org/10.1080/09654313.2011.548467>
- Florida, R., Adler, P., & Mellander, C. (2017). The city as innovation machine. *Regional Studies*, 51(1), 86–96. <https://doi.org/10.1080/00343404.2016.1255324>
- Garud, R., & Karnøe, P. (2001). Path creation as a process of mindful deviation. In R. Garud & P. Karnøe (Eds.), *Path Dependence and Creation* (pp. 124–209). New York: Psychology Press.
- Garud, R., Kumaraswamy, A., & Karnøe, P. (2010). Path dependence or path creation? *Journal of Management Studies*, 47(4), 760–774. <https://doi.org/10.1111/j.1467-6486.2009.00914.x>
- Gibson, C. (2016). Material inheritances: How place, materiality, and labor process underpin the path-dependent evolution of contemporary craft production. *Economic Geography*, 92(1), 61–86. <https://doi.org/10.1080/00130095.2015.1092211>
- Golejewska, A. (2018). Innovativeness of enterprises in Poland in the regional context. *Journal of Entrepreneurship, Management and Innovation*, 14(1), 29–44. <https://doi.org/10.7341/20181412>
- Gomm, R. (2004). *Social Research Methodology. A Critical Introduction*. Basingstoke: Palgrave MacMillan.
- Graffenberger, M., & Vonnahme, L. (2019). Questioning the “periphery label” in economic geography: Entrepreneurial action and innovation in South Estonia. *ACME: An International Journal for Critical Geographies*, 18(2), 529–550.
- Grillitsch, M., Asheim, B., & Trippl, M. (2018). Unrelated knowledge combinations: The unexplored potential for regional industrial path development. *Cambridge Journal of Regions, Economy and Society*, 11(2), 257–274. <https://doi.org/10.1093/cjres/rsy012>
- Grillitsch, M., & Sotarauta, M. (2018). *Regional Growth Paths: From Structure to Agency and Back* (Papers in Innovation Studies No. 2018/1). Retrieved from <http://www.circle.lu.se/publications>
- Gummesson, E. (2000). *Qualitative Methods in Management Research*. (E. Gummesson, Ed.) (2nd ed.). California, US: Sage Publications.
- Hansen, T., & Winther, L. (2011). Innovation, regional development and relations between high- and low-tech industries. *European Urban and Regional Studies*, 18(3), 321–339. <https://doi.org/10.1177/0969776411403990>
- Hassink, R., Isaksen, A., & Trippl, M. (2019). Towards a comprehensive understanding of new regional industrial path development. *Regional Studies*, 1–10. <https://doi.org/10.1080/00343404.2019.1566704>
- Huggins, R., & Johnston, A. (2009). Knowledge networks in an uncompetitive region: SME innovation and growth. *Growth and Change*, 40(2), 227–259. <https://doi.org/10.1111/j.1468-2257.2009.00474.x>

- Huggins, R., & Thompson, P. (2019). The behavioural foundations of urban and regional development: Culture, psychology and agency. *Journal of Economic Geography*, 19, 121–146. <https://doi.org/10.1093/jeg/lbx040>
- Isaksen, A. (2015). Industrial development in thin regions: Trapped in path extension? *Journal of Economic Geography*, 15(3), 585–600. <https://doi.org/10.1093/jeg/lbu026>
- Isaksen, A., Jakobsen, S. E., Njøs, R., & Normann, R. (2019). Regional industrial restructuring resulting from individual and system agency. *Innovation: The European Journal of Social Science Research*, 32(1), 48–65. <https://doi.org/10.1080/13511610.2018.1496322>
- Isaksen, A., & Karlsen, J. (2016). Innovation in peripheral regions. In R. Shearmur, C. Carrincazeaux, & D. Doloreux (Eds.), *Handbook on the Geographies of Innovation* (pp. 277–285). Cheltenham, UK, Massachusetts, USA: Edward Elgar. <https://doi.org/10.4337/9781784710774>
- Kalantaridis, C. (2009). SME strategy, embeddedness and performance in East Cleveland, North East England. *International Small Business Journal*, 27(4), 496–521. <https://doi.org/10.1177/0266242609335019>
- Korsgaard, S., Ferguson, R., & Gaddefors, J. (2015). The best of both worlds: How rural entrepreneurs use placial embeddedness and strategic networks to create opportunities. *Entrepreneurship and Regional Development*, 27(9–10), 574–598. <https://doi.org/10.1080/08985626.2015.1085100>
- Kvale, S. (2007). *Doing Interviews*. Los Angeles: Sage Publications.
- Květoň, V., & Blažek, J. (2018). Path-development trajectories and barriers perceived by stakeholders in two Central European less developed regions: Narrow or broad choice? *European Planning Studies*, 26(10), 2058–2077. <https://doi.org/10.1080/09654313.2018.1509061>
- Lafuente, E., Vaillant, Y., & Serarols, C. (2010). Location decisions of knowledge-based entrepreneurs: Why some Catalan KISAs choose to be rural? *Technovation*, 30(11–12), 590–600. <https://doi.org/10.1016/j.technovation.2010.07.004>
- Martin, R. (2010). Roepke lecture in economic geography-Rethinking regional path dependence: Beyond lock-in to evolution. *Economic Geography*, 86(1), 1–27. <https://doi.org/10.1111/j.1944-8287.2009.01056.x>
- Martin, R., & Sunley, P. (2006). Path dependence and regional economic evolution. *Journal of Economic Geography*, 6(4), 395–437. <https://doi.org/10.1093/jeg/lbl012>
- Mayer, H., & Baumgartner, D. (2014). The role of entrepreneurship and innovation in peripheral regions. *DisP - The Planning Review*, 50(1), 16–23. <https://doi.org/10.1080/02513625.2014.926720>
- Mcpherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27, 415–444. Retrieved from [www.jstor.org/stable/2678628](http://www.jstor.org/stable/2678628).
- Mitchell, C. J.. (2013). Creative destruction or creative enhancement? Understanding the transformation of rural spaces. *Journal of Rural Studies*, 32, 375–387. <https://doi.org/10.1016/j.jrurstud.2013.09.005>

- Müller, S., & Korsgaard, S. (2018). Resources and bridging: The role of spatial context in rural entrepreneurship. *Entrepreneurship and Regional Development*, 30(1–2), 224–255. <https://doi.org/10.1080/08985626.2017.1402092>
- Neffke, F., Hartog, M., Boschma, R., & Henning, M. (2018). Agents of structural change: The role of firms and entrepreneurs in regional diversification. *Economic Geography*, 94(1), 23–48. <https://doi.org/10.1080/00130095.2017.1391691>
- OECD/Eurostat. (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data* (3rd ed.). Paris: OECD Publishing. <https://doi.org/10.1787/9789264013100-en>
- OECD. (2006). *The New Rural Paradigm: Policies and Governance*. Paris: Organisation for Economic Development. Retrieved from <http://www.oecd.org/gov/regional-policy/thenewruralparadigmpoliciesandgovernance.htm>
- OECD. (2014). *Innovation and Modernising the Rural Economy*. OECD Publishing. <https://doi.org/dx.doi.org/10.1787/9789264205390-en>
- Petrov, A. N. (2011). Beyond spillovers: Interrogating innovation and creativity in the peripheries. In H. Bathelt, M. P. Feldman, & D. F. Kogler (Eds.), *Beyond Territory: Dynamic Geographies of Knowledge Creation, Diffusion, and Innovation* (pp. 168–190). Oxon: Routledge. <https://doi.org/10.4324/9780203814871>
- Plüschke-Altobelli, B., & Grootens, M. (2019). Leading through image making? On the limits of emphasising agency in structurally disadvantaged rural places. In T. Lang & F. Görmar (Eds.), *Regional and Local Development in Times of Polarisation. New Geographies of Europe* (pp. 319–341). Singapore: Palgrave Macmillan. <https://doi.org/10.1007/978-981-13-1190-1>
- Pylak, K. (2015). Changing innovation process models: A chance to break out of path dependency for less developed regions. *Regional Studies, Regional Science*, 2(1), 46–72. <https://doi.org/10.1080/21681376.2014.979433>
- Ratajczak-Mrozek, M. (2014). The importance of locally embedded personal relationships for SME internationalisation processes – from opportunity recognition to company growth. *Journal of Entrepreneurship, Management and Innovation*, 10(3), 89–108. <https://doi.org/10.2139/ssrn.2578709>
- Ray, C. (2001). *Culture Economies: A Perspective on Local Rural Development in Europe*. Newcastle: Centre for Rural Economy.
- Reidolf, M. (2016). Knowledge networks and the nature of knowledge relationships of innovative rural SMEs. *European Journal of Innovation Management*, 19(3), 317–336. <https://doi.org/http://dx.doi.org/10.1108/EJIM-06-2015-0043>
- Ring, J. K., Peredo, A. M., & Chrisman, J. J. (2010). Business networks and economic development in rural communities in the United States. *Entrepreneurship Theory and Practice*, 34(1), 171–195. <https://doi.org/10.1111/j.1540-6520.2009.00307.x>
- Shearmur, R. (2017). Urban bias in innovation studies. In H. Bathelt, P. Cohendet, S. Henn, & L. Simon (Eds.), *The Elgar Companion to Innovation*

- and Knowledge Creation* (pp. 440–456). Cheltenham, UK: Edward Elgar Publishing.
- Shearmur, R., Carrincazeaux, C., & Doloreux, D. (2016). The geographies of innovations: Beyond one-size-fits-all. In *Handbook on the Geographies of Innovation* (pp. 1–16). Cheltenham, UK: Edward Elgar Publishing. <https://doi.org/10.4337/9781784710774>
- Siemens, L. (2010). Challenges, responses and available resources: Success in rural small businesses. *Journal of Small Business & Entrepreneurship*, 23(1), 65–80. <https://doi.org/10.1080/08276331.2010.10593474>
- Simmie, J. (2012). Path dependence and new technological path creation in the Danish wind power industry. *European Planning Studies*, 20(5), 753–772. <https://doi.org/10.1080/09654313.2012.667924>
- Solesvik, M., & Gulbrandsen, M. (2014). Interaction for innovation: Comparing Norwegian regions. *Journal of Entrepreneurship, Management and Innovation*, 10(3), 7–28. <https://doi.org/doi.org/10.7341/20141031>
- Sotarauta, M., & Beer, A. (2017). Governance, agency and place leadership: Lessons from a cross-national analysis. *Regional Studies*, 51(2), 210–223. <https://doi.org/10.1080/00343404.2015.1119265>
- Sotarauta, M., & Suvinen, N. (2018). Institutional agency and path creation: Institutional path from industrial to knowledge city. In A. Isaksen, R. Martin, & M. Trippel (Eds.), *New Avenues for Regional Innovation Systems - Theoretical Advances, Empirical Cases and Policy Lessons*. (pp. 1–17). New York: Springer.
- Spyridakis, M., & Dima, F. (2016). Reinventing traditions: Socially produced goods in Eastern Crete during economic crisis. *Journal of Rural Studies*, 53, 269–277. <https://doi.org/10.1016/j.jrurstud.2017.04.007>
- Stathopoulou, S., Psaltopoulos, D., & Skuras, D. (2004). Rural entrepreneurship in Europe: A research framework and agenda. *International Journal of Entrepreneurial Behaviour & Research*, 10(6), 404–425. <https://doi.org/10.1108/13552550410564725>
- Strambach, S. (2008). *Path Dependency and Path Plasticity: the Co- evolution of Institutions and Innovation - the German Customized Business Software Industry* (Working Papers on Innovation and Space). Marburg. Retrieved from <http://hdl.handle.net/10419/111860> %0AStandard-Nutzungsbedingungen
- Strambach, S., & Halkier, H. (2013). Editorial. Reconceptualizing change. *Zeitschrift Fur Wirtschaftsgeographie*, 57(1–2), 1–14. <https://doi.org/10.1515/zfw.2013.0001>
- Šumane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., Rios, I. des I., ... Ashkenazy, A. (2018). Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies*, 48, 232–241. <https://doi.org/10.1016/j.jrurstud.2017.01.020>



- Torre, A. (2015). New challenges for rural areas in a fast moving environment. *European Planning Studies*, 23(4), 641–649. <https://doi.org/10.1080/09654313.2014.945811>
- Torre, A., & Wallet, F. (2016). *Regional Development in Rural Areas. Analytical Tools and Public Policies. Springer Briefs in Regional Science*. Cham, Switzerland: Springer. <https://doi.org/10.1007/978-3-319-02372-4>
- van Hemert, P., Nijkamp, P., & Masurel, E. (2012). From innovation to commercialization through networks and agglomerations: Analysis of sources of innovation, innovation capabilities and performance of Dutch SMEs. *The Annals of Regional Science*, 50(2), 425–452. <https://doi.org/10.1007/s00168-012-0509-1>
- Virkkala, S. (2007). Innovation and networking in peripheral areas - a case study of emergence and change in rural manufacturing. *European Planning Studies*, 15(4), 511–529. <https://doi.org/10.1080/09654310601133948>
- Ward, N., & Brown, D. L. (2009). Placing the rural in regional development. *Regional Studies*, 43(10), 1237–1244. <https://doi.org/10.1080/00343400903234696>

### Abstrakt

*Niniejszy artykuł analizuje rolę lokalnych zasobów (fizycznych, ludzkich, niematerialnych, społecznych, społecznościowych oraz finansowych) w kształtowaniu innowacyjności przedsiębiorstw i rozwoju ścieżek na obszarach wiejskich. Istniejące badania nad innowacyjnymi badaniami przestrzennymi w dużej mierze pominięły specyficzne dla danego regionu zasoby obszarów wiejskich jako cechy ułatwiające innowacje. Niniejszy artykuł porusza następujące pytania badawcze: (i) jaka jest rola lokalnych zasobów wiejskich w działalności innowacyjnej firmy oraz (ii) w jaki sposób te zasoby kształtują ścieżki rozwoju regionalnego? Proponujemy ramy, które przyjmują całościowy obraz zasobów wiejskich i ich roli w kształtowaniu innowacji i ścieżek rozwoju regionalnego. Analizy empiryczne sugerują, że zasoby wiejskie oferują cenne i różnorodne możliwości wzrostu innowacyjności firmy, pod warunkiem, że firmy (pro) aktywnie mobilizują i celowo wykorzystują te zasoby w ramach swoich wysiłków na rzecz innowacji. Stwierdzamy, że zasoby wiejskie mają potencjał, aby rozszerzyć i ulepszyć ścieżki rozwoju regionalnego i działać jako składniki wzbogacające istniejące ścieżki o dodatkowe funkcje, a tym samym uczynić je bardziej zorientowanymi na przyszłość. Jednak samo poleganie na zasobach wiejskich nie wystarcza do ułatwienia istotnych zmian w ścieżkach regionalnych. Nasze analizy oparte są na częściowo ustrukturyzowanych wywiadach z przedstawicielami firm zlokalizowanych w wiejskiej części Estonii, działających w różnych branżach produkcyjnych i usługowych. Niniejszy artykuł przyczynia się do powstawania, ale nadal fragmentarycznej, literatury na temat innowacji na obszarach wiejskich i oferuje (kontekstowo) oparte, na poziomie mikro, ramy dotyczące roli lokalnych zasobów wiejskich dla trwałych innowacji na obszarach wiejskich. Ponadto badanie stanowi empiryczny wkład rzadko badanego kontekstu regionalnego w Europie Środkowej i Wschodniej.*

**Słowa kluczowe:** zasoby lokalne, obszary wiejskie, innowacje, ścieżka rozwoju, zasoby, Estonia

### **Bibliographical notes**

**Merli Reidolf** is a deputy director and researcher at the department of Business Administration in Tallinn University of Technology, Estonia. She is a PhD candidate in a final stage of her studies in Business Administration, her master thesis was in Public Administrations. Her research interests are regional development, rural innovation, entrepreneurship, knowledge transfer and regional innovation systems.

**Martin Graffenberger** is a researcher at the Leibniz-Institute for Regional Geography in Leipzig (Germany) and a Ph.D. student at the University of Leipzig. His research is on firm innovation outside of agglomerations, focussing in particular on the relational and spatial contexts and dynamics that drive innovation. Further research interests include cooperative small town development processes and regional change.

# Business ecosystems policy in Stra.Tech. Man terms: The case of the Eastern Macedonia and Thrace region

Charis Vlados<sup>1</sup> , Dimos Chatzinikolaou<sup>2</sup> 

## Abstract

*In the current state of globalization's restructuring, numerous studies are examining policies to strengthen local entrepreneurship and productive systems, in terms of clusters and ecosystems. In this article, we apply and extend the Stra.Tech. Man approach to entrepreneurial dynamics as an alternative base of articulating a business ecosystems development policy. By studying the case of the Eastern Macedonia and Thrace region, one of the less developed regions in Greece, we find that there are possibilities for using the Stra.Tech.Man approach to imprint, record and, by extension, give the possibility of strengthening the strategic, technological, and managerial capacity of the "cells" of specific business ecosystems. In this context, the aim of this study is to outline a new possible direction for policy planning and implementation, in order to expand the local business ecosystems' innovative and competitive competence, especially in the context of a less developed region, by the usage of the ILDI (Institutes of Local Development and Innovation) mechanism. In this direction, we present an "introductory" and qualitative field research we carried out in the region of Eastern Macedonia and Thrace, on a sample of SMEs, in diagnostic terms of Stra.Tech.Man physiology.*

**Keywords:** *business ecosystems policy, clusters, Stra.Tech.Man physiology, small and medium entrepreneurship, Eastern Macedonia and Thrace region, globalization dynamics*

1 Charis Vlados, Ph.D. Scholar, Lecturer, Department of Economics, Democritus University of Thrace, Panepistimioupoli Komotini, 69100, tel. +302531039824, e-mail: vlad.coop@gmail.com (ORCID ID: 0000-0002-4138-8828). Also, Lecturer, University of Nicosia, School of Business, 46 Makedonitissas Avenue, CY-2417, P.O. Box 24005, CY-1700, Nicosia, Cyprus, tel. +35722841528.

2 Dimos Chatzinikolaou, Ph.D. candidate, Democritus University of Thrace, Department of Economics, Panepistimioupoli Komotini, 69100, tel. +302531039824, e-mail: dimos.chatzinikolaou@gmail.com (ORCID ID: 0000-0003-2509-6961).

Received 1 November 2018; Revised 10 March 2019, 28 March 2019; Accepted 29 March 2019

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

## INTRODUCTION

---

In the current era of globalization's restructuring (Laudicina & Peterson, 2016; Vlado, Denizos, Chatzinikolaou, & Demertzis, 2018), there is a growing interest in the ways of diagnosing, curing and preventing local and regional underdevelopment and inequalities (Pike, Rodríguez-Pose, & Tomaney, 2017; Wei, 2015). The structural changes that the various local systems are facing (Haddad, 2018; Isaksen, Tödtling, & Trippl, 2018; Neffke, Hartog, Boschma, & Henning, 2018; Uyerra & Flanagan, 2010) are leading to comparative developmental gaps. In this context, there is an ongoing effort to explain them in terms of entrepreneurial development and innovative capacity (Blackburn, 2016; Golejewska, 2018; Roundy & Asllani, 2018; Schaltegger, Lüdeke-Freund, & Hansen, 2016; Storey, 2016) and innovation (Acs, Audretsch, Lehmann, & Licht, 2017; Etzkowitz & Zhou, 2017; Frederickson, 2016). This thematic rearrangement of the current research tends to focus on the conditions that create innovation and competitiveness, always based on the particularities of each spatial socioeconomic system.

In this context, the production of knowledge and innovation within business clusters (Gancarczyk & Bohatkiewicz, 2018; Jensen, Johnson, Lorenz, & Lundvall, 2016; Piperopoulos, 2016) and regional innovation systems (Asheim, Grillitsch, & Trippl, 2016; Stuck, Broekel, & Diez, 2016) reveal the dynamic interdependence of localities in the global system. They also make the small and medium-sized enterprise a crucial development hub of the evolution of the entire regional-national-global system (Bathelt, Malmberg, & Maskell, 2004).

In this direction, the study of clusters holds a central interpretive position. Cluster theory tries to analyze individual locations in terms of business competitiveness and agglomeration of economic performance. However, the cluster, as a different way of organizing the value chain (Porter, 1998, 2000), although it is part of many policies, cannot capture, as treated by the business ecosystems, the growing competitive complexity in the modern world (Ahokangas, Boter, & Iivari, 2018; Kurtz, 2018), the new evolutionary development dynamics (Mack & Mayer, 2016; Sako, 2018) and the need for interdisciplinary and cross-thematic perception of the relative phenomena (Liguori, Winkler, Hechavarría, & Lange, 2018).

Although innovation policy in our days uses the cluster logic widely, the concept of the cluster faces criticism, because for some analysts cluster theory seems unable to explain all the factors contributing to the success of specific localities (Kim, 2015; Majava, Rinkinen, & Harmaakorpi, 2016).

In this context, and in search for articulating more effective local development policies, the aim of this study is to find out if there are any

possibilities to reposition the applied development policies at local business ecosystems through dynamic business approaches of “biological” order and understanding (Belussi & Caldari, 2008; Hammerstein & Hagen, 2005; Kennedy, Miller, & Niewiarowski, 2018; McMullen, 2018; Meyer & Davis, 2003; Reeves, Levin, & Ueda, 2016; Weber & Hine, 2015; Witt, 2006).

The following steps explain the methodology and structure of the article:

- 1) We review the business ecosystems and clusters literature and introduce the Stra.Tech.Man triangle approach.
- 2) We examine different policies for the enhancement of local entrepreneurship capacities in analytical terms of ecosystems and clusters in Europe and introduce an alternative enhancement policy of business ecosystems (the Institutes of Local Development and Innovation).
- 3) We study the current crisis in Greece and its relation to small and medium-sized enterprises, by examining the case study of a less developed region. We focus, via field research in Eastern Macedonia and Thrace, on a qualitative and non-weighted sample of small and medium-sized enterprises. Specifically, in this direction, we shared questionnaires and obtained data from 45 SMEs operating in the region of Eastern Macedonia and Thrace, irrespective of their sector of activity. After completing the company’s contact information and the number of employees, the respondent—a member of the enterprise or the business owner himself or herself—had to answer 24 questions, ranging from “zero to five” on a Likert-type scale (Batterton, Hale, 2017; Harpe, 2015). For each question, the respondent had to mark the score on two levels: today and five years ago, according to his or her personal view. The answer to each question was at the respondent’s discretion, without additional help and guidance. Additionally, the respondent could write if he or she wanted a short comment to justify the answer.
- 4) We analyze the findings of the field research to articulate a first diagnosis of the dynamic physiology of these enterprises in Stra.Tech.Man terms.
- 5) We arrive at specific conclusions and limitations of the field research.

---

## LITERATURE REVIEW

### The concept of business ecosystems and clusters

The concept of clusters refers to the local agglomeration of organizations of different nature and purpose, directed towards a particular market, industry, or specific technological sector. The clusters are dynamic units including private enterprises and public institutions, research and funding institutions, and every other institutional construct involved in the development process

of a locality (Ketels, 2011; Lazzeretti, Sedita, & Caloffi, 2014; Nathan & Overman, 2013; Porter & Ketels, 2009).

The theoretical roots of this analytical class of clusters can be found in the work of Alfred Marshall (1890), although the revival and theoretical reactivation took place only in the 1970s and 1980s, mostly by some Italian theorists (Becattini, 1979), in the study and construction of the concept of post-Fordism (Hirsch & Roth, 1986; Holloway, 1988; Jessop, 1988; Sayer, 1989). Subsequently, the approaches of industrial agglomerations (Storper & Scott, 1989), of “technopoles” (Scott & Paul, 1990) and “milieu innovateur” (Camagni, 1995) have highlighted the importance of institutional and non-market interactions in the development process and have attached increasing importance to the exploration of innovation dynamics and knowledge (Foray, David, & Hall, 2009).

With similar conceptual roots, the “ecosystemic” thinking in economic science borrows analytically and metaphorically from evolutionary biology (Ben Letaifa, Gratacap, Isckia, & Pesqueux, 2013; Korhonen, 2001; Parisot, 2013). It suggests that it is imperative in our days to study the networks of co-evolving and “co-opetitive” participants, who are mutually dependent for their shared efficiency and survival, and which, with their action, lead the socioeconomic system to either its self-renewal or its irrevocable death (Iansiti & Levien, 2002; Jacobides, Cennamo, & Gawer, 2018; Moore, 1993; Valkokari & Ketonen-Oksi, 2018).

However, how does the entrepreneurial ecosystem bibliography perceive the evolutionary dynamics of entrepreneurship? The main feature that we find in a growing body of literature is the effect of this new biological perspective on the formulation of organizational strategy and management (Baldwin, 2012; Bosch & Olsson, 2018; Iansiti & Levien, 2004; Isenberg, 2010; Liu & Rong, 2015; Moore, 2013; Williamson & Meyer, 2012).

Also, we find some contributions which study the strategic impacts of biological/ecosystem thinking on innovation (Adner & Kapoor, 2010; Blondel & Gratacap, 2016; Isckia & Lescop, 2009) and the diffusion of knowledge within organizations (Valkokari, 2015; Wulf & Butel, 2017). In addition, the increasing interest in business ecosystems is now reflected in the multitude of studies that attempt to highlight the central body of the literature, its historical formation and evolution (Acs, Stam, Audretsch, & O’Connor, 2017; Malecki, 2018; Maroufkhani, Wagner, & Wan Ismail, 2018; Rong, Lin, Li, Burström, Butel, & Yu, 2018). In this context, we have some useful definitions, which highlight the connection between the biological and economic interpretation in business ecosystems:

- According to Zahra and Nambisan (2012, p. 222), *“As with biological and ecological ecosystems, business ecosystems are susceptible to change, adaptation, and evolution. However, the outcomes of these processes are hard to predict and take time to materialize.”*
- According to Alvedalen and Boschma (2017, p 889), *“The biological/ecological view on entrepreneurship helps to establish a structure and relationships in the ecosystem. Ecosystems are depicted as geographically bounded areas with mutually dependent components.”*
- According to Cavallo, Ghezzi, and Balocco (2018, p. 9), *“... in the same way as the system of living organisms is considered to be at the heart of the ecosystem in biology, in entrepreneurship, the systemic conditions, such as networks of entrepreneurs, leadership, finance, talent, knowledge and support services, are considered to be at the heart of the entrepreneurial ecosystem, while the framework conditions entail a social context that enables or constrains human interaction.”*

We understand, therefore, that the ecosystemic thinking links dynamically the different systemic components of socioeconomic environments, where the function of entrepreneurship is crucial. However, it seems that the variety of definitions and the proposed approaches do not result in unanimity on the theoretical basis for the sufficient articulation of developmental policy for the locally based business ecosystems. In this direction, Rinkinen, and Harmaakorpi (2018), by distinguishing the different theoretical orientations between clusters and business ecosystems, observe their different interpretation in terms of policy articulation. The structure of clusters, according to the authors, refers to specific sectors and related businesses, which are characterized by high knowledge specialization, while the role of the public sector is “top-down,” intending to expand the local cluster. In contrast, the analytical class of business ecosystems is capable of exploring complementary businesses that create and diffuse knowledge within the “organic” system they create and reproduce. Finally, the role of the public sector in business ecosystem creation is open to questioning, since the authors wonder whether public intervention should have to remove the bottlenecks of evolution as a goal.

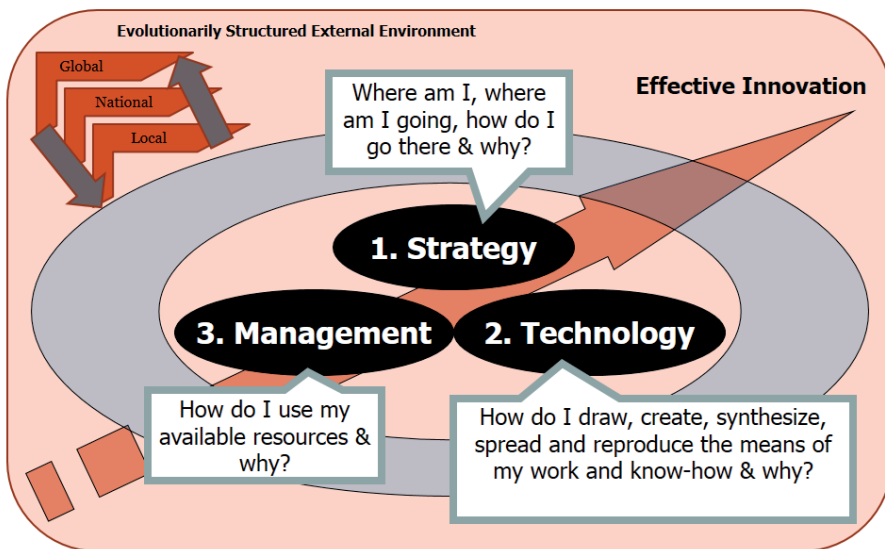
### **Focusing on the cellular component of the business ecosystem: The Stra.Tech.Man physiology of the business**

Therefore, by agreeing that a business ecosystems policy needs to identify the evolutionary action of the agents at a local level, we will try to interpret how the “cellular” level synthesizes the socioeconomic organization structurally; and we will do that by utilizing the Stra.Tech.Man approach (Vlados, 2004, 2005).

The Stra.Tech.Man approach suggests that the structural and evolutionary center of each business ecosystem is the living enterprise. The Stra.Tech.Man approach draws elements from business biology and the evolutionary theory of systems (Forrester, 1984; Georgescu-Roegen, 1971; Geus, 2002; Gowdy, 1997; Hanusch & Pyka, 2007; Harlé & Jouanneault, 1983; Lesourne, 1976; Penrose, 1952; Rothschild, 1990; Schumpeter, 1942) and suggests that a socioeconomic organization/enterprise is a complex evolutionary entity that synthesizes at its core three co-evolving spheres: Strategy (Stra), Technology (Tech), and Management (Man).

In particular, the following three internal questions, continuously and evolutionarily, decide the exceptional, explicit, and consistently advancing dynamic Stra.Tech.Man triangle:

- In terms of Strategy confronting the question: “Where am I, where am I going, how do I get there & why?”
- In terms of Technology confronting the question: “How do I draw, create, synthesize, spread, and reproduce the means of my work and know-how & why?”
- In terms of Management confronting the question: “How do I use my available resources & why?” (see Figure 1).

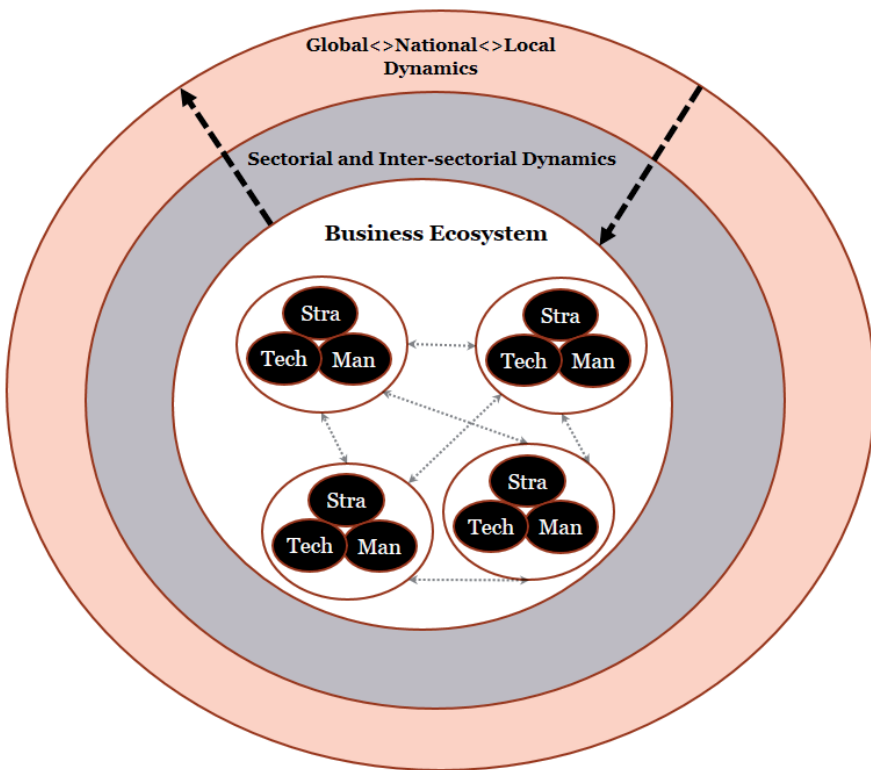


**Figure 1.** The evolutionary Stra.Tech.Man core of the enterprise.

Source: adapted from Vlados (2004).



Specifically, the term physiology Stra.Tech.Man (Strategy-Technology-Management synthesis) refers to the firm as a living socioeconomic organism. However, the traditional literature perceives relatively superficial the concepts of business culture and vision, the mission, and the business strategy. On the contrary, we argue that all these dimensions have an endogenous, structural, and evolutionary character: we perceive them as organic and physiological processes transformed over time by the evolutionary complexity that does not allow any mechanistic approach. Via this theoretical approach, we can conceive the innovation as an evolutionary synthesis that determines the insertion of every living socioeconomic organization in the spatially unifying dynamics of its external environment (see Figure 2).



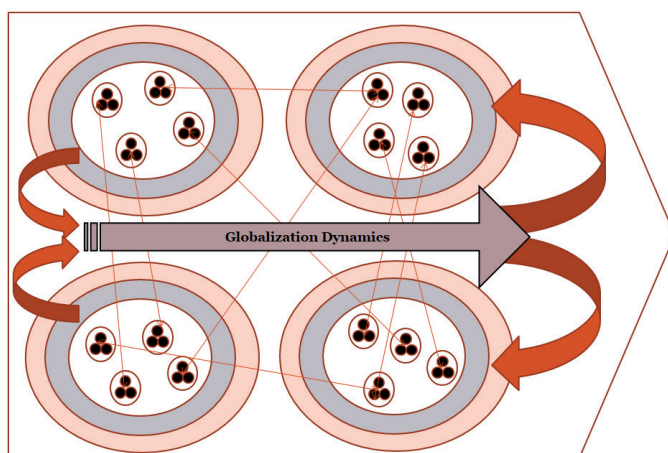
**Figure 2.** Business ecosystems in inter-sectorial and trans-spatial dynamics

Therefore, we argue that the perception of the firm in Stra.Tech.Man terms can improve our entire understanding of business ecosystems, in critical comprehensions:

- the firm is the cellular epicenter in the composition of the different business ecosystems;
- the business ecosystems are operating at the same time as producers and receivers of sectorial and inter-sectorial dynamics synthesized at the global level evolutionarily;
- the complete evolutionary procedure unifies and reproduces the partial local, national, and supranational dynamics in the global socioeconomic system.

This approach is founded, indeed, over Alfred Marshall's (1890) theoretical comprehension, in which it became clear that there are no "great leaps in nature" in economic and business evolution (*natura non facit saltum*). According to Marshall, the Mecca of the economist lies in economic biology rather than in a "conventional" Economics perspective, which perceives the reality usually static and mechanistic. Therefore, by extending this view, we could say that there are no "leaps of physiology" also in Stra.Tech.Man terms and for any organization.

In this direction, we understand that all firms, as "living" socioeconomic organizations, develop complex parallel relationships of competition and cooperation, according to the evolutionary constraints of their internal and external environment. In the current era of globalization's restructuring, a multitude of business ecosystems, with different prospects for evolution, interact with dynamic processes, both in inter-sectorial and inter-spatial level. The spatial socioeconomic systems, hosting and reproducing sectorial and inter-sectorial dynamics, shape what we call the dynamics of globalization (Carroué, 2002; Delapierre, Moati, & Mouhoud, 2000; Veltz, 2014) (see Figure 3).



**Figure 3.** The co-evolution of business ecosystems in global dynamics

## Policies to enhance the local entrepreneurship in terms of ecosystems and clusters in Europe

How can we strengthen these “living cells” of the local business ecosystem? Initially, there seems no clear conclusion in the study of the effectiveness of business ecosystem policies (Autio & Levie, 2017). At the same time, it is generally challenging to prove that a business ecosystem has indeed emerged because of focused government interventions (Mason & Brown, 2014). However, some national clustering policies (Li, 2014; Meier zu Köcker & Müller, 2015; Pitelis, 2012) follow a cross-sectoral perspective and tend to look like the analytical methodology of business ecosystems. In the member-states of the European Union, national governments in cooperation with regional or local authorities (Obadić, 2013) mainly implement the policies aimed at cluster development.

In this context, some “in-business” aid interventions can enhance our understanding, through the national studies of the European Restructuring Monitor (Hurley & Storrie, 2017), and in particular through the Restructuring in SMEs in Europe (Eurofound, 2013). We see that the restructuring of a small and medium-sized enterprise involves the use of external experts and business consultants, which should be approached as early as possible to assist both in the planning and preparation, as well as the management, of restructuring of the “patient-business.”

In this context, there is an ongoing dialogue about the role of a modern, local economic policy (Barca, McCann, & Rodríguez-Pose, 2012; Cooke, Clifton, & Oleaga, 2005; Rodríguez-Pose, 2013; Scott & Storper, 2003) which, according to our view, must be able to provide counselling and other support to local businesses.

Therefore, based on the data from the European Restructuring Monitor, we can have a picture of some of the related attempts already implemented:

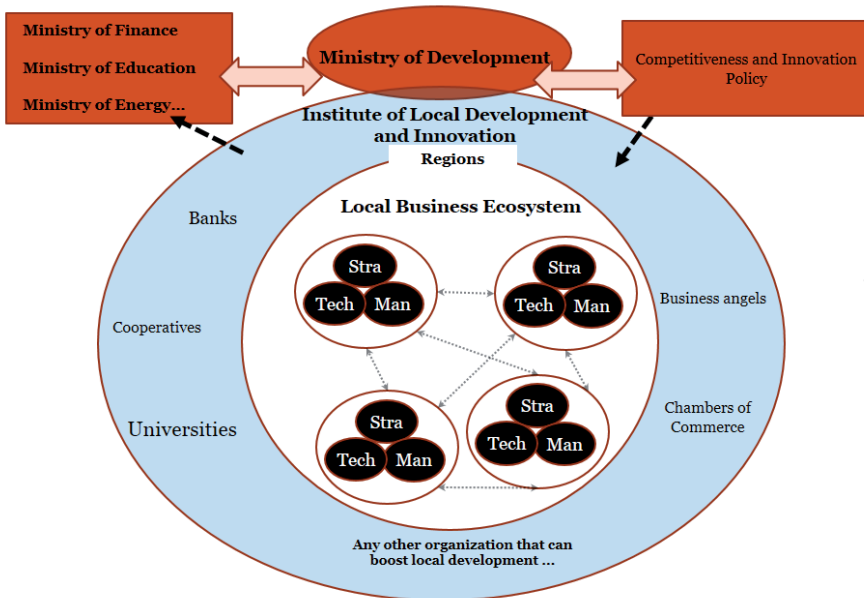
- In France, the poles of competitiveness (Poles de compétitivité) combine large and small enterprises, research laboratories, specialized suppliers, and education or training providers. The poles of competitiveness in France are either regional or interregional, while generally maintaining a cross-sectoral focus. The “Fonds Unique Interministériel” that is managed by BPIfrance, a state-owned public investment bank founded in 2012, funds these poles. The BPIfrance amalgamated in one place the pre-existing investment funds of France and now supports the innovation and export of French business products by providing financial support and advisory services at every stage of the business development cycle (European Monitoring Centre on Change, 2018b). Overall, today, the competitiveness poles

include 7,200 businesses employing 760,000 people, with around 73% being small businesses (European Monitoring Centre on Change, 2018a).

- In Finland, there is also an extensive network of public and private partnerships. Team Finland (European Monitoring Centre on Change, 2018c), for example, is geared towards the internationalization of Finnish businesses by providing services such as information, business consulting, training, and funding. Team Finland is, in fact, an umbrella for all the organizations that support the internationalization of Finnish enterprises (ministries, regional and local economic development centers, investment funds, and chambers of commerce). This policy creates a one-stop shop that connects national, regional, and local agencies. According to a 2017 survey (Elinkeinoelämän keskusliitto, 2018), about a quarter of the 6,000 internationalized Finnish SMEs have used the services of Team Finland (Akola & Havupalo, 2013).
- In Norway, there is a state-owned company set up by special legislation, Innovation Norway, which acts as a national development bank and cooperates with all the main actors at the national and local level related to innovation and business development. Innovation Norway enables domestic businesses to access a broad network of business and financial support. It provides consulting services and networking and promotion services. According to Innovation Norway's 2017 annual report (Innovasjon Norge, 2017), Norwegian companies supported by Innovation Norway had 13.7% higher sales, 5% higher productivity and 8.7% more value added than other domestic companies (European Monitoring Centre on Change, 2018d).
- In Ireland, the Local Enterprise Offices (LEOs) are the one-stop shop for anyone looking for information and support to start or develop a business. They provide, among other things, advisory services, direct funding to micro-businesses, education and training, and information about the local business environment (Local Enterprise Offices, 2018). These offices consist of 31 regional support centers, funded by the central government while being supported by local authorities. Local Enterprise Offices are local access points of Enterprise Ireland (EI), the governmental organization responsible for the growth of Irish businesses in global markets (European Monitoring Centre on Change, 2018e, 2018g). Since their establishment in 2014, the Local Enterprise Offices have provided about 32,000 jobs (European Monitoring Centre on Change, 2018f).

## The Institutes of Local Development and Innovation as an alternative policy articulation mechanism to enhance business ecosystems

Extending the analysis of Vlahos et al. (Katimertzopoulos & Vlahos, 2017; Vlahos, Deniozos, & Chatzinikolaou, 2018), a new local development policy for Greece could be the Institutes of Local Development and Innovation (ILDI). It is a one-stop shop service to strengthen the local business ecosystems in the Greek regions (see Figure 4).

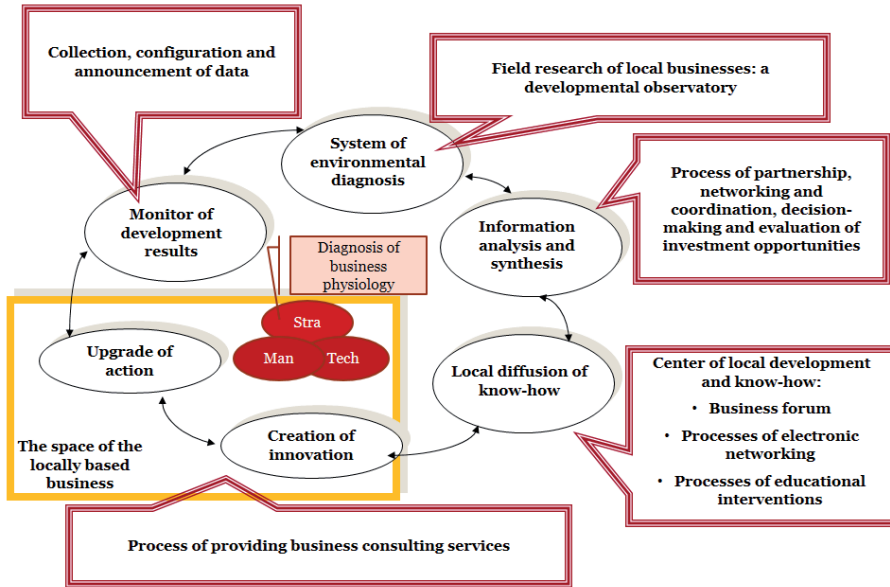


**Figure 4.** For a new business ecosystem policy in Greece

Bearing in mind that the fundamental objective of a modern ecosystem policy is to improve the environment, both external and internal, in which entrepreneurs and other stakeholders operate (Simatupang, Schwab, & Lantu, 2015), the ILDIs aim to connect all those who communicate directly or indirectly with the local business ecosystem, providing a comprehensive framework of business consulting and advisory. The ILDI is a service center for entrepreneurship aimed at interconnecting public and private bodies and organizations. In this way, it strengthens the existing business ecosystem as it has access to actors that can support the locally established entrepreneurship.

The ILDI approach is a top-down and, at the same time, a bottom-up policy. The “living” capitalistic enterprise, which operates at the same time

as a receptor of the policy intervention and as a generator of the central development procedure, is the cellular element of the local business ecosystem in Stra.Tech.Man terms (see Figure 5).



**Figure 5.** The mechanism of ILDI

The mechanism of ILDI:

- It can be a useful developmental link for the continuous competitive empowerment of the local enterprise and entrepreneurship.
- It can be an efficient center for the coordination, dissemination, and promotion of expertise at the local level, with the ultimate goal of reproducing the innovation and extroversion of the local entrepreneurial system.
- It can be an adaptive mechanism appropriate for enhancing, reproducing, and reorganizing the established dynamic value chain of local entrepreneurship.

The ILDI proposes a circular procedure that can diagnose the specific Stra. Tech.Man organizational physiology, provide consultation, and upgrade the innovative potential of local entrepreneurship while activating mechanisms of systematic feedback and monitoring of development results at the local level.

---

## **The crisis and the SMEs in Greece: The business ecosystem of SMEs in the Eastern Macedonia and Thrace region**

The Greek national socioeconomic system has continued to be under the shadow of a lasting structural crisis for more than a decade now. More profoundly than the macroeconomics of the phenomenon, a view that is limited to financial figures and results (Hardouvelis & Gkionis, 2016; Ioannides & Pissarides, 2015; Rapanos & Kaplanoglou, 2014), what the Greek socioeconomic system is currently experiencing is a crisis in the overall socioeconomic development model (Aglietta, 2010; Boyer, 2015; Rosier, 1985; Schumpeter, 1939).

In particular, based on the results of the 2016-2017 annual entrepreneurship report from the Greek Foundation for Economic & Industrial Research ("IOBE") (Τσακανίκας, Γιωτόπουλος, Σταυράκη, & Βαλαβανιώτη, 2017), in the framework of Global Entrepreneurship Monitor (GEM), the innovation and entrepreneurship environment is one of the worst in the European Union. The lack of a systematic policy support framework for entrepreneurship creates barriers to entrepreneurial activity in Greece. Significant obstacles to entrepreneurship also arise due to the difficulty of accessing funding, the high barriers to entry in the market, as well as the prevailing culture of entrepreneurship.

Thus, we see that the competitiveness problem of Greek SMEs is not merely "conjunctural" but structural. As the European 2017 SBA Fact Sheet for Greece (European Commission, 2018) notices, policy priorities for SMEs in Greece should include, among other things, the structuration of policies for the development of internationalized activities, entrepreneurship, linking universities to the real economy, while improvements in excessive regulatory burdens and administrative complexity are necessary. The report also notices that the main feature reflecting the competitiveness gap is the comparatively low value added: that is, productivity, measured as value added per the number of persons employed.

### **Eastern Macedonia and Thrace regional economy**

The region of Eastern Macedonia and Thrace is one of the thirteen Greek regions and is a less developed border region that combines socioeconomic and cultural peculiarities and deficiencies. As a border region is both peripheral, because of its reduced socioeconomic relations with other areas, and disadvantageous due to the existence of inherent weaknesses that impede the development process (Blakely & Leigh, 2013; Boudeville, 1974).

To illustrate that, in Table 1, we calculate some key regional indicators that highlight the comparative lower growth of the region of Eastern Macedonia and Thrace.

**Table 1.** Eastern Macedonia and Thrace – regional figures

<b>Gross Value Added</b>								
<b>By industry, 2008 &amp; 2014* (EUR, current prices, in millions)</b>								
<b>Selected Industries:</b> AFF: Agriculture-Forestry-Fishing, MEG: Mining-Electricity-Gas, M: Manufacturing, C: Construction, TTAFS: Trade-Transportation-Accommodation-Food Services, FIA: Financial and Insurance Activities, PSTA: Professional, Scientific and Technical Activities								
<b>2008</b>								
	<b>AFF</b>	<b>MEG</b>	<b>M</b>	<b>C</b>	<b>TTAFS</b>	<b>FIA</b>	<b>PSTA</b>	<b>SUM</b>
Eastern Macedonia & Thrace	499	298	947	439	2094	205	323	4805
<b>2014</b>								
Eastern Macedonia & Thrace	433	248	689	180	1261	162	125	3098
<b>Gross Value Added</b>								
<b>By region and sector, 2014* (EUR, current prices, in millions)</b>								
<b>I= Primary, II= Secondary, III= Tertiary</b>								
	<b>I</b>		<b>II</b>		<b>III</b>		<b>TOTAL</b>	
Greece	5843		25047		126297		157187	
Eastern Macedonia & Thrace	433		1117		4548		6098	
<b>Location Quotient (LQ)</b>								
<b>By region and sector, 2014 (based on Gross Value Added)</b>								
<b>I= Primary, II= Secondary, III= Tertiary</b>								
	<b>LQ (I)</b>		<b>LQ (II)</b>		<b>LQ (III)</b>			
Eastern Macedonia & Thrace	1.90746		1.14953		0.92821			
<b>Employment by region and sectors, 2014</b>								
	<b>I</b>		<b>II</b>		<b>III</b>		<b>TOTAL</b>	
Greece	488413		579473		2931410		3999296	
Attica	13705		210338		1303370		1527413	
North Aegean	8546		7809		52288		68643	
South Aegean	10460		19111		104041		133612	
Crete	41097		32908		163775		237780	



Eastern Macedonia & Thrace	60086	26631	124086	210803
Central Macedonia	87749	94586	453511	635846
Western Macedonia	15693	21706	52446	89845
Epirus	23081	17503	75983	116567
Thessaly	62642	40684	159428	262754
Ionian Islands	12471	9608	59646	81725
Western Greece	50926	27927	148379	227232
Central Greece	39826	42907	111202	193935
Peloponnese	62130	27754	123255	213139

**Regional Multiplier and Total Multiplier by region, 2014**

Attica			7.09	8.31
North Aegean	52.32		26.5	32.13
South Aegean			17	3.45
Crete	3.4			19.71
Eastern Macedonia & Thrace	1.75			6.14
Central Macedonia	79.8	38.6		179
Western Macedonia	3.32	2.5		6.7
Epirus	2.6	28.6		12.32
Thessaly	2.05	15.58		46.36
Ionian Islands	5			32.81
Western Greece	2.2			9.8
Central Greece	2.47	2.9		6.26
Peloponnese	1.72			5.9

Source: based on Vlados, Deniozos, and Chatzinikolaou (2018).

Table 1 shows that the gross value added in selected productive sectors between 2008 and 2014, across the region, fell by 35.5%, which is indicative of the economic crisis across the country. From the calculation of the location quotient (1) and according to the literature (Barff & Iii, 1988; Davis, 1990), when  $LQ > 1$  then the activity is standard or exporting, when  $LQ < 1$  then the activity is non-standard and when  $LQ = 1$  the activity is balanced.

$Air$  = Employment of sector  $i$  and region  $r$

$Ar$  = Total employment of the region  $r$

$Ain$  = Employment of sector  $i$  in country's total

$An$  = Total country's employment

Location quotient:

$$LQ = (Air / Ar) / (Ain / An) \quad (1)$$

Regional multiplier:

$$Kir = Air / [Air - (Ain / An)Ar] \quad (2)$$

Total regional multiplier:

$$Kr = Ar / \Sigma eir \quad (3)$$

$\Sigma eir$  = Employment of total export activity of the region (There is no multiplying effect when  $eir < 0$  or  $eir = 0$ ):

$$eir = Air - (Ain / Ain)Ar \quad (4)$$

Therefore, the primary (I) and secondary (II) productive sectors of Eastern Macedonia and Thrace are basic, while the tertiary (III) sector is non-standard. These findings contrast with the gross value added of the tertiary sector, which is much higher than the primary and secondary sectors, something that suggests low cross-sectoral competitiveness of the enterprises operating in the region. Also, because the regional multiplier calculation (2) (3) results in a value greater than 1 (1.75), there is a multiplying effect and thus exporting activity only in the primary sector, even though the majority of the employees are in the tertiary sector. The regional multiplier measures the region's total raise of employment by taking into account the increase in the number of employed in export sectors (4) (Vlados, Deniozos, & Chatzinikolaou, 2018). The regional multiplier shows that the region of Eastern Macedonia and Thrace is one of the least competitive regions of Greece, overall.

## FIELD RESEARCH

---

In this work, we propose that the Stra.Tech.Man approach could be a mechanism to strengthen the competitiveness and innovation potential of small and medium-sized enterprises in a less developed region, such as Eastern Macedonia and Thrace. In this direction, we shared questionnaires, without weighing our sample, and obtained data from 45 SMEs operating in the region of Eastern Macedonia and Thrace, irrespective of their sector of activity. The majority of interviewed SMEs were active in the retail and

food and beverages industry. One of the criteria we set was that enterprises had to employ a workforce of 20 or more people. Our final goal was the first investigation of how the Stra.Tech.Man physiology has changed for these enterprises and the region as a whole, in times of crisis.

This qualitative research (Shields & Rangarajan, 2013) does not intend to discover, suggest and test a case of a general hypothesis (with full interpretative and predictive possibilities), nor to identify specific representative causality relationships. Specifically, we have emphasized the qualitative introduction of measuring the physiological evolution of specific enterprises, in terms of exploratory research (Stebbins, 2001). This exploratory research is an induction process (Neergaard & Ulhøi, 2007) that attempts to generalize in qualitative terms, in such a way as to make it possible to investigate in the future the appropriate integrated cases. In the future, this research can be more comprehensive and empirically controllable by drawing data more systematically (Johnson, 2001).

### **Presentation of the questionnaire**

The questionnaire (see Table 2) contains questions divided equally into the three dimensions of Stra.Tech.Man, to find out the particular physiology of the company. In the questionnaire, the average of scores marks three physiological types as follows:

- 0 and 1: Strong evidence that the enterprise is of monad-centered type;
- 2 and 3: Strong evidence that the enterprise is of massive type;
- 4 and 5: Strong evidence that the enterprise is of flexible type.

According to Vlados (2004, 2012; Βλάχος, 2006), there are three major physiological categories for enterprises operating mainly in Greece, but also abroad: the monad-centered, the massive, and the flexible:

- The majority of enterprises operating in Greece are monad-centered. In the management dimension are following mostly their practical experience, their technological choices are usually sporadic and uncoordinated, and their central strategic logic is based solely on intuition and instinctive choices.
- The massive type of physiology focuses on the managerial specialization, a linear model of exploiting technology, and a strategy that depends on “mechanistic” efficiency and productivity. It does not deviate easily from the rule, based on the intensive exploitation of economies of scale.

- The last type, the flexible enterprise, although not thriving in Greece, operates based on the extensive participation of members inside the enterprise. It seems able to assimilate the growing complexity in technological terms while facing its strategic challenges with a profound evolutionary logic. This firm is not only able to “play by the rules,” but also with its innovative action can “change the rules” with its systematic innovation ability.

**Table 2.** A compressed form of the 45 answered questionnaires. Each question gets a score of 0 to 5. The score of each question in the table shows the average of the 45 responses.

Stra.Tech.Man. physiology						Past five years	Today
<b>M.1 Management philosophy:</b> What is the image given to the outside observer about the philosophy/culture of management that governs the enterprise?						2.53	3.22
Based on “traditional values”	Based on market experience	In the transition to the systematic management	Systematic management, based on measurements and orders	In the transition from strict hierarchical to participatory management	Systematic, participatory management, based on teamwork		
<b>M.2 Family character and tradition:</b> To what extent has the departure of the founder’s (and/or his/her family) “face” affected the administration of the enterprise?						1.09	1.04
<b>M.3 Organizing and organization chart:</b> The organizational chart of the company gives an image of a business that has:						2.91	3.49
Informal, ambiguous and fluid structure	Been paving the way for a clear organizational structure	Clear organizational structure but not fully covering its organizational needs	Full systematization, with “centralized” organizational structure	A modest organizational structure that meets organizational needs with limited use of decentralization	A flexible organizational structure of multidimensional decentralization		
<b>M.4 Administration and labor relations:</b> To what extent is there a well-developed and fertile framework of labor relations management centered on modern forms of motivation and leadership within the enterprise (business climate)?						3.00	3.71
<b>M.5 Intra-company training and development of human resources:</b> To what extent does the enterprise have and utilize a systematic framework for intra-company training and human resources development?						3.27	3.93
<b>M.6 Social responsibility and action:</b> To what extent does the enterprise manage to cultivate and develop the image of social responsibility and sensitivity?						2.87	3.56
<b>M.7 External contact mechanism:</b> To what extent is an external communication and public relations department, capable of informing the outside observer of the enterprise, present?						2.60	3.64
<b>M.8 Certified quality management:</b> To what extent is a systematic quality management framework, followed by ISO quality certification, in place?						3.11	3.62
Not at all	A phase of a preliminary study	A phase of quality control implementation	Quality control operation focused on the production process	Quality assurance through quality certification (of ISO type) of the whole enterprise	Complete methodology of Total Quality Management centered on the enterprise’s people and groups		
<b>Management total – Average</b>						2.67	3.28
<b>T.1 Phase of potential technological development:</b> By looking at the overall technological potential of the enterprise, you would primarily characterize it as						3.51	4.00
Almost outdated	On a downward trend	With signs of a downward trend	In a stable condition	In progress	In the emergence of robust new data		
<b>T.2 Modernization of facilities:</b> To what extent has a general program of modernization and extension of the enterprise’s manufacturing facilities been implemented?						3.09	3.64

<b>Management total – Average</b>						<b>2.67</b>	<b>3.28</b>
<b>T.3 New production processes:</b> To what extent does the enterprise use its technological potential to develop new technologically productive processes?						<b>2.96</b>	<b>3.67</b>
<b>T.4 Technological superiority at low prices/cost:</b> To what extent does the enterprise hold the image of technological excellence in the Greek market, explicitly based on the beneficial (low) price of its products?						<b>3.22</b>	<b>3.69</b>
<b>T.5 Technological excellence in a wide range of products:</b> To what extent does the enterprise hold the image of technological excellence in the Greek market, based on the high coverage of its customers' requirements by providing a wide range of products?						<b>3.33</b>	<b>3.96</b>
<b>T.6 Rate of updating the variety of products – New products:</b> At what pace does the enterprise exploit its technological potential by refreshing its range of products and bringing to market new innovative products?						<b>3.13</b>	<b>3.84</b>
Zero					Too fast		
<b>T.7 Technological excellence in high-quality product core:</b> To what extent does the enterprise have the image of technological excellence in the Greek market, based primarily on the high quality of its core products?						<b>3.22</b>	<b>3.87</b>
<b>T.8 Use of Information and Communication Technology:</b> To what extent does the enterprise use IT and communication technology (computerization, internet, etc.) to develop its communication capabilities in its internal and external environment?						<b>3.22</b>	<b>4.36</b>
<b>Technology total – Average</b>						<b>3.21</b>	<b>3.88</b>
<b>S.1 Degree of vertical integration:</b> What is the degree of vertical integration into the enterprise's core sectorial activity?						<b>2.80</b>	<b>3.13</b>
Zero	Very small	Small	Medium	Large	Very big		
<b>S.2 Sectoral and sub-sectoral diversification of activities:</b> What is the sectoral and sub-sectoral dispersion of the enterprise's activities?						<b>2.60</b>	<b>3.16</b>
Strictly in a sub-sector	In a sector with a trend of expansion in its sub-sectors	In a sector with limited presence in its sub-sectors	In a sector with a broad presence in its sub-sectors	In at least two sectors and a presence in several corresponding sub-sectors	With a strong presence in more sectors and sub-sectors		
<b>S.3 Geographic spread of commercial sales activities:</b> What is the geographical dispersion of the enterprise's commercial sales activities?						<b>1.80</b>	<b>2.24</b>
Local level	Local to national	National	National to international	International (weight given to exports)	Global (integrated global marketing strategy)		
<b>S.4 Geographical dispersion of supply activities:</b> What is the geographical dispersion of the enterprise's suppliers of input materials?						<b>2.60</b>	<b>2.96</b>
Local level	Local to national	National	National to international	International	Global		
<b>S.5 Geographical dispersion of financial/capital relationships:</b> What is the geographical dispersion of the enterprise's financial/capital relationships?						<b>1.91</b>	<b>2.13</b>
Local level	Local to national	National	National to international	International	Global		
<b>S.6 Geographical spread of access to technological resources:</b> What is the geographical dispersion of the enterprise's access to technological resources?						<b>2.42</b>	<b>2.84</b>
Local level	Local to national	National	National to international	International	Global		
<b>S.7 Geographical spread of access to human resources and management:</b> What is the geographical dispersion of the enterprise's access to human and administrative resources?						<b>1.60</b>	<b>1.89</b>
Local level	Local to national	National	National to international	International	Global		
<b>S.8 Geographical dispersion of productive activities:</b> What is the geographical dispersion of the enterprise's productive activities?						<b>1.31</b>	<b>1.56</b>
Local level	Local to national	National	National to international	International	Global		
<b>Strategy total – Average</b>						<b>2.13</b>	<b>2.49</b>
<b>Stra.Tech.Man total – Average</b>						<b>2.67</b>	<b>3.21</b>

## Presentation and analysis of findings

Therefore, we can now make a first generalization of how the physiology of sample changes over the past five years, according to the views of the questioned sample. Based on the 24 questions, we can summarize the following notes:

### *Management dimension:*

M1. Management philosophy has a relatively weak tendency towards systematization. It is worth mentioning that hardly any answer comments on or justifies the process of this systematization explicitly.

M2. The family character of the enterprise is not only present but also is reinforced in the crisis conditions.

M3. In theory, the trend towards massiveness shows that a small and medium-sized enterprise can evolve, under specific conditions, into massive. In practice, however, such a move requires investment in managerial capacities and expertise. In this context, we did not find any comments in the questionnaire to present these investments.

M4. In the same logic, leadership and administration seem to evolve slowly towards a more systematic logic, although there is insufficient clarification from the respondents to justify this high score fully.

M5. Many monad-centered enterprises, operating based on “business instinct,” believe that they ensure conditions that are “more humane” for their workforce. This seems to be the case here, as there is also no definite answer justifying this evolution of physiology via systematic forms of in-company training.

M6. In terms of social responsibility and action, the respondents have not justified this trend towards massiveness and more systematization explicitly.

M7. The extroversion of these enterprises seems to increase slowly.

M8. The quality management of the sample seems to grow, but the replies of the respondents do not justify this trend entirely.

Overall, in terms of management, the answers converge to the observation that during the crisis, there is an effort of managerial systemization, although with overall weak results in terms of physiological transition.

### *Technology dimension:*

T1. The technological potential seems to develop progressively, although without explicit mention by the respondents on how they draw, disseminate, and utilize this potential.

- T2. A specific modernization of facilities seems to be in progress, although the respondents do not specify the level and extent of relative investments.
- T3. The use of new technology seems to increase relatively productivity; however, the entrepreneurs do not specify their methods of continuous technological amelioration explicitly.
- T4. The importance of technological amelioration based on the low price of products seems to increase.
- T5. Our sample perceives the same trend about providing a more extensive range of products.
- T6. The pace of change in the augmentation of variety of products seems to rise slowly.
- T7. The core product in terms of technology seems to claim progressively higher quality, although the answers do not indicate the relative chosen procedures.
- T8. The use of information technology seems to be in a relatively developing and integrating trajectory.

Overall, in terms of technology, the answers converge to the finding that during the crisis, there is a relative effort of technological modernization, although with overall weak results in terms of total physiological transition.

*Strategy dimension:*

- S1. The vertical integration is relatively weak as strategic output.
- S2. Sectoral dispersion has a tendency of limited presence in direct sub-sectors.
- S3. Geographical dispersion of sales tends to overcome the narrow local level during the crisis, towards a national presence.
- S4. Geographical dispersion of suppliers appears relatively small, tending to move in a more expanded spatial range.
- S5. The same trend, although declining, applies to the financial dispersion. These enterprises seem that they cannot escape their local “frontiers” to find financial resources.
- S6. Although we have received relatively “optimistic” responses about the more and more expanded use of information technology, the access to strategic resources seems to remain limited to the local-national level. This suggests a relatively narrow concept and use of new strategic directions.
- S7. The employment of human resources seems to be limited to the local and national level.
- S8. There is an increase in the dispersion of the enterprise’s productive activities, which however remains limited at the local level.

Overall, in terms of strategy, the answers converge to the finding that during the crisis, there is an attempt of strategic repositioning, although with overall weak results in terms of physiological and structural transition.

## CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

---

Nowadays, the literature on local development (analyzed in clusters and business ecosystems terms) shows that there is an increasing tendency of “biological” study to the dynamic evolution of enterprises (Alvedalen & Boschma, 2017; Baldwin, 2012; Bosch & Olsson, 2018; Cavallo, Ghezzi, & Balocco, 2018; Iansiti & Levien, 2004; Isenberg, 2010; Liu & Rong, 2015; Moore, 1993; Williamson & Meyer, 2012; Zahra & Nambisan, 2012). In this context, we can understand clearly that the enterprises are socioeconomic organizations that lie at the evolving epicenter of all business ecosystems in globalization. However, there seems to be no explicit, applied methodology, in terms of policy articulation, to enhance the competitiveness of the local business ecosystems (Rinkinen & Harmaakorpi, 2018).

In this context, by applying the concept of Stra.Tech.Man transformative physiology of the enterprise, we have tried to propose a new approach of business ecosystems comprehension and policy articulation. The data from our research show that the vast majority of the sample enterprises we studied have a relatively low systematization in articulating their strategic, technological and managerial potential; the location of these enterprises, that is, a less favored business ecosystem and one of the less developed European regions is related to this observation. Specifically, we have found in this study indications that a relatively stable evolution of “physiological” type exists in the sample of these enterprises. The three spheres of strategy, technology and management seem, in the vast majority of cases, to co-evolve into an increasing business processes systematization direction (Chang, 2016; Rosemann & vom Brocke, 2015), within the current crisis conditions of the Greek economy. We have not observed any extreme deviation from the Stra.Tech.Man dimensions’ co-evolution and, therefore, the evolution of each sphere is not independent and distant from the “physiological data” of these enterprises. In this context, it is valid to argue that a consistent physiological “hybridism” (Battilana & Dorado, 2010; McMullen, 2018), without physiological leaps (Marshall, 1890) or/and extremely varied Stra. Tech.Man syntheses are present.

In light of the above findings, we think that the Stra.Tech.Man approach, under specific conditions, can be the basis for a qualitative method of studying the evolutionary physiology of enterprises; and, by extension, an instrument



---

for understanding and monitoring the specific strategic, technological and managerial needs of the enterprises on a local scale, in order to assist the articulation of appropriate policies to enhance them. Overall, therefore, we think that the Stra.Tech.Man physiology approach can be a useful analytical tool for both the enterprises to understand their evolutionary dynamics and prospects and to develop their innovative capacity, as well as for the articulation of local development policies.

However, the implementation of this approach in the field is in the initial phase of development and, as expected, it has several limitations:

- 1) It does not yet have a final operational form, which could combine qualitative and quantitative dimensions to implement more comprehensive field research.
- 2) It has not tested a sufficient number of firm cases and different local business ecosystems.
- 3) It has not reached a final investigative content so that an “action research” can ameliorate and enrich the results (Coghlan & Brannick, 2014; Eden & Ackermann, 2018).

These limitations, indeed, seem to be the reason why the average score of the Stra.Tech.Man physiology of the sample enterprises we studied does not reflect the competitiveness potential of the Eastern Macedonia and Thrace region’s business ecosystem. The respondents probably “beautified” their responses to some extent, which cannot be identified clearly with the method we applied in this research.

Our research team should try to remove in the future these limitations and develop a complete applied investigational tool and, furthermore, a new policy framework. In future field research, in which the respondent would answer the Stra.Tech.Man physiology questions with the guidance of a business research consultant and with a composite qualitative-quantitative tool of investigation, we think the responses would be significantly more precise.

Furthermore, a representative sample of enterprises can also be particularly useful in articulating relevant policy support. In this direction, a mechanism such as the Institute of Local Development and Innovation, which can combine elements from other effective local policies, like the ones we presented in this article, can function as a “business clinic” that can serve the locally based “business-patient,” for all sectors and types of enterprises in the local business ecosystem. Of course, an overall evaluation of the existing policies performing similar roles in the regions in future research is necessary.

## References

- Acs, Z. J., Stam, E., Audretsch, D. B., & O'Connor, A. (2017). The lineages of the entrepreneurial ecosystem approach. *Small Business Economics*, 49(1), 1–10. <https://doi.org/10.1007/s11187-017-9864-8>
- Acs, Z. J., Audretsch, D. B., Lehmann, E. E., & Licht, G. (2017). National systems of innovation. *The Journal of Technology Transfer*, 42(5), 997–1008. <https://doi.org/10.1007/s10961-016-9481-8>
- Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal*, 31(3), 306–333. <https://doi.org/10.1002/smj.821>
- Aglietta, M. (2010). *La Crise: Le Voies de Sortie* (Nouv. éd). Paris: Michalon.
- Ahokangas, P., Boter, H., & Iivari, M. (2018). Ecosystems perspective on entrepreneurship. In R. V. Turcan & N. M. Fraser (Eds.), *The Palgrave Handbook of Multidisciplinary Perspectives on Entrepreneurship* (pp. 387–407). Cham: Springer International Publishing. [https://doi.org/10.1007/978-3-319-91611-8\\_18](https://doi.org/10.1007/978-3-319-91611-8_18)
- Akola, E., & Havupalo, N. (2013). *Restructuring in SMEs: Finland*. Luxembourg: Publications Office of the European Union.
- Alvedalen, J., & Boschma, R. (2017). A critical review of entrepreneurial ecosystems research: Towards a future research agenda. *European Planning Studies*, 25(6), 887–903. <https://doi.org/10.1080/09654313.2017.1299694>
- Asheim, B. T., Grillitsch, M., & Trippl, M. (2016). Regional innovation systems: Past–present–future. In R. Shearmur, C. Carrincazeaux, & D. Doloreux, *Handbook on the Geographies of Innovation* (pp. 45–62). Cheltenham, UK; Northampton, MA: Edward Elgar Publishing. <https://doi.org/10.4337/9781784710774.00010>
- Autio, E., & Levie, J. (2017). Management of entrepreneurial ecosystems. In G. Ahmetoglu, T. Chamorro-Premuzic, B. Klinger, & T. Karcisky (Eds.), *The Wiley Handbook of Entrepreneurship* (pp. 423–449). Hoboken, New Jersey: Wiley-Blackwell. <https://doi.org/10.1002/9781118970812.ch19>
- Baldwin, C. Y. (2012). Organization design for business ecosystems. *Journal of Organization Design*, 1(1), 20–23. <https://doi.org/10.7146/jod.6334>
- Barca, F., McCann, P., & Rodríguez-Pose, A. (2012). The case for regional development intervention: Place-based versus place-neutral approaches. *Journal of Regional Science*, 52(1), 134–152. <https://doi.org/10.1111/j.1467-9787.2011.00756.x>
- Barff, R. A., & Iii, P. L. K. (1988). Dynamic shift-share analysis. *Growth and Change*, 19(2), 1–10. <https://doi.org/10.1111/j.1468-2257.1988.tb00465.x>
- Bathelt, H., Malmberg, A., & Maskell, P. (2004). Clusters and knowledge: Local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography*, 28(1), 31–56. <https://doi.org/10.1191/0309132504ph469oa>

- Batterton, K. A., & Hale, K. N. (2017). The Likert scale what it is and how to use it. *Phalanx*, 50(2), 32–39.
- Battilana, J., & Dorado, S. (2010). Building sustainable hybrid organizations: The case of commercial microfinance organizations. *Academy of Management Journal*, 53(6), 1419–1440. <https://doi.org/10.5465/amj.2010.57318391>
- Becattini, G. (1979). Dal settore industriale al distretto industriale. Alcune considerazioni sull'unità d'indagine dell'economia industriale. *Rivista Di Economia e Politica Industriale*, V(1), 7–21.
- Belussi, F., & Caldari, K. (2008). At the origin of the industrial district: Alfred Marshall and the Cambridge school. *Cambridge Journal of Economics*, 33(2), 335–355. <https://doi.org/10.1093/cje/ben041>
- Ben Letaifa, S., Gratacap, A., Isckia, T., & Pesqueux, Y. (2013). *Understanding Business Ecosystems: How Firms Succeed in the New World of Convergence?* Bruxelles: De Boeck.
- Blackburn, R. A. (2016). *Government, SMEs and Entrepreneurship Development: Policy, Practice and Challenges*. London; New York: Routledge. <https://doi.org/10.4324/9781315585666>
- Blakely, E. J., & Leigh, N. G. (2013). *Planning Local Economic Development: Theory and Practice* (Fifth edition). Los Angeles: SAGE.
- Blondel, F., & Gratacap, A. (2016). Entrepreneur, dynamique d'innovation et écosystème d'affaires. *Marché et organisations*, 1(25), 15–28. <https://doi.org/10.3917/maorg.025.0015>
- Bosch, J., & Olsson, H. H. (2018). Ecosystem traps and where to find them. *Journal of Software: Evolution and Process*, 30(11), 1-16. <https://doi.org/10.1002/smr.1961>
- Boudeville, J. R. (1974). *Problems of Regional Economic Planning*. Edinburgh: Edinburgh University Press.
- Boyer, R. (2015). *Économie Politique des Capitalismes: Théorie de la Régulation et des Crises*. Paris: La Découverte. <https://doi.org/10.4000/regulation.11923>
- Camagni, R. (1995). Espace et temps dans le concept de milieu innovateur. In A. Rallet & A. Torre (eds.), *Economie Industrielle et Economie Spatiale* (pp. 192-210). Paris: Economica.
- Carroué, L. (2002). *Géographie De La Mondialisation*. Paris: Armand Colin.
- Cavallo, A., Ghezzi, A., & Balocco, R. (2018). Entrepreneurial ecosystem research: Present debates and future directions. *International Entrepreneurship and Management Journal*, 1-31. <https://doi.org/10.1007/s11365-018-0526-3>
- Chang, J. F. (2016). *Business Process Management Systems: Strategy and Implementation*. New York: Auerbach Publications. <https://doi.org/10.1201/9781420031362>
- Coghlan, D., & Brannick, T. (2014). *Doing Action Research in Your Own Organization* (4th ed.). Los Angeles; London; New Delhi; Singapore; Washington DC: SAGE.

- Cooke, P., Clifton, N., & Oleaga, M. (2005). Social capital, firm embeddedness and regional development. *Regional Studies*, 39(8), 1065–1077. <https://doi.org/10.1080/00343400500328065>
- Davis, H. C. (1990). *Regional Economic Impact Analysis and Project Evaluation*. Vancouver: University of British Columbia Press.
- Delapierre, M., Moati, P., & Mouhoud, E. M. (2000). *Connaissance Et Mondialisation*. Paris: Economica.
- Eden, C., & Ackermann, F. (2018). Theory into practice, practice to theory: Action research in method development. *European Journal of Operational Research*, 271(3), 1145–1155. <https://doi.org/10.1016/j.ejor.2018.05.061>
- Elinkeinoelämän keskusliitto. (2018, January 3). EK:n yritys­kysely: Lähes 60 % vienti­yrityksistä tarvitsee ja 26 % käyttää Team Finlandin palveluita. Retrieved October 10, 2018, from <https://ek.fi/ajankohtaista/tiedotteet/2018/01/03/ekn-yrityskysely-lahes-60-vientiyrityksista-tarvitsee-ja-26-kayttaa-team-finlandin-palveluita/>
- Etzkowitz, H. & Zhou, C. (2017). *The Triple Helix: University–Industry–Government Innovation and Entrepreneurship*. London: Routledge. <https://doi.org/10.4324/9781315620183>
- Eurofound. (2013). *Restructuring in SMEs in Europe*. Luxembourg: Publications Office of the European Union.
- European Commission (2018) SBA Fact Sheet Greece. Retrieved March 7, 2019, from <https://ec.europa.eu/docsroom/documents/32581/attachments/13/translations/en/renditions/native>
- European Monitoring Centre on Change. (2018a, July 22). Poles of competitiveness | Eurofound [Restructuring Support Instruments]. Retrieved October 10, 2018, from <https://www.eurofound.europa.eu/observatories/emcc/erm/support-instrument/poles-of-competitiveness>
- European Monitoring Centre on Change. (2018b, August 7). Public Investment Bank | Eurofound [Restructuring Support Instruments]. Retrieved October 10, 2018, from <https://www.eurofound.europa.eu/observatories/emcc/erm/support-instrument/public-investment-bank>
- European Monitoring Centre on Change. (2018c, August 7). Team Finland - Services supporting the internationalisation of busi... | Eurofound [Restructuring Support Instruments]. Retrieved October 10, 2018, from <https://www.eurofound.europa.eu/observatories/emcc/erm/support-instrument/team-finland-services-supporting-the-internationalisation-of-busi>
- European Monitoring Centre on Change. (2018d, September 18). Innovation Norway | Eurofound [Restructuring Support Instruments]. Retrieved October 10, 2018, from <https://www.eurofound.europa.eu/observatories/emcc/erm/support-instrument/innovation-norway>
- European Monitoring Centre on Change. (2018e, September 26). Enterprise Ireland | Eurofound [Restructuring Support Instruments]. Retrieved October 11, 2018, from <https://www.eurofound.europa.eu/observatories/emcc/erm/support-instrument/enterprise-ireland>

- European Monitoring Centre on Change. (2018f, September 26). Local Enterprise Offices (LEOs) | Eurofound [Restructuring Support Instruments]. Retrieved October 11, 2018, from <https://www.eurofound.europa.eu/observatories/emcc/erm/support-instrument/local-enterprise-offices-leos>
- European Monitoring Centre on Change. (2018g, October 2). Enterprise Ireland Mentor Network | Eurofound [Restructuring Support Instruments]. Retrieved October 11, 2018, from <https://www.eurofound.europa.eu/observatories/emcc/erm/support-instrument/enterprise-ireland-mentor-network>
- Foray, D., David, P. A., & Hall, B. (2009). Smart specialisation—the concept. *Knowledge Economists Policy Brief*, 9(85), 1-5.
- Forrester, J. W. (1984). *Principes des Systèmes*. Lyon: Presses Universitaires de Lyon.
- Frederickson, H. G. (2016). *The Adapted City: Institutional Dynamics and Structural Change: Institutional Dynamics and Structural Change*. London; New York: Routledge. <https://doi.org/10.4324/9781315290171>
- Harpe, S. E. (2015). How to analyze Likert and other rating scale data. *Currents in Pharmacy Teaching and Learning*, 7(6), 836–850. <https://doi.org/10.1016/j.cptl.2015.08.001>
- Gancarczyk, M., & Bohatkiewicz, J. (2018). Research streams in cluster upgrading: A literature review. *Journal of Entrepreneurship, Management and Innovation*, 14(4), 17–42. <https://doi.org/10.7341/20181441>
- Georgescu-Roegen, N. (1971). *The Entropy Law and the Economic Process*. Cambridge, Mass: Harvard University Press. <https://doi.org/10.4159/harvard.9780674281653>
- Geus, A. de. (2002). *The Living Company*. Boston, Mass: Harvard Business School Press.
- Golejewska, A. (2018). Innovativeness of enterprises in Poland in the regional context. *Journal of Entrepreneurship, Management and Innovation*, 14(1), 29–44. <https://doi.org/10.7341/20181412>
- Gowdy, J. (1997). Introduction: Biology and economics. *Structural Change and Economic Dynamics*, 8(4), 377–383. [https://doi.org/10.1016/S0954-349X\(97\)00021-0](https://doi.org/10.1016/S0954-349X(97)00021-0)
- Haddad, E. A. (2018). *Regional Inequality and Structural Changes: Lessons from the Brazilian Experience*. London: Routledge. <https://doi.org/10.1201/9780429449406>
- Hammerstein, P., & Hagen, E. H. (2005). The second wave of evolutionary economics in biology. *Trends in Ecology & Evolution*, 20(11), 604–609. <https://doi.org/10.1016/j.tree.2005.07.012>
- Hanusch, H., & Pyka, A. (2007). *Elgar Companion to Neo-Schumpeterian Economics*. Cheltenham, UK: Edward Elgar Publishing. <https://doi.org/10.4337/9781847207012>
- Hardouvelis, G. A., & Gkionis, I. (2016). A decade long economic crisis: Cyprus versus Greece. *Cyprus Economic Policy Review*, 10(2), 3–40.

- Harlé, E., & Jouanneault, J.-D. (1983). *L'Entreprise en Tant que Système*. Lyon: Presses Universitaires de Lyon.
- Hirsch, J., & Roth, R. (1986). *Das neue Gesicht des Kapitalismus: Vom Fordismus zum Post-Fordismus*. Hamburg: VSA-Verlag.
- Holloway, J. (1988). The great bear, post-fordism and class struggle: A comment on Bonefeld and Jessop. *Capital & Class*, 12(3), 93–104. <https://doi.org/10.1177/030981688803600105>
- Hurley, J., & Storrie, D. W. (2017). *Globalisation Slowdown? Recent Evidence of Offshoring and Reshoring in Europe*. Luxembourg: Publications Office of the European Union.
- Iansiti, M., & Levien, R. (2002). The new operational dynamics of business ecosystems: Implications for policy, operations and technology strategy. *Harvard Business School Working Paper*, (03–030).
- Iansiti, M., & Levien, R. (2004). *The Keystone Advantage: What the New Dynamics of Business Ecosystems mean for Strategy, Innovation, and Sustainability*. Boston, Mass: Harvard Business School Press.
- Innovasjon Norge (2017). Annual Report 2017. Retrieved March 7, 2019, from <https://arsrapport.innovasjon Norge.no/en/arsrapport-2017-eng/>
- Ioannides, Y. M., & Pissarides, C. A. (2015). Is the Greek crisis one of supply or demand? *Brookings Papers on Economic Activity*, 2015(2), 349–373. <https://doi.org/10.1353/eca.2015.0004>
- Isaksen, A., Tödtling, F., & Trippel, M. (2018). Innovation policies for regional structural change: Combining actor-based and system-based strategies. In A. Isaksen, R. Martin, & M. Trippel (Eds.), *New Avenues for Regional Innovation Systems - Theoretical Advances, Empirical Cases and Policy Lessons* (pp. 221–238). Cham: Springer International Publishing. [https://doi.org/10.1007/978-3-319-71661-9\\_11](https://doi.org/10.1007/978-3-319-71661-9_11)
- Isckia, T., & Lescop, D. (2009). Open innovation within business ecosystems: A tale from amazon.com, *Communications & Strategies*, (74), 37-54.
- Isenberg, D. (2010). The big idea: How to start an entrepreneurial revolution. *Harvard Business Review*, 88(6), 40–50.
- Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, 39(8), 2255–2276. <https://doi.org/10.1002/smj.2904>
- Jensen, M. B., Johnson, B., Lorenz, E., & Lundvall, B.-Å. (2016). Forms of knowledge and modes of innovation. In B.-Å. Lundvall, *The Learning Economy and the Economics of Hope* (Vol. 155, pp. 155–182). London: Anthem Press.
- Jessop, B. (1988). Regulation theory, post fordism and the state: More than a reply to Werner Bonefield. *Capital & Class*, 12(1), 147–168. <https://doi.org/10.1177/030981688803400110>
- Johnson, B. (2001). Toward a new classification of nonexperimental quantitative research. *Educational Researcher*, 30(2), 3–13. <https://doi.org/10.3102/0013189X030002003>

- Katimertzopoulos, F., & Vlahos, C. (2017). Local support mechanisms for entrepreneurship: The approach of local development and innovation institutions. *International Journal of Business and Economic Sciences Applied Research*, 10(1), 30–41. <https://doi.org/10.25103/ijbesar.101.04>
- Kennedy, E. B., Miller, D. J., & Niewiarowski, P. H. (2018). Industrial and biological analogies used creatively by business professionals. *Creativity Research Journal*, 30(1), 54–66. <https://doi.org/10.1080/10400419.2017.1411631>
- Ketels, C. (2011). Clusters and competitiveness: Porter's contribution. In R. Huggins & H. Izushi, *Competition, Competitive Advantage, and Clusters: The Ideas of Michael Porter* (pp. 173–192). Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199578030.003.0010>
- Kim, S.-T. (2015). Regional advantage of cluster development: A case study of the San Diego biotechnology cluster. *European Planning Studies*, 23(2), 238–261. <https://doi.org/10.1080/09654313.2013.861807>
- Korhonen, J. (2001). Four ecosystem principles for an industrial ecosystem. *Journal of Cleaner Production*, 9(3), 253–259. [https://doi.org/10.1016/S0959-6526\(00\)00058-5](https://doi.org/10.1016/S0959-6526(00)00058-5)
- Kurtz, C. (2018). Are we ready for complexity? *Journal on Policy and Complex Systems*, 4(1), 135–154. <https://doi.org/10.18278/jpcs.4.1.7>
- Laudicina, P. A., & Peterson, E. R. (2016). *From Globalization to Islandization* (Global Business Policy Council (GBPC) /Research Report) (p. 26). ATKearney. Retrieved March 3, 2019, from <https://www.atkearney.com/web/global-business-policy-council/article?/a/from-globalization-to-islandization>
- Lazzeretti, L., Sedita, S. R., & Caloffi, A. (2014). Founders and disseminators of cluster research. *Journal of Economic Geography*, 14(1), 21–43. <https://doi.org/10.1093/jeg/lbs053>
- Lesourne, J. (1976). *Les Systèmes du Destin*. Paris: Dalloz.
- Li, Y. R. (2014). The cluster policies to nation competitiveness based on business ecosystem perspective — Case study of Taiwanese smart phone industry. In *2014 IEEE International Conference on Industrial Engineering and Engineering Management* (pp. 887–891). <https://doi.org/10.1109/IEEM.2014.7058766>
- Liguori, E., Winkler, C., Hechavarria, D., & Lange, J. (2018). Guest editorial. *Journal of Enterprising Communities: People and Places in the Global Economy*, 12(2), 86–91. <https://doi.org/10.1108/JEC-02-2018-0017>
- Liu, G., & Rong, K. (2015). The nature of the co-evolutionary process: Complex product development in the mobile computing industry's business ecosystem. *Group & Organization Management*, 40(6), 809–842. <https://doi.org/10.1177/1059601115593830>
- Local Enterprise Offices. (2018). About US | Services. Retrieved October 11, 2018, from <https://www.localenterprise.ie/About-Us/Services/>
- Mack, E., & Mayer, H. (2016). The evolutionary dynamics of entrepreneurial ecosystems. *Urban Studies*, 53(10), 2118–2133. <https://doi.org/10.1177/0042098015586547>

- Majava, J., Rinkinen, S., & Harmaakorpi, V. (2016). Development of San Diego life sciences ecosystem. In *Finnish policy research seminar: Growth ecosystems as an innovation policy tool*. The Ministry of Economic Affairs and Employment of Finland.
- Malecki, E. J. (2018). Entrepreneurship and entrepreneurial ecosystems. *Geography Compass*, 12(3), e12359. <https://doi.org/10.1111/gec3.12359>
- Maroufkhani, P., Wagner, R., & Wan Ismail, W. K. (2018). Entrepreneurial ecosystems: a systematic review. *Journal of Enterprising Communities: People and Places in the Global Economy*, 12(2), 158-177. <https://doi.org/10.1108/JEC-03-2017-0025>
- Marshall, A. (1890). *Principles of Economics* (8th Edition, published in 1920). London: Macmillan.
- Mason, C., & Brown, D. R. (2014). *Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship* (p. 38). The Hague, Netherlands: OECD.
- McMullen, J. S. (2018). Organizational hybrids as biological hybrids: Insights for research on the relationship between social enterprise and the entrepreneurial ecosystem. *Journal of Business Venturing*, 33(5), 575–590. <https://doi.org/10.1016/j.jbusvent.2018.06.001>
- Meier zu Köcker, G., & Müller, L. (2015). *Cluster Programmes in Europe* (European Cluster Observatory) (p. 35).
- Meyer, C., & Davis, S. M. (2003). *It's Alive: The Coming Convergence of Information, Biology, and Business*. New York: Crown Business.
- Moore, J. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review*, 71(3), 75–86.
- Moore, J. (2013). *Shared Purpose: A Thousand Business Ecosystems, A Connected Community, and the Future*. Mountain view: Create space publishing platform.
- Nathan, M., & Overman, H. (2013). Agglomeration, clusters, and industrial policy. *Oxford Review of Economic Policy*, 29(2), 383–404. <https://doi.org/10.1093/oxrep/grt019>
- Neergaard, H., & Ulhøi, J. P. (Eds.). (2007). *Handbook of Qualitative Research Methods in Entrepreneurship*. Cheltenham, UK; Northampton, MA: Edward Elgar. <https://doi.org/10.4337/9781847204387>
- Neffke, F., Hartog, M., Boschma, R., & Henning, M. (2018). Agents of structural change: The role of firms and entrepreneurs in regional diversification. *Economic Geography*, 94(1), 23–48. <https://doi.org/10.1080/00130095.2017.1391691>
- Obadić, A. (2013). Specificities of EU cluster policies. *Journal of Enterprising Communities: People and Places in the Global Economy*, 7(1), 23–35. <https://doi.org/10.1108/17506201311315581>
- Pariset, X. (2013). Metaphor in organizational theory, the business ecosystem case. In *Volume 22th AIMS International Conference*. Clermont-Ferrand, France.
- Penrose, E. T. (1952). Biological analogies in the theory of the firm. *The American Economic Review*, 42(5), 804–819.



- Pike, A., Rodríguez-Pose, A., & Tomaney, J. (2017). Shifting horizons in local and regional development. *Regional Studies*, 51(1), 46–57. <https://doi.org/10.1080/00343404.2016.1158802>
- Piperopoulos, P. G. (2016). *Entrepreneurship, Innovation and Business Clusters*. London: Routledge. <https://doi.org/10.4324/9781315579948>
- Pitelis, C. (2012). Clusters, entrepreneurial ecosystem co-creation, and appropriability: A conceptual framework. *Industrial and Corporate Change*, 21(6), 1359–1388. <https://doi.org/10.1093/icc/dts008>
- Porter, M. (1998). Clusters and the new economics of competition. *Harvard Business Review*, 76(6), 77–90.
- Porter, M. (2000). Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly*, 14(1), 15–34. <https://doi.org/10.1177/089124240001400105>
- Porter, M., & Ketels, C. (2009). Clusters and industrial districts: Common roots, different perspectives. In G. Becattini, M. Bellandi, & L. De Propris (eds.), *A Handbook of Industrial Districts* (pp. 172–183). Cheltenham: Edward Elgar Publishing.
- Rapanos, V. T., & Kaplanoglou, G. (2014). Governance, growth and the recent economic crisis: The case of Greece and Cyprus. *Cyprus Economic Policy Review*, 8(1), 3–34.
- Reeves, M., Levin, S., & Ueda, D. (2016). The biology of corporate survival. *Harvard Business Review*, 94(1), 2.
- Rinkinen, S., & Harmaakorpi, V. (2018). The business ecosystem concept in innovation policy context: Building a conceptual framework. *Innovation: The European Journal of Social Science Research*, 31(3), 333–349. <https://doi.org/10.1080/13511610.2017.1300089>
- Rodríguez-Pose, A. (2013). Do institutions matter for regional development? *Regional Studies*, 47(7), 1034–1047. <https://doi.org/10.1080/00343404.2012.748978>
- Rong, K., Lin, Y., Li, B., Burström, T., Butel, L., & Yu, J. (2018). Business ecosystem research agenda: More dynamic, more embedded, and more internationalized. *Asian Business & Management*, 17(3), 167–182. <https://doi.org/10.1057/s41291-018-0038-6>
- Rosemann, M., & vom Brocke, J. (2015). The six core elements of business process management. In J. vom Brocke & M. Rosemann (Eds.), *Handbook on Business Process Management 1: Introduction, Methods, and Information Systems* (pp. 105–122). [https://doi.org/10.1007/978-3-642-45100-3\\_5](https://doi.org/10.1007/978-3-642-45100-3_5)
- Rosier, B. (1985). *Croissance et Crise Capitalistes* (2nd edition). Paris: Presses Universitaires de France - PUF.
- Rothschild, M. (1990). *Bionomics: The Inevitability of Capitalism*. New York: H. Holt.
- Roundy, P. T., & Asllani, A. (2018). The themes of entrepreneurship discourse: A data analytics approach. *Journal of Entrepreneurship, Management and Innovation*, 14(3), 127–158. <https://doi.org/10.7341/20181436>

- Sako, M. (2018). Business ecosystems: How do they matter for innovation? *Communications of the ACM*, 61(4), 20–22. <https://doi.org/10.1145/3185780>
- Sayer, A. (1989). Postfordism in question. *International Journal of Urban and Regional Research*, 13(4), 666–695. <https://doi.org/10.1111/j.1468-2427.1989.tb00141.x>
- Schaltegger, S., Lüdeke-Freund, F., & Hansen, E. G. (2016). Business models for sustainability: A co-evolutionary analysis of sustainable entrepreneurship, innovation, and transformation. *Organization & Environment*, 29(3), 264–289. <https://doi.org/10.1177/1086026616633272>
- Schumpeter, J. (1939). *Business cycles: A theoretical, historical, and statistical analysis of the capitalist process*. New York: McGraw-Hill.
- Schumpeter, J. (1942). *Capitalism, Socialism, and Democracy*. New York; London: Harper & Brothers.
- Scott, A., & Paul, A. S. (1990). Collective order and economic coordination in industrial agglomerations: The technopoles of southern California. *Environment and Planning C: Government and Policy*, 8(2), 179–193. <https://doi.org/10.1068/c080179>
- Scott, A., & Storper, M. (2003). Regions, globalization, development. *Regional Studies*, 37(6–7), 579–593. <https://doi.org/10.1080/0034340032000108697a>
- Shields, P. M., & Rangarajan, N. (2013). *A Playbook for Research Methods: Integrating Conceptual Frameworks and Project Management*. Stillwater, OK: New Forum Press.
- Simatupang, T. M., Schwab, A., & Lantu, D. C. (2015). Building sustainable entrepreneurship ecosystems, *International Journal of Entrepreneurship and Small Business*, 26(4), 389–398. <https://doi.org/10.2139/ssrn.3161598>
- Stebbins, R. A. (2001). *Exploratory Research in the Social Sciences*. Thousand Oaks, Calif: Sage Publications. <https://doi.org/10.4135/9781412984249>
- Storey, D. J. (2016). *Entrepreneurship and New Firm: Theory and Policy*. London: Routledge. <https://doi.org/10.4324/9781315544502>
- Storper, M., & Scott, A. (1989). The geographical foundations and social regulation of flexible production complexes. In J. Wolch, *The Power of Geography (RLE Social & Cultural Geography): How Territory Shapes Social Life*. London; New York: Routledge.
- Stuck, J., Broekel, T., & Diez, J. R. (2016). Network structures in regional innovation systems. *European Planning Studies*, 24(3), 423–442. <https://doi.org/10.1080/09654313.2015.1074984>
- Uyarra, E., & Flanagan, K. (2010). From regional systems of innovation to regions as innovation policy spaces. *Environment and Planning C: Government and Policy*, 28(4), 681–695. <https://doi.org/10.1068/c0961>
- Valkokari, K. (2015). Business, innovation, and knowledge ecosystems: How they differ and how to survive and thrive within them. *Technology Innovation Management Review*, 5(8), 17–24.
- Valkokari, K., & Ketonen-Oksi, S. (2018). Understanding platforms and ecosystems as structures for value co-creation (p. 14). Presented at the

- ISPIIM Innovation Conference – Innovation, The Name of The Game*, Stockholm, Sweden. <https://doi.org/10.22215/timreview/919>
- Veltz, P. (2014). *Mondialisation, Villes Et Territoires: L'économie D'archipel* (2nd edition). Paris: PUF. <https://doi.org/10.3917/puf.velt.2014.01>
- Vladoş, C. (2004). *La Dynamique du Triangle Stratégie, Technologie et Managemen : l'Insertion des Entreprises Grecques dans la Globalisation*. Thèse. Paris 10.
- Vladoş, C. (2005). The insertion of Greek firms into globalization: The dynamics of the triangle of strategy, technology and management. In *Managing Global Trends and Challenges in a Turbulent Economy*, University of the Aegean, Department of Business Administration. <https://doi.org/10.2139/ssrn.3218009>
- Vladoş, C. (2012). The search of competitiveness and the entrepreneurial evolution in a global environment: Toward a new approach of development dynamics based on the case of Greek productive system. *Journal of Management Sciences and Regional Development*, (8), 91–116. <https://doi.org/10.2139/ssrn.3218008>
- Vladoş, C., Deniozos, N., & Chatzinikolaou, D. (2018). Towards a new approach of local development under crisis conditions: Empowering the local business ecosystems in Greece, by adopting a new local development policy. *International Journal of Regional Development*, 5(1), 1–24. <https://doi.org/10.5296/ijrd.v5i1.11955>
- Vladoş, C., Deniozos, N., Chatzinikolaou, D., & Demertzis, M. (2018). Towards an evolutionary understanding of the current global socio-economic crisis and restructuring: From a conjunctural to a structural and evolutionary perspective. *Research in World Economy*, 9(1), 15–33. <https://doi.org/10.5430/rwe.v9n1p15>
- Weber, M., & Hine, M. (2015). Who inhabits a business ecosystem? The technospecies as a unifying concept. *Technology Innovation Management Review*, 5(5), 31–44. <https://doi.org/10.22215/timreview/896>
- Wei, Y. D. (2015). Spatiality of regional inequality. *Applied Geography*, 61, 1–10. <https://doi.org/10.1016/j.apgeog.2015.03.013>
- Williamson, P. J., & Meyer, A. D. (2012). Ecosystem advantage: How to successfully harness the power of partners. *California Management Review*, 55(1), 24–46. <https://doi.org/10.1525/cmr.2012.55.1.24>
- Witt, U. (2006). Evolutionary concepts in economics and biology. *Journal of Evolutionary Economics*, 16(5), 473–476. <https://doi.org/10.1007/s00191-006-0034-4>
- Wulf, A., & Butel, L. (2017). Knowledge sharing and collaborative relationships in business ecosystems and networks: A definition and a demarcation. *Industrial Management & Data Systems*, 117(7), 1407–1425. <https://doi.org/10.1108/IMDS-09-2016-0408>
- Zahra, S. A., & Nambisan, S. (2012). Entrepreneurship and strategic thinking in business ecosystems. *Business Horizons*, 55(3), 219–229. <https://doi.org/10.1016/j.bushor.2011.12.004>

- Βλάδος, Χ. Μ. (2006). *Η Δυναμική της Παγκοσμιοποίησης και οι Επιχειρήσεις στην Ελλάδα*. Αθήνα: Εκδόσεις Κριτική.
- Τσακανίκας, Α., Γιωτόπουλος, Ι., Σταυράκη, Σ., & Βαλαβανιώτη, Ε. (2017). *Ετήσια Έκθεση Επιχειρηματικότητας 2016-2017: Σε κάμψη η νέα επιχειρηματικότητα* (GEM Greece 2016-17 Report: Global Entrepreneurship Monitor). Athens: Foundation for Economic & Industrial Research.

### Abstrakt

*W obecnym stanie restrukturyzacji globalizacji liczne badania badają strategie na rzecz wzmocnienia lokalnej przedsiębiorczości i systemów produkcyjnych pod względem klastrów i ekosystemów. W tym artykule stosujemy i rozszerzamy podejście Stra. Tech.Man do dynamiki przedsiębiorczości jako alternatywnej podstawy formułowania polityki rozwoju ekosystemów biznesowych. Badając przypadek regionu Wschodniej Macedonii i Tracji, jednego z mniej rozwiniętych regionów w Grecji, stwierdzamy, że istnieją możliwości wykorzystania podejścia Stra.Tech.Man do nadruku, zapisu i, co za tym idzie, możliwości wzmocnienia strategicznego, technologicznego i zarządczego zdolności „komórek” określonych ekosystemów biznesowych. W tym kontekście celem niniejszego opracowania jest nakreślenie nowego możliwego kierunku planowania i wdrażania polityki, w celu rozszerzenia innowacyjnych i konkurencyjnych kompetencji lokalnych ekosystemów biznesowych, zwłaszcza w kontekście słabiej rozwiniętego regionu, dzięki wykorzystaniu mechanizm ILDI (Institutes of Local Development and Innovation). W tym kierunku przedstawiamy „wstępne” i jakościowe badania terenowe, które przeprowadziliśmy w regionie Wschodniej Macedonii i Tracji, na próbie MŚP, w kategoriach diagnostycznych fizjologii Stra.Tech.Man.*

**Σлова κλειζωτε:** *polityka ekosystem biznesowy, klastry, fizjologia Stra.Tech.Man, mała i średnia przedsiębiorczość, region Wschodniej Macedonii i Tracji, dynamika globalizacji*

### Biographical notes

**Charis Vlados** holds a Ph.D. degree with a “Very Honorable Distinction” for his thesis on the types/forms of evolutionary integration of the enterprises operating in Greece into globalization that took place within the framework of the Research and Studies Center on Multinational Enterprises (C.E.R.E.M) of the “Paris X-Nanterre” University. The author’s primary focus is on the fields of corporate strategy, competitiveness, entrepreneurship, economic policy, and globalization, while he has established and developed the “Stra.Tech.Man approach” in the field of business dynamics. Charis Vlados has been working with various research institutes and as a business consultant, both in Greece and abroad, for approximately twenty years. He is now a lecturer (academic tenure) with the Department of Economics of the Democritus University of Thrace in the scientific field of “International Economic Relations and Entrepreneurship,” while has also taught in the past at the Universities

of the Aegean and Peloponnese, and at various Public and Private Centers of Studies. Charis Vlados has authored until now seven scientific textbooks and monographs (in Greek) and more than 50 scientific publications in peer-reviewed scientific journals and conference proceedings.

**Dimos Chatzinikolaou** holds an M.Sc. diploma from the Postgraduate Courses in “South-Eastern Europe Studies (specialization in Economics)” from the Department of Law of Democritus University of Thrace with degree excellent (10/10). Dimos Chatzinikolaou is now a Ph.D. Candidate with the Department of Economics of the Democritus University of Thrace at the field of “competitiveness, business ecosystems, and industrial policy.” He is the co-author in more than twenty scientific articles in peer-reviewed scientific journals and conference proceedings, while his main areas of research include, among others, the fields of globalization, competitiveness, economic policy, and entrepreneurship.