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# Rethinking the role of local knowledge networks in territorial innovation models

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## 1. Background and objective

Traditionally, territorial innovation models (Moulaert and Sekia 2003), such as clusters, industrial districts, and regional innovation systems, are characterised by a geographic concentration of competences and knowledge as well as by the spatial diffusion of competences and knowledge (Saxenian 1994; Sorenson and Stuart 2001; Tallman et al. 2004; Marshall 1920). However, competences and knowledge are not ubiquitous and available to all organisations located within such geographic concentrations. Knowledge, for instance, rather diffuses through internal and external knowledge networks (Giuliani and Bell 2005; Giuliani 2013; Fitjar and Rodriguez-Pose 2017). Consequently, it has been recognised for a long time that a comprehensive understanding of the working and success of territorial innovation systems is only possible when it is based on a framework centred on these systems' internal and external knowledge networks (Giuliani 2005; Glückler 2007).

Inspired by this idea, a rich stream of research has emerged that seeks to generate insights into the emergence, working, and structures of such networks. For instance, works in this stream analyse factors explaining the emergence and evolution over time of internal knowledge network relations (Cassi and Plunket 2015; Menzel, Feldman, and Broekel 2017; Niosi and Banik 2005; Plum and Hassink 2011; Ter Wal 2014), the embeddedness of clusters (and their internal networks) into inter-regional and global knowledge linkages (see many contributions in the special issue by Scherngell (2013); Broekel, Fornahl, and Morrison 2015), and the role-specific organisations play in the establishment of such external linkages (Graf 2011; Morrison 2008).

This special issue contributes to this general debate and aims to rethink the role of local knowledge networks in territorial innovation models unveiling also new research opportunities. It partly consists of papers presented at two international conferences on 'Rethinking Clusters'<sup>1</sup> in Florence in 2018 and in Padua, in 2019.

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## 2. Articles in the special issue

The first paper in this special issue (Sabbado et al. 2021) discusses recent developments in the investigation of proximities and highlights that many contemporary studies treat proximities as being static, while in fact, they evolve over time. Notwithstanding some contributions on (quantitative) evolution of proximities over time (Balland 2012; Balland, De Vaan, and Boschma 2013; Broekel 2015; Lazzeretti and Capone 2016; Broekel and Bednarz 2018), yet, little is still known about these dynamics in particular, from a qualitative perspective. This paper contributes with an empirical investigation that assesses the importance of several proximity types at different phases of a knowledge network development. More precisely, the authors identify institutional, personal, and social proximity to be relatively important in the early (recognition and entry) phase of the development of a business leader network in Brittany ('Produit en Bretagne'). In the subsequent (integration) phase of the network, rather temporal geographical and cognitive proximities are found to be essential. Besides shedding additional light on the changing relative importance of proximities over the development of knowledge networks, the study contributes to the literature by illustrating the usefulness of qualitative research approaches for the analysis of network evolution. That is, the authors assess the content of 32 face-to-face interviews from a life narrative perspective to learn about individuals' trajectory of engaging with and in the network.

Clearly, this literature stream is still growing, and many issues remain to be addressed. For instance, most contributions in this line of research concentrate on formal relationships, such as R&D partnerships (D'Este, Guy, and Iammarino 2012; Capaldo and Petruzzelli 2014; Broekel 2015; Lazzeretti and Capone 2016), EU projects (Autant-Bernard et al. 2007; Balland 2012), patents (Ter Wal 2014) or publications (De Stefano and Zaccarin 2013). However, formal relationships only partially reflect knowledge flows, as they neglect the role of social ties, personal bonds and in a broader sense the role of the social context and embeddedness for innovation processes (Rutten et al. 2014; Broekel and Boschma 2012; Crescenzi, Nathan, and Rodríguez-Pose 2016; Balland, Morrison, and Belso-Martínez 2016; Abbasiharofteh and Broekel 2020). Such kinds of informal, social relations going beyond purely mechanical economic transactions are still under-researched partly due to the difficulty of collecting data (Capone and Lazzeretti 2018). Much of this research is employing quantitative methods (Hermans 2021). Complementing these studies with qualitative approaches, more longitudinal data (as Sabbado et al. 2021) and multiple case study analyses (Stake 2013) will deepen the understanding of network processes within and between territorial innovation models even further. In addition, less attention has been paid to the types of knowledge diffusing within local knowledge networks, which is, however, shown to be of relevance for their working (Aral 2016; Aral and van Alstyne 2011). Consequently, studies focusing on the structure of knowledge networks will benefit from complementary research on attributes of knowledge diffusing therein.

However, as many contributions in this special issue highlight, there is another deficit in the field. Studies investigating knowledge networks in space usually refer to and draw from the literature on territorial innovation models. However, in many instances this is little more than lip-service. This is most noticeable when considering one of the core aspects that research on territorial innovation models highlights the context- and

location-specificity of innovation and learning processes. That is, actors engage in learning, innovation, and knowledge exchange processes everywhere, the underlying reasons, ways it is taking place, and outcomes are greatly dependent on the institutional, cultural, socio-economic, and frequently even physical geographic context they are part of. Put differently, these processes are shaped by the particular territorial innovation system they are embedded in. This implies that knowledge networks are not 'just' formative elements of these systems, they are co-evolving with the system and context, and are also largely shaped by as well as dependent upon the system and context (Glückler 2007). Hence, although much of the research on local knowledge networks originates from the more traditional literature on territorial innovation models (with a strong blending in from sociology), this strand seems to become increasingly separated from it.

At first sight, this emerging deficit masquerades as another manifestation of the long-lasting conflict in (geographical) research of identifying generalisable mechanisms (quasi-universal mechanisms related to local knowledge networks), on the one hand, and their incomparableness due to context-specificity on the other (Cox and Evenhuis 2020; Gong and Hassink 2020). However, nothing could be further from the truth, as several contributions in this special issue show. While evolutionary approaches highlight the relevance of agents and their individual behaviour (Broekel and Bednarz 2018), so far, little cross-fertilisation has taken place between the cluster literature and behavioural studies. This literature may provide useful insights into how the quality of government, different regulatory systems, and collaboration culture shape agents' knowledge exchange and networking behaviour. Context-specificity implies that each region and each knowledge network is a unique outcome of evolutionary processes and agency unfolding with and within a specific socio-economic framework. Yet, the processes, agency, and socio-economic framework as well as their relations are characterised by systematic and generalisable variation. To be more precise, the traditional literature on territorial innovation models and that on (local) knowledge networks need to be stronger (re-) integrated by research focusing on relationship between the characteristics of these systems and their knowledge network. In fact, this is something which has been called for a long time (see, e.g., Glückler 2007). However, so far, few attempts exist that explicitly make this connection. For instance, in the cluster life cycle approach, different stages of cluster evolution are hypothesised to go hand in hand with more open and more closed networks (Menzel and Fornahl 2010; Boschma and Ter Wal, 2011). Only recently, this has been extended to predictions about cluster's life cycle phases and the emergence of more complex network structures such as clustering, core-periphery, and small-worldness (Abbasiharofteh 2020). With respect to different types of regional innovation systems (as proposed by Cooke 2004), Stuck et al. (2016) propose that they are related to specific network structures such as hub-and-spoke patterns, small-worldness, and centralisation. However, most of this work is theoretical in nature and limited to rather general structures and categorisations. It is a promising sign that the bulk of works in this special issue is working on eliminating this deficit.

The second paper in the special issue (Maghssudipour, Balland, and Giuliani 2021) concentrates namely on to what extent local knowledge networks are shaped by the heterogeneity of organisations in clusters. The empirical investigation draws attention towards one dimension that is impacting firms' embeddedness into local knowledge

networks, which however, has received comparatively little attention so far, namely status. The authors argue status to be of high relevance for the formation of knowledge links, as information deficits frequently leave organisations with little choice than to choose their potential collaboration partners based on their (and their peers') perceptions. The authors empirically test these arguments using a novel self-collected data set on a knowledge network in the Bolgheri and Val di Cornia wine cluster. Noticeably, the data is longitudinal in nature allowing for the application of a Stochastic Actor Oriented Model (SAOM) to be employed in the study. In contrast to (the few) previous empirical studies on the matter, the authors do not measure status based on firms' positions in the network but rather utilise information on the ranking of wineries' wines. The results of the analysis reveal that differences in status explain the establishment of knowledge links. Firms with (perceived) high status are likely to transfer knowledge to other firms and consequently act as crucial knowledge sources for the entire cluster. Similarity in status further makes knowledge links more likely, which implies that firms with lower status will have difficulties connecting to the (knowledge) core of the cluster. Consequently, hierarchies in status among organisations within clusters appear to translate into hierarchical network structures that are likely to reinforce the initial hierarchical status differences.

The article by Tsouri and Pegoretti (2021) also focuses on the heterogeneity in a regional innovation systems' composition with respect to their organisations and its relevance of the functioning of local knowledge networks. More precisely, their interests lie on the relevance of prominent actors for the resilience of the network, i.e., to what degree a network can maintain its function for inter-organisational knowledge diffusion and innovation when one or multiple of its core actors fail. Hence, the paper addresses a timely issue, what happens to (knowledge) networks when for instance a crisis leads to a (regional) core organisation to go out of business. Similarly, like Maghssudipour, Balland, and Giuliani (2021), the authors track the evolution of a knowledge network over time, in this case that of the (publicly funded) R&D collaboration network of the ICT industry in Trentino in Italy. With the use of node-level centrality measures, actors are ranked according to their prominence in the network. Central actors are subsequently artificially removed from the network to simulate the potential impact of their (hypothetical) defaulting. The analysis reveals that the three most central actors are important for maintaining a functioning knowledge network. Put differently, their removal would substantially hurt other organisations in the Trentino area with respect to their access to knowledge from other local, national, and international sources. By linking (regional) knowledge networks to the idea of resilience, the paper establishes a promising connection to the growing literature stream on (regional) resilience, which surely will spur much more research in the future.

Alberti, Belfanti, and Giusti (2021) add to this line of research by focusing on the relevance of actor heterogeneity, which is mediated by local knowledge networks, for the overall performance of clusters. In their case, actor heterogeneity refers to differences in leadership. That is, the authors first follow an established argument in the literature that variations in the leadership among members of an innovation system and the corresponding knowledge network are likely to boost their performance. From there, however, they expand this discussion and make the case for a general rotation of cluster members being beneficial as well. The two points are tested empirically by means of a case study of

interactions among 112 firms in the LE2C cluster in Lombardy (Northern Italy). The empirical findings support both ideas, i.e., changes in the leadership and membership of clusters tend to go along with higher innovation activities. Alberti, Belfanti, and Giusti (2021) thereby add insights into the relation of local how the evolution of knowledge networks and shapes the performance at the level of the innovation system.

The study of Galaso and Rodríguez Miranda (2021) in this special issue adds further insights into the relevance of actor heterogeneity. More precise, the authors look at heterogeneity in terms of the presence of support organisations in clusters and test for their importance for innovation processes. However, this work adds to further aspects. The first one is that of policy and the question of what can be done (by policy) in case knowledge networks did not evolve into strongly supportive structures of regional development. The second one explores the differences between sectors, which is another prominent dimension of context-specificity. Situations of knowledge networks providing rather weak support are particularly likely in developing countries implying that (local) knowledge diffusion is substantially hampered and innovation process do not reach their full potential. Galaso and Rodríguez Miranda (2021) explore how public policies through support organisations may provide some relief in such circumstances. Such organisations can be expected to create and maintain a certain level of connectedness even when private organisations are less engaged in network activities. Moreover, through their connections to knowledge sources outside the local cluster, they have the potential to introduce novel ideas and knowledge from which connected firms will benefit. The authors put these arguments to a test using primary data collected from 265 firms who are active in different (rubber and plastics, pharmaceutical, dairy, and hotels and restaurants) sectors and located in four clusters in Paraguay, Uruguay, Chile, and El Salvador. Using social network analysis and multivariate regression techniques, the authors confirm that support organisations are central actors in knowledge networks whereby this varies to a certain degree between sectors. In any case, the benefits of collaboration with other organisations are conditional on the type of activity, i.e., R&D activities particularly gain from links to research centres and public organisations which appear to be especially valuable to stimulate collaborative projects. In sum, support organisations are shown to be an essential element for cluster support policies in developing countries. By differentiating between sectors and confirming inter-sectoral variations, Galaso and Rodríguez Miranda (2021) add further evidence that the sectoral dimension is crucial when analysing knowledge networks in general (Broekel and Graf 2012) and that it is one approach to address parts of the context-specificity of knowledge network development and effects.

So far, the presented studies looked at the relation from characteristics of the territorial innovation models (and herein especially actor heterogeneity) to developments of its local knowledge network and overall performance. The last contribution in this special issue changes this perspective by asking to what extent regional development trajectories create general frameworks within which knowledge networks develop their unique configurations. Thereby, Plechero et al. (2020) take a unique perspective for gaining additional insights into the evolution and drivers of knowledge networks' evolution. Empirically, the authors collect primary data on 38 firms in the new media industry located in the cluster of Bangalore (India) and Beijing (China). Similar to Sabbado et al. (2021), this investigation is another illustration of the power of qualitative approaches to the study of knowledge networks. On the basis, the authors identify noticeable differences

between the two clusters and their respective networks, with the one in Beijing being strongly shaped by institutional processes and political influence while a much more bottom-up growth process is observed in the case of Bangalore. In case of the latter, it is the existing knowledge base that drives (and limits) the development. Crucially, the evolution of the networks and RIS structures are interlinked through co-evolutionary dynamics adding further evidence to the close relationship between knowledge networks and (regional) innovation systems' structures.

### 3. Outlook

In sum, most studies in this special issue are contributing to an unpacking of the link between territorial innovation models and their (local) knowledge networks. Clearly, the literature is approaching the context-specificity of knowledge network development and effects utilising the framework of territorial innovation models. Yet, it seems that these systems' heterogeneity in terms of actors draws much attention. While this is certainly crucial for a better understanding of the evolution of knowledge networks in space and for the working of territorial innovation models, it still leaves the system level somewhat under-researched. Regional innovation systems are noticeably more than the sum of their actors and hence, all their dimensions cannot be fully accounted for by actor-centric analyses. Taking the notion of innovation systems seriously implies modelling, comparing, and investigating system-level characteristics and processes. It requires looking beyond the organisations that are members of the system. Aspects such as local cultures, institutions, place-based agencies, life-cycle stages, and circumstances are examples of such. Moreover, this special issue presents papers investigating clusters in different countries and contexts, which increases the generalisability of insights into clusters, which, so far, are frequently based on cases from western countries and rather prosperous sectors.

While some theoretical contributions already establish connections between local networks and such types of system-level features (see, e.g., Abbasiharofteh 2020; Menzel and Fornahl 2010; Stuck et al. 2016), and some noticeable empirical works (Capone, Lazzarotti, and Innocenti 2021; Breschi and Lenzi 2016; Fleming and Frenken 2007), we still lack a profound understanding on these types of aspects. That is, it is still relatively unclear what types of network structures and mechanisms are essential for the evolution of specific types of territorial innovation models, to what extent their relative importance varies across space and time; what relevance starting conditions and external shocks play for the development of local knowledge networks; what type of feedback loops exists between innovation systems and their knowledge networks, etc. This requires additional theoretical work developing taxonomies, categorisations, and new dimensions alongside which territorial innovation models can be captured in a systematic manner. Crucially, it will involve translating many of the rich qualitative insights into discrete categories or even continuous measures. Differentiating between cluster life cycle phases (Menzel and Fornahl 2010) or types of regional innovation systems (Cooke 2004), industrial areas (Tödting and Trippel 2005), as well as different kinds of paths (Isaksen and Trippel 2016) are leading examples and excellent starting points for such types of endeavours. Nevertheless, these approaches will always imply neglecting many aspects and capturing just specific aspects of context-specificity. We therefore also call for critical

mindsets and reflections about simplifications that clearly present their limitations. At the same time, rigorous assessments are required that assess the validity of the assumptions being made.

In addition to more theoretical works, tackling these questions requires empirical studies with system-level, or when possible, multi-level approaches. That is, empirical studies need to capture processes at various levels (micro, meso, macro) and their interplay to derive an understanding of the system. As this special issue also shows, structures and processes at the macro level are still underrepresented in contemporary studies. Consequently, we still know little about how differences between institutional set-ups, network structures, agency, and geography shape the evolution of local knowledge networks and territorial innovation models. Crucially, this includes (regional) policy and its effects on local knowledge relations (Graf and Broekel 2020). Given the undisputed role local networks play in the shaping of territorial innovation models, this seriously contrasts what the literature on local knowledge networks has to offer in terms of policy implications. Similarly, and quite related, although there is abundant literature on regional resilience (Martin 2018; Gong and Hassink 2017), as well as some work on cluster resilience (Elola, Parrilli, and Rabellotti 2013), there is still little work on the specific role of network resilience in territorial innovation models (Suire and Vicente 2014). Tackling this will require comparisons of different systems and tracing the evolution of systems and their networks at times when fundamental conditions change (an example of the latter can be found in Menzel, Feldman, and Broekel 2017). Such will allow for understanding the underlying mechanisms and similarities, as well as context-specific differences between the cases and their evolution (Gong and Hassink 2019, 2020).

## Disclosure of potential conflicts of interest

No potential conflict of interest was reported by the author(s).

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