

Vallance P, Blazek J, Edwards J, Kveton V. [Smart specialisation in regions with less-developed research and innovation systems: a changing role for universities?](#). *Environment and Planning C: Politics and Space* 2017

Copyright:

This is the authors' accepted manuscript of an article that has been published in its final definitive form by Sage Publications Ltd, 2017

DOI link to article:

<https://doi.org/10.1177/2399654417705137>

Date deposited:

02/05/2017



This work is licensed under a [Creative Commons Attribution-NonCommercial 3.0 Unported License](#)

Smart specialisation in regions with less-developed research and innovation systems: a changing role for universities?

Published in *Environment and Planning C: Politics and Space* (2017)

Paul Vallance, Centre for Urban and Regional Development Studies (CURDS), Newcastle University

Jiří Blažek, Charles University, Faculty of Science

John Edwards, Joint Research Centre, European Commission

Viktor Květoň, Charles University, Faculty of Science

Funding Acknowledgement: This paper is part of the Research Project ‘SmartSpec – Smart Specialisation for Regional Innovation’. This project received funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement number 320131.

Smart specialisation in regions with less-developed research and innovation systems: a changing role for universities?

Abstract

Universities and other knowledge institutions have quickly come to be seen as central to smart specialisation. However, their exact role in Research and Innovation Strategies for Smart Specialisation (RIS3) has yet to receive much critical attention in the academic literature. This is particularly notable as defining features of smart specialisation - such as the entrepreneurial dynamic of the strategy-formation process, and differentiated nature of the goals for strategies in regions with varying research and innovation capabilities – represent challenges to the notion that public research organisations should be drivers of smart specialisation in all regions. This paper articulates these conceptual tensions and then explores how they are unfolding in practice with particular reference to regions with less-developed research and innovation systems. The empirical material is drawn from a European-wide survey of institutional factors affecting the implementation of RIS3 and two regional case studies from Central and Eastern Europe. Overall the paper reveals a multifaceted picture of still emerging (and potentially conflicting) dynamics around the introduction of smart specialisation that have the potential to reconfigure the role of universities in regional innovation systems in Europe.

Keywords: knowledge institutions; RIS3; regional innovation capacity; academic-business linkages; Central and Eastern Europe.

Introduction

The requirement for localities to develop Research and Innovation Strategies for Smart Specialisation (RIS3) as an *ex-ante conditionality* of EU Structural Funds has pushed this new concept to the forefront of contemporary debates about regional innovation policy. Smart specialisation calls for regions to engage in ‘entrepreneurial discovery processes’ through which they can identify development opportunities in distinctive innovation domains (Aranguren *et al.*, 2015). The intention is that the adoption of this approach on a European scale will increase the overall efficiency of innovation policy by reducing duplication and fragmentation of investment in similar areas across different regions (Foray and Van Ark, 2007). Public research organisations, tertiary education institutions, and particularly universities have, unsurprisingly as core innovation actors, featured prominently in the documentation commissioned by the EU to support the implementation of RIS3 (e.g. Foray *et al.*, 2012; European Commission, 2014; Kempton *et al.*, 2014). However, beyond the uniformly positive message contained in this practical guidance, the exact role of these knowledge institutions in smart specialisation has yet to receive sustained critical attention in the academic literature. In particular, core features of the new approach - such as the entrepreneurial dynamic of the strategy-formation process, and differentiated nature of the goals for strategies in regions with varying research and innovation capabilities – represent challenges to the received notion that universities and related institutions should be central to RIS3 in all regions.

This paper will address this gap by articulating the issues around these tensions and investigating how they are playing out in current practice using a combination of extensive and intensive research findings. It reveals a multifaceted picture of still emerging dynamics around the introduction of smart specialisation that have the potential to reconfigure the role of universities in European regional innovation systems. The emphasis will be on regions with

less-developed research and innovation systemsⁱ, which are explored primarily in reference to Central and Eastern Europe (CEE). In these regions, it is argued, RIS3 priorities should not simply be based on existing academic research capabilities. As an alternative, however, universities can still help build the broader institutional and innovation capacity that is required for smart specialisation. Amongst these ‘developmental’ roles, their contribution to enhancing human capital and inter-organisational relationships within less-innovative regions are particularly emphasised.

This paper has four further sections. A conceptual section critically discusses the implications of the theory and practice behind smart specialisation for the role of knowledge institutions in regional innovation policy. The first empirical section draws on results from a European-wide survey of public authorities to give an overall picture of the current role of universities in the development of RIS3 in more- and less-developed regions. The second empirical section builds on these findings by exploring university links to innovation processes and policy in the more specific context of two CEE regions with relatively strong university sectors, but otherwise limited innovation capacityⁱⁱ. A concluding section summarises the various dynamics and issues raised in the paper.

Positioning knowledge institutions in smart specialisation

European Cohesion Policy to support regional economic development has for over twenty years involved a strong focus on the development of strategies to promote innovation (Landabaso, 1997; Morgan and Nauwelaers, 1999). However, the low existing innovation capabilities of the less-developed regions most in need of structural economic transformation have proved to be a major barrier to the effectiveness of this policy (Oughton *et al.*, 2002; Muscio *et al.*, 2015). The unevenness of the regional landscape in-part reflects wide variations

in modes and levels of knowledge production within innovation systems across Europe (Capello, 2013), which persist despite (and in tension with) efforts to create a coordinated European Research Area (de Bruijn and Lagendijk, 2005). This diversity has been magnified over the past ten years with the enlargement of the EU to encompass CEE countries with a legacy of communist state systems of science and technology (Radosevic, 1999; Tchalakov *et al.*, 2010; Kwiek, 2012).

This focus on what Autio (1998) calls the knowledge generation and diffusion subsystem of public research, educational, and technology intermediary institutions should, however, be balanced by an equal focus on the corresponding knowledge application and exploitation subsystem of private firms and their networks. The concept of national or regional innovation capacity is now widely recognised to have multiple components, including those that affect the demand for and absorption of knowledge, and the quality of governance (Radosevic, 2004; Muller *et al.*, 2008; Navarro *et al.*, 2009; Rodríguez-Pose and Di Cataldo, 2014). In less-developed regions the specific structure of the economy is a key factor determining this capacity (Novotný *et al.*, 2016). Liagouras (2010) argues that the main reason for the past failures of technology and innovation policies in peripheral European countries is a “lack of domestic demand for technology” (p.332), related to the dominant organisational forms in these economies – such as an overreliance on foreign direct investment in CEE countries. The industrial profile of a region will also strongly influence the main knowledge bases and mode of innovation in its economy; with firms in many regions, and particularly those dominated by traditional manufacturing or engineering-based sectors, likely to be more dependent on learning-by-doing through practical problem solving and responding to customer needs than on participation in or access to scientific-based R&D processes (Isaksen and Karlsen, 2010; Asheim, 2012). These fundamental points have not, however, been well reflected in the thrust

of European innovation strategy for less-developed regions. Despite progressing from earlier supply-side objectives of investment in upgrading public research infrastructure and capabilities (Deniozos, 1997), this became too focused on the undifferentiated application of ‘one size fits all’ policy models (Tödting and Tripl, 2005) aimed at replicating best practice examples of leading international high-technology clusters (Hospers, 2006; Sokol, 2013). Increasing acceptance of the limits of this approach means that European research and innovation policy needs to accommodate qualitatively different innovation patterns reflecting the varying needs and strengths of different regions (Camagni and Capello, 2013; Camagni and Lenzi, 2016).

This line of criticism can be seen as a point of departure for the smart specialisation concept first proposed by the EU *Knowledge for Growth* Expert Group. The similarity of innovation policy priorities across Europe, centred around broad domains in common science and technology fields (e.g. ICTs, biotechnology, nanotechnology), was identified as contributing to the fundamental problem identified by this group; namely a perceived duplication of R&D capabilities between countries and regions, and therefore failure to develop globally competitive ‘centres of excellence’ able to generate agglomeration effects (Foray and van Ark, 2007). The core solution they proposed was for regions to re-orientate their strategies around an entrepreneurial learning process to discover opportunities in specific research and innovation domains from which they would be able to develop areas of distinctive competitive advantage (Foray *et al.*, 2009). A subsequent iteration of this thinking describes smart specialisation as a “process of diversification through the local concentration of resources and competences in a certain number of new domains that represent possible paths for the transformation of productive structures” (Foray, 2015, p.1)ⁱⁱⁱ. This entrepreneurial discovery process is seen to require a form of collaborative governance that engages regional actors from

different sectors (government, private, academia) who can combine their diverse knowledge of local science/technology capabilities and market opportunities (Aranguren *et al.*, 2015). According to Foray (2015) this policy process can correct ‘market failures’ that prevent the generation of knowledge spillovers and agglomeration economies around specific activities, in doing so helping to unlock growth and structural change in the regional economy.

This linking of smart specialisation priorities to existing productive structures, as well as new knowledge or technology domains, means that broad goals pursued in the strategies of different regions should be commensurate with the varying levels of innovation capabilities discussed above. In the work of the *Knowledge for Growth* Expert Group this aspect of the theory was approached through a framework describing a division of labour between ‘leader’ and ‘follower’ regions: where leader regions were advised to invest in the invention and combination of General Purpose Technologies, and follower regions in the more modest development of applications of these technologies in specific domains (Foray *et al.*, 2009, p.3). Camagni and Capello (2013), while also appealing for regionally-differentiated ‘smart innovation policies’, criticise the crude dualistic nature of this core and periphery scheme. As an alternative to a simplistic split of Europe into a research and co-application area, they propose a taxonomy of regions based on empirical analysis of different innovation patterns across the continent. This distinguishes between R&D-intensive ‘science’ and ‘applied science’ areas that support endogenous innovation, ‘technological application’ and ‘creative diversification’ areas that make novel use of knowledge generated elsewhere, and an ‘imitative innovation’ area that is restricted to adapting existing technologies or applications. Notably, only in the science and applied science areas – where maximising returns to R&D is promoted as the core goal – are universities, research centres, and large R&D laboratories cited alongside private sector firms as key actors (Camagni and Capello, 2013, p.381-382). As the regions

classified into these areas are highly concentrated in central and northern European member states (e.g. Germany, Austria, Denmark, Finland, Sweden) this analysis raises questions about the role of public knowledge institutions in innovation strategies throughout the rest of Europe.

A general implication of the principle behind smart specialisation that can be drawn, therefore, is that local universities may become less integral to the innovation strategies of regions if these shift away from attempting to promote the development of new economic activities based primarily on academic research capabilities (Goddard *et al.*, 2013). This interpretation is confirmed by Foray, who describes the role of universities and public research organisations in smart specialisation as:

large ... [but] less central [than previous Structural Fund periods]. The centre of gravity of the smart specialisation dynamic is the firms since they are best placed to conduct entrepreneurial discovery processes. In fact, the principle of smart specialisation strategy cannot be reduced to a tool for strengthening existing public research capacities The strategy is much more broadly a tool for economic development through research and innovation that must associate all the actors concerned in projects not necessarily centred on public research or universities.

(Foray, 2015, p.84)

The tension hinted at here is likely to become apparent when fields of research strength in local universities are not well aligned with the productive sector of the economy from which these

opportunities for future innovation-driven development, and therefore RIS3 priorities for concentration of resources, should in theory emerge (Goddard *et al.*, 2013)^{iv}.

In practice, however, following the smart specialisation logic to this end may be challenging for policymakers. Previous experience has indicated that relatively peripheral less-innovative regions, who should arguably avoid building their RIS3 around science-based activities, have paradoxically often been most reliant on local universities as one of their few sources of indigenous research and development assets to leverage within economic development policy (Boucher *et al.*, 2003; Huggins and Johnston, 2009). Indeed, formal guidance and policy briefs commissioned to accompany the introduction of RIS3 have tended to affirm that universities can make a range of crucial inputs into smart specialisation across all regions, including playing a central role in the entrepreneurial discovery process (Foray *et al.*, 2012; European Commission, 2014; Kempton *et al.*, 2014). This partly reflects a more fundamental objective of mobilising publicly-funded university research and education for economic and social development in Europe, particularly in regions where these ‘engagement’ practices are not established (European Commission, 2014).

The main forms this engagement takes should, however, still depend on regional circumstances. As described above, smart specialisation encourages regions to follow pathways of economic transformation related to their current industrial structure and opportunities for innovation. Lester (2007) has previously demonstrated that channels of university-industry linkages will vary with these pathways. For instance, where the creation of a new science-based industry may require universities to contribute to new enterprise formation through mechanisms such as spin-off firms, the upgrading or diversification of existing

industries will rely more on academic interactions with established firms through consultancy or joint research projects (also Vallance, 2016). Additionally, the education and training function of universities will be a key means of engagement with local employers, particularly in regions where a ‘doing, using, interacting’ mode of innovation is more prevalent than a ‘science, technology, innovation’ mode (Isaksen and Karlsen, 2010). Patterns of engagement will also be affected by the mix of different types of higher education institutions (e.g. research-intensive versus teaching-focused, traditional versus entrepreneurial, globally-oriented versus locally-embedded) in a region (Pinheiro *et al.*, 2012). Notwithstanding this organisational diversity, the dominant institutional frameworks and policies of national higher education systems will support certain models of university ‘third stream’ activity over others (Trippel *et al.*, 2015). These contextual factors are evident in post-communist CEE countries where continuing weaknesses in academic research systems, as well as in wider economic environments, have been identified as forming barriers to universities adopting the entrepreneurial forms of knowledge generation and exploitation (e.g. spin-off firms) that are more common in Western Europe and North America (Tchalakov *et al.*, 2010; Gál and Ptáček, 2011; Kwiek, 2012).

More collaborative forms of university-industry engagement may, however, help cultivate the inter-organisational network capabilities in a region that Foray (2015) recognises are an essential pre-condition for collective entrepreneurial discovery processes. The formation of strong, enduring partnerships of trust between universities, public authorities, and other actors has been identified as particularly important for smart specialisation in organisationally thin regions (Kempton, 2015). This kind of embeddedness of universities in a regional system can enable them to assume a more ‘developmental’ role in territorial innovation (Gunasekara, 2006; Gál and Ptáček, 2011; Goddard and Vallance, 2013), through which they can improve the

institutional and governance capacity of peripheral as well as core regions (Rodrigues *et al.*, 2001; Sotarauta and Kosonen, 2004; Goldstein and Glaser, 2012). Recent analyses of smart specialisation have emphasised the importance of this institutional capacity for a region to be able to handle the greater strategic demands of the new policy approach (Grillitsch, 2016; Morgan, 2016a). Above all this will apply in CEE countries where effective governance routines along these lines have yet to develop (Karo and Kattel, 2015; McCann and Ortega-Argilés, 2016).

These tensions identified with smart specialisation in theory and practice frame the ensuing two sets of empirical findings. The first is based on the results from relevant questions in a survey of institutional factors involved in the implementation of RIS3 at the regional (and sometimes national) level. This provides a European-wide overview of the multifaceted contribution of universities in smart specialisation, and allows comparative analysis of results for respondents from more- and less-developed countries or regions. The second section explores key processes of interaction between universities and other regional actors, and how these have been affected by the more entrepreneurial strategic logic of smart specialisation, through case studies of regions in Czechia (South Moravia) and Poland (Lodzkie). Notwithstanding differences in innovation system and capabilities between these CEE countries and the selected regions within them (Radosevic, 2004; Muller *et al.*, 2008), their shared heritage as former communist countries ensures some broadly common features in terms of the public research system and relationship to the rest of the economy.

Analysis of Institutions Survey

This section reports on the results of an online survey designed to investigate the levels of institutional capacity of European regions in the context of smart specialisation. It included questions on the design, implementation and background to RIS3 in the country or region of respondents^v. It was sent to 354 regional or national policy makers that belong to the more than 150 members of the S3 Platform. Altogether, 138 responses were received from 87 authorities, representing 25 different EU Member States and two candidate countries.

The survey consisted mainly of multiple choice questions where respondents were asked whether they agreed with certain statements from a scale of one to seven. The responses have been cross-tabulated against Cohesion Policy eligibility, self-reported levels of research and innovation, as well as broad geographic areas. Here the questions related to universities are presented. A full reporting of this survey can be found in a European Commission technical report (European Commission, 2017).

Overall, the results of the survey suggest that investing in research in Europe's less-developed regions is less of a priority than investing in other innovation drivers, in particular education and institutional capabilities. Respondents were asked to rate the level of research and innovation in their areas (regions or countries). On average, across the three categories of regions in the Cohesion Policy (More Developed, Transition, Less Developed), the level of research is considered higher than innovation, with 49.3% of respondents giving research a score of five or more out of seven compared to 40.5% for innovation. However, in More Developed regions the pattern is reversed, since the level of innovation is considered stronger than the level of research. Conversely, in Less Developed regions 36.1% of respondents rate the level of research as five or more, but the level of innovation is rated considerably lower with just 13.9% of respondents giving a high score. As the preceding section showed, many

authors have argued that regions often lack the capabilities to absorb knowledge, and the rest of the survey provides evidence to support this – although it also suggests that the RIS3 process may be a force for change.

Involvement of universities in RIS3 development

One of the questions enquired about the involvement of ten different actors in the development of the RIS3, including multinational firms, SMEs, professional associations, universities, voluntary organisations, research institutes, and local government. The results show that the involvement of universities has been very high since almost 80% of respondents gave a score of six or seven, which is the largest proportion of high scores for any of the ten actors. However, this did not vary much between the different categories of regions for Cohesion Policy, with 77.7% of respondents from Less Developed regions giving such a high score, and 83.6% from More Developed regions. Similar results were found when compared to the self-reported level of regional innovation. Overall, there is a slight correlation between the strong involvement of universities in RIS3 design and the level of development and innovation of a region. At the same time, as shown in Figure 1, a larger proportion of respondents from Less Developed regions considered that universities were more protective of their own interests, which suggests that smart specialisation has increased the awareness of the higher education sector in the potential role of the EU's Cohesion Policy in institutional funding.

[FIGURE 1]

Changing role of universities in regional innovation systems

The survey casts light on how the role of universities in some European regions may be changing with the advent of smart specialisation. Respondents refer to their role in providing

research services for the development of priority areas which can be expected in research-intensive institutions. Many respondents also pointed to the links between universities and business, especially in engineering subjects. However, a large proportion of respondents revealed that to different extents universities were involved in the process of strategy formation, including analysis but also the entrepreneurial discovery process and governance structures. Moreover, those respondents who underlined this role mostly came from Less Developed regions, suggesting that they may be contributing to building regional institutional capacity.

Capacity to absorb public funds

The survey shows that the capacity of universities to apply and engage in publicly funded innovation projects is lower in Less Developed regions. Compared to More Developed regions, a greater proportion of respondents reported that universities have strongly benefited from innovation projects in the past, but less believe that they have the skills or experience to submit successful proposals, and slightly less believe that they are well positioned to benefit from the RIS3.

Importance of education for Less Developed regions

In terms of the functions of universities, the survey shows that education is more important for Less Developed than for More Developed regions. One of the questions in the survey asked respondents to rate the importance of six policy areas in the implementation of RIS3. When comparing Less and More Developed regions, a greater proportion of respondents from Less Developed regions attached the highest importance to all policy areas (Table 1). The biggest difference in the proportion of respondents giving the highest importance to the policy areas however was in education. As shown in Table 1, in Less Developed regions 25% of respondents

attached high importance whereas in More Developed regions the figure was 11.5%. The pattern of attaching highest importance to all policy areas is also pronounced when comparing CEE with the rest of the continent (with the exception of social innovation). However, the difference is greatest for research and science, with the smallest proportion of respondents being located in Southern Europe and the largest in CEE. This shows that in Southern Europe there is a recognition that, while still important, research and science alone cannot solve their regional development challenges. On the other hand, policymakers in CEE still attach a very high importance to research and science reflecting a view that they may be able to catch up with strong investments in this area. When given the opportunity to elaborate further on the level of education deemed most important, many more Less Developed regions pointed to vocational training and lifelong learning than their More Developed counterparts, who were more likely to emphasise the importance of postgraduates.

[TABLE 1]

Survey conclusions on the role of universities

The FP7-S3 Platform survey on institutional capacity gives an overview of the importance and changing role of universities with the advent of the EU's smart specialisation policy. Firstly, their role has grown because there is much more of a strategic approach to innovation spending in the new Cohesion Policy. The potential of universities as institutional actors as well as a source of knowledge is recognised in the results above (which were reinforced by respondent text box comments). Secondly, this broader role of universities is more important in Less Developed regions, where institutional capacity for innovation is lower overall. Thirdly, focusing only on the research output of universities will fail to harness this capacity, especially in less-innovative regions. In fact, it is (higher) education and its function of human capital

production in support of research which the survey shows to be important in many cases. This supports other policy documents and evaluations of smart specialisation, such as from the European Commission's DG for Research: "Ultimately, science and technology intensive industries can emerge only in these less developed regions that have – and maintain – a sufficient supply of adequately trained workers" (European Commission, 2015, p.30).

Overall therefore, the survey underlines the fact that it is innovation capacity rather than research capacity that will be the crucial factor in the successful implementation of RIS3. Universities can contribute to this capacity but only if their different functions are more integrated and if they adjust their profile and activities to the regional priorities and context. The case study material from two CEE countries below builds on these findings by identifying the different mechanisms through which this developmental function can be enacted in less-innovative regions. At the same time, however, these examples illustrate that the strategic role attributed to universities as part of RIS3 will depend on the territorially-specific institutional set-ups in question.

Case studies: Lodzkie and South Moravia

The aim of this section is to understand how key regional stakeholders perceive changes in the role of universities and other knowledge institutions, such as public research institutes, that have been induced by the smart specialisation process. It is based on two rounds of interviews (between June and November 2014 and June and October 2015) performed by the authors in two case study regions (Lodzkie in Poland and South Moravia in Czechia). All types of key stakeholders were selected (e.g. entrepreneurs, cluster managers, academics, officers of technology transfer centres, managers of innovation centres, regional development agencies, etc.). Altogether 48 interviews were performed (13 and 18 in Lodzkie, 9 and 8 in South

Moravia)^{vi}. The interviewees were first asked about their perception of recent evolutionary dynamics of the overall regional innovation system, and particularly changes since embarking on their RIS3. Questions about the role of universities followed, covering *inter alia* the capacity of universities and public research organisations in the region to engage in the design and implementation of the RIS3, via participation in entrepreneurial discovery processes and shifting modalities of academia-business collaboration.

Socio-economic characteristics

Lódzkie is a less-developed region undergoing profound transformation of its traditional economic base that was for about two centuries dominantly centred upon the textile industry. A persisting unfavourable economic and employment structure and subsequent negative image of the Lodzkie region still influence current regional innovation performance, which can be considered rather weak (between a moderate and modest innovator on the Regional Innovation Scoreboard) (see table 2)^{vii}. Regarding the role of universities, there is a strong academic community in the regional capital city of Lodz (several tens of thousands of university students and several thousand academics). An especially strong position is enjoyed by the Technical University of Lodz, which ranks in fourth place among Polish technical universities (Lodzkie Region, 2014).

South Moravia belongs to the group of relatively advanced Czech regions with a considerable concentration of high value-added activities. The importance of South Moravia primarily arises from the strong position of its main agglomeration of Brno. Universities (6 public, 6 private, 29 faculties, almost 90,000 students) represent a large potential for R&D cooperation (South Moravian Innovation Centre, 2014). Jihovýchod (the NUTS2 region that is mainly comprised

of South Moravia) is, like all other Czech regions, a moderate innovator on the Regional Innovation Scoreboard (table 2).

[TABLE 2]

Knowledge institutions in the case study regions

Morgan (1997) already argued two decades ago that the fundamental problem of less-developed regions is low demand for innovation from most local firms caused by numerous external and internal factors, which are unlikely to be solved by implanting public R&D institutions into these regions. Similarly, Rodríguez-Pose (2001) emphasized that in the case of less-developed regions there is a systematic mismatch between often basic research conducted by public R&D institutions and the needs and absorptive capacity of regional SMEs. In contrast, large foreign companies usually enter these regions to economise on production costs, and not to perform R&D. While these arguments apply in the case of various CEE regions (e.g. Blažek and Csank, 2016), the role of universities and other knowledge institutions is multifaceted and, therefore, it would be incorrect to derive that in such regions this can be dismissed altogether.

In our case study regions, a broad range of linkages between knowledge institutions and private companies has been identified. First and foremost, supporting findings from the survey above, the obvious and crucial role of the universities as providers of high quality labour was acknowledged by all key stakeholders. One interviewee from South Moravia aptly argued that “without universities the innovative firms would not be here”. In this sense, the greatest pressure (some stakeholders even referred to a “battle for talents”) has been identified in the IT

sector. Major IT companies designated employees solely responsible for communication with the IT faculties. These employees intensively (or even aggressively) recruit talented potential graduates. However, academic interviewees from both regions emphasised that in numerous technical branches there is only limited demand for graduates with a PhD degree, indicating either the limited extent of corporate R&D in these branches or dubious relevance of PhD programmes compared to actual challenges faced by R&D teams in companies.

Unsurprisingly, the majority of academics consider joint R&D with companies as a dominant channel of academia-business linkages, which is moreover effectively supported by various national and EU programmes. However, according to our interviewees, this type of collaboration is strongly grant-driven, and consequently when the research project ends, the mutual cooperation practically ends as well. In the best case, the consortium looks for new opportunities to continue joint research activities.

In contrast, entrepreneurs, but also some academics, consider trouble-shooting (e.g. supplying expert advice and/or testing) on the request of companies as the most important channel of academia-business collaboration. This cooperation is usually only short-term and, moreover, often encompasses only small financial volume. Nevertheless, this type of cooperation cannot be disregarded as in addition to direct benefits for the company in question, it can enhance mutual understanding and trust between academics and entrepreneurs and, consequently, can form the preconditions for more intensive cooperation in the future. Accordingly, both academics and entrepreneurs stressed that the links between industry and universities are based mostly on personal relationships, as firms command sufficient know-*who* (especially in historically embedded branches like the textile industry in Lodzkie). Thus, university-business

collaboration is to a decisive extent driven by personal relationships between entrepreneurs and academics.

Importantly, with the exception of biotech and ICT firms, the size of firms seems to be a substantial factor shaping the nature of academia–business cooperation. While local SMEs prefer more down-to-earth forms of cooperation such as measuring and testing, localized MNCs generally possess their own R&D capacities (ideally located in the region, but more often outside) and cooperation with local researchers is for them not of crucial importance, but if it develops, tends to be long-term and R&D-intensive.

Contrary to advanced regions with renowned universities, where spin-off companies can yield important economic impacts (Vincett, 2010), in our case-study regions the number of spin-offs is still limited to individual cases and their economic impact is so far negligible^{viii}. Nevertheless, interviewed stakeholders are aware of the relevance of spin-off companies as these could represent one potentially important way of commercialising academic knowledge and, more generally, strengthening academia–business linkages.

However, interviewees emphasized one important internal barrier for more strategic and responsive behaviour of universities. Namely, universities, since the collapse of state-socialism, have enjoyed considerable autonomy from the state (for example, universities are practically unrestrained in the spectrum of study programmes they offer) as well as high level of internal democracy (i.e. strong role of academic senates). Under such internal institutional set-ups, representatives of universities are unlikely to attempt to change the mode of university operation. Therefore, the strongest driver impinging on the behaviour of academics seems to

be the national formula used for financing of universities. Currently, in both countries, the financing formula encourages academia-business linkages, even though the size of this financial incentive differs (still marginal in Czechia, but more important in Poland). Consequently, unless the academia-business cooperation is properly embedded into the financial formula, the role universities play in their regions is unlikely to change significantly^{ix}. In contrast, the current funding of universities in both countries is based predominately on the number of students (or teaching performance measured through number of teaching hours) with some adjustment based on scientometric indicators. However, in Poland, academia-business collaboration does represent one of the cornerstones of periodic evaluation of universities with subsequent implications for their financing. The existing model of financing of Czech universities has – given severe competition for students under conditions of a demographic slump – reinforced the predominate attention that representatives of universities pay to recruitment of students, while a more serious engagement with the needs of businesses is still not high on their agenda.

Changes in academia-business linkages over the last decade

Opinions of interviewees about changes concerning the intensity and nature of academia-business linkages over the last decade differ. While several were unable to identify any discernible change, most of our interviewees argued that the situation is gradually turning towards a more collaborative model. Namely, a gradual change of general mindset among academics, who do not consider cooperation with businesses a sort of “illegal” activity anymore, has been reported. However, the main driving force differs between the two regions. In Lodzkie, respondents acknowledge that the key driver of change is a shift in national discourse about the role of universities in society and economy - expecting them to be much

more open to cooperation with firms, but also with various public sector bodies. In contrast, in South Moravia, the interviewees identified regional initiatives as being the primary driving force and the changes induced at the national level were considered only of secondary relevance.

As a result of these changing conditions, but also a changing mindset of leading academics such as university rectors/presidents, technology transfer offices (TTOs) were established and some universities also tried to support the formation of spin-off companies and be more responsive to the needs of businesses. Enhancement of cooperation between university and business has probably been taken most seriously in case of the Lodz University of Technology, where the first “vice-rector for innovation” was appointed in 2012. Despite acknowledging some differences among the opinions of respondents about particular universities, the actual effect of these activities (e.g. number of spin-offs, patents, etc.) generally seems to be modest. The experience of university TTOs shows that the predominant form of cooperation with businesses is not commercialisation of new ideas or products developed by academics, but the provision of services at the request of entrepreneurs. However, even such an embryonic form of cooperation is important, as it forms the preconditions for a more intensive and long-term collaboration. Secondly, entrepreneurs still exhibit a preference for cooperation with recognized individuals instead of having the official contract with the University. One academic even went as far as to argue that university TTOs are of a “parasitic” nature and their mission is “totally unrealistic” as the demand from companies cannot be induced in this "artificial" way.

Changes induced by the RIS3 process

Surprisingly, the researchers themselves were modest or even sceptical when assessing the contribution of their institutions to the RIS3 process. In particular, academics in both regions argued that the key factor shaping the character of university–business collaboration is the intensity and the nature of demand from companies. This observation has been confirmed by entrepreneurs who strongly disregarded those academics who exclusively pursue basic research without ambition to consider the potential for commercialisation of their ideas. This feeling was aptly expressed by an entrepreneur in Lodzkie who posed the following question: “Why perform research which is not relevant to our companies?”.

Nevertheless, there was a broad agreement among interviewees in both regions that efforts connected with the RIS3 process resulted in much higher intensity of academia-business linkages. A particularly strong effort to prepare joint projects has been recorded in Lodzkie. Furthermore, the RIS3 process helped to redefine and enhance the mid-term strategy of some research institutions and faculties.

In both regions, important insights about the changing role of universities and businesses induced by the RIS3 process have been formulated by representatives of intermediary bodies. In particular, these interviewees emphasised that when regional authorities embarked upon a pro-innovation approach, they considered universities as their first “natural” partners, as universities are recognised actors performing research and providing qualified labour. In contrast, regional authorities had previously only limited contact with and awareness about the needs and challenges facing regional businesses. The RIS3 process with its strong emphasis on involvement of entrepreneurs helped significantly to moderate this asymmetry. While during the drafting process of the previous strategies entrepreneurs often played only a minor role

through one-off consultations with erratically selected entrepreneurs, during the implementation phase entrepreneurs were left aside completely. In contrast, an explicit effort to involve representatives of at least key industries has been made in both regions. Moreover, the entrepreneurs have been involved not only in the drafting of the RIS3 strategy, but via various modes they are also involved in its implementation (see Table 3).

[TABLE 3]

Consequently, enhanced involvement of the regional business sector both during the drafting process and the early phases of RIS3 implementation has contributed to the transformation of predominately bilateral (i.e. public administration–academia) relationships into tri-lateral (public administration–academia–business). Thus, long-lasting marginalization of entrepreneurs during the preparation and implementation of regional innovation strategies have been overcome in both regions. Nevertheless, there are systemic differences between academic institutions and businesses (such as a vast difference in number and heterogeneity of businesses compared to universities) making a real involvement of entrepreneurs in RIS3 more challenging. Still, certain fears were expressed by academics that the enhanced emphasis being placed upon the role of businesses in the innovation processes (see the very concept of *entrepreneurial* discovery process) excessively favoured the private sector to the detriment of universities. For example, a widespread requirement that the lead partner for joint R&D projects should be a company was criticized as it leads to a marginalisation of universities in the tendering process, and *inter alia* also disregards their need for stable financing as within these cooperative projects only a fraction of the academics are usually engaged.

Nevertheless, despite the enhanced role of companies in RIS3 process, the extent, to which their broader involvement would translate into better and more embedded decision-making process (see Morgan, 2016b), and therefore ultimately into a more effective and efficient regional innovation policy, remains an open question.

Conclusion

This paper has explored the role of knowledge institutions (particularly universities) in smart specialisation in regions with less-developed research and innovation systems. Through a combination of conceptual and empirical discussion it has shown that the introduction of smart specialisation as a guiding principle for European innovation policy is the source of a number of underexplored dynamics with different, and possibly conflicting, implications for the role of universities in these regional contexts. This concluding section will summarise the different themes from across the sections above and identify areas for future research building on this paper.

As noted earlier, RIS3 in general represents a more strategic approach to innovation spending as part of EU Cohesion Policy. Universities, and other non-governmental and non-firm knowledge institutions, have been part of this shift through their central involvement in shaping innovation strategies in their regions. The survey results reported above indicate that universities are amongst the types of organisations that are most likely to participate in the development of RIS3 in less- as well as more-developed regions – ahead of, for instance, multinational firms and SMEs. This does, however, conflict with the theoretical implication of smart specialisation outlined earlier that less-innovative regions should adopt strategies that are not predicated on local academic research capabilities if these do not have potential to become

innovation domains that are related to (and possibly transformative of) existing productive structures. In terms of the EU territorial context for RIS3, this will particularly apply to regions in CEE. The preceding section highlights that, despite the various linkages that have formed between HEIs and business in the featured regions, there are still a number of factors that limit the connection of university-based scientific research to business activities in these countries – including those that shape the level of private sector demand for knowledge and the inclination of academics to engage in commercial pursuits (e.g. starting spin-off companies). As suggested by the literature, these barriers are shaped by the national higher education system in question, and they will circumscribe the participation of universities in RIS3 supported activities to particular forms of engagement with business.

There is some evidence of these theoretical implications having been reflected in the actual development of RIS3. In the cases of Lodzkie and South Moravia, smart specialisation (and particularly undertaking an entrepreneurial discovery process) has helped induce a shift from bi-lateral (public administration-academia) to tri-lateral (public administration-academia-business) relationships at the heart of regional innovation strategy formation. The more extensive results from the survey also indicate that respondents from less-developed regions recognise that increasing levels of innovation is a greater priority than increasing levels of research more narrowly. This supports the basic argument of Foray *et al.* (2009) that less-innovative regions should focus on specific applications of existing knowledge or technology rather than attempting to develop these endogenously. It also, therefore, raises the interesting possibility that these regions should seek to form links with leading universities in other territories (Goddard *et al.*, 2013). Further research is, however, needed to explore the practicalities of this type of arrangement.

This is not, however, to suggest that universities and other knowledge institutions in less-innovative regions will no longer have an important role in regional policy. In particular, the empirical work above has identified two areas where these institutions should make a leading contribution to the development of smart specialisation moving forward. First, both the survey and case study material strongly emphasised the educational (rather than research) function of universities and related organisations as part of a broadly defined innovation policy, and that this function is considered of greatest significance in less-developed regions. The mobilisation of higher education programmes to address specific knowledge or skills gaps in regional labour markets has previously been recognised as a potentially transformative local economic development policy intervention (Arbo and Benneworth, 2007). However, this human capital dimension has yet to feature prominently in the smart specialisation debate, despite the possible gains from matching skills provision to locally-embedded industrial assets (McCann and Ortega-Argilés, 2015). Further work is needed to understand how the RIS3 prioritisation of certain innovation domains will generate demand for specialist labour within a region, and how universities can respond to this through supply of graduate labour to local employers. Second, engaged universities in less-innovative regions can enhance the governance and networking capabilities that are vital to smart specialisation. This ‘developmental’ role is reflected in their direct participation in the formation of their region’s RIS3. The empirical sections also highlight the potential for smart specialisation to feed into an ongoing process of strengthening relationships between universities and regional business, which over time can have the ‘virtuous cycle’ effect of increasing future demand for knowledge and absorptive capacity of firms. For instance, the preceding case studies point to universities responding to RIS3 by aligning their strategies with those of their region, and deepening connections with local firms through joint projects.

Both of these roles also highlight some of the limitations of the smart specialisation concept as it has initially been theorised and implemented. In less-developed regions, particularly, the further building of innovation capacity (including human capital, institutional, and knowledge absorption components) will be required before undertaking an entrepreneurial discovery process alone is likely to elicit economic diversification and structural change (Dogaru *et al.*, 2017). Universities, as demonstrated here, can be important actors in developing these systemic capabilities, even in territorial contexts where the theoretical logic of smart specialisation challenges the assumption that their research strengths should be a driver of the regional innovation strategy. Any future iteration of smart specialisation in subsequent Cohesion Policy funding rounds will need to expand its conceptual foundations to accommodate these possibly conflicting positions on the role of knowledge institutions in less-innovative regions.

Figure 1: Percentage of survey respondents that consider universities to be very protective of their own interests (score of six or seven out of seven)

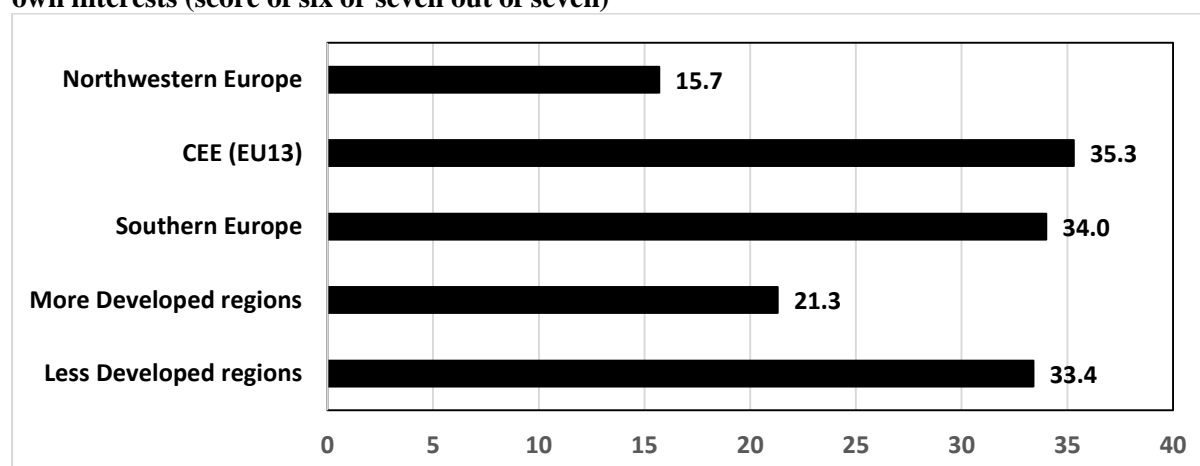


Table 1: Reported importance of different policy areas for implementation of smart specialisation strategies in less developed and more developed regions: Percentage of respondents assigning highest importance (a score of 7 from scale of 1-7)

Policy area	All Regions	Less Developed	More Developed	Northwestern Europe	Southern Europe	CEE (EU13)
Education	16.2	25.0	11.5	8.0	20.0	24.2
Vocational training	12.5	17.1	8.2	6.0	12.2	23.5
Research and science	42.8	47.2	37.7	41.2	36.0	55.9
Innovation in firms	66.7	69.4	65.6	64.7	66.0	70.6
Infrastructure investments	13.8	19.4	13.1	7.8	14.0	20.6
Social innovation	15.3	25.7	14.3	7.8	28.0	9.1

Table 2: Basic socio-economic indicators for case study regions

Basic socio-economic indicators	Jihovýchod	Lódzkie
Population (2014)	1.68 million (South Moravia: 1.17 million)	2.50 million
Unemployment rate in % (2014) <i>EU-28 average: 10.2</i>	5.9 (national rate: 6.1)	8.9 (national rate: 9.0)
GDP per capita; purchasing power parity (2014) <i>EU-28 average 100 (27,500)</i>	79 (21,700) (Czechia: 84 (23,200))	63 (17,400) (Poland: 68 (18,600))
Regional Innovation Scoreboard group	2012: Moderate Innovator 2014: Moderate Innovator 2016: Moderate Innovator	2012: Modest Innovator 2014: Modest Innovator 2016: Moderate Innovator

Source: Eurostat; Regional Innovation Scoreboard (Hollanders *et al.*, 2016)

Table 3: Involvement of entrepreneurs in RIS3

Region	Type of entrepreneurs involved	Drafting of strategy	Selection of priorities/domains of specialization	Involvement of entrepreneurs in implementation phase	Entrepreneurial discovery process (EDP)
Lodzkie	Predominately local SMEs, only limited interest for involvement from branches of foreign MNCs.	Extensive consultation process.	Yes, ICT introduced as one of the regional specializations on the basis of intervention of regional ICT cluster representatives. Supported by technical university.	Entrepreneurs are along with the academics involved in the process of prioritization of projects fitting into RIS3 for funding.	An extensive involvement of entrepreneurs in development of the action plan for each of vertical priorities as well as in foresight studies.
South Moravia	Relatively balanced representation of both local firms and branches of foreign firms.	Extensive consultations, all innovative companies invited for a semistructured interview.	Yes, via membership in working groups as well as via semistructured interviews and consultations.	Membership in RIS3 steering committee.	“Idea labs” for identification of promising business arenas established for each of the five regional vertical priorities; membership of these labs is strongly dominated by entrepreneurs.

ⁱ For brevity throughout the paper we will mainly just refer to these regions with less developed research and innovation systems as ‘less-innovative regions’. Following Trippel *et al.* (2016), we understand these in a primarily conceptual rather than empirical way, emphasising the diverse forms of system failure or deficiency that hinder the development of innovation capabilities. Hence, our main interest is not the performance of regions against standardised innovation metrics, but rather their more contextual structural and institutional characteristics that should help determine appropriate expectations of where and how knowledge institutions can most effectively contribute to regional development through RIS3.

ⁱⁱ These regional case studies are drawn from the EU Seventh Framework Programme *Smart Specialisation for Regional Innovation (SmartSpec)* project (2013-2016). This project was in-part concerned with the empirical analysis of regional ‘living laboratories’ across Europe where the RIS3 process was in the early stages of being implemented. The institutional survey reported on in this paper was also designed as part of this *SmartSpec* project (with Cardiff University), and carried out by the European Commission’s S3 Platform.

ⁱⁱⁱ Along these lines, economic geographers have framed smart specialisation as a process of regional diversification based on ‘related variety’ (e.g. McCann and Ortega-Argilés, 2015; Boschma, 2017).

^{iv} In a recent review article, Bonaccorsi (2016) identifies this absence of ‘co-specialization’ between local industry and academic research as one of main factors that can in general explain the limited impact of universities on peripheral regional economies. For such cases he recommends that policymakers should be content for local universities and industry to remain ‘decoupled’ rather than trying to engender collaboration where there is no commonality.

^v Some EU Member States have RIS3 only at the national level, whereas most have just regional or both national and regional strategies.

^{vi} The interviews were conducted in accordance with a predetermined structure and generally lasted 45 to 90 minutes. Most questions were open-ended. The interviews were not recorded, as in the authors’ experience this limits the openness of interviewees. Instead, a detailed protocol was elaborated from each interview on the same day to capture the maximum insights provided by the respondents.

^{vii} The Regional Innovation Scoreboard classifies regions into four tiers, where moderate innovators are the third-ranked group and modest innovators the fourth-ranked (Hollanders *et al.*, 2016).

^{viii} As interview respondents indicated, this is partly because the legal procedure for setting-up spin-off firms is in practice considered to be cumbersome and requiring sophisticated legal support.

^{ix} Moreover, this incorporation of university-business collaboration into financing formula has in practice proved to be challenging as there is a lack of relatively simple, relevant and readily available data capturing various modes of academia-business cooperation.

References

- Aranguren MJ, Navarro M and Wilson, JR (2015) Constructing research and innovation strategies for smart specialisation (RIS3): lessons from practice in three European regions. In: Valdaliso, JM and Wilson, JR (eds) *Strategies for Shaping Territorial Competitiveness*. Abingdon: Routledge, pp.218-242.
- Arbo P and Benneworth P (2007) Understanding the Regional Contribution of Higher Education Institutions: A Literature Review. *OECD Education Working Papers* No.9. Paris: OECD.
- Asheim B (2012) The changing role of learning regions in the globalizing knowledge economy: a theoretical re-examination. *Regional Studies* 46(8): 993-1004.
- Autio E (1998) Evaluation of RTD in regional systems of innovation. *European Planning Studies* 6(2): 131-140.
- Blažek J and Csank P (2016) Can Emerging Regional Innovation Strategies in Less Developed European Regions Bridge the Main Gaps in the Innovation Process. *Environment and Planning C: Government and Policy*, 34(6): 1095-1114.
- Bonaccorsi A (2016) Addressing the disenchantment: universities and regional development in peripheral regions. *Journal of Economic Policy Reform*. Epub ahead of print 31 August 2016. DOI: [10.1080/17487870.2016.1212711](https://doi.org/10.1080/17487870.2016.1212711).
- Boschma R (2017) Regional diversification and smart specialization policy. In: McCann P, van Oort F and Goddard J (eds) *The Empirical and Institutional Dimensions of Smart Specialisation* (pp.23-38). Abingdon: Routledge.
- Boucher G, Conway C and Van Der Meer E (2003) Tiers of engagement by universities in their region's development. *Regional Studies* 37(9): 887-897.
- Camagni R and Capello R (2013) Regional innovation patterns and the EU regional policy reform: toward smart innovation policies. *Growth and Change* 44(2): 355-389.
- Capello R (2013) Science-based activities in European regions: the knowledge-innovation nexus. In: Capello R, Olechnicka A and Gorzelak G (eds) *Universities, Cities and Regions: Loci for Knowledge and Innovation Creation*. London: Routledge, pp.13-42.
- Capello R and 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.
- De Bruijn P and Lagendijk A (2005) Regional innovation systems in the Lisbon Strategy. *European Planning Studies* 13(8): 1153-1172.
- Denizos D (1997) Relevance of research and technological activities for economic development in some less-favoured European countries. *Science and Public Policy* 24(3): 183-188.

Dogaru T, van Oort F and Cortinovis N (2017) Smart specialisation and local economic development in Eastern Europe. In: McCann P, van Oort F and Goddard J (eds) *The Empirical and Institutional Dimensions of Smart Specialisation*. Abingdon: Routledge, pp.145-164.

European Commission (2014) *The Role of Universities and Research Organisations as Drivers for Smart Specialisation at Regional Level*. Brussels: European Commission Directorate-General for Research and Innovation.

European Commission (2015) *Perspectives for Research and Innovation Strategies for Smart Specialisation (RIS3) in the Wider Context of the Europe 2020 Growth Strategy*. Luxembourg: Publications Office of the European Union.

European Commission (2017) *Institutions and Smart Specialisation Strategies: Results from a Survey of the S3 Platform*. Luxembourg: Publications Office of the European Union.

Foray D (2015) *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. London: Routledge.

Foray D, David PA and Hall B (2009) *Smart Specialisation – The Concept*. (Knowledge Economists Policy Brief no.9) Brussels: European Commission.

Foray D, Goddard J, Beldarrain XG, Landabaso M, McCann P, Morgan K, Nauwelaers C and Ortega-Argilés R (2012) *Guide to Research and Innovation Strategies for Smart Specialisation*. Brussels: European Commission.

Foray D and Van Ark B (2007) *Smart Specialisation in a truly integrated research area is the key to attracting more R&D to Europe*. (Knowledge Economists Policy Brief no.1) Brussels: European Commission.

Gál Z and Ptáček P (2011) The role of mid-range universities in knowledge transfer in non-metropolitan regions in Central Eastern Europe. *European Planning Studies* 19(9): 1669-1690.

Goddard J, Kempton L and Vallance P (2013) Universities and Smart Specialisation: challenges, tensions and opportunities for the innovation strategies of European regions. *Ekonomiaz* 83(2): 83-102.

Goddard J and Vallance P (2013) *The University and the City*. Abingdon: Routledge.

Goldstein HA and Glaser K (2012) Research universities as actors in the governance of local and regional development. *Journal of Technology Transfer* 37(2): 158-174.

Grillitsch M (2016) Institutions, smart specialisation dynamics and policy. *Environment and Planning C: Government and Policy* 34(1): 22-37.

Gunasekara C (2006) The generative and developmental roles of universities in regional innovation systems. *Science and Public Policy* 33(2): 137-150.

Hollanders H, Es-Sadki N and Kanerva M (2016) *Regional Innovation Scoreboard 2016*. Brussels: European Commission.

Hospers G-J (2006) Silicon somewhere? Assessing the usefulness of best practices in regional policy. *Policy Studies* 27(1): 1-15.

Huggins R and Johnson A (2009) The economic and innovation contribution of universities: a regional perspective. *Environment and Planning C: Government and Policy* 27(6): 1088-1106.

Isaksen A and Karlsen J (2010) Different modes of innovation and the challenge of connecting universities and industry: case studies of two regional industries in Norway. *European Planning Studies* 18(12): 1993-2008.

Karo E and Kattel R (2015) Economic development and evolving state capacities in Central and Eastern Europe: can “smart specialisation” make a difference? *Journal of Economic Policy Reform* 18(2): 172-187.

Kempton L (2015) Delivering smart specialization in peripheral regions: the role of Universities. *Regional Studies, Regional Science* 2(1): 489-496.

Kempton L, Goddard J, Edwards J, Hegyi FB and Elena-Pérez S (2014) *Universities and Smart Specialisation*. (S3 Policy Brief Series No. 03/2013) Seville: European Commission/Joint Research Centre/Institute for Prospective Technological Studies.

Kwiek M (2012) Universities and knowledge production in Central Europe. *European Educational Research Journal* 11(1): 111-126.

Landabaso M (1997) The promotion of innovation in regional policy: proposals for a regional innovation strategy. *Entrepreneurship and Regional Development* 9(1): 1-24.

Lester RK (2007) Universities, innovation, and the competitiveness of local economies: an overview. In: Lester RK and Sotarauta M (eds) *Technology Review 214/2007*. Helsinki: Tekes, pp.9-30.

Liagouras G (2010) What can we learn from the failures of technology and innovation policies in the European periphery? *European Urban and Regional Studies* 17(3): 331-349.

Lodzkie Region (2014) *Regional Innovation Strategy for the Lodzkie Region: LORIS 2030*. Lodz: Marshal Office of the Lodzkie Region.

McCann P and Ortega-Argilés R (2015) Smart specialization, regional growth, and applications to European Union Cohesion Policy. *Regional Studies* 49(8), 1291-1302.

McCann P and Ortega-Argilés R (2016) The early experience of smart specialization implementation in EU cohesion policy. *European Planning Studies* 24(8): 1407-1427.

Morgan K (1997) The learning region: institutions, innovation and regional renewal. *Regional Studies* 31(5): 491-503.

Morgan K (2016a) Nurturing novelty: regional innovation policy in the age of smart specialisation. *Environment and Planning C: Government and Policy*. Epub ahead of print May 32016. DOI: 10.1177/0263774X16645106.

Morgan K (2016b) Speaking truth to power: The political dynamics of public sector innovation. In: Kyriakou D (ed) *Governing Smart Specialisation: The Institutions of Entrepreneurial Discovery*. London: Routledge.

Morgan K and Nauwelaers C (eds) (1999) *Regional Innovation Strategies: The Challenges for Less-Favoured Regions*. London: Routledge.

Muller E, Doloreux D, Heraud A, Jappe A and Zenker A. (2008) Regional innovation capacities in new member states: a typology. *European Integration* 30(5): 653-669.

Muscio A, Reid A, and 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.

Navarro M, Gibaja JJ, Bilbao-Osorio B and Aguado R. (2009) Patterns of innovation in EU-25 regions: a typology and policy recommendations. *Environment and Planning C: Government and Policy* 27(5): 815-840.

Novotný J, Blažek J, and Květoň V (2016) The anatomy of difference: comprehending the evolutionary dynamics of economic and spatial structure in the Austrian and Czech economies. *European Planning Studies* 24(4): 788-808.

Oughton C, Landabaso M. and Morgan K. (2002) The regional innovation policy paradox: innovation policy and industrial policy. *Journal of Technology Transfer* 27(1): 97-110.

Pinheiro R, Benneworth P and Jones GA (2012) Understanding regions and the institutionalization of universities. In Pinheiro R, Benneworth P, and Jones GA (eds) *Universities and Regional Development: A Critical Assessment of Tensions and Contradictions*. Abingdon: Routledge, pp.11-32.

Radosevic S (1999) Transformation of science and technology systems into systems of innovation in central and eastern Europe: the emerging patterns and determinants. *Structural Change and Economic Dynamics* 10(3), 277-320.

Radosevic S (2004) A two-tier or multi-tier Europe? Assessing the innovation capacities of central and eastern European countries in the enlarged EU. *Journal of Common Market Studies* 42(3): 641-666.

Rodrigues C, Rosa Pires AD and Castro ED (2001) Innovative universities and regional institutional capacity building: the case of Aveiro, Portugal. *Industry and Higher Education* 15(4): 251-255.

Rodríguez-Pose A (2001) Is R&D investment in lagging regions of Europe worthwhile? Theory and empirical evidence. *Papers in Regional Science* 80(3): 275-295.

Rodríguez-Pose A and Di Cataldo M (2015) Quality of government and innovative performance in the regions of Europe. *Journal of Economic Geography* 15(4): 673-706.

Sokol M (2013) Silicon Valley in Eastern Slovakia? Neoliberalism, post-socialism and the knowledge economy. *Europe-Asia Studies* 65(7): 1324-1343.

Sotarauta M and Kosonen K-J (2004) Strategic adaptation to the knowledge economy in less favoured regions: a South Ostrobothnian university network as a case in point. In Cooke P and Piccaluga A (eds) *Regional Economies as Knowledge Laboratories*. Cheltenham: Edward Elgar. pp.1-19.

South Moravian Innovation Centre (2014) *Regional Innovation Strategy for the South Moravian Region 2014-2020*. Brno: South Moravian Innovation Centre.

Tchalakov I, Mitev T and Petrov V (2010) The academic spin-offs as an engine of economic transition in Eastern Europe. A path-dependent approach. *Minerva* 48(2): 189-217.

Tödting F and Tripl M (2005) One size fits all? Towards a differentiated regional innovation policy approach. *Research Policy* 34(8): 1203-1219.

Tripl M, Asheim B, and Miörner J (2016) Identification of regions with less-developed research and innovation systems. In Parrilli MD, Fitjar RD and Rodríguez-Pose A (eds) *Innovation Drivers and Regional Innovation Strategies*. Routledge: London, pp.23-44.

Tripl M, Sinozic T and Lawton Smith H (2015) The role of universities in regional development: conceptual models and policy institutions in the UK, Sweden and Austria. *European Planning Studies* 23(9): 1722-1740.

Vallance P (2016) Universities, public research, and evolutionary economic geography. *Economic Geography* 92(4): 355-377.

Vincett PS (2010) The economic impacts of academic spin-off companies, and their implications for public policy. *Research Policy* 39(6): 736-747.