

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

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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*

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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	Pre-catching-up stage: natural, resource-based, commodity exports. Limited technological capabilities.	Catching-up stage: basic infrastructure, growing capacity to imitate. Engaged in low-value-adding-manufacturing, often as OEM supplier.	Pre-frontier stage: 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.	Frontier-sharing stage: 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 20th 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:

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- 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

	Technology consumers	Potential innovators	Emerging innovators	Mature innovators
<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.

	Technology consumers	Potential innovators	Emerging innovators	Mature innovators
<i>Focus of the policy mix</i>	<ul style="list-style-type: none"> • Demand-side incentives (innovative public procurement, pre-commercial procurement, other market incentives, e.g., facilitation of ICT in all sectors). • Capacity development (attracting highly qualified specialists, learning, technology upgrading – grants or tax incentives for production of new technology) 	<ul style="list-style-type: none"> • Incentives for transformation (support for networking - technology platforms, clusters, foresight); • Support for experimentation • 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; • R&D subcontracts fostering linkages with research institutions, innovation vouchers 	<ul style="list-style-type: none"> • Start-up acceleration (mentors, seed and risk capital, business plan competitions, prizes for young entrepreneurs, business incubation, etc.). • Targeted FDI attraction. 	<ul style="list-style-type: none"> • Grants for R&D projects; • Grants for international R&D projects – FP7, Horizon 2020 and other international initiatives; • R&D infrastructure support (for companies, not universities). • Promotion of technology diffusion and transfer from high-tech to low-tech industries.
<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).

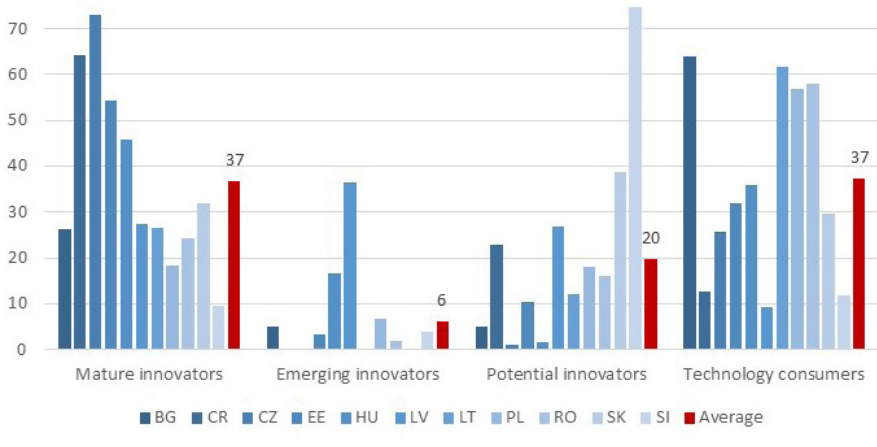


Figure 1 Share of budget (%) allocated to policy instruments per innovator category, per country

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, Petraité, & 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.

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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

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