Editorial

Luís Farinha*

Instituto Politécnico de Castelo Branco,
Largo do Município, 6060-163 Idanha-a-Nova, Portugal
and
NECE Research Unit in Business Sciences,
Estrada do Sineiro, 6201-209 Covilhã, Portugal
Email: luis.farinha@ipcb.pt
*Corresponding author

João Ricardo Faria

Florida Atlantic University,
777 Glades Road, Boca Raton, FL 33431, USA
Email: jfaria@fau.edu

João J. Ferreira

NECE Research Unit in Business Sciences,
Estrada do Sineiro, 6201-209 Covilhã, Portugal
and
Departamento de Gestão e Economia,
Faculdade de Ciências Sociais e Humanas,
Universidade da Beira Interior,
Estrada do Sineiro, 6201-209 Covilhã, Portugal
Email: jjmf@ubi.pt

Biographical notes: Luís Farinha is an Adjunct Professor at the Polytechnic Institute of Castelo Branco, and Auxiliar Professor and an Associate Researcher at the University of Beira Interior (UBI-NECE), in Portugal. His research on entrepreneurship has been presented at numerous international conferences and published in high-quality international journals. His research interests include entrepreneurial economics, economic geography and business economics. He is the Founder and Dean of the *Regional Helix – International Conference*. He is the editor of two books and author of several journal articles and book chapters. It is also linked to innovation and entrepreneurship programs in cooperation with business incubators and national business associations and sectoral clusters. Previously he was a manager in companies with businesses in the international market.

João Ricardo Faria holds a PhD in Economics from University of Kent in 1998. His research and instructional areas are macroeconomics; entrepreneurship; economics of education; economics of conflict and terrorism. He published over 125 journal articles in international journals. He is a member of the editorial board of several journals and referee for the National Science Foundation, British Academy, Social Sciences and Humanities Research Council of Canada, Israel Science Foundation and Czech Science Foundation.

He was a Visiting Professor at Technical University of Lisbon, Universite Paris XIII, University of Alberta, and University of York. Besides his academic research, he has worked as consultant for the World Bank and European Central Bank.

João J. Ferreira is an Associate Professor at the University of Beira Interior (UBI), Portugal. He holds a PhD in Entrepreneurship and Small Business Management from the Autonomous University of Barcelona (UAB), Spain. Currently, he is the scientific coordinator of the UBI Research Unit for Business Sciences (NECE), Portugal. He has published over 200 papers in premier international journals, and edited or co-edited several books on innovation and entrepreneurship. His research interests include strategy, competitiveness and entrepreneurship.

1 Introduction

The innovation literature explores how diverse actors and institutions promote and spread innovation. Over the last decades social scientists and policy makers have been paying more and more attention to regions as designated sites of innovation and competitiveness in the globalised economy (Asheim and Coenen, 2005). According to Etzkowitz and Leydesdorff (2000) the national organisation of the system of innovation has historically been important in determining competition. Jiao et al. (2016) argue which when the interaction between local producers and users of knowledge becomes increasingly active, R&D investment from firms, universities and research institutes has a stronger effect on the building of regional innovation systems. Active interactions in R&D networks of the triple helix (TH) institutional actors can arguably improve the innovative capabilities of countries (Lee and Kim, 2016).

This TH model emerged from a workshop on Evolutionary Economics and Chaos Theory: New Directions in Technology Studies (Leydesdorff and Meyer, 2006). In terms of the collaboration between institutional stakeholders in an economy, the TH metaphor of university–industry–government interactions (Etzkowitz and Leydesdorff, 2000, 1995; Leydesdorff and Etzkowitz, 1996, 1998) quickly spread among academics and policy makers for their important contribution to national and regional innovation systems. The TH model assumes that relations between academia (universities and other public research organisations), industry and government (local, regional, national and supranational) are key to fostering innovation and regional competitiveness in the current context of the knowledge economy (Leydesdorff, 2000).

The TH metaphor more or less invites proposals to extend the model to more than three helices (Björk, 2014; Carayannis et al., 2012; MacGregor et al., 2010; Peris-Ortiz et al., 2016a, 2016b). In many remote, rural and less-favoured regions, there may not be a university or other knowledge-intensive institution present which makes a difference in terms of local development agendas. In the same sense, the business fabric also may be dispersed and bear fragile capacity for innovation. In this alignment the public sector itself may not have this ability to improve innovation. In these cases, it is assumed that social groups and the community can also play an important role in the entrepreneurial context and in particular on the social entrepreneurship field (Kolehmainen et al., 2016; Lawton Smith and Bagchi-Sen, 2012). According to Leydesdorff (2012), the TH model

can be extended algorithmically, for example, with local-global as a fourth dimension or, more generally, to an N-tuple of helices. Carayannis and Campbell (2009, 2010) have named the fourth helix as media-based and culture-based public and civil society. This is the understanding that additional perspectives must be added to comprehend open innovation (OI) in the unfolding 21st century (Park, 2014).

The model of 'OIs' (Chesbrough, 2003) can be compared with the TH model as it attempts to bring industrial innovation closer to public R&D (Leydesdorff and Ivanova, 2016). The TH and 'multiple helices' case studies inform us about the best collaborative practices we can find in science and economics, which may result in science and innovation outputs, wealth and jobs creation, all based on the emergence of new collaborative business models and new market scales possibilities (Farinha et al., 2016; Lee and Kim, 2016; Leydesdorff et al., 2014; Peris-Ortiz et al., 2016a, 2016b; Reis et al., 2014). Virkkala et al. (2017) present a connectivity model as a potential tool for smart specialisation strategies based on the TH dynamics. This model applied to the regional innovation systems gives us new clues about how the TH model can contribute to the entrepreneurial discovery process (EDP). The TH actors are expected to be at the forefront of the EDP and they should work according to the regions' smart specialisation strategies. Leydesdorff et al. (2014) argue that it is now important to find a routine to measure the synergy in triple-helix and quadruple-helix relationships.

The relations between the TH indicator as an indicator of synergy and the TH model that specifies the possibility of feedback by an overlap of communications are also discussed. According to Pugh (2016), universities, and the knowledge they hold, are increasingly seen as stimulants for regional economic development and are at the heart of strategies to leverage the knowledge-based economy. However, in lagging regions the reading of the dynamics of TH and its relationship with economic growth is not always so linear. In another reading, Guerrero and Urbano (2017) argue that TH has been operationalised in different ways, spaces, and contexts where those agents are transforming their roles in the development and strengthening of national innovation and entrepreneurial ecosystems. In the last decades, several studies have confirmed the contribution of TH interactions to economic growth, through the dynamics of innovation and entrepreneurship (Farinha et al., 2016, 2014; Guerrero et al., 2016; Leydesdorff and Meyer, 2006).

Thus, in the relationships of TH and sustainable economic growth, reviewing the past (Etzkowitz et al., 2000; Leydesdorff and Etzkowitz, 1996, 1998), we will better understand the present (Chen et al., 2016; Guerrero et al., 2016; Lee and Kim, 2016), and we will have a new vision for the future (Peris-Ortiz et al., 2016b; Virkkala et al., 2017; Yoon and Park, 2017).

This special issue focuses on providing a more integrated theory and development policy based on the TH dynamics for innovation and their contribution to the regional growth.

All articles were original empirical articles that aim to close the gap between the TH dynamics and regional growth literature. It is the increasing debate around the topic of how the TH interactions can contribute to economic growth and the regional development.

The collection of articles covers a wide range of aspects related to knowledge management, smart specialisation, academic spin-offs and start-ups, sectoral and regional clusters, entrepreneurship and innovation.

How can TH dynamics contribute to the regional growth and what are the dynamics between the academia, industry, government and civil society that should be prioritised to make the territories smarter and competitive remains a key drive for future research that articles in this special issue address. This special issue attracted articles from different countries highlighting the universal interest in these research themes. In this introduction article, we provide focused sum-ups of the articles in the special issue and highlight how each study contributes to the literature. We hope this special issue will encourage researchers to develop new research in this field, including the development of new opportunities for cooperation and sharing of successful case studies.

2 Overview of articles

The first article titled 'Towards combining the triple helix concept with competence-based approach of educational management theory' aims to find ways to correlate the concept of the TH of university-industry-government relationships with competence-based approach of university management theory. The rapid deployment of innovative processes in the regional context has led to the emergence of new business models of universities, based on the 'TH' model, combining universities, business and government with the semi-autonomous centres that interact with the environment (Etzkowitz and Leydesdorff, 2000). More recently, the 'TH' model was complemented by a civil society and public institutions (Carayannis and Campbell, 2009), ecological institutions (Carayannis and Campbell, 2010), or integrating the perspectives of regional innovative systems (Lazzeroni and Piccaluga, 2015). The methodological framework is supported on several theoretical provisions, which integration allowed to substantiate the concept of improving mechanisms of master students' research competencies formation in universities. According to the authors, research results are of interest to the regional development authorities, being able incorporated into management practices, assisting to improve the efficiency and competitiveness of regional innovation systems.

The second article titled 'Analysis of the researcher's motivators to collaborate with firms as drivers of the triple helix dynamics' argues that science commercialisation contributes in some extent to determine the innovation capacity of industries of a country. In addition, the process of research transfer from universities to firms has economic, political and cultural implications. Also explains that in the context of the academy-industry-government links (TH approach), the innovation rate of a country requires the interaction of agents involved in the knowledge generation, innovation commercialisation and innovation-incentivising policies (Etzkowitz and Leydesdorff, 2000; Leydesdorff and Meyer, 2006). More specifically, the networked management is especially relevant to let the three 'helices' converge to support innovation and entrepreneurship in the context of regional competitiveness (Farinha and Ferreira, 2012; Farinha et al., 2016). In addition, from a dynamic approach, quadruple and quintuple helix models (Carayannis and Campbell, 2006, 2009, 2010) bring to us the inclusion of the civil society sphere and the perspective of the natural environments of society and the economy for the knowledge production and innovation systems. Based on a conceptual framework that relates the agency theory with other variables that literature considers as motivators of the researchers and firms to collaborate, this study used a sample of 420 research groups of eight regions of Spain, France and Portugal.

The third article titled 'Innovation centres as anchor spaces of the 'knowledge city'' explores the role of innovation centres and investigates their contribution in the making of the knowledge city. In the last two decades, new collaborative spaces, such as hacker spaces, makerspaces, Living Labs, Fab Labs, and co-working spaces, have emerged as a result of knowledge and collaborative economy (Botsman and Rogers, 2011; Capdevila, 2015). The research methodology uses a multiple case study in which three cases were selected: Barcelona Growth Centre in Barcelona (Spain), Ruta N in Medellin (Colombia), and Station F in Paris (France). This study finds that innovation centres are initiatives that participate in the making of the knowledge city.

In the fourth article titled 'National, regional or industrial explanation for firms' deaths in the European Union since 2010 until 2014 – a shift-share application', it is mentioned that business demography is one of the many possible applications of the whole demography concept. In this framework, are studied the births, deaths and evolution of firms (Van Dijk and Pellenbarg, 2000), as well as firms' age, change in size, growth and decline, mergers and spin-offs (Van Wissen, 2002; Van Dijk and Pellenbarg, 2000). This article analyses the factors that may drive business closure in European Union countries between 2010 and 2014. Was applied a shift-share decomposition analysis of business closure will be applied. The results proved that regional component had the highest impact on firms' deaths during the investigated period for almost all countries included in the analysis.

The fifth article titled 'University spin-offs and triple helix dynamics in regional innovation ecosystems: a comparison of technology intensive start-ups in Sweden' aims to explain how university spin-offs contribute to TH dynamics and the evolutionary processes of industrial renewal in regional innovation ecosystems. Recent research recognises the role of technology-intensive initiatives as engines of economic growth and their significant contribution to industrial renewal, economic restructuring, and local economic development (Kirchhoff, 1994; Delmar and Wennberg, 2010). In methodological terms, the authors analysed three groups of technology-intensive start-ups: university spin-offs, corporate spin-offs, and technology-independent start-ups. A questionnaire survey was applied to 341 young companies operating in two technology-intensive sectors in Sweden. The results suggest that university spin-offs differ from the other two groups in relation to their contribution to triple-helix dynamics in regional innovation ecosystems. University spin-offs cooperate more closely with universities, conduct more in-house R&D, purchase more R&D services, and offer more innovative products and services in the introduction stage of their industry life cycles.

Over the years, the importance of developing regional innovation systems to generate competitiveness and economic growth has gained considerable attention, especially in the context of the TH relationships (Etzkowitz and Leydesdorff, 1995). In this assumption, innovation clusters are increasingly seen as agents of change capable of positively influencing the regions' competitiveness (Porter, 1990). In the sixth article titled 'The new triple-helix policy of Lombardy region: evidence from nine innovation clusters', authors collected data according to an embedded comparative case study research design on Lombardy region, where the regional government promoted a triple-helix inspired policy of implementing nine innovation clusters. Their findings have both conceptual and policy implications regarding triple-helix, clusters and regional innovation systems.

The seventh article titled 'Effectiveness of regional biotechnology clusters to support innovation activities: case of biotech cluster in Russia' presents an exploratory study that

intends to evaluate the level of development of support infrastructure in regional biotechnology clusters in Russian Federation. This study is based on a case-study design involved a semi-structured survey of 54 participants of a Russian biotechnology cluster is revealed an immature nature of support infrastructure that inhibits innovation in biotechnology companies, being presented a conceptual framework of organisation of the regional biotech cluster under conditions of serious market failure in the support infrastructure.

In the knowledge economy, innovation serves as the engine of growth and competition among regions are increasing more and more due to their ability to create, acquire and valorise knowledge (Cooke and Leydesdorff, 2006). Building on the evidence on emerging competitiveness gaps in the Global Innovation Index analysis, the eighth article titled 'Supporting the regional development in the knowledge economy: the adoption of a system dynamic approach in Ghana' discusses the huge disconnects among the key players in Ghana's innovation ecosystem. Using a recognised modelling tool (Vensim), in the context of TH interactions, the study aims to explore the impact of interactions between academy (university) and industry (market), highlighting areas of causality, relationships and addictions.

India has been identified as one of the potential sources of tech start-ups in the global economy (Gai and Joffe, 2013). The ninth article titled 'Role of the triple helix in the ecosystems for tech start-ups in India: a gap analysis' aims to ascertain the gap between an ideal ecosystem and the prevailing ecosystems and its causal factors, based on four-stage interactions with ecosystem stakeholders (by means of Delphi technique application) in Bangalore and Hyderabad, in India. In methodological terms, the gap analysis is done by means of a hierarchical regression model for five different sets of components of the ecosystem structure:

1 TH comprising government, industry and academia

2 a nucleus consisting of tech start-ups and prospective tech start-ups

3 five indispensable components, i.e., finance, market, human resources, support system and mentors

4 three supplementary components, i.e., culture, media and weather

5 level of interactions between the various components, apart from a control (dummy) variable to distinguish Bangalore from Hyderabad.

The results brought out the fundamental but inadequate role of the TH followed by tech start-ups, five indispensable components, three supplementary components, and the level of interactions as the factors contributing to the overall gap prevailing in the two start-up hubs.

The tenth article titled 'New and growing firms' entrepreneurs' perceptions and their discriminant power in EDL countries' intents to analyse the entrepreneur's perceptions about the conditions to create new and growing companies and respective significance to the level of the countries' economic development. According to Reynolds et al. (2005) the Global Entrepreneurship Monitor (GEM) is a research program that focuses on a major driver of economic growth: the entrepreneurship. GEM is a large-scale database for internationally comparative entrepreneurship that includes information on many aspects of entrepreneurship activities, perceptions, conditions, national and regional policy, among others, of a large number of countries (Correia et al., 2016). In addition,

the GEM has always sought to explore the widely accepted link between entrepreneurship and economic development (Carree and Thurik, 2003; Acs, 2006; Audretsch, 2007). The study concludes that there is statistical evidence that the levels of economic development are distinguished by the perceptions of entrepreneurs about new and growing companies.

The 11th article titled 'Agricultural entrepreneurship and the financial crisis' aims to analyse the changes on the profile of the European agricultural entrepreneurs after the recent financial crisis, that began in 2008, given the impact of the crisis on European economic activity and the lack of studies on agricultural entrepreneurship. The agricultural sector is nowadays confronted with rapid changes and new challenges that have emerged both on the demand side and on the supply side (Gellynck et al., 2015). Entrepreneurship research has ignored the agricultural sector, focusing mainly on the manufacture, high technology and services sectors. This gap is partly justified by the exclusion of the agricultural sector from many public and private databases, which makes it difficult for researchers who want to analyse this sector (Alsos et al., 2011). Using individual-level data from the total early-stage entrepreneurial activity for the European agricultural sector in 2007 (before the crisis) and 2012 (after the crisis), taken from the GEM, the authors investigate if after the crisis changes the role of motive, demographic and economic factors (gender, age, education, household income), perceived characteristics (opportunity perception, self-confidence, fear of failure, meeting other entrepreneurs) and innovativeness (clients, technology, competition). This article includes 22 European countries and the results allow us to conclude that the role of these variables is changed by the crisis, except for the role of gender, to meet other entrepreneurs, customers and competition, which may reflect specific characteristics of the agricultural sector.

The 12th article titled 'Strategies and obstacles for marketing innovation activities' is focused on the importance of innovation and its role in the competitiveness of firms, intending to explore the particular case of marketing innovation. Innovation plays a key role in the competitiveness of firms, and marketing innovation is, by no means, an exception (Hasan, 2017; Dinis, 2006; Gupta et al., 2016). Based on a sample of 6,840 Portuguese firms, multivariate techniques (factor analysis and multivariate linear regression) have been used to measure the factors associated with main strategies and obstacles of marketing innovation, to better understand the role of marketing in firms' innovation processes. The results of the study suggest that most Portuguese firms display a limited marketing innovation strategy, with some focus on innovation in design or packaging, product promotion, placement and pricing.

3 Conclusions

In last decades there has been an increased interest in understanding entrepreneurship practices in a regional development context, underlining the importance of regional innovation systems, including here the dynamics of the TH metaphor (Cooke and Leydesdorff, 2006). Entrepreneurial embeddedness is an important part of regional development as it helps to address the creative ways local and regional resources are used to build external and local ties amongst economic agents in an innovation system (Farinha et al., 2018).

We have discussed the role of the TH interactions in regional innovation systems, underlying the role of entrepreneurial initiatives and the sectoral clusters contributions to economic growth.

We discussed the main findings of the 12 articles and provided an agenda for future research. Overall, this special issue suggests that TH dynamics in regional context provide a useful way to understand economic growth. We hope that our special issue inspires future research to continue to look at TH dynamics and innovative and entrepreneurial perspective, especially at the regional level, to yield new insights.

References

Acs, Z. (2006) 'How is entrepreneurship good for economic growth?', *Innovations*, Vol. 1, No. 1, pp.97–107.

Alsos, G.A. et al. (2011) 'Entrepreneurship capital and economic growth', *Oxford Review of Economic Policy*, Vol. 23, No. 1, pp.63–78.

Asheim, B.T. and Coenen, L. (2005) 'Knowledge bases and regional innovation systems: comparing Nordic clusters', *Research Policy*, Vol. 34, No. 8, pp.1173–1190 [online] http://doi.org/10.1016/j.respol.2005.03.013.

Audretsch, D.B. (2007) 'Entrepreneurship capital and economic growth', *Oxford Review of Economic Policy*, Vol. 23, No. 1, pp.63–78.

Björk, P. (2014) 'The DNA of tourism service innovation: a quadruple helix approach', *Journal of the Knowledge Economy*, Vol. 5, No. 1, pp.181–202 [online] http://doi.org/10.1007/s13132-014-0183-x.

Botsman, R. and Rogers, R. (2011) *What's Mine Is Yours: How Collaborative Consumption Is Changing the Way We Live*, Collins, London.

Capdevila, I. (2015) 'Co-working spaces and the localized dynamics of innovation in Barcelona', *International Journal of Innovation Management*, Vol. 19, No. 3 [online] https://doi.org/10.1142/S1363919615400046.

Carayannis, E.G. and Campbell, D. (2010) 'Triple helix, quadruple helix and quintuple helix and how do knowledge, innovation and the environment relate to each other? A proposed framework for a transdisciplinary analysis of sustainable development and social ecology', *International Journal of Social Ecology and Sustainable Development*, Vol. 1, No. 1, pp.41–69.

Carayannis, E.G. and Campbell, D.F.J. (2006) 'Mode 3: meaning and implications from a knowledge systems perspective', in *Knowledge Creation, Diffusion, and Use in Innovation Networks and Knowledge Clusters*, pp.1–25, Praeger, Westport, CN.

Carayannis, E.G. and Campbell, D.F.J. (2009) ''BMode 3' and 'quadruple helix': toward a 21st century fractal innovation ecosystem', *International Journal of Technology Management*, Vol. 46, Nos. 3/4, pp.201–234.

Carayannis, E.G., Barth, T.D. and Campbell, D.F. (2012) 'The quintuple helix innovation model: global warming as a challenge and driver for innovation', *Journal of Innovation and Entrepreneurship*, Vol. 1, No. 1, p.2 [online] http://doi.org/10.1186/2192-5372-1-2.

Carree, M.A. and Thurik, R. (2003) 'The impact of entrepreneurship on economic growth', Acs, Z.J. and Audretsch, D.B. (Eds.): *International Handbook of Entrepreneurship Research*, pp.437–471, Kluwer – Academic Publishers, Boston/Dordrecht.

Chen, F., Wu, C. and Yang, W. (2016) 'A new approach for the cooperation between academia and industry: an empirical analysis of the triple helix in East China', *Science Technology & Society*, Vol. 21, No. 2, pp.181–204 [online] https://doi.org/10.1177/0971721816640617.

Chesbrough, H.W. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, Boston.

Cooke, P. and Leydesdorff, L. (2006) 'Regional development in the knowledge-based economy: the construction of advantages', *Journal of Technology Transfer*, Vol. 31, No. 1, pp.5–15.

Correia, A., Costa e Silva, E., Lopes, I.C. and Braga, A. (2016) 'MANOVA for distinguishing experts' perceptions about entrepreneurship using NES data from GEM', *AIP Conference Proceedings*, AIP Publishing, p.140002.

Delmar, F. and Wennberg, K. (2010) *Knowledge Intensive Entrepreneurship – The Birth, Growth and Demise of Entrepreneurial Firms*, Edward Elgar Publishing, Cheltenham.

Dinis, A. (2006) 'Marketing and innovation: useful tools for competitiveness in rural and peripheral areas', *European Planning Studies*, Vol. 14, No. 1, pp.9–22.

Etzkowitz H. and Leydesdorff L. (1995) 'The triple helix – university–industry–government relations: a laboratory for knowledge-based economic development', *EASST Review*, Vol. 14, No. 1, pp.14–19.

Etzkowitz, H. and Leydesdorff, L. (2000) 'The dynamics of innovation: from National Systems and 'mode 2' to a triple helix of university – industry – government relations', *Science and Technology*, Vol. 29, pp.109–123.

Etzkowitz, H., Webster, A., Gebhardt, C. and Terra, B.R.C. (2000) 'The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm', *Research Policy*, Vol. 29, No. 2, pp.313–330 [online] https://doi.org/http://dx.doi.org/10.1016/S0048-7333(99)00069-4.

Farinha, L. and Ferreira, J. (2012) 'Triangulation of the triple helix: a conceptual framework for regional competitiveness focused on innovation and local entrepeneurship', in *Triple Helix 10th International Conference 2012, Emerging Triple Helix Models for Developing Countries*, Penerbit ITB, Bandung, Indonesia, pp.487–501.

Farinha, L., Ferreira, J. and Gouveia, B. (2016) 'Networks of innovation and competitiveness: a triple helix case study', *Journal of the Knowledge Economy*, Vol. 7, No. 1, pp.259–275 [online] http://doi.org/10.1007/s13132-014-0218-3.

Farinha, L., Ferreira, J. and Ratten, V. (2018) 'Regional innovation systems and entrepreneurial embeddedness', *European Planning Studies*, Vol. 26, No. 11, pp.2105–2113 [online] https://doi.org/10.1080/09654313.2018.1530146.

Farinha, L., Ferreira, J.J. and Gouveia, J.B. (2014) 'Innovation and competitiveness: a high-tech cluster approach', *Romanian Review Precision Mechanics, Optics & Mechatronics*, Vol. 45, No. 1, pp.41–48.

Gai, B. and Joffe, B. (2013) *India Start-up Report*, World Start-up Report [online] http://www.worldstartpreport.com (accessed 18 October 2018).

Gellynck, X. et al. (2015) 'Association between innovative entrepreneurial orientation, absorptive capacity, and farm business performance', *Agribusiness*, Vol. 31, No. 1, pp.91–106.

Guerrero, M. and Urbano, D. (2017) 'The impact of triple helix agents on entrepreneurial innovations' performance: an inside look at enterprises located in an emerging economy', *Technological Forecasting and Social Change*, Vol. 119, pp.294–309 [online] https://doi.org/10.1016/j.techfore.2016.06.015.

Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M. and Mian, S. (2016) 'Entrepreneurial universities: emerging models in the new social and economic landscape', *Small Business Economics*, Vol. 47, No. 3, pp.551–563 [online] https://doi.org/10.1007/s11187-016-9755-4.

Gupta, S., Malhotra, N., Czinkota, M. and Foroudi, P. (2016) 'Marketing innovation: a consequence of competitiveness', *Journal of Business Research*, Vol. 69, No. 12, pp.5671–5681.

Hasan, A. (2017) 'How do innovation culture, marketing innovation and product innovation affect the market performance of small and medium-sized enterprises (SMEs)?', *Technology in Society*, Vol. 51, pp.133–141

Jiao, H., Zhou, J., Gao, T. and Liu, X. (2016) 'The more interactions the better? The moderating effect of the interaction between local producers and users of knowledge on the relationship between R&D investment and regional innovation systems', *Technological Forecasting and Social Change*, Vol. 110, pp.13–20 [online] http://doi.org/10.1016/j.techfore.2016.03.025.

Kirchhoff, B.A. (1994) *Entrepreneurship and Dynamic Capitalism: The Economics of Business Firm Foundation and Growth*, Praeger Publishers, Westport, CT.

Kolehmainen, J., Irvine, J., Stewart, L., Karacsonyi, Z., Szabó, T., Alarinta, J. and Norberg, A. (2016) 'Quadruple helix, innovation and the knowledge-based development: lessons from remote, rural and less-favoured regions', *Journal of the Knowledge Economy*, Vol. 7, No. 1, pp.23–42 [online] http://doi.org/10.1007/s13132-015-0289-9.

Lawton Smith, H. and Bagchi-Sen, S. (2012) 'The research university, entrepreneurship and regional development: research propositions and current evidence', *Entrepreneurship & Regional Development*, Vol. 24, Nos. 5–6, pp.383–404 [online] http://doi.org/10.1080/08985626.2011.592547.

Lazzeroni, M. and Piccaluga, A. (2015) 'Beyond town and gown: the role of the university in small and medium sized cities', *IndHighEduc*, Vol. 29, No. 1, pp.11–23.

Lee, Y.H. and Kim, Y.J. (2016) 'Analyzing interaction in R&D networks using the triple helix method: evidence from industrial R&D programs in Korean government', *Technological Forecasting and Social Change*, Vol. 110, pp.93–105 [online] http://doi.org/10.1016/j.techfore.2015.10.017

Leydesdorff, L. (2000) 'The triple helix: an evolutionary model of innovations', *Research Policy*, Vol. 29, No. 1, pp.243–255.

Leydesdorff, L. (2012) 'The triple helix, quadruple helix, …, and an N-tuple of helices: explanatory models for analyzing the knowledge-based economy?', *Journal of the Knowledge Economy*, Vol. 3, No. 1, pp.25–35 [online] http://doi.org/10.1007/s13132-011-0049-4.

Leydesdorff, L. and Etzkowitz, H. (1996) 'Emergence of a triple helix of university-industry-government relations', *Science and Public Policy*, Vol. 23, No. 5, pp.279–286 [online] http://doi.org/10.1093/spp/23.5.279.

Leydesdorff, L. and Etzkowitz, H. (1998) 'The triple helix as a model for innovation studies', *Science and Public Policy Beech Tree Publishing*, Vol. 25, No. 3, pp.195–203 [online] http://doi.org/10.1016/j.vaccine.2010.03.035.

Leydesdorff, L. and Ivanova, I. (2016) 'Open innovation' and 'triple helix' models of innovation: can synergy in innovation systems be measured?', *Journal of Open Innovation: Technology, Market, and Complexity* [online] http://doi.org/10.1186/s40852-016-0039-7.

Leydesdorff, L. and Meyer, M. (2006) 'Triple helix indicators of knowledge-based innovation systems. Introduction to the special issue', *Research Policy*, Vol. 35, No. 10, pp.1441–1449 [online] https://doi.org/10.1016/j.respol.2006.09.016.

Leydesdorff, L., Park, H.W. and Lengyel, B. (2014) 'A routine for measuring synergy in university-industry-government relations: mutual information as a triple-helix and quadruple-helix indicator', *Scientometrics*, Vol. 99, No. 1, pp.27–35 [online] http://doi.org/10.1007/s11192-013-1079-4.

MacGregor, S.P., Marques-Gou, P. and Simon-Villar, A. (2010) 'Gauging readiness for the quadruple helix: a study of 16 European organizations', *Journal of the Knowledge Economy*, Vol. 1, No. 3, pp.173–190 [online] http://doi.org/10.1007/s13132-010-0012-9.

Park, H.W. (2014) 'Transition from the triple helix to N-tuple helices? An interview with Elias G. Carayannis and David F.J. Campbell', *Scientometrics*, Vol. 99, No. 1, pp.203–207 [online] http://doi.org/10.1007/s11192-013-1124-3.

Peris-Ortiz, M., Farinha, L., Ferreira, J.J. and Fernandes, N.O. (Eds.) (2016a) *Multiple Helix Ecosystems for Sustainable Competitiveness*, Springer [online] http://doi.org/10.1007/978-3-319-29677-7.

Peris-Ortiz, M., Ferreira, J.J., Farinha, L. and Fernandes, N.O. (2016b) 'Introduction to multiple helix ecosystems for sustainable competitiveness', in Peris-Ortiz, M., Ferreira, J.J., Farinha, L. and Fernandes, N.O. (Eds.): *Multiple Helix Ecosystems for Sustainable Competitiveness*, 1st ed., Vol. 187, p.12, Springer International Publishing [online] https://doi.org/10.1007/978-3-319-29677-7.

Pugh, R. (2016) 'Universities and economic development in lagging regions: 'triple helix' policy in Wales', *Regional Studies*, Vol. 51, No. 7, pp.1–12.

Reis, A., Heitor, M., Amaral, M. and Mendonça, J. (2014) 'Revisiting industrial policy: lessons learned from the establishment of an automotive OEM in Portugal', *Technological Forecasting and Social Change*, Vol. 113, pp.195–205 [online] http://doi.org/10.1016/j.techfore.2016.04.006.

Reynolds, P., Bosma, N., Autio, E., Hunt, S., De Bono, N., Servais, I. and Chin, N. (2005) 'Global Entrepreneurship Monitor: data collection design and implementation 1998–2003', *Small Business Economics*, Vol. 24, No. 1, pp.205–231.

Van Dijk, J. and Pellenbarg, P.H. (2000) 'Spatial perspectives on firm demography', papers in *Regional Science*, Vol. 79, No. 2, pp.107–110 [online] https://doi.org/10.1111/j.1435-5597.2000.tb00763.x.

Van Wissen, L.J.G. (2002) 'Demography of the firm: a useful metaphor?', *European Journal of Population*, Vol. 18, No. 3, pp.263–279 [online] https://doi.org/10.1023/A:1019750727018.

Virkkala, S., Mäenpää, A. and Mariussen, Å. (2017) 'A connectivity model as a potential tool for smart specialization strategies', *European Planning Studies*, pp.1–19 [online] http://doi.org/10.1080/09654313.2017.1283391.

Yoon, J. and Park, H.W. (2017) 'Triple helix dynamics of South Korea's innovation system: a network analysis of inter-regional technological collaborations', *Quality and Quantity*, Vol. 51, No. 3, pp.989–1007 [online] https://doi.org/10.1007/s11135-016-0346-x.