

Eristian WIBISONO *

UNIVERSITIES AND SMART SPECIALISATION IN LESS DEVELOPED EUROPEAN REGIONS: AN EVIDENCE-BASED OVERVIEW

Abstract. This paper aims to review the evidence demonstrating the role of universities in the knowledge diffusion function for Smart Specialisation strategies. It is not new if many experts question whether Smart Specialisation will apply equally in all regions, plus the reason that the study of the role of universities in Smart Specialisation still needs much attention. Through this evidence-based literature review, I have identified three main points that support the role of universities for Smart Specialisation in less developed regions of Europe, including resources in regional innovation systems, public sector investment support for RandD, and strong bonds of the Triple Helix actors.

Key words: universities, Smart Specialisation, regional development, less developed region, Europe.

1. INTRODUCTION

Smart Specialisation emerged as a place-based cohesion policy to encourage regions to find their transformation activities according to a region's characteristics, which would encourage the region to have a new, more competitive economic structure. The Smart Specialisation approach focuses on discovering local entrepreneurship and combining it with critical technological discoveries that underpin entrepreneurial activity in the region. This process requires good absorption from local entrepreneurs (Foray *et al.*, 2009; Foray, 2016, 2018). In this case, the

* Eristian WIBISONO, University of Pecs, Faculty of Business and Economics, Rákóczi street 80., H-7622 Pécs, Hungary; e-mail: wibisono.tian@gmail.com, ORCID: <https://orcid.org/0000-0002-2645-580X>

transfer of knowledge to the industry and business in the process of Smart Specialisation involves several stakeholders in the field of research and innovation, including research institutions at universities and research institutions in local government (Kempton, 2015; Kempton *et al.*, 2013).

Doubts have arisen whether Smart Specialisation could be applied in the same way to obtain the same results in all regions (Hassink and Gong, 2019). Foray (2019) responded to the criticism and stated that Smart Specialisation had never been concluded as being suitable for all types of regions. It is clear that regions are considered, but less developed or structurally weak regions will have difficulty with the entrepreneurial discovery process (EDP), especially in the form of institutional issues.

In contrast, some capabilities need to be possessed by regions to apply Smart Specialisation, namely the ability to diffuse knowledge to support the Smart Specialisation process as producers of local knowledge universities have a very strategic role for the success of Smart Specialisation (González-López *et al.*, 2015; Pavlova and Burenina, 2016). In the European Commission's documentation (2014) by Fotakis *et al.* (2014), public research organisations and universities on the application of S3 are considered core innovation actors. It means that a region should make universities and public research institutes centres of Smart Specialisation (Foray *et al.*, 2012; Kempton, 2015; Kempton *et al.*, 2013; Vallance *et al.*, 2018). Research on the role of universities in implementing Smart Specialisation policies during the 2014–2020 period of Smart Specialisation has not received much attention.

The dynamics of studies and research on Smart Specialisation during the 2014–2020 implementation period continue today. The main issue of emerging barriers in underdeveloped regions is still the concern of several leading academics (i.e., Asheim *et al.*, 2017; Asheim, 2019; Barzotto *et al.*, 2019). The challenges that often arise in the implementation of S3 in various regions often attract the attention of scholars. For example, a paper by Vallance *et al.* (2018) investigates the implications of universities and public research institutions in Smart Specialisation. According to it, the dynamics are very diverse where the role of the university for Smart Specialisation in regional innovation systems needs to be reconfigured, especially in less innovatively developed regions. In a recent study Lilles *et al.* (2020) has examined the capabilities of all EU regions with regional divisions and examined how the potential for university collaboration is well supported and implemented in these regions. This research has shown that potential support for each actor involved in university and industrial collaboration in each region is not homogeneous because each region has its own characteristics. A paper by Papamichail (2019) and Papamichail *et al.* (2019) highlights the problem of weak collaboration between universities and industry in terms of capacity and network. It studied two regions of Greece that were dramatically affected by the Greek economic crisis. The results showed that the implementation of S3 in this area was practically strongly influenced by absorption capacity (knowledge) and network (organisation).

Based on this description, this paper aims to reviews how universities as the house of knowledge play an essential role in the Smart Specialisation process. I compiled several sources that specifically review university and Smart Specialisation strategies in less developed regions of Europe. The structure of the paper in the next section presents a systematic methodology used to conduct this review. In the third section, I review the position and role of universities in the region implementing Smart Specialisation strategies and review how universities relate to key actors in regional innovation systems for Smart Specialisation. In the fourth section, I review evidence of university and industry collaboration for Smart Specialisation in less developed regions of Europe. The paper closes with a discussion of the critical factors that can improve the university's relationship with innovation actors within the framework of Smart Specialisation, and provides policy recommendations and future research.

2. METHODOLOGY

This study begins with a simple bibliometric analysis using available data from the Web of Science and Scopus and analysing the research network using the VOS Viewer software. I apply the keyword “universit* and smart speciali*ation” to get the data and limit only the article document type. I apply the keywords “universit* and smart speciali*ation” to obtain data and limit the type of document to articles only. The use of “*” in keywords is intended so that the same terms but with different spellings, namely universit(y), universit(ies), speciali(z)ation and speciali(s)ation, are expected to appear in the article search process. 29 most relevant articles were successfully exported in this process, and then I compiled and anticipated duplication. Then using the VOS Viewer software, I analyse the network and the density of research in this field.

The results of network analysis show that research related to the university and Smart Specialisation have a fairly close relationship, as shown in Fig. 1. The network distance is quite far, but the term smart specialisation/specialization strategy also appears in this network and is close to each other. I did not limit the year of research, but if I refer to the period since the concept of Smart Specialisation was introduced by Foray *et al.* (2009), and when its first phase of implementation started in 2014–2020, not much literature studies on Smart Specialisation and universities have been conducted, as shown in Fig. 2. Density Research on this topic is seen in the density network, which is the green part, while the yellow color indicates that much research in this area has been conducted. Therefore, I think that studies related to the university and Smart Specialisations still have enough space for novelty. This review paper is proposed to fill those objectives.

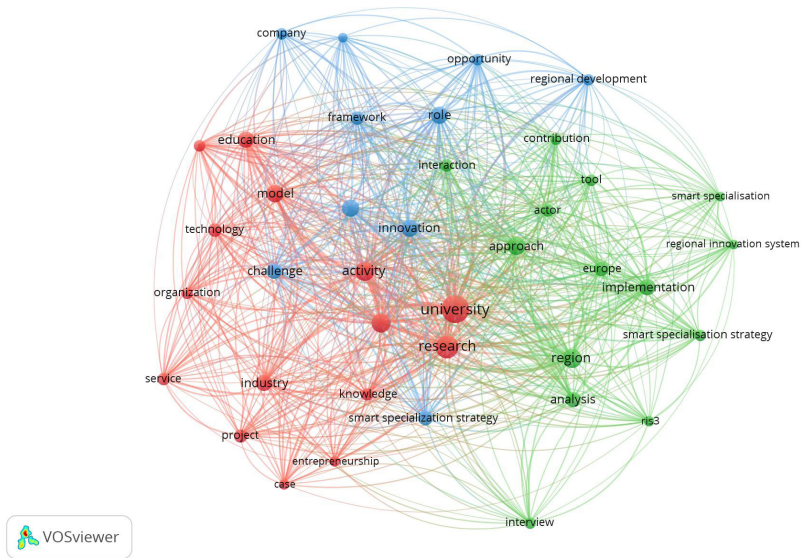


Fig. 1. Network Visualisation
Source: VOSViewer output, own work.

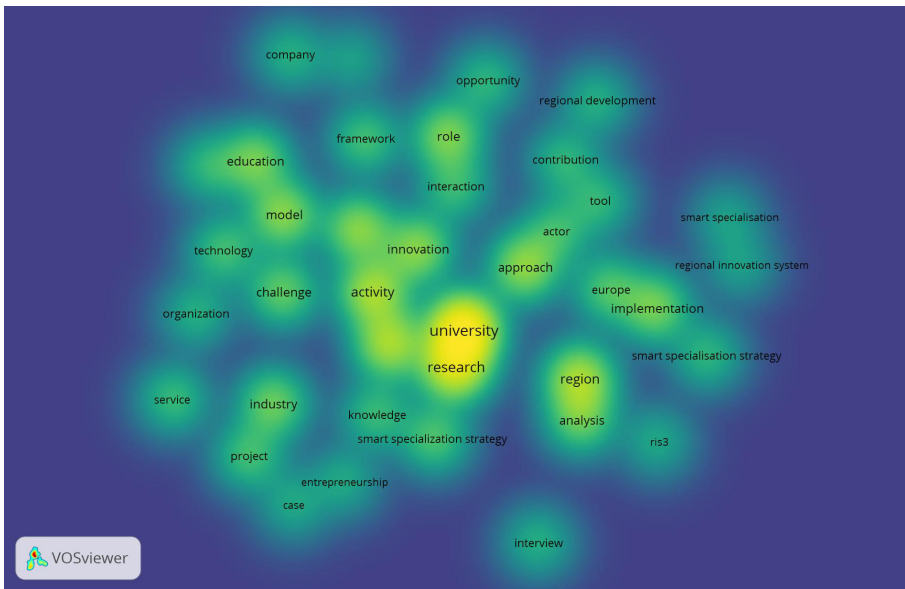


Fig. 2. Density Visualisation
Source: VOSViewer output, own work.

In the next stage, I collected and analysed this collection of articles based on the specific topics discussed, both as theoretical and empirical supports, including university and industry collaboration, university organisations and institutions for Smart Specialisation, knowledge transfer, and university innovation for Smart Specialisation, and implementation of Smart Specialisation involving universities in less developed regions. I was then interested in focusing on implementing Smart Specialisation in less developed regions due to the limitations of this related study in several leading journals. I consider it essential to take a deeper look at the position and role of the university in the context of Smart Specialisation in these regions. The obstacles and challenges that often arise in this region are raised in the discussion section to generate policy recommendations and future research.

3. UNIVERSITY IN SMART SPECIALISATION FRAMEWORK

The effectiveness of the EU's Cohesion Policy that focuses on promoting innovation is not easily realised in less developed regions. This condition is common and is a significant obstacle to economic development in Europe (Landabaso, 1997; Muscio *et al.*, 2015; Oughton *et al.*, 2002; Morgan and Nauwelaers, 1999). The problem of inequality in the innovation system in Europe, according to Capello (2013), appears with regional landscape differences. This inequality has widened since the addition of new EU Member States from Central and Eastern European (CEE) countries, the majority of which inherited innovation systems related to their historical and political backgrounds (Radosevic, 1999; Tchalakov *et al.*, 2010).

The economic structure in this region also influences the capacity to absorb knowledge needed for innovation (Muller *et al.*, 2008; Navarro *et al.*, 2009). This area tends to have a traditional industrial character that learns more from customers' practical experience than from being active in research and development-based activities. Such an industry profile is very influential on the success of innovation in the region (Asheim, 2012; Isaksen and Karlsen, 2010). Despite the many facts that have been demonstrated to show that the less innovatively developed regions are different, the innovation strategy established for the whole of Europe has not specifically facilitated this type of region. There is a demand from European innovation studies that leads to the particular need for innovation policy strategies considering regional differences (Camagni and Capello, 2017; Capello and Lenzi, 2019; Capello and Lenzi, 2016).

The innovation policy originally conceptualised for Smart Specialisation by the Knowledge Experts Group for Growth found common innovation domains across Europe in the regions of basic science and technology such as biotechnology and nanotechnology (Foray, 2017). This group has proposed solutions so that

the regions can find new opportunities for research and innovation in their priority regions which are then used as superior and competitive sectors or sub-sectors through a process they call the Entrepreneurial Discovery Process (EDP) (Foray *et al.*, 2009).

Smart Specialisation can also be described as the concentration of all local resources to transform the regional structure (Foray *et al.*, 2015). According to him, the EDP process requires important actors in the region, such as universities, the private sector, and the government, and the process also requires good governance that connects all these actors. The various links between the region's economic structure and the goal of Smart Specialisation emphasize that the regional structural transformation desired by the Smart Specialisation strategy must clearly consider the region's innovation capability. The role of knowledge institutions, universities in this case, was expressed by Camagni and Capello (2017) and suggests that innovation policies are differentiated for specific regions and based on innovation patterns. One of the classifications has been discussed in applied sciences, where universities and the private sector/industry are considered key actors for the diffusion of knowledge in this science and applied field. Conducted studies have shown that Northern Europe and Central Europe are the concentrations of this classification. Nevertheless, the next question is what about the actual pattern of innovation in European regions.

Foray *et al.* (2015) have described research at universities as not the only centre of Smart Specialisation activities. Smart Specialisation must associate all research and innovation actors. In its dynamics, the company is central in the EDP process, while universities and public research institutions play a less central role in their capacity as research centres. If so, controversy may arise at the level of policy-makers. So far, in the experience of less developed regions in particular, universities have played an essential role in the framework of science-based activities, and even development studies conducted by universities have been often used as recommendations in setting regional development policies (Boucher *et al.*, 2003; Huggins and Johnston, 2009). Formally, the central role of universities in EDP is possible but only to mobilise public research funds for development purposes (Foray *et al.*, 2012; Kempton, 2015).

Whatever the university's role for Smart Specialisation may be, its engagement with industry and local government is essential to enhance networking capabilities in regions. The network is also an essential factor in the EDP process. The university is systemically tied to regional innovation. In regions that tend to be lagging with organisational thinness, Smart Specialisation will be strong with the strength of mutual trust between innovation actors (Kempton, 2015). Universities can also play a more significant role in supporting local governance and institutions (Goldstein and Glaser, 2012; Rodrigues *et al.*, 2001; Sotarauta and Kosonen, 2004). Institutional capacity is important for a new policy approach (Grillitsch, 2016). However, in regional innovation discourses, governance and

institutional issues in less developed regions often emerge as obstacles and challenges (McCann and Ortega-Argilés, 2016). In addition, one of the main reasons innovation is less developed in the region is due to the low response of local companies in absorbing local knowledge. Studies conducted by regional research institutions are often not in accordance with the needs of local businesses (Barzotto *et al.*, 2019; Rodríguez-Pose, 2001).

Universities are now contributing in different ways apart from their traditional functions in educational and research activities (Benneworth *et al.*, 2009; Gunasekara, 2006). In the Triple Helix model, the interaction of actors (university-industry-government) is essential for innovation (Etzkowitz, 2003). In the model, the spatial dimensions of the region are considered. It is in accordance with the concept of regional innovation, where it can describe the process of intensive knowledge diffusion. Universities play a role in the knowledge diffusion process, while government and the industry are more involved in knowledge application and policy implementation. To channel knowledge outside an area, the capabilities of these regional actors must be reliable so that the region and the actors within it have advantages and competitiveness (Hashi and Stojčić, 2013; Isabel Maria *et al.*, 2014; Lawson, 2003; Smith *et al.*, 2018).

Interesting studies of Smart Specialisation in less developed regions prove the diversity of innovation systems, innovation performance, and collaboration between universities and industry (Radosevic, 2017; Seppo *et al.*, 2014). This last point requires sufficient intervention from the government as a policymaker. The government should promote university-industry cooperation and increase their engagement to realise the advantages and competitiveness of regional innovation.

4. THE UNIVERSITY AND SMART SPECIALISATION IN LESS-DEVELOPED EUROPEAN REGIONS. REVIEW OF THE EVIDENCE

Vallance *et al.* (2018) conducted a case study research in one of the less developed European regions, namely Łódzkie (Poland). Łódzkie has the characteristics of a less developed region due to a strong historical background in the textile industry for more than two centuries, a fact which has greatly influenced the innovation process in the region. However, there is a fairly high potential for innovation due to sources of knowledge such as higher education institutions – the numbers of academics and students that are quite large and complete, especially those centered in the capital. It makes Łódź one of the cities with the best technology universities in Poland. This study aims to analyse the perspectives of regional stakeholders in examining the role of knowledge institutions involved in the Smart Specialisation process, for example, in terms of organisational capacity

and university and industry collaboration in the EDP process for Smart Specialisation. Interviews were conducted with many actors such as entrepreneurs, actors in regional research institutions, planning agencies, etc.

Vallance *et al.* (2018) have stated that identifying the relationship between knowledge institutions such as universities and public research institutions with companies or industries is very important to achieve recognition of whether the results of the institution's studies and other outputs such as the quality of education and skills of prospective workers meet the expectations of these end users. From the results of the survey and interviews, this satisfaction can be seen in several companies in Łódzkie that think that universities and research results are important for the sustainability of their business. Moreover, bona fide companies such as IT companies in the area formally appoint their company management to conduct special recruitment among university graduates in the region. However, companies also admits that not all levels of education at universities are suitable for their needs. There are recruitment limitations, such as a low demand for Ph.D. graduates to work in the company R&D departments, while the need for diploma and undergraduate graduates was more likely. With this relationship, the university also recognises that the reciprocal relationship between business and academia has become quite dominant in educational activities. Unfortunately, a paradigm emerges that this collaboration is often only motivated by research grants where academics need companies as data sources or research subjects. The bad part is that when a project ends, the collaboration between the two is severed, and a new grant will require a new company profile. In this case, a long-term research program to maintain the relationship between the two can be a fairly good consideration.

The findings of Vallance *et al.* (2018) prior to the case study were in the form of a survey of 150 S3 platform members from 27 EU Member States. The results have shown that research investment is not a priority in less developed regions when compared to investment priorities in education and institutions. In fact, in general, respondents (regional actors) in all types of regions (developed, transitional, and less developed) gave high ratings of the level of research in their area. Less developed regions mostly gave high scores to the level of research, while less than 15% gave high scores to the level of regional innovation. It is in contrast to the assessment of respondents in more developed regions where the level of innovation scores higher than the level of research. The evidence in this field also shows that university involvement is seen to be very high, and there is no significant difference between developed regions (80%) and less developed regions (77%). It shows how a university's role is significant in the S3 process.

Of the six regions of RIS3 policy study (Education, Vocational Training, Research and science, Innovation in companies, Infrastructure investment and Social Innovation), actors in less developed regions gave the highest responses to the field of education, in contrast to developed regions which were more concerned

with Innovation. Some regions in the South saw that investment in research could not simply support regional development, whereas local governments were generally more concerned with this. According to them, vocational education and training could be much more helpful for developing regions in the South.

In conjunction with the RIS3 process, regional actors naturally regard universities as their first innovation partners because core education and research activities are at universities. The RIS3 process essentially emphasizes the role of entrepreneurs, but often the role of entrepreneurs is not maximised in the EDP process. The involvement of entrepreneurs is of low frequency, and the selection is random. However, less developed regions generally focus more on the involvement of key industrial actors in that region rather than involving too many industry actors. Furthermore, leading industry actors are also involved in implementing S3 in the field.

Kempton (2015) conducted a study in the Värmland Region, a suburb in Sweden with a small population (less than 300,000 people) and about 25% of the population living in urban regions. This region has socio-economic problems in education and research due to a relatively small share of the productive-age population and a low involvement of the population in higher education. The Värmland Region's involvement in Smart Specialisation is realised through collaboration with one of Sweden's youngest universities, Karlstad University, and involving business actors from the region's leading industrial clusters. Through a cooperation agreement, this collaboration has developed education and knowledge in the region for more than ten years.

The capacity to absorb knowledge which is common in peripheral regions in Europe (Cohen and Levinthal, 1990), also occurs in Värmland, where SMEs still dominate the industrial structure. To address this problem, the Värmland Region established in 2014 an innovation park which facilitates research and business actors to meet, discuss and provide support. Collaboration is then created through this innovation park, and regional innovation development is maintained by making formal ties through cooperation agreements. Thus, the change of personnel in the institution does not necessarily damage the existing governance of regional Innovation.

In this process the role of the private sector appears to be a vital concern; it participates in supervising the collaboration that is created. They even participated in the process of recruiting ten professors to support organisations and institutions at the university. It is imperative to make this collaboration transparent among all parties involved and accountable in management. Another positive evidence of collaboration in the Värmland Region is an increase by more than twofold in terms of university collaboration with entrepreneurs from the steel industry. It is a testament to how the business environment can absorb knowledge from research results, although specific indicators are still needed to measure this absorption capacity.

The collaboration between the industry and universities in the Värmland Region can influence the study program development at the University of Karlstad

to the masters and doctoral levels. It means that universities can prepare graduates according to the skills required by the labour market in the region. However, when competing globally, universities also face challenges in recruiting university students and staff, and meeting the skills requirements of the local labor market while competing on a global level.

Lilles *et al.* (2020) have mapped all EU Member States with regional divisions at the NUTS 1 or NUTS 2 levels. The results of the study have shown that strong regions such as Baden-Württemberg and Bavaria in Germany or Stockholm and Sydsverige in Sweden have the best support from the private sector. Different things have been indicated in several regions in Romania, Poland, and Spain, which tend to be weak in getting support from the private sector to cooperate with universities. Meanwhile, in terms of support from the public sector, it seems that support in all these regions is more evenly distributed. The northern regions of Europe, such as Sweden and Denmark, and the western regions of Europe, such as the Netherlands, UK, Ireland, and the South of France, have received better support from the public sector. R&D investment in regions (i.e., Utrecht in the Netherlands and Stockholm in Sweden) has great support from the public sector. Highly educated population is more concentrated in these regions and increases the local knowledge absorption capacity. However, the situation is the same for some regions in the central and eastern parts (Romania and Poland) and the south (Italy and Portugal), which receive weaker support from the public sector.

Lilles *et al.* (2020) have seen that the ability to collaborate between industry and universities is very heterogeneous in this European region. The implementation of an S3 emphasising entrepreneurship emerges from the entrepreneur's side so that solid cooperation and mutual trust between universities and entrepreneurs are essential to the flow of all critical technology information. Thus, the industry's knowledge absorption and regional innovation systems function properly. This paper also evaluates how the region (at the NUTS 1 level) supports collaboration between universities and industry. It found the primary key to support university and industry cooperation, namely the strength of the support from the three main actors of Triple Helix. However, the very heterogeneous character of the region has always been a challenge in realising this collaboration. By contrast, insufficient support is seen in much of Central and Eastern Europe and Southern Europe.

The diversity of regional capabilities in supporting industrial cooperation and government-supported universities (in the Triple Helix triangle) is important for implementing Smart Specialisation in less developed regions. Bonaccorsi (2009) has stated that it is not easy to realise the Triple Helix in less developed regions. That is because not all actors' goals are necessarily aligned. Meanwhile, a study conducted by Lilles *et al.* (2020) has shown very little evidence of adequate collaboration in less developed regions due to the weak role of actors in the dynamics of regional collaboration.

5. DISCUSSION AND CONCLUSION

In this paper, I discussed how the role of universities in the knowledge diffusion function plays a strategic role in the policy of Smart Specialisation. The discovery of local entrepreneurship is the first target of Smart Specialisation through EDP. Thus, the ability of local entrepreneurs to absorb critical knowledge and technology from universities significantly affects the successful implementation of Smart Specialisation. It is not new that many scholars have questioned whether Smart Specialisation will apply equally to all regions in terms of setting up the EDP process to its implementation. Therefore, universities as producers of local knowledge are considered core innovation actors in Smart Specialisation. But in fact, the study of the role of universities in Smart Specialisation still needs much attention from scholars.

During the initial period of implementing Smart Specialisation, i.e., 2014–2020, the issue of its challenges in less developed regions continued to arise and did not receive a meaningful solution. Likewise, studies on the role of universities for Smart Specialisation in less developed regions still receive a large enough space to be filled as a research novelty. Through this brief literature review method, I re-articulated the evidence for the role of universities in Smart Specialisation in less developed regions of Europe. This paper discussed two focus regions, Łódzkie (Poland) and the Värmland Region (Sweden). However, in the final section, I discussed investigations across Europe that ultimately discovered university relationships in less developed regions.

From the results of this evidence-based review, I identified three main points that support the role of universities for Smart Specialisation. First, resources in regional innovation systems define the role of universities for Smart Specialisation in less developed regions. In this case, the involvement of academics and university students in research becomes crucial. Likewise, when they are already in touch with the job market. Less developed regions generally have a lengthy social background and history in specific industrial fields, as in Łódzkie (Poland). The presence of universities in this city as a producer of skilled labour and a source of knowledge and technology can support the region to apply Smart Specialisation. It is important to identify whether the knowledge outputs generated by university research and public research institutions match the needs of industry in the region. This identification must be supported by recognising the entrepreneur/industry who would later be involved in the Smart Specialisation process. The reciprocal relationship between universities and industry will ultimately increase the productivity and growth of the region. This bond needs to be maintained so that it is not just a short-term relationship. Both actors must formulate this relationship so that it lasts in the long term.

Second, public sector investment support for research and development must receive an appropriate portion. Smart Specialisation leverages the diffusion of key technologies to initiate the EDP process. For this reason, R&D investment support

in less innovative regions must be appropriately proportioned. Education is still the dominant goal in less developed regions instead of increasing investment in R&D. This is a challenge in itself, i.e., how policymakers find solutions to this problem. At the same time, the region also wants to continue encouraging the economic structure's transformation through Smart Specialisation.

Third, there is the strength of the bond between the three main actors in the Triple Helix. Many findings prove the weak support and ties of actors in the Triple Helix in less developed regions, especially in Central and Eastern Europe and some parts of Southern Europe. Although it is not easy to realise the Triple Helix in these regions, the three actors' common perception and alignment of goals can support and form a strong bond. The government as a policymaker can take a central position or tend to be neutral between universities and industry. Instead of over-intervention, the government may be able to take a more persuasive approach to increase interest and encourage more solid cooperation between the Triple Helix entities, e.g., by creating a more harmonious and dynamic collaboration and communication environment, managing appropriate public spending on Entrepreneurial Discovery Processes (EDP) for Smart Specialisation in regions with less-developed R&D and innovation ecosystems, and offering special incentives to encourage their interest and increase their productivity.

This paper has limitations that I could not have avoided. Articles discussing universities and Smart Specialisations are not widely available. Although I found more than 50 articles that discussed this issue in Web of Science or Scopus, I wanted to focus on articles published in leading journals instead of proceeding papers. In addition, the relatively narrow topic of Smart Specialisation has limited this paper to discuss more broadly the university role in regional development in general. Therefore, formulating a better methodology to conduct a systematic review of the university, regional development, and Smart Specialisation opens great opportunities for next papers to provide a better research impact.

Acknowledgements. The author gratefully acknowledges support provided by POLISS (<https://poliss.eu>) funded project under European Union's H2020 Research and Innovation Programme, Grant Agreement No. 860887. The author also thanks the two anonymous reviewers for their constructive criticism and suggestions.

Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

REFERENCES

- ASHEIM, B. (2012), 'The changing role of learning regions in the globalizing knowledge economy: A theoretical re-examination', *Regional Studies*, 46 (8), pp. 993–1004. <https://doi.org/10.1080/00343404.2011.607805>

- ASHEIM, B., GRILLITSCH, M. and TRIPPL, M. (2017), 'Smart Specialization as an Innovation-Driven Strategy for Economic Diversification: Examples From Scandinavian Regions', *Advances in the Theory and Practice of Smart Specialization*. <https://doi.org/10.1016/b978-0-12-804137-6.00004-8>
- ASHEIM, B. T. (2019), 'Smart specialisation, innovation policy and regional innovation systems: what about new path development in less innovative regions?', *Innovation: The European Journal of Social Science Research*, 32 (1), pp. 8–25. <https://doi.org/10.1080/13511610.2018.1491001>
- BARZOTTO, M., CORRADINI, C., FAI, F. M., LABORY, S. and TOMLINSON, P. R. (2019), *Enhancing innovative capabilities in lagging regions: An extra-regional collaborative approach to RIS3*. <https://doi.org/10.1093/cjres/rsz003>
- BENNEWORTH, P., COENEN, L., MOODYSSON, J. and ASHEIM, B. (2009), 'Exploring the multiple roles of Lund University in strengthening Scania's regional innovation system: towards institutional learning?', *European Planning Studies*, 17 (11), pp. 1645–1664. <https://doi.org/10.1080/09654310903230582>
- BODAS-FREITAS, I. M., ROSSI, F. and GEUNA, A. (2014), 'Collaboration objectives and the location of the university partner: Evidence from the Piedmont region in Italy', *Papers in Regional Science*, 93, S203–S226. <https://doi.org/10.1111/pirs.12054>
- BONACCORSI, A. (2009), 'Towards better use of conditionality in policies for research and innovation under Structural Funds. The intelligent policy challenge', *Barca 'An Agenda for a Reformed Cohesion Policy*.
- BOUCHER, G., CONWAY, C. and VAN DER MEER, E. (2003), 'Tiers of engagement by universities in their region's development', *Regional Studies*, 37 (9), pp. 887–897. <https://doi.org/10.1080/0034340032000143896>
- CAMAGNI, R. and CAPELLO, R. (2017), 'Regional innovation patterns and the EU regional policy reform: towards smart innovation policies', *Seminal studies in regional and urban economics*, Cham: Springer, pp. 313–343. https://doi.org/10.1007/978-3-319-57807-1_16
- CAPELLO, R. (2013), *Knowledge, Innovation, and Regional Performance: Territorial Patterns of Innovation in Europe*. <https://doi.org/10.4324/9780203085660>
- 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), pp. 52–72. <https://doi.org/10.1177/0263774X15614655>
- CAPELLO, R. and LENZI, C. (2019), 'Structural dynamics of regional innovation patterns in Europe: the role of inventors' mobility', *Regional Studies*. <https://www.tandfonline.com/doi/abs/10.1080/00343404.2017.1379600>
- COHEN, W. M. and LEVINTHAL, D. A. (1990), 'Absorptive capacity: A new perspective on learning and innovation', *Administrative Science Quarterly*, pp. 128–152. <https://doi.org/10.2307/2393553>
- ETZKOWITZ, H. (2003), 'Innovation in innovation: The triple helix of university-industry-government relations', *Social Science Information*, 42 (3), pp. 293–337. <https://doi.org/10.1177/05390184030423002>
- FORAY, D. (2016), 'On the policy space of smart specialization strategies', *European Planning Studies*. <https://doi.org/10.1080/09654313.2016.1176126>
- FORAY, D. (2017), 'The economic fundamentals of smart specialization strategies', [in:] *Advances in the theory and practice of smart specialization*, Academic Press, pp. 37–50. <https://doi.org/10.1016/B978-0-12-804137-6.00002-4>
- FORAY, D. (2018), 'Smart specialisation strategies and industrial modernisation in European regions – theory and practice', *Cambridge Journal of Economics*. <https://doi.org/10.1093/cje/bey022>
- FORAY, D. (2019), 'In response to 'Six critical questions about smart specialisation'', *European Planning Studies*, 27 (10), pp. 2066–2078. <https://doi.org/10.1080/09654313.2019.1664037>
- FORAY, D., DAVID, P. A. and HALL, B. (2009), 'Smart Specialisation – The Concept', *Knowledge economists policy brief*, 9 (85), p. 100.

- FORAY, D., GODDARD, J., BELDARRAIN, X. G., LANDABASO, M., MCCANN, P., MORGAN, K., NAUWELAERS, C. and ORTEGA-ARGILÉS, R. (2012), *Guide to Research and Innovation Strategies for Smart Specialization (RIS3)*, Issue March 2012. <https://doi.org/10.2776/65746>
- FORAY, D., MCCANN, P. and ORTEGA-ARGILÉS, R. (2015), 'Smart specialization and European regional development policy', *Oxford handbook of local competitiveness*, pp. 458–480.
- FOTAKIS, C., ROSENMÖLLER, M., BRENNAN, J., MATEI, L., NIKOLOV, R., PETIOT, C. and PUUKKA, J. (2014), 'The role of Universities and Research Organisations as drivers for Smart Specialisation at regional level', *EU Directorate-General for Research and Innovation*.
- GOLDSTEIN, H. A. and GLASER, K. (2012), 'Research universities as actors in the governance of local and regional development', *The Journal of Technology Transfer*, 37 (2), pp. 158–174. <https://doi.org/10.1007/s10961-010-9193-4>
- GONZÁLEZ-LÓPEZ, M., DILEO, I. and LOSURDO, F. (2015), *University-industry collaboration in the European regional context: The cases of Galicia and Apulia Region*. <https://doi.org/10.2139/ssrn.2578691>
- GRILLITSCH, M. (2016), 'Institutions, smart specialisation dynamics and policy', *Environment and Planning C: Government and Policy*, 34 (1), pp. 22–37. <https://doi.org/10.1177/0263774X15614694>
- GUNASEKARA, C. (2006), 'Reframing the role of universities in the development of regional innovation systems', *The Journal of Technology Transfer*, 31 (1), pp. 101–113. <https://doi.org/10.1007/s10961-005-5016-4>
- HASHI, I. and STOJČIĆ, N. (2013), 'The impact of innovation activities on firm performance using a multi-stage model: Evidence from the Community Innovation Survey 4', *Research Policy*. <https://doi.org/10.1016/j.respol.2012.09.011>
- HASSINK, R. and GONG, H. (2019), 'Six critical questions about smart specialization', *European Planning Studies*. <https://doi.org/10.1080/09654313.2019.1650898>
- HUGGINS, R. and JOHNSTON, A. (2009), 'The economic and innovation contribution of universities: a regional perspective', *Environment and Planning C: Government and Policy*, 27 (6), pp. 1088–1106. <https://doi.org/10.1068/c08125b>
- 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), pp. 1993–2008. <https://doi.org/10.1080/09654313.2010.516523>
- KEMPTON, L. (2015), 'Delivering smart specialization in peripheral regions: the role of Universities', *Regional Studies, Regional Science*. <https://doi.org/10.1080/21681376.2015.1085329>
- KEMPTON, L., GODDARD, J., EDWARDS, J., HEGYI, F. B. and ELENA-PÉREZ, S. (2013), 'Universities and smart specialisation', *S3 Policy Brief Series*, 3.
- LANDABASO, M. (1997), 'The promotion of innovation in regional policy: proposals for a regional innovation strategy', *Entrepreneurship and Regional Development*, 9 (1), pp. 1–24. <https://doi.org/10.1080/08985629700000001>
- LAWSON, T. (2003), 'Institutionalism: on the need to firm up notions of social structure and the human subject', *Journal of Economic Issues*, 37 (1), pp. 175–207. <https://doi.org/10.1080/00213624.2003.11506562>
- LAWTON SMITH, H., SHARMISTHA BAGCHI-SEN, S. and EDMUNDS, L. (2017), 'Innovation cycles and geographies of innovation: a study of healthcare innovation in Europe', *European Urban and Regional Studies*, 25 (4), pp. 405–422. <https://doi.org/10.1177/0969776417716220>
- LILLES, A., RÕIGAS, K. and VARBLANE, U. (2020), 'Comparative View of the EU Regions by Their Potential of University-Industry Cooperation', *Journal of the Knowledge Economy*, 11 (1), pp. 174–192. <https://doi.org/10.1007/s13132-018-0533-1>
- MCCANN, P. and ORTEGA-ARGILÉS, R. (2016), 'The early experience of smart specialization implementation in EU cohesion policy', *European Planning Studies*. <https://doi.org/10.1080/09654313.2016.1166177>

- MORGAN, K. and NAUWELAERS, C. (1999), *Regional innovation strategies: The challenge for less favoured regions*, 25, Psychology Press.
- MULLER, E., DOLOREUX, D., HERAUD, J., JAPPE, A. and ZENKER, A. (2008), 'Regional innovation capacities in new member states: A typology', *European Integration*, 30 (5), pp. 653–669. <https://doi.org/10.1080/07036330802439624>
- MUSCIO, A., REID, A. and LEON, L. R. (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), pp. 153–171. <https://doi.org/10.1080/17487870.2015.1013545>
- NAVARRO, M., GIBAJA, J. J., 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), pp. 815–840. <https://doi.org/10.1068/c0884r>
- OUGHTON, C., LANDABASO, M. and MORGAN, K. (2002), 'The regional innovation paradox: innovation policy and industrial policy', *The Journal of Technology Transfer*, 27 (1), pp. 97–110. <https://doi.org/10.1023/A:1013104805703>
- PAPAMICHAIL, G. (2019), *Implementation challenge of smart specialisation innovation strategies in catch-up regions: the role of institutions, governance and capacity building*. era.ed.ac.uk. <https://era.ed.ac.uk/handle/1842/35616>
- PAPAMICHAIL, G., ROSIELLO, A. and WIELD, D. (2019), 'Capacity-building barriers to S3 implementation: an empirical framework for catch-up regions', *Innovation: The European Journal of Social Science Research*, 32 (1), pp. 66–84. <https://doi.org/10.1080/13511610.2018.1537844>
- PAVLOVA, I. and BURENINA, M. (2016), 'University-industry cooperation in the context of the regional innovation system in Russia: A case of the Tomsk region', *Journal of Eastern Europe Research in Business and Economics*. <https://doi.org/10.5171/2016.623415>
- 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 (3–4), pp. 277–320. [https://doi.org/10.1016/S0954-349X\(99\)00016-8](https://doi.org/10.1016/S0954-349X(99)00016-8)
- RADOSEVIC, S. (2017), 'Assessing EU smart specialization policy in a comparative perspective', [in:] *Advances in the theory and practice of smart specialization*, pp. 1–36, Academic Press. <https://doi.org/10.1016/B978-0-12-804137-6.00001-2>
- RODRIGUES, C., DA ROSA PIRES, A. and DE CASTRO, E. (2001), 'Innovative universities and regional institutional capacity building: The case of Aveiro, Portugal', *Industry and Higher Education*, 15 (4), pp. 251–255. <https://doi.org/10.5367/000000001101295740>
- SEPPO, M., RÖIGAS, K. and VARBLANE, U. (2014), 'Governmental support measures for university – industry cooperation – Comparative view in Europe', *Journal of the Knowledge Economy*, 5 (2), pp. 388–408. <https://doi.org/10.1007/s13132-014-0193-8>
- SMITH, L. H., BAGCHI-SEN, S. and EDMUNDS, L. (2018), 'Innovation cycles and geographies of innovation: a study of healthcare innovation in Europe', *European Urban and Regional Studies*, 25 (4), pp. 405–422. <https://doi.org/10.1177/0969776417716220>
- 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', *Regional Economies as Knowledge Laboratories*, pp. 1–19.
- 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), pp. 189–217. <https://doi.org/10.1007/s11024-010-9149-8>
- VALLANCE, P., BLAŽEK, J., EDWARDS, J. and KVĚTOŇ, V. (2018), 'Smart specialisation in regions with less-developed research and innovation systems: A changing role for universities?', *Environment and Planning C: Politics and Space*, 36 (2), pp. 219–238. <https://doi.org/10.1177/2399654417705137>