2020

A New Innovation Paradigm: European Cohesion Policy and the Retreat of Public Science in Countries in Europe's Scientific Periphery

Jadranka Švarc
Institute of Social Sciences Ivo Pilar

Marina Dabic
University of Zagreb

Tugrul Daim
Portland State University, tugrul@etm.pdx.edu

Citation Details

Švarc J, Dabic M, Daim TU. A new innovation paradigm: European cohesion policy and the retreat of public science in countries in Europe's scientific periphery. Thunderbird Int. Bus. Rev. 2020;62:531–547. https://doi.org/10.1002/tie.22166

DOI: 10.1002/tie.22166

RESEARCH ARTICLE

WILEY

A new innovation paradigm: European cohesion policy and the retreat of public science in countries in Europe's scientific periphery

Jadranka Švarc[1] | Marina Dabić[2,3] | Tugrul U. Daim[4,5,6]

[1]Institute of Social Sciences Ivo Pilar, Zagreb, Croatia

[2]Faculty of Economics and Business, University of Zagreb, Zagreb, Croatia

[3]Management Division, Nottingham Business School, Nottingham Trent University, Nottingham, UK

[4]Department of Engineering and Technology Management, Portland State University, Portland

[5]National Research University Higher School of Economics Moscow, Russian Federation, Moscow, Russia

[6]Chaoyang University of Technology, Taichung, Taiwan

Correspondence
Marina Dabić, Faculty of Economics and Business, University of Zagreb, J. F. Kennedy square 6, Zagreb 1000, Croatia.
Email: mdabic@net.efzg.hr, marina.dabic@ntu.ac.uk

Abstract

This article seeks to undertake a critical assessment of the changing position of public science in the entrepreneurial ecosystem of the countries on the periphery of European research. These countries are driven by new innovation paradigm based on entrepreneurship, which are implemented within the European Smart specialization strategy (S3). This article argues that S3 is widely implemented in the cohesion countries and, while it provides substantial resources for science, technology, and innovation, it fails to provide sustainability in the public research sector. This has direct implications for policies concerning innovation and entrepreneurial ecosystems. In order to prove the thesis, the article provides theoretical argumentation for emergence of a new innovation paradigm, driven by the rise of the entrepreneurial ecosystem, its incorporation into S3, and a consequent retreat of science policy in favor of entrepreneurial policy. The empirical analysis is focused on the funding trends seen in the business and public research sectors over the last decade (2008–2017), which have clearly shown that S3 has not contributed, despite expectations, to an increase in public expenditure for science. This signifies S3's neglect of public research within entrepreneurial ecosystems and challenges the ability of S3 to reduce wide disparities in research and innovation performance across the European Union. This ultimately endangers the innovation potential of the entrepreneurial ecosystem itself.

KEYWORDS

cohesion countries, entrepreneurial ecosystem, entrepreneurship, innovation paradigm, public science, science periphery, smart specialization

1 | INTRODUCTION

One of the great ongoing debates in the area of science, technology, and innovation (STI) studies is the role of public science and research-based innovation for the advancement of socio-economic progress and entrepreneurial ecosystems. Both concepts are subject to radical evolution and irreversible changes driven by many mutually supportive processes of deindustrialization and digitalization of the economy such as lethargic growth in economy, productivity, and product innovations since 1970 (Gordon, 2016), secular stagnation (Cowen, 2011), premature deindustrialization (Rodrik, 2016), reducing the "epistemic base of technique" in service economy (Mokyr, 2003), to mention some of them. The process of economic restructuring driven by the collapse of large industrial companies, along with the rise of new layers of small and medium sized companies (SMEs) with limited capacities for research and development (R&D), in the 1980s has additionally questioned the role of science in economic development. These processes have led to the (re)discovery of individual entrepreneurship in Kirznerian terms of opportunity recognition (Roininen & Ylinenpää, 2009) and the importance of entrepreneurial capital and economy for national competitiveness, well established by a group of scholars gathered around the GEDI project (Global Entrepreneurship and Development Index; Acs, Autio, & Szerb, 2014; Audretsch, 2007; Audretsch & Thurik, 2000; Thurik, Stam, & Audretsch, 2013). This perspective has been extended and developed by the concept of the entrepreneurial ecosystem (EES). The term "ecosystem" was originally borrowed from the field of biology but, when incorporated with entrepreneurial perspectives, it quickly emerged as a promising area of research in entrepreneurship (Alvedalen & Boschma, 2017; Audretsch, Cunningham, Kuratko, Lehmann, & Menter, 2019; Cavallo, Ghezzi, & Balocco, 2019; Malecki, 2018; Maroufkhani, Wagner, Khairuzzaman, Ismail, 2018; Mujahid, Mubarik, & Naghavi, 2019; O'Connor, Stam, Sussan, & Audretsch, 2018; Song, 2019) with an explicit focus on individual entrepreneurs as the creators of new economic value (Acs, Stam, Audretsch, & O'Connor, 2017; Autio, Nambisan, Thomas, & Wright, 2018; Stam, 2015) and fostering change toward innovation culture Švarc, Lažnjak, & Dabić, 2019).

Although entrepreneurs are the key drivers of economic competitiveness and growth, as they transform scientific achievements into innovation, the current trend demonstrating the dominance of entrepreneurship over science is shifting the focus of STI policies from scientific research to business ventures, transforming national innovation systems into national entrepreneurship systems (Acs et al., 2014) and entrepreneurial ecosystems (Audretsch et al., 2019; Malecki, 2018; Song, 2019). The terms "entrepreneurship system" and "entrepreneurial ecosystem" are often used interchangeably (Alvedalen & Boschma, 2017, p. 889), giving impetus to an innovation paradigm based on entrepreneurship (Autio, Kenney, Mustar, Siegel, & Wright, 2014; Stam, 2015; Thurik et al., 2013). An illustrative example of this new innovation paradigm is the prevalence of innovation regarding changes in business models in digital economy, as opposed to "technology-push" innovation, which translates scientific knowledge and research advances into commercial applications (Autio et al., 2018, p. 78).

This change in innovation paradigm and STI policy is much more prominent in those European countries with weak scientific potentials, which receive substantial support for R&D from the EU Structural and Investment Funds (ESI Funds) as part of the EU Cohesion policy, which seeks to reduce regional European disparities in economic and social development. Some scholarly observations question the potential of the current trend of the European STI policies, formulated through the Smart specialization strategy (S3), to strengthen public science and its economic outcomes by strengthening local entrepreneurs and entrepreneur-led regional projects (Archibugi, Filippetti, & Frenz, 2018; Bonaccorsi, 2016; Muscio, Reid, & Rivera Leon, 2015).

The aim of this article is to undertake a critical assessment of the new innovation paradigm, embraced conceptually by the S3 and funded by the ESI Funds for countries with weak research capacities, in the hope of answering the following questions: Is there a tendency to replace science policy with entrepreneurial policy and scientific research with business innovation? Is public support for entrepreneurship and SMEs made at the expense of public science?

Within this context, the main goals of this article are twofold. First, this research aims to demonstrate the ways in which this new innovation paradigm, based on entrepreneurship, has emerged and how it is reflected on the European STI policy embodied in the S3 through the Entrepreneurs discovery process (EDP). EDP is essential component of S3 focused on strengthening regional development and entrepreneurship and seeks for those scientific research which serve innovation needs of local entrepreneurs and business ventures;

Second, this research aims to show that ESI Funds, although they bring many benefits to the research systems of EU peripheral countries, supports mainly research in the business sector for its relation to EDP and tends to replace, under the budget austerity policy, national funds for public science, leading eventually to the neglect of national research capacities and to the retreat of public science policy.

This research contributes to theories and practices pertaining to STI and entrepreneurship policies. From a theoretical point of view, the research builds several arguments. First, it documents the emergence of the new innovation paradigm, with entrepreneurship as the outcome of the current intersection of STI and entrepreneurship policy. Second, it provides a novel insight into the relationship between science, innovation, entrepreneurship policy, and S3 as a part of the European cohesion policy, explaining the ways in which the new innovation paradigm and the concept of the EES is incorporated into S3. Third, the article critically evaluates the neglected position of public science within S3 in countries in Europe's scientific periphery, which appeared as an unintended consequence of the excessive interference of science, innovation, and entrepreneurship policies. This is supported by empirical data on the decline in funding trends for the public research sectors over the last decade (2008–2017) in the EU.

The above findings have direct policy implications. First, the identified neglect of public science in research-weak countries suggests a need for careful re-consideration of the national public science policy with regards to S3 in order to: (a) reinforce/enforce the role that national polices play in fostering high-quality research and scientific excellence; (b) provide adequate national resources for this purpose, aside from EU funds; and (c) consider the consequences of the uncritical Europeanization of STI policy. Second, it aims to draw the attention of policy makers to the fact that national and European research funding both have different focal points and should act in a complementary rather than substitutive way.

Overall, this research contributes to ongoing debates about the role of science, innovation, and entrepreneurship in current STI polices, with the main message being that the incorporation of public science under the wide umbrella of S3 may result in divergence rather than convergence in the innovation potential of EU countries. This outcome is adverse to production and innovation oriented entrepreneurship.

The article begins with the description of the methods used in this research (Section 2). It continues with a discussion of the evolution toward the new innovation paradigm and the rise of EES (Section 3). The analysis is then expanded upon through a discussion of the incorporation of entrepreneurship based innovation and EES into S3, as well as the adverse consequences for public science (Section 4). Empirical data on the trends in the funding of public science, which support the main thesis, is given in Section 5. The results of this research are discussed in Section 6, and concluding remarks and policy implications are given in Section 7.

2 | METHODOLOGY

This research combines a conceptual and empirical approach. The first part of the research is primarily conceptual, and its methodology is based on a critical qualitative analysis of the current concepts of research, innovation, and entrepreneurship. This approach allows for the explanation of the evolution of innovation paradigms and policies and the consequences for public science in research-marginal and peripheral countries.

The second part of the article provides empirical analysis reliant on state-of-the-art literature and relevant statistical data concerning investments in science in order to illustrate the structural changes in the composition of Gross Expenditure on R&D (GERD). Statistical data is taken from the EUROSTAT for the 10-year period between 2007 and 2018. This involves nation-wide aggregated data on R&D funding in business and government sectors, enabling the detection of long term trends in investments in science at a macro level.

3 | THE EVOLUTION TOWARD THE NEW INNOVATION PARADIGM BASED ON ENTREPRENEURSHIP AND THE RISE OF THE ENTREPRENEURIAL ECOSYSTEM

The concept of entrepreneurship for economic development and innovation is currently attracting considerable attention from scholars (Alvedalen & Boschma, 2017; Audretsch, Hayter, & Link, 2015; Carlsson et al., 2013; Landström & Harirchi, 2018) while interest in the exploitation of scientific discoveries and science-based innovation seems stagnant. The reasons are various and include phenomena such as the decline of innovation activities due to the global crisis (OECD, 2012), premature deindustrialization (Rodrik, 2016, p. 2), secular stagnation (Gordon, 2016), the slowing down of technological progress (Cowen, 2011), the rise of digital economy (Nambisan, Wright, & Feldman, 2019), and many others. Alongside these, the service innovations that dominate modern economies further reduce the need for R&D and education and lessen the "epistemic base of technique" (Mokyr, 2003), making room for low-wage, low-skill, routinized work and the same type of SMEs. The knowledge intangibles are exchanged with "service intangibles" (Svarc & Dabic, 2017) and physical innovation for digital innovation (Fichman, Dos Santos, & Zheng, 2014).The nature of innovation has been altered, and innovation paradigms have been shifted from innovation based on technological change toward business-like innovation, including "day-to-day activities" (Edison, Ali, & Torkar, 2013, p. 1402).

This reconceptualization begun within mainstream economics, which abolished the classic definition of innovation, which dated back to the 1970s (OECD, 1971, p. 11) as "the first application of science and technology in a new way with commercial successes", in favor of a much broader concept of innovation, which takes into account the nontechnological aspects of innovation (Adam, 2014, p. 9). Within statistical measurement, the Frascati manual, which measured research inputs into innovation (OECD, 2002), was complemented by the Oslo Manual (OECD, 2005, p. 46), which focused on innovation outputs (Godin, 2011) and, in its latest edition, broadened the definition of innovation to include organizational and marketing to ensure that policymakers take nontechnological aspects of innovation into account (Godin, 2008).

There is growing recognition that innovation may not be something new and radical in nature. By contrast, innovation is primarily incremental (Tidd, 2006) and combines various qualities of three different aspects of innovation: outcome, process, and mindset, and none should include major breakthroughs (Kahn, 2018). Changes in organizational structure, work environments, cost reduction, or entering new markets also count, even though they are quite ordinary. In short, technology-based innovation paradigms have evolved into a new innovation paradigm that assumes innovation to be any entrepreneurial activity that enables a company to survive on the market.

Evolution toward the new innovation paradigm based on entrepreneurship (Table 1) presents a departure from previous two main paradigms of innovation: the linear or "science-push" model of innovation based and on the idea that basic research is the main source of technological change (Suurna and Kattel, 2010), and interactive model of innovation (Kline & Rosenberg, 1986) which appeared during economic recession in the 1970s, which initiated a growing scepticism over the plausibility of science solving socio-economic problems. Science was challenged to prove its economic viability and social utility, and scientists had to shape their research objectives to socio-economic needs (Martin, 2012; Schot & Steinmueller, 2016). The global race for national competiveness gave rise to the concept of innovation shaped by the evolutionary theory of technological change (Nelson & Winter, 1982), national systems of innovation (Freeman, 1988; Lundvall, 2010; Nelson, 1993), and an endogenous growth theory (Romer, 1990) which shares the common idea that innovation is produced by interaction between scientific knowledge, learning, and industry. Variations of the STI model, based on this interactionist paradigm of technological innovation, are numerous. They include concepts such as new knowledge production or Mode 2 (Gibbons, Limoges, Nowory, Schwartzmann, & Scott, 1994), the concept of postacademic science (Ziman, 1996), and the model of the triple helix, including the concept of entrepreneurial universities (Etzkowitz, 2008).

TABLE 1 Stylized facts about the evolution of innovation paradigms

Innovation paradigm	Science-based (1945–1980)	Technology-based (1980–2010)	Entrepreneurship-based (2010 to present day)
Innovation drivers	R&D	Technological change	Entrepreneurs' needs and abilities
Type of economy	Market-led economy	Managed economy	Entrepreneurial economy
Policy framework	National research system	National innovation system	National entrepreneurial system; Entrepreneurial ecosystem
Background theory	Exogenous growth theories; Linear innovation model; Solow neoclassical economic model	Systems of innovation; Interactive model of innovation; Endogenous growth model	Entrepreneurial economy; Entrepreneurial ecosystem; Smart specialization strategy
Principle agents	Researchers and scientists	Institutions of the national innovation systems	Entrepreneurs
STI policy emphasis	Scientific research	Science–industry co-operation; commercialization of scientific of knowledge	Firms' creation and growth; Entrepreneurial discovery process—EDP

Source: authors.

The concept of innovation imbedd in belief that scientific and technological advancements are fundamental for economic growth was productive and fertile for the postwar economic regimes of the so-called managed economy (Thurik et al., 2013), when R&D was performed by large companies in an era of mass production, high employment, and economies of scale. Its peak coincided with the expansion of high-tech sectors and science-based industries, drawing upon the pool of knowledge and infrastructure provided by science (Rosenberg & Nelson, 1994). This era was challenged in the 1980s by a new "entrepreneurial" economy (Audretsch & Thurik, 2000), which perceives entrepreneurship's dynamics, flexibility, heterogeneity, and varieties of new ventures and ideas as important growth factors—a perspective which was absent from standard growth theories (Acs et al., 2014, 2017). The downsizing of large corporations and the rise of small garage-like companies that transformed the global economy by creating radical innovations in information technologies and biotechnologies (Hughes, 2011) have demonstrated the power of innovation capacities of small start-up companies. The individual entrepreneur was practically absent from the European development policy agenda since efforts of innovation polices were focused on establishing institutional set-up for fostering innovations and on the co-operation, interaction, and flow of knowledge between science and the economy (Acs et al., 2014). In such a national system of innovation, the entrepreneur remains a "black box" (Stam, 2015) and is personified through large corporations. In the entrepreneurial economy, an entrepreneur has become a moderator between R&D and innovation, establishing a new innovation paradigm based on business-type innovation, open innovation, and the business capacities of individual entrepreneurs as determined by the specific country's institutional setup for entrepreneurship, which is today recognized as the EES (Acs et al., 2017; Malecki, 2018; Cavallo, Ghezzi, & Balocco, 2019; Pustovrh, Rangus, & Drnovšek, 2020; Song, 2019; Stam, 2015).

The theoretical foundations of entrepreneurial society (Audretsch, 2009), entrepreneurial economy (Thurik et al., 2013), entrepreneurship capital (Audretsch, 2007), and the national system of entrepreneurship (Acs et al., 2014) announced the rise of a new innovation era, driven by individual entrepreneurs and small- and medium-sized enterprises (SMEs), through which the concept of innovation was significantly changed (Autio et al., 2014; Acs et al., 2017; Autio et al., 2018; Stam, 2015).

After these ground-breaking contributions, a need for more holistic and systemic views of entrepreneurship emerged, resulting in the concept of the entrepreneurial ecosystem, which arose in the 2000s but has only been dominant since 2016 (Malecki, 2018; (Stam & van de Ven, 2019). As observed by O'Connor et al. (2018) and Stam (2015), interest in entrepreneurial systems has recently grown, as demonstrated by the amount of literature which has been summarized in several literature reviews showing how the field of EES has evolved (Malecki, 2018; Maroufkhani et al., 2018; Mujahid et al., 2019), and what it really means (Alvedalen & Boschma, 2017; Acs et al., 2017; Cavallo et al., 2018; Audretsch et al., 2019; Song, 2019; Stam, 2015).

Despite abundant literature and many definitions of EES (Malecki, 2018) scholars largely agree that the systemic nature of entrepreneurial activity is still underdeveloped. The persistent question of exactly what is and what comprises an EES remains open (Audretsch et al., 2019, p. 313). The crucial dilemma regarding EES, which is of utmost importance in this research, is how this concept differs from similar or previous concepts, such as clusters, industrial districts, regional or national systems of innovation, and so on. Is the EES just "old wine sold in new skins" ask Audretsch et al. (2019).

The clear answer to this question is provided by distinctive scholars, such as Acs et al. (2014), Stam (2015), O′ Connor et al. (2018), Autio et al. (2018), Audretsch et al. (2019), and Song (2019), whose analyses converge to the same conclusion. They assert that EES is distinctively different from other similar concepts by positioning the entrepreneurs at the center of the EES dynamic. Although earlier analytical frameworks assigned entrepreneurs a significant role, they did not (as clarified by Autio et al., 2018), treat the pursuit of entrepreneurial opportunity as the defining aspect of the system. In contrast to similar frameworks, entrepreneurial ecosystems revolve around entrepreneurial opportunity discovery and pursuit, for which entrepreneurs and their ventures are the central agents. Although this statement reflects the idea of a national entrepreneurship system, as defined previously by Acs et al. (2014, p. 479), the concept of EES consolidated the field of entrepreneurship research and firmly established entrepreneurs as key drivers of regional and national development.

This distinctive feature of EES provides legitimation for the key concept of this research—the emergence of the new innovation paradigm based on entrepreneurship. This paradigm was implicit in the analytical frameworks prior to EES, but was somehow buried beneath many other ideas, approaches, and narratives. The new innovation paradigm became explicit within EES when individual entrepreneurs and their business ventures appeared as prime movers.

In this context, the business capacities of entrepreneurs has come to the center of the innovation system especially in the research weak countries which can hardly compete in the cutting-edge and general purpose technologies which ultimately emerge from science. The national innovation system has been challenged in these countries with the national entrepreneurial ecosystem.

4 | INCORPORATION OF ENTREPRENEURSHIP BASED INNOVATION AND ENTREPRENEURIAL ECOSYSTEMS IN S3

Fostering innovation became a strategic goal of the EU in the mid-1990s as Europe experienced growing unemployment, economic stagnation, and fierce competition with the USA, Japan, South Korea, and China (European Commission, 2010; 2011). European innovation policy has gradually evolved since the instigation of the "research triangle" by the 2000 Lisbon agenda, which focused on the integration of innovation, science, and higher education policies (European Commission, 2000) striving toward the S3 corresponding with the vision for the Europe 2020 Strategy. S3 has developed from the reaction of the EU to the deficiencies prompted by the 2008 global crisis (Karo & Kattel, 2015) into the EU's new industrial innovation policy, which resonates with all member states (Radosevic, Curaj, Gheorghiu, Andreescu, & Wade, 2018; Foray & Goenaga, 2013, p.8).

S3 became a core concept of the EU's 2014–2020 Cohesion policy, with special emphasis on the support for less developed countries, aiming to reduce regional disparities in Europe (Foray, David, & Hall, 2009; Karo & Kattel, 2015). National or regional S3 strategies were required as an ex-ante conditionality for receiving funding from the ESI funds—the main funding instrument of the Cohesion Policy. This conditionality applies specifically for the Thematic objective 1 of the European Research and Development Fund (ERDF) which provide budget for strengthening research, technological development and innovation. Therefore, every member states should have such a well-developed S3 in place, to receive financial support from ERDF (Foray et al., 2012, p. 10) thorough the ERDF's Operational programs and specific subsequent instruments envisaged by the complex architecture of EU Cohesion Policy.

S3 is considered to be the largest innovation policy experiment in the world (Radosevic & Ciampi Stancova, 2018) and a major twist in terms of contemporary policy thinking (McCann & Ortega-Argilés, 2015). It provided policy-prioritization relevant for regional development, inspired by economic geography and place-based arguments (Barca, McCann, & Rodrıguez-Pose, 2012; McCann & Ortega-Argilés, 2013, 2015) pertaining to growth, taking into account a region's contextual factors (Avdikos & Chardas, 2016, p. 104).

S3 represents a break from the top-down policy approach to standard innovation policy, in favour of a bottom-up approach to regional innovation, by introducing a new "policy-prioritisation logic" (McCann & Ortega-Argilés, 2013) grounded in the entrepreneurial discovery process (EDP; Vallance, Blažek, Edwards, & Kveton, 2018, p. 220). EDP is at the heart of S3 and designates a learning process through which entrepreneurs can discover the research and innovation domains through which a region can stand out (Foray et al., 2009, p. 2). In referring to the critical role of entrepreneurs in discovering promising areas of future R&D specialization, S3 presents a new and radical approach in innovation policy, and a distinctly new way of understanding the phenomenon of innovation. It differs from previous innovation paradigms, based on technological change and science commercialization, as it sees innovation resultant of the actions of entrepreneurs, not necessarily involving R&D or advanced technology (Foray et al., 2009; McCann & Ortega-Argilés, 2015; Vallance et al., 2018).

S3 supported by ESI funds brought not only financial resources, but also new paradigms of innovation and STI policy which was largely oriented toward entrepreneurs. On the global stage, a growing share of the government budget for R&D has been allocated to the business sector, instead of public research, signaling a policy shift in strategic objectives (increasing firms' capacity to innovate), instruments and targets (OECD, 2016 p. 174). The impact of this policy orientation is pervasive in research weak countries because funds for S3 greatly outweigh national resources for R&D, as briefly outlined in the next chapter. As a consequence, the economic outcomes of public science in the European cohesion countries are supposed to be generated through business ventures and entrepreneur-led regional projects. The nature, pace, and dynamic of innovation in this context is determined by the needs of local entrepreneurs, who are the main beneficiaries of ESI funds and determine not only research priorities, but the ways in which science is organized and performed.

S3 practically implements the ideas established by the entrepreneurial economy and it is consolidated within entrepreneurial ecosystems that economic growth and innovation are primarily the responsibility of the individual entrepreneurs who pursue business opportunities (Acs et al., 2017, Autio et al., 2018; Stam, 2015). It incorporates ideas surrounding the centrality of entrepreneurs through the EDP, which is a process led by entrepreneurs to identify business activities and industries that could exceed their local capabilities and productive assets, in order to establish the areas of smart specialization. S3, therefore, closely corresponds to ideas surrounding the national entrepreneurial system

(Acs et al., 2014) and entrepreneurial economy (Thurik et al., 2013) which has become explicit within the EES (Autio et al., 2018; Stam & Spigel, 2018).

This process does not necessarily involve new technologies or R&D, but it can be imitative (Capello & Lenzi, 2016; Foray, David, & Hall, 2011, p. 6; Foray, Morgan, Radosevic, 2018; Radosevic et al., 2018). Academics are expected to adapt their activities, skills, and technological proficiencies to foster regional development by assisting entrepreneurs in developing their competences. In other words, S3 preserves the basic idea of science/industry/government co-operation but on different premises: while, in the national innovation system, the dynamics of innovation are determined by the interplay of institutional stakeholders with the prominent role of public science, the dominant role in S3 for fostering innovation is given to SMEs and entrepreneurs. Seeing as the main mission of S3 is to encourage regions to follow their own paths of economic transformation, related to their current production and innovation strengths, the "centre of gravity of the S3 dynamic is the firms since they are best placed to conduct EDP" (Vallance et al., 2018, p. 221) rather than public research or universities. The original concept of S3 emphasized the importance of R&D and, in particular, R&D in high-technology sectors, but it gradually shifted, through the nine policy briefs produced by the Knowledge for Growth expert group between 2006 and 2009, toward the practical application of general purpose technologies (e.g., ICT), and to the promotion of entrepreneurship (McCann & Ortega-Argilés, 2015, p. 1300). This confirms the presumption that S3, although stemming from the "research triangle," somehow restricted R&D in later phases. It was rather implicit from the inception of the concept that the general purpose technologies could be developed by research leaders, while those who were less technologically advanced would only use them for their technological upgrading (Foray et al., 2009, p. 3), marking the beginning of the research divide between the central and peripheral countries of the EU.

In the European core countries, S3 is focused on high-technology and knowledge-intensive sectors as this industry relies on universities to source technological knowledge while, in the noncore countries, the existing industrial base may be completely unrelated to the fields of academic research (Bonaccorsi, 2016) or scientific knowledge (Capello & Lenzi, 2016, p. 1793). This simply means that S3 is highly contextual (Karo & Kattel, 2015; Veugeleurs, 2015) and quite different in countries with weak research capacities, industrial bases, and quality of governance, and can result in little convergence (Archibugi & Filippetti, 2011; Muscio et al., 2015). The aim of the EU cohesion policy, in countries with less technological capabilities, is to build upon the existing innovation capabilities and production skills of local entrepreneurs and support locally relevant research (Foray, Morgan, Radosevic, 2018, p. 3; Muscio et al., 2015). This aspect of the S3, which clearly supports a crude division of labor between technology "leaders" and "followers," was subjected to criticism (Vallance et al., 2018), but no constructive solution was offered for the development of the public research sector in peripheral research countries.

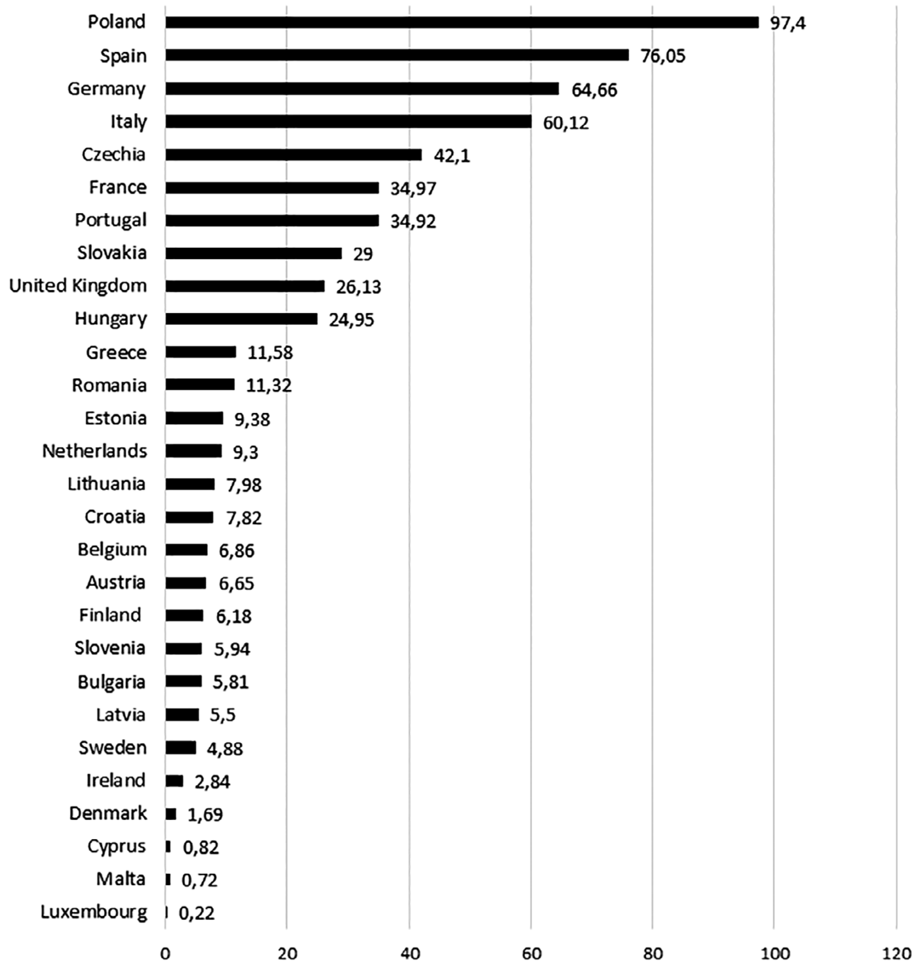
5 | PUBLIC FUNDING OF SCIENCE

Research and innovation priorities, determined by the EDP as functional models of S3, are funded by the European Regional and Development Fund (ERDF) which, as one of the five ESI funds, serves to strengthen economic and social cohesion in the European Union. A total budget for ERDF of over 279 billion euros, for the programming period between 2014 and 2020, was allocated four thematic priorities: innovation and research, the digital agenda, support for small and medium sized enterprises (SMEs), and the low-carbon economy. 62 billion euros was set for research and innovation, while support for SMEs amounted to around 50 billion euros. The remaining resources were to be spent on different activities within the remaining two priorities, such as low carbon economy, ICT, environment protection, public administration, etc. Allocations of ERDF for research and innovation to EU member states (Figure 1) were rather generous, especially in research-weak countries which spent small amounts of state budget on funding research projects, below 1% of GDP.

The impact of cohesion policy on the economies of the new member states which manly belongs the research marginal and peripheral countries, except Slovenia, Czechia and Estonia is significant. Estimates show that investments from cohesion policy programs increased their GDP by 3% in 2015, and a similar amount is expected in 2023 for the programming period of 2014–2020 which will contribute to a significant convergence of GDP per head in these countries (European Commission, 2017, p. 23). Cohesion policy is also of vital importance to overall public investments in the less developed countries, as European allocation reached over 70% of all public investments in countries such as Portugal, Lithuania, and Croatia in the period between 2015 and 2017 (European Commission, 2017, p. 22). ESI funds significantly enlarged national budgets for R&D and innovation in the research weak countries but their contribution to the sector of public science focused on strengthening national "stock of knowledge" through academic research remains ambiguous. The literature about significance of basic science for business sector and economic growth is abundant and dates back to the sixties with the seminal articles of Arrow (1962) and Nelson (1959) on economics of science. Many other prominent scholars explore different aspects of usefulness of public and basic knowledge such as Pavitt (1998), Mansfield (1998), Dasgupta and David (1994), Balconi, Brusoni, and Orsenigo (2010), to mention only a few. Despite opponents like Kealey (1996) who questioned the entire rationale for government funding of science, the prevailing opinion is that public science creates not only inputs for variety of new technologies, but also for many other forms of economic benefits (Salter & Martin, 2001).

Although the precise quantitate data about the share of ERDF in the national budgets for scientific research are lacking, many scholars estimate that ERDF budget for R&D greatly outweigh national budgets, thus having a significant impact on the national science policies. For example, contributions of national funds for R&D in Bulgaria in 2014 is estimated to be "negligible compared to European funds" (Todorova & Slavcheva, 2016). In Greece Structural funds dominate national project-funding (Chrysomallidis & Tsakanikas, 2017). In

FIGURE 1 Total ERDF budget for research and innovation, 2014–2020, by country (million euros). *Source*: <https://cohesiondata.ec.europa.eu/themes/1>



Lithuania, since joining the EU, the major proportion of R&D funding has come from ESIF (Dall'Erba & Fang, 2017). In Croatia the total national budget funds for competitive research projects in basic sciences for five years in the period 2013–2017 was around 108 million euros (Martinovic Klaric, 2019), compared to ERDF funds for R&D programs of over 110 million euros per year (782 million euros for the 2014–2020 programming period) (Figure 1).

In Croatia, for example, the ERDF resources for research and innovation are allocated mainly for activities different from basic scientific projects which are usually performed by public R&D sector. For example, the overview of public calls for activities funded by ERDF in Croatia for the period 2014–2019 within the Operational programme "Competiveness and cohesion 2014-2020" (Table 2) illustrates that only two public calls by the end 2019 are dedicated to public research organization for scientific research activates (e and k). Majority of resources are devoted for technological upgrading of companies through cooperation with the public research organizations and shaped by the interest and need of companies (a, b, and h). Only a fraction of research community is able to take advantage of these funds due to the nature of their research, which is close to industrial application. Majority researches in natural, medial, social, and other scientific disciplines are not eligible for ERDF funding. It should be however, emphasized that generous resources are reserved for revitalization of public research infrastructures (c, i, and j) which could not be financed otherwise, for example, from the scarce state budget. This is a crucial contribution from the ESI funds to public science.

The purpose of statistical analysis in this research is to provide evidence of divergence in public science investments between research-core and noncore countries, despite abundant resources of ESI funds for the latter. Unfortunately, there is no systematized and readily available microdata at a national level concerning investments of ESI funds into public science, which means this analysis is based indirectly on the aggregate level of the Gross expenditure on R&D (GERD) and related indicators, extracted from EUROSTAT on 25 April, 2019.

Such broad-based statistical analyses are usually employed in scientific research which seeks for internationally comparable indicators to show trends in science funding at macro level of countries (Archibugi et al., 2018; Archibugi & Coco, 2005; Archibugi & Filippetti, 2018; Bonaccorsi, 2016; Kim, 2014; Makkonen, 2013; Veugelers, 2014; Veugelers, 2016). The aggregate indicators, such as those presented in this research, allow to distinguish between countries in research intensity in terms of expenditures in R&D and to identify growing divide in government funding of scientific research across European Union. This provides argument that existing data are presented in an innovative way that make an original approach to the rather modest literature in the respective domain.

TABLE 2 An overview of public calls funded by ERDF in Croatia for Research and innovation 2014–2019 within the Operational program "Competiveness and cohesion 2014–2020"

	Content of call	Status	Applicants	Approximate budget in million €
a.	Development of new products and services resulting from R&D activities (IRI II)	Open by mid-2020	Enterprises	105
b.	Development of new products and services resulting from R&D activities (IRI I)	Closed in 2018	Enterprises	100
c.	Preparation of R&D infrastructures	Closed in 2017	Public research organizations	6
d.	Synergies between Horizon 2020, Twinning and ERA Chairs (equipment and premises)	Closed in 2018	Public research organizations	7
e.	Capacity building for research, development and innovation	Closed in 2018	Public research organizations	25
f.	Children's Center for Translational Medicine at Srebrnjak Children's Hospital	Closed in 2018	Health organizations	*58*
g.	Croatian Science and Education Cloud	Closed in 2018	Universities	26
h.	Centers of competence	Closed in 2017	Entrepreneurs, clusters, networks	105
i.	Centre for Advanced Laser Techniques	Closed in 2017	Public institute	17
j.	Organizational reform and infrastructure in the public R&D organizations	Closed in 2017	Public research organizations	102
k.	Research centers of excellence	Closed in 2017	Public research organizations	50

Source: https://strukturnifondovi.hr/natjecaji/.

TABLE 3 Countries by research intensity, 10 year average of GERD, 2008–2017

Category by research intensity	Average GERD (2008–2017)	Countries
Research leaders	Above 2% of GDP	Slovenia, Belgium, France, Germany, Sweden, Austria, Denmark, Finland
Research followers	1.5–2% of GDP	Estonia, Czechia, United Kingdom, the Netherlands
Research moderate followers	1–1.5% of GDP	Hungary, Spain, Italy, Portugal, Luxembourg, Ireland
Research marginal countries	0.7–1% of GDP	Slovakia, Greece, Croatia, Poland, Lithuania
Research periphery	Up to 0.7% of GDP	Romania, Cyprus, Latvia, Bulgaria, Malta

Source: Eurostat relevant tables, extracted on April 25, 2019.

The member states are grouped into five categories according their research intensity, measured by the average GERD in the decade, from 2008 (first precrisis year) to 2017 (Table 3).

It can be seen (Figure 2) that there is a huge difference in research intensity between research leaders/followers whose GERD as percentage of GDP is above 1.5%, reaching almost 3% in some countries, and research marginal/peripheral countries whose GERD is around 0.6–0.7%, reaching a maximum of 1% of GDP (Figure 2).

The magnitude of this disparity is better seen in absolute amounts of GERD, expressed in euro per inhabitants (Table 4). Research peripheral countries invested, as recorded in 2017, seven times less in their public research sector (measured by government expenditures on R&D) than research leaders, yet this ratio in the business sector is remarkably higher and reaches 18 times smaller expenditures. The data presented in Figure 2 revealed that the share of the R&D budget, as a share of GDP (GERD) in innovation leaders and followers, has been declining since 2011/2012 while, in moderate followers, this downward trend begun in 2009, probably as a result of postcrisis austerity policies pursued by the governments of those countries. In research peripheral countries a slightly upward trend is observable, mainly due to the investments of Cyprus (from 0.39 in 2008 to 0.56% in 2017) and Bulgaria (from 0.45% in 2008 to 0.75% in 2018). In research peripheral countries, there is also upward trend, as Greece, Slovakia, and Poland almost doubled their investments in R&D in the last decade, which was still a far cry from research investments of research-core countries. Lithuania increased investments by a modest 0.1% of GDP and, only in Croatian investments, are R&D reduced (Figure 2).

However, the observed increases in GERD in research peripheral and marginal countries were mainly driven by the expenditures of the business sector (BERD) while expenditures of the government sector (GOV) remained in a "steady" or declining state, except in research-leading countries (Figures 3 and 4).

The largest increase in investment in the business sector was recorded in the research marginal countries, more than doubling the investments in the last decade as all countries in the group increased their business R&D; especially Slovakia, Greece, and Poland, whose

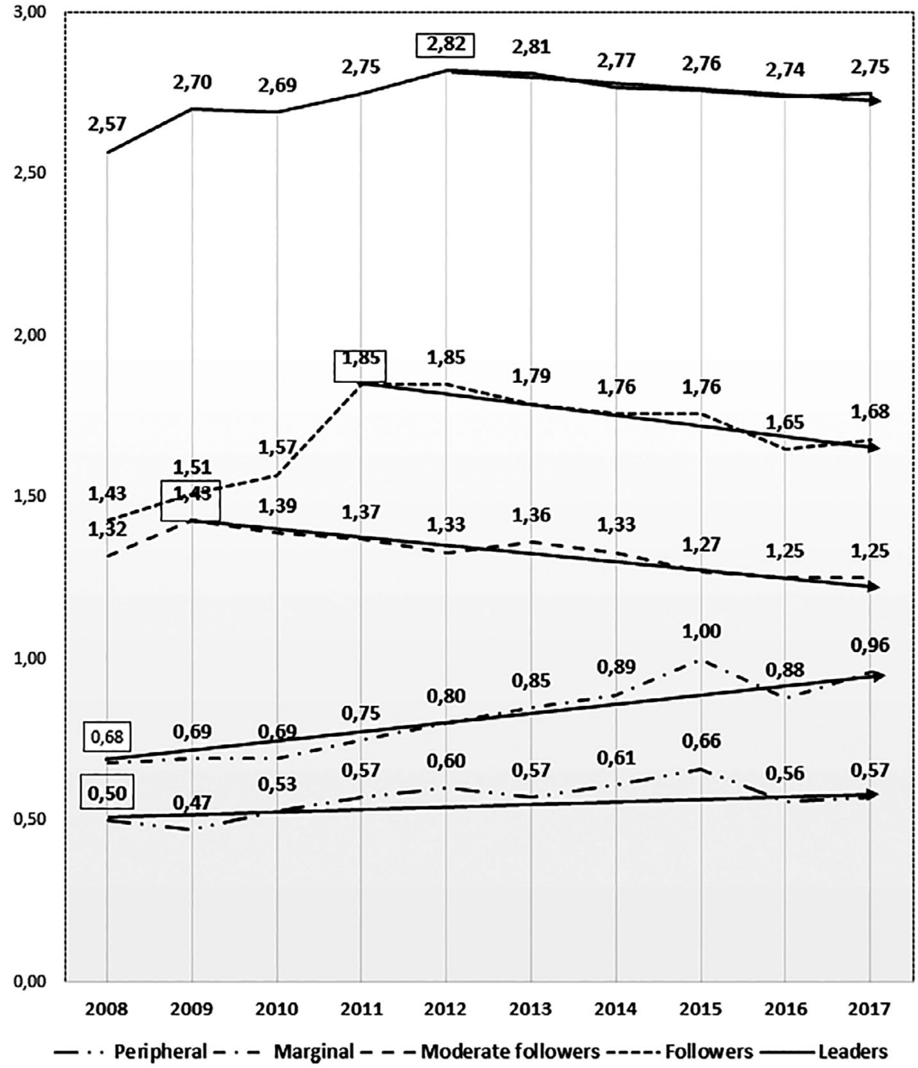


FIGURE 2 Trends in GERD in the EU, 2008–2017. *Source*: own calculation based on data

TABLE 4 Trends in GERD by euro per inhabitant in business and public sectors, 2008–2017

Business sector				Government sector		
Countries by category	**2008**	**2017**	**2008–2017 difference**	**2008**	**2017**	**2008–2017 difference**
Peripheral	21	42	100%	14	12	−14%
Marginal	30	69	130%	26	26	0%
Moderate followers	317	290	−8.5%	64	79	23%
Followers	206	304	47.5%	48	55	15%
Leaders	630	763	21%	73	89	22%

investments were almost tripled (Figure 3). In absolute amounts of GERD, expressed in euros per inhabitants, it was an increase of 130% from 30 euros in 2008 to 69 euros in 2017 (Table 4). Research marginal countries are followed by peripheral countries, which increased these investments from 0.18% to 0.3% of GDP (or from 21 euro per inhabitant in 2008 to 42 euro per inhabitant in 2017as presented in the Table 4), mainly due to Romania and Cyprus, which doubled, and Bulgaria, which almost quadrupled these investments (Figure 3).

Research leaders and followers also recorded an increase in BERD, which was significantly lower than research-weak countries. This could signify European core countries having reached their limits in business investments in R&D, calling for new designs for supporting measures and incentives. Moderate followers recorded a slight decline, probably due to economic crisis, which strongly hit three countries in this group (Portugal, Spain, and Italy).

In contrast to business expenditures, the expenditures in the public (government) sector did not change much in any group of

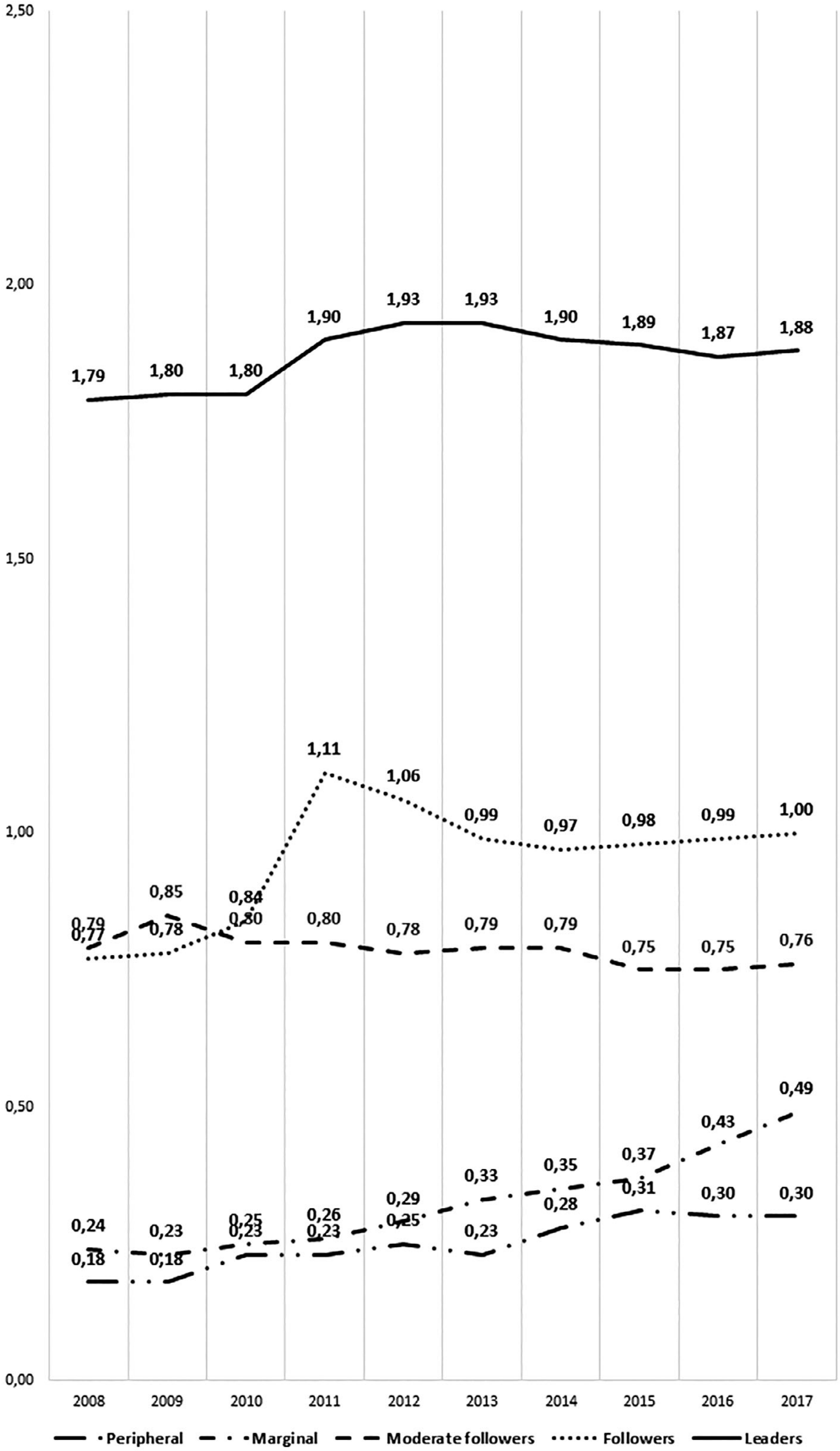


FIGURE 3 Trends in BERD in the EU, 2008–2017. *Source*: own calculation based on data

countries, indicating a steady state of investments in public research in Europe with no increase in the last decade (Figure 4). Research peripheral and marginal countries, as well as moderate followers and followers, recorded a negligible downward trend of between 0.01 and 0.05% of GDP, while research leaders showed an insignificant increase of 0.01%. The absolute amounts of GERD, expressed in euros per inhabitants (Table 4), show an increase in investments in government R&D in all groups of countries except research peripheral and marginal countries. These changes, however small they were, demonstrate the decade-long downward trend in public investments in R&D in research-weak countries.

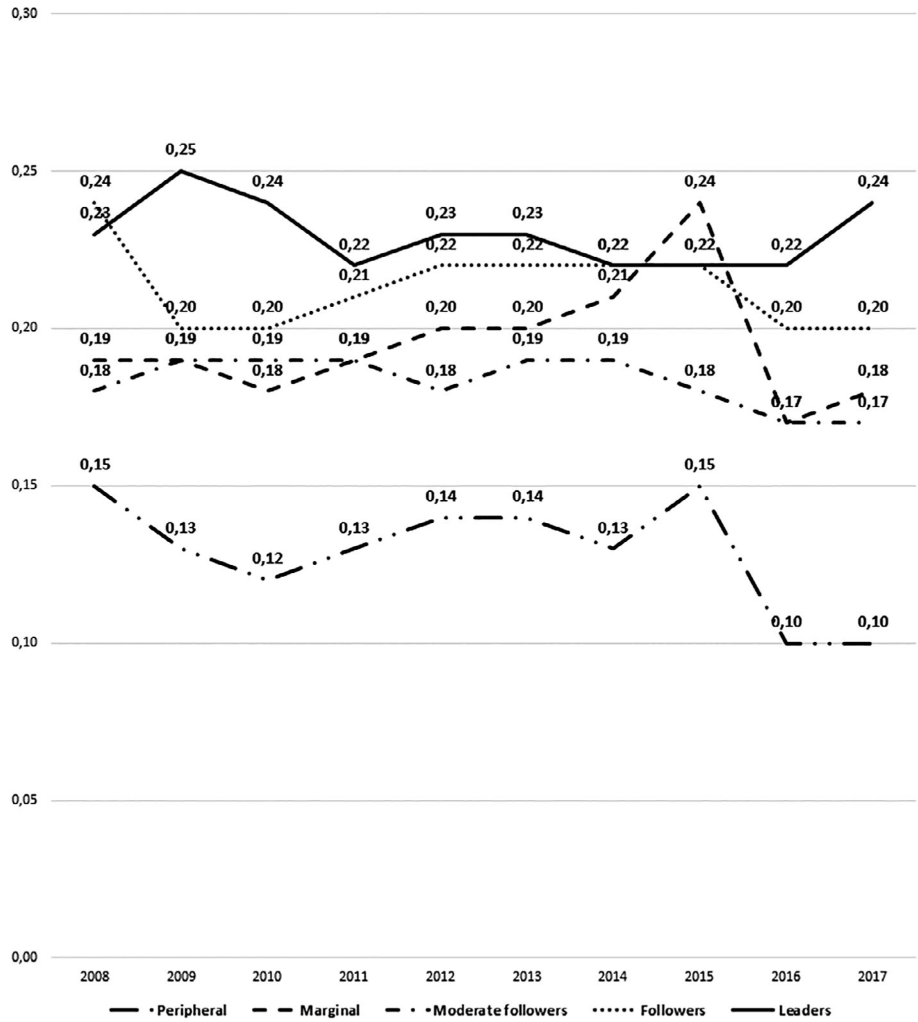


FIGURE 4 Trends in government expenditures of R&D in the EU, 2008–2017. *Source*: own calculation based on data

TABLE 5 GERD financed by the business sector and the public sector, as a percentage of GDP

	GERD funded by business sector			GERD funded by government		
Countries by category	**2008**	**2016**	**2008–2016 difference**	**2008**	**2016**	**2008–2016 difference**
Peripheral	31	41	32.2%	54	37	−31.5%
Marginal	33	44	33.0%	56	41	−26.8%
Moderate followers	47	50	6.4%	41	31	−24.4%
Followers	43	48	11.6%	42	33	−21.4%
Leaders	59	59	0%	30	27	−10%

Note: For BERD the first year for leaders was 2009 and the last year was 2015.

The structure of R&D investments has changed remarkably in favour of business expenditures (Table 5). The percentage of gross expenditures of R&D, funded by the government, declined in all groups of countries in the period between 2008 and 2016. The most considerable drop occurred in countries with the weakest research potential (peripheral and marginal, for 31.5 and 26.8%, respectively). On the other hand, the percentage of gross expenditure toward R&D, funded by the business sector, increased in all countries except research leaders and research-weak countries took the lead. In other words, the share of the business sector in GERD increased in peripheral countries by 32.6% and, in marginal countries, by 34.62%. This clearly shows that the focus of science policy in research-weak counties has been shifted from public science to research in the business sector, signaling that competitive knowledge catering to the needs of entrepreneurs has now come to the forefront of scientific policy. This structural change in itself would be more than welcome (bearing in mind the lack of innovation capacities for businesses in these countries) if, at the same time, there was no reduction in investment in the public sector of science. The supposed trade-off between investments in sectors of public and business research suggests that the strengthening of research in the entrepreneurial sector was done at the expense of public science.

Since scientific research is seen as one the critical factors of S3's success, ESI funds would be expected to contribute largely to the increase in investment in public science, to avoid striking austerity on R&D systems in research-weak countries. Obviously, this has not happened. The data clearly illustrates that ESI funds have not contributed toward investments in public science in research-weak countries and might only compensate for the probable decrease in national funds driven by austerity policies and financial crises. In both cases, the research-peripheral and -marginal countries, diverge rather than converge to research leaders and followers with regards to investments in public science. Unfortunately, there is no systematized and readily available microdata on a national level concerning a potential trade-off between national and European funds, which could prove this statement with certainty.

6 | DISCUSSION

S3 stems from radically new policy presumptions which are rather different form previous innovation policies. While innovation policy is focused on the capitalization of scientific research by knowledge flowing between different stakeholders of national innovation systems, usually co-ordinated by the central state, the S3 put local companies in the center as they serve as agents of science capitalization through their innovation and technology, and should spur regional development. The entrepreneurial learning process (EDP) of discovering innovation and research priorities of regional competitive advantage has come to the forefront of STI policies, which is a rather promising solution in terms of the progress and evolution of the national innovation polices when faced with their own inefficiency to generate economic growth. This new approach, in which scientific research is a beneficial but unnecessary component of innovation, fits perfectly with the rising concepts of entrepreneurial economy and entrepreneurial ecosystems. It supports the new innovation paradigm based on entrepreneurship, which considers traditional manufacturing or low-tech industries to be important to national economics (Hansen & Winther, 2011), providing a window of opportunity for research-weak and low-tech regions/countries to advance and complement those that are well-developed.

The practical realization of this new STI policy approach is enabled by the European Cohesion policy, which provide concepts (S3), methodologies (operational programs), and funds (ESI funds) to support new STI policies based on business innovation and competitiveness at a regional level. However, beyond the positive effect of cohesion policies on less developed European countries, S3 and ESI funds have also brought negative and unintended consequences from the development of their research capacities. It is often overlooked that operational programs funded by ESI funds, and supported conceptually by S3, have provided not only funds, but also deliberate research policies shaped by S3. If research policies are considered as strategic visions that include a certain system of norms, plans, and procedures (measures and instruments) for co-ordinating scientific research in line with developmental visions, it follows that ESIF operational programs, by providing the lion's share of the science funding, practically replaces the substantial components of the national research policy in cohesion countries, such as: (a) goals and purposes of science; (b) research priorities; (c) funding systems; (d) conducting research projects; and (e) evaluation procedures and rules. There is no doubt that ESI funds already have (and will in the future) bring much progress to the research system (e.g., bottom-up approach, recovery of infrastructure, and industrial research), but the overall and long-term impact on research systems, intellectual assets, and national research base is yet ambiguous.

The above analyses suggest the following findings:

- There are great disparities in research and innovation capacities in the EU; 10 EU member states in the last decade invested on average less than 1% of GDP in R&D, which is usually considered the minimum investment needed for R&D to have impact on economic development.
- The share of the public R&D budget in GDP has declined in all EU member states in the last decade and the most significant declines occurred in countries with the weakest research potential (research-marginal and -peripheral countries); this illustrates that ESI funds, despite expectations, have not contributed to the support of public science in those countries, but could possibly only compensate for shrinking national research budgets.
- In contrast to the public expenditures of R&D, business expenditures toward R&D recorded a significant increase in research-peripheral and -marginal countries, especially compared to research-core countries, which had possibly reached the limits of their investments.
- Given the technological and financial weaknesses of the business sector in research-weak countries, it can be reasonably assumed that increased investment is the result of the European cohesion policy, that is, ESI funds.
- Structural changes in the composition of GERD (decreasing public and increasing business shares in GERD) in research-weak countries illustrates that the focus of science policies in these countries has been shifted from public science to business innovation.

As the strategic goals of the ESI funds are to support business innovation to strengthen competiveness between local entrepreneurs and foster regional development, the public research capacities of cohesion countries suffering from scarce budget resources are not systematically addressed. This suggests that these capacities may be in danger of further weakening, which may result in divergence rather than convergence among EU member states.

The results of this research largely comply with the results of previous analyses, which point to changes in the strategic objectives of STI polices, from science to business capacities on a global level (OECD, 2016, p. 162), and the retreat of public research and its adverse consequences on innovation (Archibugi & Filippetti, 2018). Scholars also emphasize that this pattern is stronger in the European research periphery, and warns that disparities between the stronger core countries of Europe and those at the periphery are widening, potentially as a result of different rates in investment and, in particular, in innovation and R&D, both by the public and business sectors (Archibugi et al., 2018; Pellens, Peters, Hud, Rammer, & Licht, 2018; Veugelers, 2016). Critical driver was financial 2008 crisis and austerity policy which hit less developed countries much stronger than developed EU member states (Archibugi & Filippetti, 2011; Veugelers, 2016) and led to decrease of public R&D investments (Pellens et al., 2018) and to the collapse of national public support for R&D in Southern Europe (Izsak & Radosevic, 2017).Countries in the south of Europe are faced with the instability and uncertainty of their research systems like in Spain (Cruz-Castro & Sanz-Menéndez, 2015) or suffers from the lack of trust between the government and the research community, which generate important barriers to needed reforms like in Greece (Kastrinos, 2013).

7 | CONCLUSION

This research documented the emergence of the new innovation paradigm driven by entrepreneurship and its incorporation into the European cohesion policy through the S3 and ESI funds. Evidence has been provided to show that the focus of STI policies in research-weak (peripheral and marginal) European countries has shifted from public science toward business innovation, which is seen as necessary for regional competitiveness. The findings suggest that competitive knowledge concerning the needs of entrepreneurs has come to the forefront of science policy in research-weak countries, primarily under the influence of S3, which provides strategic and conceptual frameworks for STI policies. The S3 is supported by ESI funds, which are disproportionately greater than scarce and fluctuating national resources and have a tendency to determine not only research priorities, but also the ways in which science is organized, performed, and evaluated.

Even though ESI funds bring many benefits to the weaker research systems of peripheral EU countries, primarily through the renewal of research infrastructures, they also interfere with national science polices in adverse ways which may, in the long run, jeopardize public science and research capacities. Statistical data provides evidence that the division of the public R&D budget in GDP has considerably deteriorated in the last decade, specifically for countries with the weakest research potential while, at the same time, business expenditures on R&D have been intensified. Structural changes in the composition of GERD in favor of business R&D illustrates that ESI funds, despite expectations, have not contributed to the support of public science in those countries which could serve to deepen the innovation gap between the European center and periphery, ultimately putting the cohesion at risk.

However, alternative conclusion could be also drawn—that the retreat of public research is compensated by research performed in the business sector—which is desirable and anticipated goal of S3. However, such an interpretation should be taken with caution because strengthening of research in business sector does not complements but displace the public science in research marginal/peripheral countries which is still in those countries a major source of innovation and technological potentials, including the business sector.

Entrepreneurship policy has a tendency to substitute science policy and to replace internal logic and dynamics of scientific research with the needs of entrepreneurs who often lacks interest for science. Science policy retreats in the face of entrepreneurial policies promoted by operational programs of ESI funds, which have produced unintended consequences such as the decreasing of expenditures for public science which, in the long term, seems to weaken not only national research capacities, but also knowledge generation and human resources. This reduces the chance of research weak countries to absorb advanced and general purpose technologies which ultimately emerge from science

This also raises the question as to whether public research for the needs of medium- to low-technology local industries and businesses is sufficient for long-term socio-economic development and international technology transfer, or whether basic academic research unrelated to local development also plays an important role. This question is emphasized by the lack of domestic demand for technology and R&D in peripheral European countries (Vallance et al., 2018) and the absence of "co-specialization" between local industries and academy (Bonaccorsi, 2016). This has prompted some scholars to campaign for a decoupling industry from university where common interests do not exist (Bonaccorsi, 2016), hoping to revive support for public science (Archibugi et al., 2018).

The above arguments raise questions concerning the consequences of the Europeanization of science policies in research-peripheral countries brought by S3, and about the roles of public knowledge institutions with regards to regional development. This topic is rarely a matter of scientific discussion and critical consideration. S3 was launched a decade ago in 2009 and more than 120 smart specialization strategies were formulated in the first 8 years alone. However, there is still little evidence in terms of the technological specialization and structural changes that foster innovation and entrepreneurial capacities for local and regional economies (Muscio & Ciffolilli, 2018). Besides, the role of public sector research, with the emphasis on universities in S3, has yet to receive sustained critical attention in academic literature (Vallance et al., 2018).

This research has relevant policy implications pertaining to the reconsideration of the role of ESI funds in national science policies in research-weak countries and the re-balancing of investments both in basic research and business innovation and in science and entrepreneurial policy. Therefore, this research is relevant for both—academic discussion about the evolution of innovation theory and for policy debate about the role of scientific research within the new innovation paradigm as exercised in the research weak countries.

Developing the national entrepreneurial ecosystem, which is integral to economic progress (Acs et al., 2017; Audretsch et al., 2019; Autio et al., 2018) should not diminish the importance of public science and the national knowledge base as a result of the narrowly determined scope of S3. There is no room to discuss this topic here in depth, but the rich literature concerning the economic usefulness of basic research and the impact of public R&D on productivity and growth in the long run, which is well summarized in Salter and Martin (2001), provides convincing justifications for the public subsidy of academic research, including countries on the research periphery (Archibugi & Filippetti, 2018).

The results suggest that public science heavily depends on national (not European) budget resources. Consequently, its efficiency, excellency, and accountability cannot be solved by ESI funds and so national governments should take responsibility for national research development. It is still ambiguous as to whether ESI funds compensate for collapsed national resources for R&D caused by financial crisis and austerity policies (Izsak & Radosevic, 2017) or whether they crowd-out national research budgets as national governments expect ESI funds to substitute them.

Unfortunately, there is a lack of systematized and readily available microdata at a national level which could provide evidence regarding the possible trade-off between national and ESI funds for public research and enable adequate policy actions. It is also almost impossible to disentangle ESI funds intended for basic research and those intended for business innovation. This lack of microdata at a national level, and the reliance on only aggregate data concerning the composition of GERD, its trends, and its sector expenditures, is the main shortcoming of this research. This also suggests that the main area of focus for future researchers should be on ensuring deeper and more careful analyses of the role of ESI funds in strengthening public scientific research, in order to subsequently assure the sustainability of research systems in the European research periphery in the face of convergence.

ACKNOWLEDGMENT

This research has received funding from the Horizon 2020 Programme of the European Union within the OpenInnoTrain project under grant agreement no. 823971. The content of this publication does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the publication lies entirely with the author(s).

ORCID

Jadranka Švarc https://orcid.org/0000-0003-1702-3674
Marina Dabić https://orcid.org/0000-0001-8374-9719
Tugrul U. Daim https://orcid.org/0000-0003-1432-8958

REFERENCES

Acs, Z. J., Autio, J., & Szerb, L. (2014). National systems of entrepreneurship: Measurement issues and policy implications. *Research Policy*, *43*(3), 476–494. https://doi.org/10.1016/j.respol.2013.08.016

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.

Adam, F. (2014). *Measuring national innovation performance: The innovation union scoreboard revisited*. Heidelberg, New York: Springer.

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

Archibugi, D., & Coco, A. (2005). Measuring technological capabilities at the country level: A survey and a menu for choice. *Research Policy*, *34*(2), 175–194.

Archibugi, D., & Filippetti, A. (2011). Is the economic crisis impairing convergence in innovation performance across Europe? *Journal of Common Market Studies*, *49*(6), 1153–1182. https://doi.org/10.1111/j.1468-5965.2011.02191.x

Archibugi, D., & Filippetti, A. (2018). The retreat of public research and its adverse consequences on innovation. *Technological Forecasting and Social Change*, *127*, 97–111. https://doi.org/10.1016/j.techfore.2017.05.022

Archibugi, D., Filippetti, A., Frenz, M. (2018). *Investment in innovation for European recovery: A public policy priority* (IRPPS Working papers 110/2018).

Arrow, K. (1962). Economic welfare and the allocation of resources for inventions. In R. Nelson (Ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors* (pp. 609–626). New York: Princeton University Press.

Audretsch, B. D., Hayter, C. S., & Link, A. N. (Eds.). (2015). *Concise Guide to entrepreneurship, Technology and Innovation*. Cheltenham, UK and Northampton, MA: Edward Elgar.

Audretsch, D., & Thurik, A. R. (2000). Capitalism and democracy in the 21st century: From the managed to the entrepreneurial economy. *Journal of Evolutionary Economics*, *10*(1), 17–34. https://doi.org/10.1007/s001910050003

Audretsch, D. B. (2007). Entrepreneurship capital and economic growth. *Oxford Review of Economic Policy*, *23*(1), 63–78. https://doi.org/10.1093/oxrep/grm001

Audretsch, D. B. (2009). The entrepreneurial society. *Journal of Technology Transfer*, *34*(3), 245–254.

Audretsch, D. B., Cunningham, J. A., Kuratko, D. F., Lehmann, E. E., & Menter, M. (2019). Entrepreneurial ecosystems: Economic, technological, and societal impacts. *The Journal of Technology Transfer*, *44*(2), 313–325. https://doi.org/10.1007/s10961-018-9690-4

Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy*, *43*(7), 1097–1108.

Autio, E., Nambisan, S., Thomas, L. D., & Wright, M. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, *12*(1), 72–95.

Avdikos, V., & Chardas, A. (2016). European Union Cohesion Policy Post 2014: More (Place-Based and Conditional) Growth – Less Redistribution and Cohesion. *Territory, Politics, Governance*, *4*(1), 97–117. https://doi.org/10.1080/21622671.2014.992460

Balconi, M., Brusoni, S., & Orsenigo, L. (2010). In defence of the linear model: An essay. *Research Policy*, *39*(1), 1–13. https://doi.org/10.1016/j.respol.2009.09.013

Barca, F., McCann, P., & Rodrıguez-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

Bonaccorsi, A. (2016). Addressing the disenchantment: Universities and regional development in peripheral regions. *Journal of Economic Policy Reform*, *20*(4), 293–320. https://doi.org/10.1080/17487870.2016.1212711

Capello, R., & Lenzi, C. (2016). Relevance and utility of European Union research, technological development and innovation policies for a smart growth. *Environment and Planning C: Government and Policy*, *34*(1), 52–72.

Carlsson, B., Braunerhjelm, P., McKelvey, M., Olofsson, C., Persson, L., & Ylinenpaa, H. (2013). The evolving domain of entrepreneurship research. *Small Business Economics*, *41*(4), 913–930. https://doi.org/10.1007/s11187-013-9503

Cavallo, A., Ghezzi, A., & Balocco, R. (2019). Entrepreneurial ecosystem research: Present debates and future directions. *International Entrepreneurship and Management Journal*, *15*, 1291–1321. https://doi.org/10.1007/s11365-018-0526-3

Chrysomallidis, C., & Tsakanikas, A. (2017). The implementation of smart specialization strategy in Greece: Re-balancing governance between the central state and the regions. *Regional Science Policy and Practice*, *9* (3), 183–200. https://doi.org/10.1111/rsp3.12095

Cowen, T. (2011). *The Great Stagnation: How America Ate All the Low-hanging Fruit of Modern History, Got Sick, and Will (Eventually) Feel Better*. New York: Dutton.

Cruz-Castro, L., & Sanz-Menéndez, L. (2015). The effects of the economic crisis on public research: Spanish budgetary policies and research organizations. *Technological Forecast and Social Change*, *113*, Part B, 157–167. https://doi.org/10.1016/j.techfore.2015.08.001

Dall'Erba, S., & Fang, F. (2017). Meta-analysis of the impact of European Union Structural Funds on regional growth. *Regional Studies*, *51*(6), 822–832. https://doi.org/10.1080/00343404.2015.1100285

Dasgupta, P., & David, P. A. (1994). Toward a New Economics of Science. *Research Policy*, *23*(5), 487–521. https://doi.org/10.1016/0048-7333(94)01002-1

Edison, H., Ali, N. B., & Torkar, R. (2013). Towards innovation measurement in the software industry. *The Journal of Systems and Software*, *86* (5), 1390–1407. https://doi.org/10.1016/j.jss.2013.01.013

Etzkowitz, H. (2008). The triple helix: Industry, university, and government in innovation. *Social Science Information*, *42*(3), 293–337.

European Commission (2000). *Towards a European research area*, Brussels, January 18, 2000. COM (2000), (Lisbon agenda).

European Commission (2010). *Europe 2020: A strategy for smart, sustainable and inclusive growth*, Brussels, 3.3.2010 COM(2010), 2020.

European Commission. (2011). *Employment and social developments in Europe 2011, European Commission Directorate-General for Employment*. Brussels: Social Affairs and Inclusion.

European Commission (2017). *My region, my Europe, our future*. Seventh Report on Economic, Social and Territorial Cohesion, Regional and Urban Policy, Brussels.

Fichman, R. G., Dos Santos, B. L., & Zheng, Z. (2014). Digital innovation as a fundamental and powerful concept in the information systems curriculum. *MIS Quarterly*, *38*(2), 329–353. https://doi.org/10.25300/MISQ/2014/38.2.01

Foray, D., David, P. A., Hall, B. (2009). *Smart specialisation – the concept, knowledge economists*, Policy Brief no. 9, European Commission: Brussels.

Foray, D., David, P. A., & Hall, B. H. (2011). Smart specialisation from academic idea to political instrument, the surprising career of a concept and the difficulties involved in its implementation. MTEI Working Paper.

Foray, D. Goddard, J. Goenaga Beldarrain, X., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C., & Ortega-Argilés, R. (2012). *Guide to research and innovation strategies for smart specialisation (RIS 3), smart specialisation platform*. Retrieved from http://s3platform.jrc.ec.europa.eu.

Foray, D., Goenaga, X. (2013). *The goals of smart specialization*; S3 Policy Brief Series 1/2013.

Foray, D., Morgan, K., Radosevic, S. (2018). *The role of smart specialisation in the EU research and innovation policy landscape*, European Commission, Regional and Urban Policy, 2.3.2018, http://ec.europa.eu/regional_policy/sources/docgener/brochure/smart/role_smartspecialisation_ri.pdf.

Freeman, C. (1988). Japan: A new national system of innovation? In G. Dosi, C. Freeman, R. Nelson, & L. Soete (Eds.), *Technical change and economic theory* (pp. 330–349). London: Pinter Publisher Limited.

Gibbons, M., Limoges, C., Nowory, H., Schwartzmann, S., & Scott, P. (Eds.). (1994). *New production of knowledge: dynamics of science and research in contemporary societies*. London, Thousand Oaks, New Delhi: SAGE Publications.

Godin, B. (2008). *Innovation: the history of a category*, Working Paper No. 1, Retrieved from http://www.csiic.ca/PDF/IntellectualNo1.pdf.

Godin, B. (2011). *The rise of innovation surveys: Measuring a fuzzy concept*. Retrieved from <http://www.csiic.ca/PDF/Godin_16.pdf>.

Gordon, R. J. (2016). *The rise and fall of American growth*. New Jersey: Princeton University Press.

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

Hughes, S. M. (2011). *Genentech: the beginnings of biotech*. Chicago and London: The University of Chicago Press.

Izsak, K., & Radosevic, 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

Kahn, K. B. (2018). Understanding innovation. *Business Horizons*, *61*(3), 453–460. https://doi.org/10.1016/j.bushor.2018.01.011

Karo, E., & Kattel, R. (2015). Economic development and evolving state capacities in Central and Eastern Europe: Can "smart specialization" make a difference? *Journal of Economic Policy Reform*, *18*(2), 172–187, DOI. https://doi.org/10.1080/17487870.2015.1009068

Kastrinos, N. (2013). The financial crisis and Greek R&D policy from a Schumpeterian perspective. *Science and Public Policy*, *40*(6), 779–791. https://doi.org/10.1093/scipol/sct025

Kealey, T. (1996). *The Economic Laws of Scientific Research*. London: MacMillan.

Kim, S. Y. (2014). Government R&D funding in economic downturns: Testing the varieties of capitalism conjecture. *Science and Public Policy*, *41* (1), 107–118. https://doi.org/10.1093/scipol/sct040

Kline, S. J., & Rosenberg, N. (1986). An overview of innovation. In R. Landau & N. Rosenberg (Eds.), *The positive sum strategy, Harnessing technology for economic growth* (pp. 275–306). Washington, DC: National Academy Press.

Landström, H., & Harirchi, G. (2018). The social structure of entrepreneurship as a scientific field. *Research Policy*, *47*(3), 650–662. https://doi.org/10.1016/j.respol.2018.01.013

Lundvall, B. A. (Ed.). (2010). *National systems of innovation: Toward a theory of innovation and interactive learning*. London, New York, Delhi: Anthem Press.

Makkonen, T. (2013). Government science and technology budgets in times of crisis. *Research Policy*, *42*(3), 817–822. https://doi.org/10.1016/j.respol.2012.10.002

Malecki, E. J. (2018). Entrepreneurship and entrepreneurial ecosystems. *Geography Compass*, *12*(3), e12359. https://doi.org/10.1111/gec3.12359

Mansfield, E. (1998). Academic research and industrial innovation: An update of empirical findings. *Research Policy*, *26*(7-8), 773–776. https://doi.org/10.1016/S0048-7333(97)00043-7

Maroufkhani, P., Wagner, R., Khairuzzaman, W., & Ismail, W. (2018). Entrepreneurial ecosystems: A systematic review. *Journal of Enterprising Communities: People and Places in the Global Economy*, *12*(4), 545–564. https://doi.org/10.1108/JEC-03-2017-0025

Martin, B. R. (2012). Are universities and university research under threat? Towards an evolutionary model of university specialization. *Cambridge Journal of Economics*, *36*(3), 543–565. https://doi.org/10.1093/cje/bes006

Martinovic Klaric, I. (2019). *Croatian Science Foundation*, Presentation of the Croatian Science Foundation at the Ivo Pilar Institute, Zagreb, 25 April, 2019.

McCann, P., & Ortega-Argilés, R. (2013). Transforming European regional policy: A results-driven agenda and smart specialization. *Oxford Review of Economic Policy*, *29*(2), 405–431. https://doi.org/10.1093/oxrep/grt021

McCann, P., & Ortega-Argilés, R. (2015). Smart Specialization, Regional Growth and Applications to European Union Cohesion Policy. *Regional*

Studies, *49*(8), 1291–1302. https://doi.org/10.1080/00343404.2013.799769

Mokyr, J. (2003). *The knowledge society: Theoretical and historical underpinnings*, presented to the Ad Hoc Expert Group on Knowledge Systems, United Nations, New York.

Mujahid, S., Mubarik, S., & Naghavi, S. (2019). Prioritizing dimensions of entrepreneurial ecosystem: A proposed framework. *Journal of Global Entrepreneurship Research*, *9*(51). https://doi.org/10.1186/s40497-019-0176-0

Muscio, A., & Ciffolilli, A. (2018). Technological diversity in Europe: Empirical evidence from agri-food research projects. *Regional Studies*, *52*(3), 374–387. https://doi.org/10.1080/00343404.2017.1301662

Muscio, A., Reid, A., & Rivera Leon, L. (2015). An empirical test of the regional innovation paradox: Can smart specialisation overcome the paradox in Central and Eastern Europe? *Journal of Economic Policy Reform*, *18*(2), 153–171. https://doi.org/10.1080/17487870.2015.1013545

Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy*, *48*(8), 1037733. https://doi.org/10.1016/j.respol.2019.03.018

Nelson, R. R. (1959). The simple economics of basic scientific research. *Journal of Political Economy*, *67*(3), 297–306. https://doi.org/10.1086/258177

Nelson, R. R. (Ed.). (1993). *National innovation systems: A comparative analysis*. New York and Oxford: Oxford University Press.

Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. Cambridge and London: The Belknap Press of Harvard University Press.

O'Connor, A., Stam, E., Sussan, F., & Audretsch, D. B. (2018). Entrepreneurial ecosystems: The foundations of place-based renewal. In A. O'Connor, E. Stam, F. Sussan, & D. B. Audretsch (Eds.), *Entrepreneurial ecosystems place-based transformations and transitions* (pp. 1–23). Cham, Switzerland: Springer.

OECD. (1971). *Science, growth and society – A new perspective (the Brooks Report)*. Paris: OECD Publishing.

OECD. (2002). *Frascati manual. Proposed standard practice for surveys on research and experiment development*. Paris: OECD Publishing.

OECD. (2005). *Oslo manual: Guidelines for collecting and interpreting innovation data* (3rd ed.). Paris: OECD Publishing.

OECD. (2012). *Science, technology and innovation outlook in 2012*. Paris: OECD Publishing.

OECD. (2016). *Science, technology and innovation outlook in 2016*. Paris: OECD Publishing.

Pavitt, K. (1998). The social shaping of the national science base. *Research Policy*, *27*(8), 793–805. https://doi.org/10.1016/S0048-7333(98)00091-2

Pellens, M., Peters, B., Hud, M., Rammer, C. & Licht, G. (2018). *Public investment in R&D in reaction to economic crises - a longitudinal study for OECD countries*, ZEW Papers 18-005. ZEW - Zentrum für Europäische Wirtschaftsforschung/Center for European Economic Research, http://ftp.zew.de/pub/zew-docs/dp/dp18005.pdf.

Pustovrh, A., Rangus, K., & Drnovšek, M. (2020). The role of open innovation in developing an entrepreneurial support ecosystem. *Technological Forecasting and Social Change*, *152*, 119892. https://doi.org/10.1016/j.techfore.2019.119892

Radosevic, S. (2018). Assessing EU smart specialization policy in a comparative perspective. In S. Radosevic, A. Curaj, R. Gheorghiu, L. Andreescu, & I. Wade (Eds.),*Advances in the Theory and Practice of Smart Specialization*, (pp. 2–31). London, San Diego, Cambridge, Oxford: Elsevier Academic Press.

Radosevic, S., & Ciampi Stancova, K. (2018). Internationalising smart specialisation: Assessment and issues in the case of EU New member states. *Journal of the Knowledge Economy*, *9*(1), 263–293. https://doi.org/10.1007/s13132-015-0339-3

Radosevic, S., Curaj, A., Gheorghiu, R., Andreescu, L., & Wade, I. (Eds.). (2018). *Advances in the theory and practice of smart specialization* (pp. XV–XVII). London, San Diego, Cambridge, Oxford: Elsevier Academic Press.

Rodrik, D. (2016). Premature deindustrialization. *Journal of Economic Growth*, *21*(1), 1–33. https://doi.org/10.1007/s10887-015-9122-3

Roininen, S., & Ylinenpää, H. (2009). Schumpeterian versus Kirznerian entrepreneurship: A comparison of academic and non-academic new venturing. *Journal of Small Business and Enterprise Development*, *16*(3), 504–520. https://doi.org/10.1108/14626000910977198

Romer, M. P. (1990). Endogenous technical change. *Journal of Political Economy*, *98*(5), S71–S102, DOI. http://www.jstor.org/stable/293763

Rosenberg, N., & Nelson, R. R. (1994). American university and technical advance in industry. *Research Policy*, *2383*, 323–348.

Salter, A. J., & Martin, B. R. (2001). The economic benefits of publicly funded basic research: A critical review. *Research Policy*, *30*(3), 509–532. https://doi.org/10.1016/S0048-7333(00)00091-3

Schot, J., Steinmueller, W.E. (2016). *Framing Innovation Policy for Transformative Change: Innovation Policy 3.0*, Working paper, Science Policy Research Unit (SPRU), University of Sussex.

Song, A. K. (2019). The digital entrepreneurial ecosystem: A critique and reconfiguration. *Small Business Economics*, *53*(3), 569–590. https://doi.org/10.1007/s11187-019-00232-y

Stam, E. (2015). Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique. *European Planning Studies*, *23*(9), 1759–1769. https://doi.org/10.1080/09654313.2015.1061484

Stam, E., & Spigel, B. (2018). Entrepreneurial ecosystems. In R. Blackburn, D. De Clercq, & J. Heinonen (Eds.), *The SAGE handbook of small business and entrepreneurship* (pp. 407–422). London: SAGE.

Stam, E., & van de Ven, A. (2019). Entrepreneurial ecosystem elements. *Small Business Economics*, *1*(24).

Suurna, M., & Kattel, R. (2010). Europeanization of innovation policy in Central and Eastern Europe. *Science and Public Policy*, *37*(9), 646–664. https://doi.org/10.3152/030234210X12778118264459

Svarc, J., & Dabic, M. (2017). Evolution of the knowledge economy: A historical perspective with an application to the case of Europe. *Journal of the Knowledge Economy*, *8*(1), 159–176. https://doi.org/10.1007/s13132-015-0267-2

Švarc, J., Lažnjak, J., & Dabić, M. (2019). Regional innovation culture in innovation laggard: A case of Croatia. *Technology in Society*, *58*, 101123. https://doi.org/10.1016/j.techsoc.2019.03.006

Thurik, A. R., Stam, E., & Audretsch, D. B. (2013). The rise of the entrepreneurial economy and the future of dynamic capitalism. *Technovation*, *33*(8–9), 302–310. https://doi.org/10.1016/j.technovation.2013.07.003

Tidd, J. (2006). *A review of innovation models*, Discussion paper, Imperial College London. Retrieved from http://www.emotools.com/static/upload/files/innovation_models.pdf.

Todorova, A., Slavcheva, M. (2016). *RIO Country Report 2015: Bulgaria*, EUR 27878 EN. DOI:https://doi.org/10.2791/116438.

Vallance, P., Blažek, J., Edwards, J., & Kveton, V. (2018). Smart specialisation in regions with less-developed research and innovation systems: A changing role for universities? *Environment and Planning C: Politics and Space*, *36*(2), 219–238. https://doi.org/10.1177/2399654417705137

Veugelers, R. (2014). *Undercutting the future? European research spending in times of fiscal consolidation*, Policy Contribution 2014/06, Bruegel, Brussels. Retrieved from https://www.econstor.eu/bitstream/10419/106324/1/787971243.pdf.

Veugelers, R. (2016). *The European, Union's growing innovation divide, Bruegel policy contribution*, 2016/08, Bruegel, Brussels. Retrieved from http://bruegel.org/wp-content/uploads/2016/04/pc_2016_08.pdf.

Ziman, J. (1996). "Postacademic science": Constructing knowledge with networks and norms. *Science Studies*, *9*(1), 67–80.

AUTHOR BIOGRAPHIES

Jadranka Švarc (jadranka.svarc@pilar.hr) Ph.D., senior researcher at the Ivo Pilar Institute of Social Sciences, Zagreb. Dr. Švarc is an expert in scientific, technological, and innovation system in transition countries. She has worked as an innovation expert in various national and EU projects (SIS, WBC-INCO.NET, METRIS, MORRi, and MASIS) and was a national correspondent for RIO/ERAWATCH project from the beginning. She was a member of the Scientific Committee for Social Sciences and Humanities of the Croatian Science Foundation and editor in chief for the CC indexed journal Drustvena istrazivanja. She published three books, over 50 scientific articles and 40 expert studies.

Marina Dabić (mdabic@net.efzg.hr, marina.dabic@ntu.ac.uk) received the M.Sc. and Ph.D. degrees from University of Zagreb, Faculty of Economics and Business, Croatia in 1989 and 2000, respectively. She is full Professor of Entrepreneurship and International Business at University of Zagreb, Faculty of Economics & Business, Croatia and Nottingham Business School, NTU, UK. Her articles appear in wide variety of international journals, including, *the Journal of International Business Studies, Journal of World Business, Journal of Business Research, Technological Forecasting and Social Change, Organizational Dynamics, International Journal of Human Resource Management IEEE-TEM, Journal of Small Economics, Organizational Dynamics* among many others. Prof Dabić is associate editor of the *Technological Forecasting and Social Change, Technology in Society and department editor for IEEE—Transaction of Engineering Management*. In her career, Dr. Dabić has achieved success, acclaim in a range of different projects granted by European Commission like: HORIZON 2020 RISE, ERASMUS +, LLL Leonardo da Vinci, and is a primary supervisor for TEMPUS FoSentHE project granted by the European Commission. She is continuously reviewer for EC Horizon 2020 projects.

Tugrul U. Daim (ji2td@pdx.edu) is a Professor and the Director of the Technology Management Doctoral Program in the Maseeh College of Engineering and Computer Science at Portland State University. He is also the Director of the Research Group on Infrastructure and Technology Management. He is a Faculty Fellow at the Institute for Sustainable Solutions. US Department of Energy, National Science Foundation, National Cooperative Highway Research Program, and many other regional, national and international organizations have funded his research. He has published over 200 refereed articles in journals and conference proceedings. He edited more than 20 special issues in journals. He edited more than 20 books and conference proceedings. He was the adviser for 11 Ph.D. graduates who are now in leading positions in government, industry and academia. He is the Editor-in-Chief of IEEE Transactions on Engineering Management.

How to cite this article: Švarc J, Dabić M, Daim TU. A new innovation paradigm: European cohesion policy and the retreat of public science in countries in Europe's scientific periphery. *Thunderbird Int. Bus. Rev*. 2020;62:531–547. https://doi.org/10.1002/tie.22166