Papers in Evolutionary Economic Geography

21.13

The role of non-local linkages for innovation

Ron Boschma

Utrecht University

Human Geography and Planning

The role of non-local linkages for innovation

Ron Boschma

Department of Human Geography and Spatial Planning
Utrecht University
Princetonlaan 8a
3584 CB Utrecht, The Netherlands

University of Stavanger
UiS Business School
Stavanger Centre for Innovation Research
N-4036 Stavanger, Norway

chapter prepared for book

Castellani, D., A. Perri, V.G. Scalera and A. Zanfei (eds.) (2021), Cross-border Innovation in a Changing World: Players, Place and Policies, Oxford: Oxford University Press

16 March 2021

Abstract

Non-local linkages are considered to be crucial for innovation in regions because they provide access to new knowledge and ideas. This helps places to avoid or overcome lock-in situations. The cluster literature has focused on gatekeepers that may diffuse non-local knowledge to cluster firms. In the global city literature, this gatekeeping role is taken up by multinational enterprises and knowledge-intensive-business-services. However, little attention has yet been focused on the nature of these non-local linkages. Not all non-linkages matter for the capacity

of a region to innovate. What matters in particular is the extent to which types of knowledge that flow through non-local linkages are complementary to the local knowledge base. What matters is not being connected to other regions *per se*, but being linked to regions that give access to complementary capabilities. Also inflows of external agents are crucial for regional innovation, especially for more radical innovations.

Key words: non-local linkages, geography of innovation, relatedness, global innovation networks, complementary inter-regional linkages

JEL-codes: O25, O38, R11

1. From local capabilities to non-local linkages

It is a well-known fact that innovations concentrate in space. Various literatures like the ones on Industrial Districts (Becattini et al. 2009), Clusters (Porter 1990), Innovative Milieux (Camagni 1991), Regional Innovation Systems (Cooke 1992), Geography of Innovation (Feldman 1994), and Learning Regions (Asheim 1996) have contributed to our understanding of why some regions are more capable of developing and applying innovations and excelling in specific trades. All these accounts, in one way or another, refer to the crucial importance of local environments that provide access to region-specific capabilities (like knowledge, skills, institutions, et cetera) that do not easily travel or spill-over to other regions.

The role of local capabilities has been revived in more recent years in an expanding literature on regional diversification (Boschma 2017). Systematic empirical evidence shows that regions

are more likely to develop new activities related to their existing activities, because these provide capabilities on which new activities can build and draw resources from. Studies employ different indicators to measure relatedness between various activities, such as between products sharing similar market and production capabilities (Neffke et al. 2011), between technologies sharing similar knowledge (Kogler et al. 2013), between industries sharing similar skill requirements (Neffke and Henning 2013), and between industries with similar supplier-buyer relationships (Essletzbichler 2015). They all find that local capabilities condition which new activities are more likely to emerge and develop in regions (Boschma and Capone 2015). This has been demonstrated for the capacity of regions to develop new industries (Neffke et al. 2011), new technologies (Rigby 2015) and new jobs (Muneepeerakul et al. 2013).

In some of these accounts, scholars refer to the importance of non-local linkages which may come in many forms, such as knowledge spillovers, trade linkages, research collaborations, and labour flows. Non-local linkages are considered to be crucial for innovation because they provide access to new knowledge and new ideas. In early accounts, inter-regional linkages were considered to be important because they would help regions to avoid or overcome a lock-in situation (Camagni 1991; Grabher 1993; Boschma and Lambooy 1999; Rosenkopf and Almeida 2003; Hassink 2005; Maskell and Malmberg 2007). This tendency of regions to get locked-in was attributed to local agents that mainly search for new knowledge close by, within their own cognitive domains, within their own networks, and in their own local surroundings (Boschma 2005; Van der Wouden 2020). This inward orientation could lead to cognitive lock-in (Nooteboom 2000) and over-specialization of regions (Grabher 1993).

Both chapters of Belderbos et al. (2021) and Buciuni et al (2021) take up the role of non-local linkages and argue that global linkages are crucial for places to innovate, no matter whether

places are conceptualized as clusters or global cities. They build on previous work like the Cluster literature that claims that cluster firms supplement local knowledge with external knowledge by building global pipelines (Bathelt et al. 2004), that the best performing cluster firms have strong connections to knowledge outside clusters (Giuliani and Bell 2005), and that gatekeepers play a crucial role in diffusing external knowledge to actors in clusters (Morrison 2008; Graf 2011; Morrison et al. 2013; Breschi and Lenzi 2015). In the Global City literature, this gatekeeping role is taken up by Multinational Enterprises and Knowledge-Intensive-Business-Services that act as knowledge diffusion channels between local and non-local actors in global cities (Simmie and Strambach 2006; Iammarino and McCann 2013; Herstad and Ebersberger 2014).

The chapter of Belderbos et al. (2021) is embedded in the literature that looks at the growing importance of international collaboration for innovation and the important role of global cities in Global Innovation Networks. They provide a novel contribution by connecting the Global City literature more closely to the Geography of Innovation literature. Belderbos et al. (2021) succeeds to broaden the Global City literature that used to focus primarily on infrastructure connectivity and international offices of Advanced Producer Services firms. Using a newly constructed international database on geo-coded inventors, they investigate the dynamics of co-inventor linkages of 125 global cities in 46 countries. The chapter of Buciuni et al. (2021) connects the Cluster and Global Value Chain literatures, arguing that the two concepts have become increasingly interwoven, because global fragmentation of production and clusters would go hand in hand. The chapter is embedded in a body of literature that on the one hand focuses on the different roles clusters play in global networks (Gereffi et al. 2005), in which some clusters act as places of corporate control and high-end activities while others function

as branch plant economies, and that on the other hand explains why some clusters are capable of upgrading their existing value chains (Lorenzen and Mudambi 2013; Los et al. 2017).

2. But what types of non-local linkages matter for innovation?

The chapter of Belderbos et al. (2021) investigates co-inventor networks of global cities. In doing so, they go beyond the traditional focus of the Global City literature that looks at intra-firm relationships of advanced producer service firms between global cities. They focus on the analysis of ego-networks of global cities instead, and in particular, the diversity of network linkages a global city has, as proxied by the number of places a global city is connected to. This opens a new research agenda in which other dimensions of inter-regional linkages that are considered relevant for innovation can also be taken on board. An example is the extent to which the types of knowledge that flows through non-local linkages are complementary to the specific knowledge base in global cities. In this respect, Balland and Boschma (2020) has assessed whether linkages that give a region access to such complementary capabilities in other regions had an impact on the ability of that region to diversify in new activities. They found a positive relationship between the two in a study on European regions.

The chapter of Buciuni et al (2021) also highlights the role of non-local linkages for innovation in clusters. However, it is also rather silent on the type of inter-regional linkages. This is somewhat surprising as they embrace the Entrepreneurial Ecosystem (EE) concept that is known to stand for and promote a systemic approach on entrepreneurship. Now one of the key problems with the current EE literature is that it has not fully exploited this systemic or network take on entrepreneurship itself (Alvedalen and Boschma 2017). Connecting the EE and Cluster literatures to the Value Chain literature (or any network approach) might therefore be a way to make that happen. This would also shed light on yet unexplored and unresolved topics in the

Cluster literature. One such topic is to assess the role of inter-regional ties during the emergent phase of clusters (Ter Wal and Boschma 2011; Vicente 2018). Another example of such topic is to assess the possibilities of clusters to upgrade their position in existing value chains or their capacity to enter into new value chains (Giuliani et al. 2005; Los et al. 2017).

What both chapters tend to overlook is a crucial insight from the Geography of Innovation literature, and that is that regions require absorptive capacity to exploit and benefit from external knowledge (Boschma and Iammarino 2009; Miguelez and Moreno 2015). Not all non-local knowledge is of high relevance to regions, and not all non-linkages matter for the capacity of a region to innovate. What comes out of studies is that what matters is not being connected to other regions *per se* but what is crucial is being linked to regions that give access to complementary capabilities. Boschma and Iammarino (2009) made use of trade data and found a positive relationship between inter-regional linkages and regional growth when the proximity between the knowledge base of a region and the external knowledge flowing into a region is neither too small nor too large. Boschma et al. (2014) looked at the impact of relatedness between local knowledge in biotech in global cities and the inflow of non-local knowledge on the ability of these cities to develop new biotech activities. Miguelez and Moreno (2018) found that inter-regional knowledge linkages have more of an impact on innovation in a region the higher the similarity between the external knowledge and the local knowledge base (see also Barzotto et al. 2019). Moreover, they found that more radical innovations are enhanced by inter-regional linkages when the external knowledge is related to the existing knowledge base in the region. Using a new methodology, Balland and Boschma (2021) showed that linkages giving access to capabilities in other regions that are complementary to existing capabilities in a region are important for the ability of that region to diversify in new technologies. So, what these studies all tend to show is that it is not simply about being exposed to the outside world.

Instead, the presence of complementary inter-regional linkages increases the probability of regions to innovate and diversify successfully in new activities.

These insights underline that there is a connection between the importance of places for innovation and their connectivity. They also contribute to an ongoing debate in the field of economic geography about the relative importance of the two. Some scholars have argued that access to non-local capabilities is especially important for innovation when local capabilities and networks are weak (Fitjar and Rodríguez-Pose 2011; Trippl et al. 2018). Grillitsch and Nilsson (2015) suggest that in peripheral regions, non-local linkages can compensate for missing local knowledge spillovers. However, other scholars claim that both local and non-local linkages are crucial for regions to develop new activities (De Noni et al. 2017; Santoalha 2018). Balland and Boschma (2021) have demonstrated that the capacity of regions in Europe to diversify increases significantly when connecting to regions with complementary capabilities. This applies especially to peripheral regions. Non-local linkages act as complements rather than substitutes for local capabilities: they only show an effect on innovation in a region when relevant local capabilities are present. Such studies that examine the complex interplay between local capabilities and inter-regional linkages have also the potential to enrich the Global Value Chain literature (Kano et al. 2020). For instance, Yeung (2021) has made a strong and compelling argument to investigate more deeply to what extent, and how, the ability of regions to build new value chains or upgrade their existing value chains depends on the presence of local capabilities, and related capabilities in particular.

To investigate and assess the absorptive capacity of regions in the type of research that the chapter of Belderbos et al. (2021) advocates seems to be relevant for another reason. As they rightly discuss themselves in their concluding section, the relationship between local

capabilities in Global Cities and their non-local linkages is a highly complex one. To what extent is the external knowledge that flows into Global Cities publicly available and accessible for local firms? Do many of these non-local linkages not concern knowledge flows within Multinational Enterprises that are hard to access by local actors, even when the local actors would have the absorptive capacity? This is a topic that has been addressed by scholars (Iammarino and McCann 2013) but not yet prominently in the Global City literature.

3. And what types of players matter for innovation?

And which players matter for innovation? In the chapter of Belderbos et al. (2021), the main actors are inventors in Global Cities and the non-local networks they build, but also, more implicitly, Multinational Enterprises through which many of these non-local network linkages are expected to be organized and coordinated. Future research should take up how these two key players are actually interconnected in Global Innovation Networks. This has the potential to throw new light on the question how Multinational Enterprises exploit local knowledge and develop innovations in host regions (Cantwell and Iammarino 2003; Iammarino and McCann 2013; Crescenzi et al. 2015), and how non-linkages play a role in the innovation process in regions. Neffke et al. (2018), for instance, showed that new plants that are established by firms in other regions induce more radical innovations in host regions. The ownership link these subsidiaries have with their parent in the home region allow them to develop new activities that rely on resources that are missing in the host region. Elekes et al. (2019) found that this especially applies to plants that are established by Multinational Enterprises.

The chapter of Buciuni et al. (2021) looks more explicitly at the role of players. They embrace the emerging literature on Entrepreneurial Ecosystems, because it has reintroduced the entrepreneur as the main actor in a region. Somewhat curiously, they criticize the Cluster

literature for not taking on board the explicit role of entrepreneurs in the innovation process, despite seminal contributions of Porter (1990), Feldman et al. (2005), Klepper (2007), among others. Especially the work of Klepper on inheritance and spinoffs is relevant here, because it highlights a particular set of entrepreneurs (spinoffs and experienced entrepreneurs from related industries) that is considered to be crucial for the rise and development of clusters. Many papers inspired by Klepper's work (see e.g. a special issue in *Industrial and Corporate Change* published in 2015) have analyzed longitudinal micro-level data, showing that not entrepreneurs in general, but new start-ups founded by entrepreneurs coming from local related industries play a crucial role in the emergent stage of a cluster.

The chapter of Buciuni et al. argues that research should explore more the role of entrepreneurs in contributing to global innovation. However, it is not entirely clear in their chapter what the Entrepreneurial Ecosystem literature has to contribute here. Moreover, this topic has been studied quite extensively, most notably by the literature on transnational entrepreneurs (see e.g. Saxenian 2006; Drori et al. 2009; Henn 2013). There is also increasing awareness that radical or structural change is more likely to be implemented in regions by external agents. This is because local agents are more inclined to stay close to existing specializations of regions when they diversify into new activities (Boschma 2017). A recent study of Neffke et al. (2018) showed indeed that not local start-ups *per se*, but new plants coming from outside the region, are responsible for the establishment of more novel activities in the region.

The view of Buciuni et al. (2021) on entrepreneurs is also somewhat limited, focusing on firms only. There is an expanding literature that shows that other crucial players like institutional entrepreneurs (Battilana et al. 2009) and key individuals, such as top scientists, political leaders and migrants (Trippl 2013; Bahar and Rapoport 2018) have an impact on the development of

clusters and their connections to other regions. Such a broader view of entrepreneurship would recognise the importance of institutional change that facilitates the development of breakthrough innovations in clusters (Garud et al. 2002). This literature is promising as it reveals that the rise and revitalization of clusters require institutional agents that mobilize resources, create legitimacy, and build up new or reform existing institutions (Strambach 2010; Sotaraut and Pulkkinen 2011). Embracing these broader insights that include a view on entrepreneurship that goes beyond the firm are crucial to increase our understanding of the importance of entrepreneurship for the dynamics of clusters and value chains in a global world.

References

Alvedalen, J. and Boschma, R. (2017) A critical review of entrepreneurial ecosystems research: towards a future research agenda, *European Planning Studies*, 25 (6), 887-903.

Andersson, M., Bjerke, L. and Karlsson, C. (2013) Import flows: Extra-regional linkages stimulating renewal of regional sectors?, *Environment and Planning A,* 45, 2999–3017.

Asheim, B.T. (1996) Industrial districts as 'learning regions': a condition for prosperity, *European Planning Studies* 4, 379–400.

Bahar, D. and Rapoport, H. (2018) Migration, Knowledge Diffusion and the Comparative Advantage of Nations, *Economic Journal*, 128(612), 273-305.

Balland, P. and Boschma R. (2021) Complementary inter-regional linkages and Smart Specialization. An empirical study on European regions, *Regional Studies*, doi: 10.1080/00343404.2020.1861240

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, *Cambridge Journal of Regions, Economy and Society,* doi:10.1093/cjres/rsz003.

Bathelt, H., Malmberg A. and Maskell P. (2004) Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation, *Progress in Human Geography*, 28(1), 31-56.

Battilana, J., Leca, B. and Boxenbaum, E. (2009) How actors change institutions: Towards a theory of institutional entrepreneurship, *The Academy of Management Annals*, 3, 65–107.

Becattini, G., Bellandi M. and De Propis L. (eds.) (2009), *A Handbook of Industrial Districts*, Cheltenham: Edward Elgar.

Belderbos, R., Benoit, F., Edet, S. Lee, G.H. and Riccaboni M. (2021), Global cities' cross-border innovation networks, in: Castellani, D., A. Perri, V.G. Scalera and A. Zanfei (eds.), Cross-border Innovation in a Changing World: Players, Place and Policies, Oxford: Oxford University Press.

Boschma, R.A. (2005), Proximity and innovation. A critical assessment, *Regional Studies*, 39 (1), 61-74.

Boschma, R. (2017) Relatedness as driver behind regional diversification: A research agenda, *Regional Studies*, 51(3), 351–364.

Boschma, R, and Capone, G. (2015) Institutions and diversification: Related versus unrelated diversification in a varieties of capitalism framework, *Research Policy*, 44, 1902–1914.

Boschma, R, Heimeriks, G and Balland, P-A (2014) Scientific knowledge dynamics and relatedness in biotech cities, *Research Policy*, 43(1), 107–114.

Boschma, R.A. and Iammarino, S. (2009) Related variety, trade linkages and regional growth, *Economic Geography*, 85(3), 289–311.

Boschma, R.A. and Lambooy, J.G. (1999) The prospects of an adjustment policy based on collective learning in old industrial regions, *GeoJournal*, 49(4), 391–399.

Breschi, S. and C. Lenzi (2015) The role of external linkages and gatekeepers for the renewal and expansion of US cities' knowledge base, 1990-2004, *Regional Studies* 49 (5), 782-797.

Buciuni et al. (2021) Complementary Frameworks for Examining Global Innovation: Aligning GVCs, Industrial Clusters and Entrepreneurial Ecosystems, in: Castellani, D., A. Perri, V.G. Scalera and A. Zanfei (eds.), Cross-border Innovation in a Changing World: Players, Place and Policies, Oxford: Oxford University Press.

Camagni, R. (ed.) (1991) *Innovation networks: Spatial perspectives*, London: Bellhaven.

Cantwell, J.A. and Iammarino, S. (2003) *Multinational Corporations and European Regional Systems of Innovation*, Routledge, London/New York.

Cooke, P. (1992) Regional innovation systems: competitive regulation in the New Europe, *Geoforum* 23, 365– 382.

Crescenzi, R., Gagliardi, L. and Iammarino, S. (2015), Foreign multinationals and domestic innovation: Intra-industry effects and firm heterogeneity, *Research Policy*, 44(3), 596–609.

De Noni, I., Ganzaroli, A. and Orsi, L. (2017) The impact of intra- and inter-regional knowledge collaboration and technological variety on the knowledge productivity of European regions, *Technological Forecasting and Social Change* 117, 108-118.

Drori, I., Honig, B. and Wright, M. (2009) Transnational entrepreneurship. An emergent field of study, *Entrepreneurship: Theory and Practice* 33, 1001–1022.

Elekes, Z., Boschma, R. and Lengyel, B. (2019) Foreign-owned firms as agents of structural change in regions: the case of Hungary 2000-2009, *Regional Studies*, 53 (11), 1603-1613.

Essleztbichler, J. (2015) Relatedness, industrial branching and technological cohesion in US metropolitan areas, *Regional Studies* 49, 752– 766.

Feldman, M.P. (1994) *The Geography of Innovation*, Dordrecht: Kluwer.

Feldman, M.P., Francis, J. and Bercovitz, J. (2005) Creating a cluster while building a firm: Entrepreneurs and the formation of industrial clusters, *Regional Studies*, 39, 129–141.

Fitjar R.D. and Rodríguez-Pose, A. (2011) When local interaction does not suffice: Sources of firm innovation in urban Norway, *Environment and Planning A* 43(6), 1248–1267.

Garud, R, Jain, S and Kumaraswamy, A. (2002), Institutional entrepreneurship in the sponsorship of common technological standards: The case of Sun Microsystems and Java, *Academy of Management Journal*, 45(1), 196–214.

Gereffi, G., Humphrey, J. and Sturgeon, T. (2005) The governance of global value chains, *Review of International Political Economy* 12 (1), 78-104.

Giuliani, E. and Bell, M. (2005) The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster, *Research Policy* 34, 47–68.

Giuliani, E., Pietrobelli, C., and Rabellotti, R. (2005). Upgrading in global value chains: lessons from Latin American clusters. *World Development*, 33(4), 549–573.

Grabher, G. (1993). The weakness of strong ties - The lock-in of regional development in the Ruhr area. In: G. Grabher (Ed.), *The embedded firm*, London: Routledge, 255-277.

Graf, H. (2011) Gatekeepers in regional networks of innovators, *Cambridge Journal of Economics* 35, 173-98.

Grillitsch, M. and Nilsson, M. (2015) Innovation in peripheral regions. Do collaborations compensate for a lack of local knowledge spillovers?, *Annals in Regional Science*, 54(1), 299–321.

Hassink, R. (2005) How to unlock regional economies from path dependency? From learning region to learning cluster, *European Planning Studies* 13 (4), 521–535.

Henn, S. (2013) Transnational entrepreneurs and the emergence of clusters in peripheral regions: the case of the diamond cutting cluster in Gujarat (India), *European Planning Studies* 21, 1779-1795.

Herstad, S.J. and Ebersberger, B. (2014) Urban agglomerations, knowledge-intensive services and innovation: Establishing the core connections. *Entrepreneurship and Regional Development*, 26 (3–4), 211–233.

Iammarino, S. and McCann, P. (2013), *Multinationals and Economic Geography, Location, Technology and Innovation*, Edward Elgar, Cheltenham.

Kano, L., Tsang, E.W.K. and Yeung, H.W. (2020), Global value chains: a review of a multidisciplinary literature, *Journal of International Business Studies*, 51(4), 577-622.

Klepper, S. (2007) Disagreements, spinoffs, and the evolution of Detroit as the capital of the U.S. automobile industry, *Management Science*, 53(4), 616–631.

Kogler, D.F., Rigby, D.L. and Tucker, I. 2013, Mapping knowledge space and technological relatedness in US cities, *European Planning Studies*, 21(9), 1374–1391.

Lorenzen, M., and Mudambi, R. (2013). Clusters, connectivity and catch-up: Bollywood and Bangalore in the global economy. *Journal of Economic Geography*, 13(3), 501-534.

Los, B., M. Lankhuizen and Thissen M. (2017) New Measures of Regional Competitiveness in a Globalizing World, in: P. McCann, F. van Oort, and J. Goddard (Eds.), *The Empirical and Institutional Dimensions of Smart Specialisation,* Abingdon: Routledge, pp. 105-126.

Maskell, P. and A. Malmberg (2007) Myopia, knowledge development and cluster evolution, *Journal of Economic Geography* 7, 603–618.

Miguelez, E. and Moreno R. (2015) Knowledge flows and the absorptive capacity of regions, *Research Policy* 44, 833-848.

Miguelez, E. and Moreno R. (2018) Relatedness, external linkages and regional innovation in Europe, *Regional Studies* 52, 688–701.

Morrison, A. (2008) Gatekeepers of knowledge within industrial districts: who they are, how they interact. *Regional Studies* 42 (6), 817-835.

Morrison, A., Rabellotti R. and Zirulia L. (2013) When do global pipelines enhance the diffusion of knowledge in clusters?, *Economic Geography* 89, 77–96.

Muneepeerakul, R., Lobo, J., Shutters, S.T., Gomez-Lievano, A. & Qubbaj, M.R. (2013) Urban economies and occupation space: Can they get "there" from "here"?, *PLoS ONE* 8(9), doi: 10.1371/journal.pone.0073676.

Neffke, F., Hartog, M., Boschma, R. and Henning, M. (2018) Agents of structural change: The role of firms and entrepreneurs in regional diversification, *Economic Geography*, 94(1), 23–48.

Neffke, F. and Henning, M. (2013) Skill relatedness and firm diversification. *Strategic Management Journal*, 34(3), 297–316.

Neffke, F., Henning M. and Boschma, R.A. (2011) How do regions diversify over time? Industry relatedness and the development of new growth paths in regions, *Economic Geography*, 87(3), 237–265.

Nooteboom, B. (2000) *Learning and Innovation in Organizations and Economies*, Oxford: Oxford University Press.

Porter, M. E. (1990) *The Competitive Advantage of Nations*. Macmillan, London.

Rigby, D. (2015) Technological relatedness and knowledge space. Entry and exit of US cities from patent classes, *Regional Studies*, 49(11), 1922–1937.

Rodríguez-Pose, A. and Crescenzi, R. (2008) R&D, spillovers, innovation systems and the genesis of regional growth in Europe, *Regional Studies*, 41, 51–67.

Rosenkopf, L., and Almeida, P. (2003) Overcoming local search through alliances and mobility. *Management Science*, 49(6), 751-766.

Santoalha, A. (2018) Technological diversification and Smart Specialisation: the role of cooperation, *Regional Studies*, doi.org/10.1080/00343404.2018.1530753.

Saxenian, A.L. (2006) *The New Argonauts. Regional Advantage in a Global Economy*, Harvard University Press, Cambridge, MA.

Simmie, J. and Strambach S. (2006) The Contribution of KIBS to Innovation in Cities: An Evolutionary and Institutional Perspective, *Journal of Knowledge Management* 10 (5), 26-40.

Sotarauta, M. and Pulkkinen, R. (2011) Institutional entrepreneurship for knowledge regions: In search of a fresh set of questions for regional innovation studies, *Environment and Planning C*, 29, 96–112.

Strambach, S. (2010), Path dependence and path plasticity: the co-evolution of institutions and innovation–the German customized business software industry, in RA Boschma and R Martin (eds.), *The Handbook of Evolutionary Economic Geography*, Edward Elgar, Cheltenham, pp. 406–431.

Ter Wal, A. and Boschma R. (2011) Co-evolution of firms, industries and networks in space. *Regional Studies* 45, 919-933.

Trippl, M. (2013) Scientific mobility and knowledge transfer at the interregional and intraregional level, *Regional Studies*, 47(10), 1653–1667.

Trippl, M., Grillitsch M. and Isaksen A. (2018) Exogenous sources of regional industrial change: Attraction and absorption of non-local knowledge for new path development, *Progress in Human Geography* 42 (5), 687-705.

Van der Wouden, F. (2020) A history of collaboration in US invention: changing patterns of co-invention, complexity and geography, *Industrial and Corporate Change* 29 (3), 599-619.

Vicente, J. (2018) *Economics of clusters. A brief history of cluster theories and policy*, Palgrave Pivot.

Yeung, H.W. (2021) Regional worlds: From related variety in regional diversification to strategic coupling in global production networks, *Regional Studies*, doi: 10.1080/00343404.2020.1857719.