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Innovation and Knowledge Creation: Challenges to the Field

Harald Bathelt, Patrick Cohendet, Sebastian Henn and Laurent Simon

Setting the Scene

Much has been written about innovation since the early works of Schumpeter (1911) and fellow academics, who recognized the fundamental impact of technological innovation on industrial production and economic life at the turn of the 20th century (Godin, *this volume*). Technological changes have not only been drivers of growth and development at the level of the firm but also shaped entire economic landscapes, providing triggers for the expansion of cities, regions, nations and the global economy. While being characterized by cyclical ups and downs following the long waves of economic development, innovation studies in the last three decades have gradually developed as both an independent field and a perspective of academic enquiry across the social sciences, in disciplines such as economics, geography, history, management science, political science and sociology. At the beginning of the 21st century, despite much progress in academic work on innovation, we are still faced with many unanswered questions and new challenges in economic and social life that need both new analytical perspectives, as well as new answers and solutions.

While having seemingly mastered a global financial crisis, we are facing many instabilities of, and threats to, economic development in the future. In particular, we are at the verge of severe environmental impacts related to ongoing pollution and climate change; we need to overcome new conundrums of resources shortages; and we are faced with huge problems of exponential population growth, urbanization and related economic, social and spatial disparities. The need to find new technologies, processes and products to ensure continuous, sustainable economic development and growth is a top priority, now and in the future, and puts important new demands on innovation research. Within this context, this *Companion to Innovation and Knowledge Creation* aims not only to provide an overview about important developments in the field but also

tackles challenges to research on innovation that we see developing within and across different disciplines.

In the following, we give an overview of the structure of this volume, highlighting important challenges to and imperfections of innovation research, within what sometimes appears to be a stable, mature field. Each of the subsequent sections corresponds to one of the parts of this edited volume. We begin by discussing the notion and our understanding of innovation, before highlighting the interrelationship between innovation and institutions, and the interdependence of innovation, novelty and creativity. This is followed by three sections that target innovation as a social process: innovation, networking and the role of communities; innovation in permanent spatial settings; and innovation in temporary and virtual settings. The last sections focus on the relationships between innovation, entrepreneurship and market making, and on wider governance and management issues of innovation, followed by some final remarks about the unique characteristics of this edited volume.

The Notion of Innovation

Since Schumpeter's (1911) inquiry, much progress has been made in understanding innovation and knowledge creation as the central processes that trigger fundamental changes in economies and societies. From the beginning of the 20th century, based on streams of new findings regarding the production of novelty, different generations of models and understandings of innovation have developed across the social sciences. Some of these became dominant at some point but were eventually replaced by other, new models. At a given moment in time, a dominant model of innovation offers a common understanding, not only on how ideas can be turned into useful products or services, but also about how and where resources should be allocated to in order to fuel the innovation process. Such models drive and shape the behaviors and decisions of policymakers, entrepreneurs, business managers and all sorts of economic agents while they are dominant (Cohendet and Simon, *this volume*; Clark 2016).

The early innovation model, the 'linear technology-push model', which revealed the critical role of 'big science', emerged in a period marked by the end of World War I (Godin, *this volume*; Héraud, *this volume*). The linear model, which views technological change as an external condition to economic development, suggests that the key trigger to fuel innovation is the support

of basic research. In the 1980s, when evolutionary and institutional perspectives on innovation gained much momentum (Nelson and Winter 1982; Romer 1986; Dosi 1988), a new model became dominant. The ‘interactive model of innovation’ conceptualizes technological change as a process that is internal to the economy (Rosenberg 1982). What drives the emergence and development of innovative ideas according to this model is a high intensity of interactions between multitudes of networked actors in the economy. This perspective has challenged many aspects of the linear model:

First, innovation research has for a long time been primarily focused on tangible products and technologies produced within the manufacturing sector. Services and intangibles play only a minor role in this tradition and do not shape the development of concepts and theories. In fact, producer services are often viewed as a support or ‘add-on’ to innovation processes in manufacturing, interacting with the manufacturing sector through networks and innovation systems. As highlighted by Glückler (*this volume*), however, there are numerous problems associated with this view. Studies adopting this perspective sometimes fail to regard service providers as innovators. Furthermore, related work overlooks the fact that even manufacturing firms themselves increasingly rely on the provision of services to their clients and often derive most of their profits from such intangible goods. To recognize this increasing importance of services within the economy, a different perspective on innovation needs to be adopted.

Second, thinking about ways to better integrate services into innovation research, new questions also appear with respect to the measurement of innovation (Lhuillery et al., *this volume*). This is clearly reflected in the evolution of ‘manuals’ that are widely used as guidelines for the collection and use of data on innovation activities. While the Frascati Manual (OECD 1963), taking its cue from the linear model of innovation, was based on the measurement of research and development (R&D) data in manufacturing industries, the Oslo Manual (OECD 1992), grounded in the interactive model of innovation, made initial attempts to measure service industries but still focused on manufacturing (Evangelista et al. 1998).

Related to this, discussions about the measurement of innovation have been characterized by a bifurcation regarding how to proceed and what activities to include: On the one hand, innovation researchers use data about R&D expenditures or employment and patent data in quantitative analyses that compare innovation trends between firms, industries, regions and countries. On the other hand, these approaches are criticized on the grounds that a substantial part of innovation

cannot be measured using these kinds of indicators, since it has been shown that ‘normal innovation’ often proceeds in incremental steps and is associated with ongoing learning processes (Lundvall 1988; Gertler 1993; Lundvall and Johnson 1994) such as learning by interaction, by observation and by imitation (Malecki 1991; Burger-Helmchen and Hussler, *this volume*; Vellera et al., *this volume*; Li, *this volume*). Much innovation does not follow the linear model and is not related to systematic search processes within the context of dedicated laboratories. Further, for many employees, especially in small and medium-sized firms, incremental innovation occurs as a by-product of their core activities, and sometimes modifications in products or processes are not even perceived as innovations, mainly because the individuals involved are primarily focused on their core activities. That is why qualitative studies of innovation practices are needed that investigate the *processes* underlying technological change (Dougherty, *this volume*). This creates a dilemma because (i) comparative work on innovation across different contexts is difficult to conduct, as it is impossible to draw a perfect representation of innovation processes from the data; (ii) the task of linking quantitative and qualitative findings about innovation is challenging; and (iii) innovation is often viewed as a distinct process within the proprietary context of firms, networks and innovation systems.

Since the early-2000s, a number of economic trends and developments have been challenging aspects of the initial interactive model of innovation and its use (Cohendet and Simon, *this volume*; Héraud, *this volume*). The earlier perspective of the interactive model viewed the innovation process as one that is primarily controlled within the closed boundaries of an organization. Here, innovation does not progress sequentially through definite stages: it can begin in any phase of the process, and oscillates between conception, product development, production, and marketing. Such a view was initially challenged by von Hippel’s (1997) work about the importance of lead-users in innovation (Vanhaverbeke, *this volume*). Building on von Hippel’s assumptions, Chesbrough (2003) proposed to radically break with closed representations of the innovation model by adopting a conception of ‘open innovation’: a “new paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance in their technology” (Chesbrough 2003: 14). The model of open innovation (which is still in formation) suggests new ways of representing and explaining innovation activities in society (Vanhaverbeke, *this volume*). In particular, the open innovation model highlights the role of broader knowing communities (Bathelt and Cohendet 2014; Roberts, *this volume*) in shaping technology development. Knowledge exchanges and circulation

underlying these processes are not always driven by economic rationales but are sometimes delivered as free services among dedicated groups of community members. This challenges our understanding of innovation and shifts our attention to what has been described as the ‘underground’ (Arvidsson 2007; Cohendet et al. 2010; Cohendet et al., *this volume*) – a term that refers to those individuals that are part of informal communities or movements beyond the industrial or commercial world but who have related capabilities and skills that they also apply in their professional lives in firms and other organizations. The creative moments and collective innovation processes in the ‘underground’ are thereby connected with the ‘upperground’, i.e. the firms and organizations in an industry that operate according to formalized economic rationales. The open innovation model also suggests reconsidering the role of property rights. A growing number of scholars question the approach that views patents as instruments dedicated to the exclusion and restoration of appropriation, and suggest a renewed vision of patents as instruments which help to coordinate between actors in an open innovation context (Páin, *this volume*).

Since innovation is increasingly a global process involving interactive and iterative knowledge exchanges between countries, a number of scholars are questioning the traditional vision that new products and processes are normally created in highly developed ‘rich countries’ and commercialized there to serve wealthy consumers (Helmchen-Burger and Hussler, *this volume*). The concept of reverse innovation (Immelt et al. 2009) describes a counter process of innovation that originates in less-advanced countries, opening a new avenue for research at the crossroads of international business, economics, geography and political science. Within the perspective of the open innovation model, the concept of reverse innovation takes into account the creative potential of local communities from poor regions and their role in developing new models of doing sustainable business.

Innovation and Institutions

Another challenge to innovation research is the link between innovation and institutions. Often, the institutional context is not explicitly and systematically discussed when studying innovations. While most obvious in conjunction with situations of institutional hysteresis (Setterfield 1993) and lock-in (Grabher 1993; Cantner and Vannuccini, *this volume*), the institutional environment is always of great importance and intrinsically linked to the creation, design and use of

innovations (e.g. P érin, *this volume*). For instance, research on national innovation systems (Lundvall 1992; Nelson 1993; Edquist 1997), despite being initially established as an institutional approach to investigate the varying nature, focus and outcome of innovation processes in national contexts, has rarely investigated and compared the role of institutions in the innovation process in a systematic way. Different studies on innovation systems apply heterogeneous conceptualizations of institutions. For instance, while Nelson's (1993) work on innovation systems in different countries focuses on the organization, funding and research system underpinning innovation and how these elements have evolved in historical perspective, Lundvall and Maskell (2000) emphasize that national variations of innovation systems are related to different structures of producer-user interaction at the micro-level (Lundvall, *this volume*). In past research, there has been a lack of debate of how to bring these approaches together.

To conduct a meaningful analysis of the role of institutions in innovation processes it is necessary to realize that institutions are often viewed and treated in different ways: as organizations (e.g. Nelson 1993), rules (North 1990) or as practices (Dougherty, *this volume*; D'Adderio, *this volume*). Glückler and Bathelt (*this volume*) argue that firms and governments are organizations that create rules, regulations and policies to regulate and direct economic action and that neither the organizations themselves nor the rules and regulations they create should be viewed as institutions. Rules and regulations are not institutions because they may not be followed by actors or are interpreted in different ways leading to different outcomes (Bathelt and Glückler 2014). Institutions in a narrow sense are stabilizations of economic interactions or correlated patterns of behavior (Setterfield 1993). Economic action and interaction are guided by systems of rules and regulations that are defined by organizations, but their outcome is not predetermined and can take on different forms. It is the difference between the intended outcomes of rules and regulations and how they unfold in practice and lead to sometimes unintended consequences that is an important, but understudied object of academic enquiry. When studying innovations, attention should therefore be paid to the entire institutional context consisting of organizations, rules and practices – a task that yet has to become a standard in innovation research.

It is the above distinction between organizations, rules and practices that allows us to explain why specific innovation policies can have unintended effects or lead to heterogeneous results in different countries and regions (Lagendijk, *this volume*). As such, a systematic analysis of the components of the institutional context is necessary to find out why similar rules, regulations and

policies can lead to different outcomes in terms of producer-user interaction in space and time. Adopting an explicit spatial perspective is therefore an important step to better understand the relationship between innovation and institutions (Glückler and Bathelt, *this volume*). Such a perspective enables us to realize that patterns of economic action and innovation do not just differ between national contexts, but also generate regional variations and deviations within a single innovation system under specific localized conditions (Ferrary and Granovetter, *this volume*).

A broader systematic analysis of the institutional context generates important insights into the success or failure of innovation processes. For instance, institutional conditions are often not structured in such a way to support specific technological innovation. Alternatively, they may be designed in ways that actually slow down the innovation process; or users may reject an innovation because they are used to different practices and have no incentive to change their behavior (Hargadon and Douglas 2001; Douglas and Hargadon, *this volume*). Understanding such tensions and barriers allows us to identify why some innovations are adopted smoothly in a specific territorial context, while being used in different ways or even rejected elsewhere. This is especially important when pro-actively planning and/or designing innovation processes from a corporate perspective or when implementing innovation policies in a distinct regional or national setting.

When considering the interrelationship between institutions and innovation, it becomes clear that successful innovation is not a linear function of technological and economic properties alone. It is the institutional context, among other influences, that makes innovations more or less attractive for users and directly affects market legitimacy. When existing institutional conditions do not suffice to support innovation processes, challenges arise with respect to innovation management and governance. To generate an environment that enables a quick diffusion of new products and technologies, new institutions have to be created through active intervention. This insight has promoted the development of a new research field that focuses on institutional entrepreneurship (Maguire et al. 2004; von Krogh et al., *this volume*). It is crucial that these entrepreneurs are able to communicate their interests to users effectively and mobilize other actors to adapt to the new institutional arrangements. This process can be accompanied or guided by political strategies (Mahoney and Thelen 2010) that support the replacement of former institutional settings, generate links to preexisting structures, or reshape existing arrangements to fit the needs of new uses.

All of this suggests that innovation research needs to investigate the impact of institutional contexts and the co-development of institutions and innovation more systematically, and compare these processes across different territories. Such research can focus on topics such as the design of new products and technologies, the relationship between firm networks and communities, the learning processes within and beyond technological and territorial innovation systems, and the establishment and implementation of innovation policies.

Innovation, Novelty and Creativity

Many tensions in innovation research revolve around the notion of innovation itself and how it is conceptualized as a process. In a Schumpeterian perspective (1911), innovation is a process in which entrepreneurs leave their normal routines of everyday life, take risks, and deviate from existing ‘combinations’ to produce new ones. This understanding views innovation as a risky and uncertain process and posits that not every actor has the capability to engage in this process at any time. Innovation processes are extremely heterogeneous and their structure depends on the context within which innovation occurs (Cohendet and Simon, *this volume*). Often, innovation is not an unusual and unpredictable process, but becomes a routine activity itself. This occurs in incremental innovation processes where firms can calculate their risks relatively easily based on past experience. Even small firms without R&D laboratories can engage in learning processes that are interactive in nature and lead to a constant stream of modified or improved products and processes (von Hippel 1987; Lundvall 1988; Gertler 1993).

Some firms can be classified as ‘permanent innovators’ because they routinely produce new products or services and customized problem solutions. This is especially the case in creative industries, “those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property” (DCMS 2001: 4) in areas such as advertising, film production, architecture, music production, engineering and many others. The metaphor of the risk-taking innovator in Schumpeter’s (1911) sense clearly does not fit in these cases, which embody a different logic of producing novelty in society. In the Schumpeterian model, the entrepreneur takes the risk to change the existing structures of production in a ‘heroic effort’ by bringing to market new creative ideas which emerge outside of the prevailing economic sphere, driven by what could be

labelled the open science world. In the new creative economy, by contrast, the triggers of new ideas are internal to the structures of the economic system. While the Schumpeterian perspective offers a sequential vision of the development based on specialized technologies, the creative economy produces novelty in a context of diversity by orchestrating the interface between science, culture, economics, the natural environment and technology. In creative industries, human creativity and innovation at both the individual and group level actively link these domains and become key drivers of development.

If we consider creative industries as the ‘labs’ of the creative economy, where new practices to cope with diversity, new forms of open innovation and new ways of managing talents can be observed and tested, the creative economy can be viewed as a new developmental stage of society, in which the Schumpeterian vision of innovation becomes questionable as an analytical tool and in which innovation takes place in many domains, in particular in services, and not just manufacturing (Glückler, *this volume*; Rallet and Torre, *this volume*). To fully understand the potential for innovation requires more than ever that we investigate the underlying processes of creativity and knowledge production (Cohendet et al., *this volume*). Creativity is a crucial process that drives the creative and cultural economy (Pratt, *this volume*; Leslie and Rantisi, *this volume*) and stimulates diversity and innovation in urban settings (Florida 2002; Desrochers et al., *this volume*). As stated by the UNDP (2013: 16) report on the creative economy:

“Unlocking the potential of the creative economy ... involves promoting the overall creativity of societies, affirming the distinctive identity of the places where it flourishes and clusters, improving the quality of life where it exists, enhancing local image and prestige and strengthening the resources for imagining diverse new futures. In other words, the creative economy is the fount, metaphorically speaking, of a new ‘economy of creativity’, whose benefits go far beyond the economic realm alone”.

However, it can be problematic to classify entire industries or firms as creative *per se*, or as more creative than others (Meusburger 2009; Le Masson et al., *this volume*), if creativity itself is an act or a moment that occurs only occasionally – and there is also a dark side of creativity (Cropley et al., *this volume*). When focusing on creativity and the production of knowledge, we need to understand when and why creativity unfolds and how this is linked to specific institutional settings. For instance, normal operations in some creative industries may be characterized by routine processes of producing novel solutions within a well-defined set of possible outcomes and

a stable institutional framework. This may apply to advertising firms that are specialized in, and known for, generating a certain style of advertising campaign. In such creative work, individuals and firms may never leave their ‘comfort zone’ and are able to keep risks at bay. The respective creative agents or firms may even be identifiable and distinguishable from their outcomes, which have typical features that do not vary much. In contrast, a firm in a mature industrial sector, such as the shoe industry, may be highly creative on a regular basis, as it aims to generate new design elements and technological solutions for the next sports trade show in an attempt to put its products ahead of competition.

To escape problems related to the categorization of professions, firms and industries as ‘creative’ or ‘not creative’ and thus generating a static binary, it may be preferable to shift the focus of analysis toward the dynamic interrelationship between creativity and innovation. Instead of viewing creativity (i.e. the process leads to the emergence and formation of new ideas) and innovation (i.e. the process of bringing these ideas to market) as two separate and sequential processes, Cohendet et al. (*this volume*) suggest that we should consider them as parallel processes that are being coupled and decoupled on an ongoing basis. In this perspective, the success of innovative organizations relies on their ability to combine informal activities of creating, which are at the basis of idea generation, with the formal logic of innovation. When extending this perspective to the context of the creative city, we need to investigate the emergence of ecologies of creativity and how they crystallize commercially in specific organizational contexts (Cohendet et al. 2014; Leslie and Rantisi, *this volume*). Instead of simply assuming that creativity exists, such an approach studies the underlying dynamics that trigger creativity and how these are linked to communities of individuals and to firms and organizations. This opens up opportunities for place-based analyses of innovation processes that take into consideration the institutional context that mobilizes connections between the different levels of creativity and innovation (Cohendet et al., *this volume*).

Innovation, Networking and Communities

The literature has shown that innovation is an interactive social process that goes hand in hand with a specific social and spatial division of labor (Rosenberg 1982; Malecki 1991) as firms develop partnerships or collaborate with other firms and research organizations in their

technological field. This process has two components. On the one hand, firms engage with partner firms in innovation and, as a consequence, automatically become embedded over time in structures of social relations (Granovetter 1985). On the other hand, especially in uncertain or highly dynamic technological environments, they aim to reduce risks by actively embedding themselves in such networks (Ferrary and Granovetter, *this volume*). The consequence is that innovation processes are fundamentally shaped by social relations and become highly contextual and path-dependent over time (Pavitt 2005; Bathelt and Glückler 2011). The effects of this contextuality on innovation have not yet been fully explored and comparative studies that aim at unravelling common underlying processes are rare. A consequence of this contextuality is that innovation processes, while being contingent in nature, offer at some times and in some contexts a large variety of possible pathways to proceed but only few options at other times and in other contexts (Strambach and Halkier 2013). Embedded action does not always have positive consequences. When power asymmetries between actors are large or institutional conditions inadequate, the contextuality of economic action can lead to suboptimal decisions that generate lock-in (Cantner and Vannuccini, *this volume*).

The recognition that innovation processes are social in character has led to a rich literature about networks, producer-user interaction and the development of innovation systems (von Hippel 1987; Lundvall 1992; Gertler 1993; Lundvall, *this volume*). However, this focus has also produced shortcomings in the literature. First, the focus on social learning processes has resulted in an over-emphasis of vertical relationships between suppliers, producers, users and service providers (Vellera et al., *this volume*; Giuliani, *this volume*; van Assche, *this volume*). As a consequence, research on innovation networks often focuses on relationships between firms that operate at different stages in the value chain and do not directly compete with one another (Malmberg and Maskell 2002). Risks of unintended knowledge transfers in such complementary relationships are relatively low and potential benefits high. However, there are also horizontal learning processes that can play an important role and are beneficial for innovation, both in developed and developing contexts (Li, *this volume*). They are based on linkages between firms that operate at the same level of the value chain and are thus directly competing with one another. Firms in such relations try to minimize knowledge spillovers and have little incentives to closely interact with one another. Associated learning processes therefore result from observations and comparisons, rather than direct interaction and communication. Observation processes fulfill an important benchmark function, but they can also directly trigger innovation and need to be investigated

more systematically in innovation studies. As the literature on clusters emphasizes, it is the combination of both vertical and horizontal interactions that creates specific dynamic knowledge ecologies conducive for continuous learning (Bathelt and Glückler 2011; Giuliani, *this volume*).

Second, in terms of the networks relevant for innovation, many studies concentrate on organizational contexts and view technological innovation as a process that involves firms, research facilities and organizational networks (Nelson 1993; Vellera, *this volume*; Foray, *this volume*; Héraud, *this volume*). However, as illustrated in studies on project ecologies (Grabher 2002; Grabher and Ibert, *this volume*) and open innovation (Chesbrough et al. 2006; Vanhaverbeke, *this volume*), crucial parts of the innovation process are not limited to the organizational and inter-organizational domain. Rather, depending on the industry and technology context, different forms of communities play a crucial role in generating a milieu for creative interaction, collective problem solving, brainstorming or recombination of varied skills into new solutions (Amin and Cohendet 2004; Roberts, *this volume*). Such communities have been characterized as ‘knowing communities’ (Boland and Tenkasi 1995) that combine communities of practice, epistemic communities and virtual communities and play an important role in setting agendas, creating codebooks and generating structure and dynamics in the innovation process (Bathelt and Cohendet 2014; Cohendet et al. 2014). In order to better understand the role of these communities in industrial innovation and the challenges of commercializing their creative outcomes, which may not involve commercial incentives to begin with, it is necessary to investigate how their collective activities are, or can be, linked to industrial production and marketing. In other words, it becomes key to investigate the connections between the ‘underground’ and ‘upperground’ and how these can be crystallized within a specific institutional context or ‘middleground’ (Cohendet et al. 2010; Roberts, *this volume*; Cohendet et al., *this volume*).

Innovation in Permanent Spatial Settings

Along with the understanding of innovation as an interactive process, various conceptualizations have been developed that emphasize the systemic character of innovation and investigate the linkages between different elements of the system. Aside from conceptualizations about technological and sectoral systems (Carlsson and Stankiewicz 1991; Breschi and Malerba 1997;

Dewald and Truffer, *this volume*), a rich literature has developed to analyze innovation processes in permanent spatial settings, especially surrounding national systems of innovation (Lundvall 1992; Nelson 1993) and regional innovation systems (Asheim and Isakson 1997; Cooke 2004). This literature focuses on innovation networks that are organized around co-localized or proximate actors and benefit from relational, cognitive and institutional proximity (Rallet and Torre 1999; Gertler 1993; Boschma 2005) or, better, affinity (Bathelt and Glückler 2011; Rallet and Torre, *this volume*).

The literature about territorial innovation systems has clearly matured since the late-2000s and, while still important in innovation research today, faces a number of problems (Legendijk, *this volume*). First, the increasing significance of open innovation and continued globalization processes raises questions about how such tendencies affect localized learning systems and whether such settings will be able to survive under the new conditions (Lundvall, *this volume*). Related to this aspect, the question arises how specialized systems can retain their unique character or whether territorial specialties will disappear with the decreasing importance of localized exchange contexts (Hall and Soskice 2001).

Second, while national systems are important conceptual tools for understanding national variations in the organization, direction and outcome of innovation processes, few substantial discoveries have been made in this field of research in recent years. This is related to the fact that these systems are quite persistent and change only incrementally over time due to the effects of institutional hysteresis (Setterfield 1993). As a consequence, national systems are relatively stable and studies about the nature of these systems do not need constant updating. In terms of academic inquiry, this leads to elements of stagnation within the otherwise quickly changing field of innovation. This causes loss of interest in studying such systems and a lack of new ideas to revive systems research. It is a dilemma that the excitement about national systems has decreased while they appear more important today in shaping economic action than ever, as for instance the increasing heterogeneity of national views and policies within the European Union demonstrates. As a reaction to the lack of inspiration in the literature, new concepts of innovation ecosystems have recently been discussed (Adner and Kapoor 2009; Autio and Thomas 2014) but it is unclear at this point in which direction this work will lead.

Third, the relationship between regional and national innovation systems has never been fully explored and conceptualized (Bathelt and Henn, *this volume*). Both strands of literature have

tended to acknowledge one another but there is limited conceptual interaction between them. While the concept of national systems of innovation focuses on analyzing the nation-specific conditions for innovation and how they are constantly being reproduced (Lundvall, *this volume*), the regional innovation systems approach takes a stronger normative orientation to push for (regional) innovation policies that strengthen regional competitiveness and employment. One problem of integrating the two approaches is that many regions do not have the preconditions or capacity to develop into drivers of a distinct innovation system (Howells 1999). A closer link between national and regional system approaches, however, would be needed to understand interdependencies between both levels and develop multi-level governance perspectives of how regions can be successfully integrated in the context of the global economy (Bradford and Wolfe, *this volume*).

Finally, innovation research has mostly focused on industrial agglomeration in large urban areas, which is where the bulk of innovation activities is concentrated. Since these are places with a diversified economy and a high density of leading research organizations, academic studies have stressed their advantages and intrinsic superiority with respect to innovation (Jacobs 1969; Desrochers et al., *this volume*). As emphasized by Shearmur (*this volume*), this research tradition has led to an urban bias in innovation research and a neglect of important rural and peripheral contexts. In fact, such areas are characterized by high degrees of innovativeness that benefits from long-established cross-sectoral linkages based on embedded personal relationships. Such regions may be characterized by institutional settings that favor the generation of innovation across sectoral boundaries but hinder commercialization, leading to an outflow of resources and profits. This suggests that more research is required to investigate the relationships between urban and rural innovation, especially the underlying institutional conditions and how these can be shaped to support non-urban innovation systems.

Innovation in Temporary and Virtual Settings

The literature that analyzes innovation processes in the context of permanent spatial settings has been challenged in recent years by new forms of innovation that are less predictable in terms of their organization and extend ‘beyond geography’ (Bathelt et al. 2011) to include temporary and virtual settings. Rallet and Torre (*this volume*) make a distinction between spatial and organized

proximity, suggesting that spatial proximity may only play a role in innovation under certain conditions and/or at certain times. There are many examples which show how innovation processes can overcome the need for permanent co-location and that actors can successfully develop new products and technologies over large distances through different types of organized proximity. On the one hand, this is supported by relational ties between actors who have developed close linkages based on prior co-localized collaboration or joint membership and participation in communities (Amin and Cohendet 2004; Bathelt and Glückler 2011; Roberts, *this volume*). On the other hand, long-distance innovation processes can develop from virtual ties that are associated with systematically using new information and communication technologies, such as video-conferencing and remote process control, in interacting with distant partners, securing close coordination and collectively solving problems (Grabher and Ibert, *this volume*; D'Adderio, *this volume*). Over time, such virtual or computer-based interaction can lead to the establishment of social relations without the need of co-present interaction (Walther et al. 2005). Successful experience in virtual settings, in turn, improves the conditions for future innovation processes over distance.

Virtual interaction may be especially beneficial in contexts that involve occasional face-to-face interaction but do not require permanent proximity relations. This includes temporary settings such as co-working spaces (Merkel, *this volume*), as well as occasional get-togethers or community meetings such as conferences or trade fairs (Maskell et al. 2006; Bathelt et al. 2014). Although such short-term encounters often do not allow for in-depth debate or interaction, they do provide dense knowledge flows that derive from communication processes between specialized actors and the systematic inspection of the product and process developments that are exhibited or discussed in these settings. Such occasions offer important ideas about the direction of innovation processes (Bathelt, *this volume*) and can be the expression of concerted efforts to generate innovation waves, as for instance in the fashion industry (Golfetto and Rinallo, *this volume*). Limited research has thus far been undertaken to investigate the connection between innovation and such temporary get-togethers (Vlasov et al. 2017).

The study of open, virtual and temporary innovation in the context of globalization raises issues about the way in which these trends impact existing systems of innovation. This connects to the debate about whether national varieties of production and innovation will converge or diverge over the course of industrialization and globalization (Gerschenkron 1962; Meyer et al. 1975).

Studies regarding related effects on the economy and the structure of economic growth indicate that full convergence is an unlikely outcome but that we are experiencing both hybridization and ongoing specialization processes within distinct national systems (Jackson 2003). While trade fairs support the global diffusion of new products and technologies, technological search patterns suggest that firms use them in different ways depending on their production context, thus driving cumulative specialization (Bathelt and Gibson 2014). However, little research exists to date that investigates the evolution of national or regional systems related to temporary and virtual settings for innovation.

Innovation processes that are triggered by or conducted through virtual and temporary proximity are linked to existing spatial structures and go hand in hand with intensified forms of mobility (Lassen 2006). While their analysis requires a spatial perspective, it has clearly become necessary to move beyond spatial fixes, such as distinct territorial systems and co-located innovation dynamics. Although innovation processes in localized contexts are still hugely important – even two decades after Audretsch and Feldman's (1996) widely received study – and despite the fact that they can be very successful as in the case of Silicon Valley (Ferrary and Granovetter, *this volume*), today's innovation processes are less impacted by spatial boundaries through increasingly complex and varied temporary and virtual ecologies of knowledge and creativity. Conceptualizations in innovation research have thus far not convincingly incorporated these dynamics.

The increasing importance of temporary and virtual spaces in innovation dynamics raises significant strategic and managerial issues. In the former innovation regime that focusses on permanent settings, multinational firms are assumed to make trade-offs in their locational choices by establishing subsidiaries in selected countries or locations where knowledge flows allow them to strengthen learning processes (Ghoshal and Bartlett 1988; 1990; Bartlett and Ghoshal 1999). In the newly emerging regime, the transient and widespread nature of knowledge spaces and networks requires to rethink these connections in a more dynamic way by integrating temporary settings and virtual communities of knowledge regularly and permanently. This also impacts human resource strategies concerning where firms can and should hire and train employees in order to access the new dynamic knowledge ecologies. This may, for instance, involve delegating parts of the scientific, technological and strategic intelligence to external agents, and even

communities. Questions surrounding these issues open up important tasks for future research in innovation.

Innovation, Entrepreneurship and Market Making

Another important set of questions concerns the relation between innovation and entrepreneurship. From a policy perspective it is important to understand how entrepreneurial opportunities are exploited within an economy and which institutional conditions support innovative start-ups. Much of the literature affirms Shane and Venkataraman's (2000: 225) claim that "[t]wo major institutional arrangements for the exploitation of these opportunities exist – the creation of new firms (hierarchies) and the sale of opportunities to existing firms (markets) – but the common assumption is that most entrepreneurial activity occurs through de novo startups." Sometimes actors develop creative ideas into innovations within the context of an existing firm – while at other times they establish a new firm to do so. Whereas such alternatives may not always be in place, a question that has not been sufficiently addressed in innovation research is under which conditions a specific organizational form, for instance a start-up firm, is better suited than another to succeed. The choice of startup entrepreneurship over intra-firm innovation is linked to the institutional conditions and the question of market making. When institutional conditions and organizational structures for intra-firm innovation are unfavorable, individuals will decide to establish new firms. This step is associated with many challenges related to the generation of new markets (MacKenzie et al. 2007), the need to outcompete competitors for scarce resources (Casson 2005), and the task to establish new institutional settings and engage in institutional entrepreneurship (Maguire et al. 2004; von Krogh et al., *this volume*).

Because of its profound impact on innovation, entrepreneurship plays an important role in the literature. Entrepreneurs have been found to affect processes of knowledge generation and innovation in at least three different ways, all which generate agendas for research projects at the intersection of innovation and entrepreneurship studies. First, studies show that entrepreneurs can have a significant impact on the emergence of new markets (Callon, *this volume*; Dewald and Truffer, *this volume*) and the establishment of institutional conditions that are supportive of innovation (von Krogh et al., *this volume*; Foray, *this volume*; Glückler and Bathelt, *this volume*). We are currently witnessing such processes in an intensive way, for instance in the area of

‘fintech’ with the development of technological solutions to replace traditional banking services; and even more so in environmental or green technologies (Dewald and Truffer, *this volume*; Sinclair Desgagné *this volume*) that need to generate market legitimacy, broad societal support and clear normative direction. This requires more than narrowly focusing on atomistic innovation processes in isolated corporate or localized contexts (Cropley et al., *this volume*). Spillover effects between firms and industries across spatial entities and between economy, ecology and society are at stake here and demand new visions with respect to the development of sustainable innovation policies. One challenge for innovation research may be to rethink entrepreneurship as a connected, collective and collaborative endeavor (Miles et al. 2006).

A second way in which entrepreneurs influence innovation is through the creation of new knowledge, especially in the high-technology sector (Malecki and Spigel, *this volume*), and by connecting different locations worldwide through personal networks (Henn 2013; Henn and Bathelt, *this volume*). Studies indicate that a firm’s embeddedness in diverse social networks requires a profound knowledge of culture and cultural differences. Such work also points to the importance newly founded firms have on regional development and structural change.

Transnational entrepreneurs have the opportunity to constantly keep up with market and technological developments and their presence in a region can generate distinct comparative advantages as the competition between territories increases. Even small and medium-sized enterprises can become part of or develop global value chains (Gereffi and Korzeniewicz 1990; Henderson et al. 2002) and generate competitive advantages over other firms that do not have access to these kinds of global networks.

Finally, when existing institutional conditions do not support the innovation process, challenges arise with respect to innovation management and governance. New entrepreneurs may not find the right conditions to establish successful operations and may thus need to generate new markets for their activities. To be able to grow, firms need to actively shape an institutional environment that may be dominated by former technologies and block off new developments (Glückler and Bathelt, *this volume*). It is at this point that institutional entrepreneurship becomes crucial (Maguire et al. 2004), involving “change agents who initiate divergent changes, that is, changes that break the institutional status quo in a field of activity and thereby possibly contribute to transforming existing institutions or creating new ones” (Battilana et al. 2009: 67). The key challenge is how institutional entrepreneurs communicate their interests to users and how they

mobilize other actors, particularly in management, to both adapt to and shape the new institutional arrangements. As von Krogh et al. (*this volume*) underline, we still have limited knowledge whether it is possible for institutional entrepreneurs “to change their emphasis from one type of project towards another one, and to acquire the [respective] necessary skills” (Perkmann and Spicer 2007: 1118) and under what conditions this can happen.

This again raises issues for managers in organizations that are being challenged in their ability to detect such institutional movements early, to evaluate potential impacts, and to make a decision about whether to support or resist them. There is much scope for future research on how the emerging, more open and volatile balance of power between organizations, entrepreneurs, communities and institutional stakeholders can be addressed in order to enhance the performance in innovation.

Governance and Management of Innovation

The trends and new developments in innovation identified in this volume have a distinct impact on innovation policy and the governance and management of innovation, since conventional perspectives are increasingly challenged and new approaches need to be developed and implemented. We do not yet have answers as to what the best or most appropriate new policy and governance approaches could be. Thus far, innovation policy has primarily focused on technology or cost-reducing incentives for innovation and on collaboration within the context of a national state (Bradford and Wolfe, *this volume*). It becomes increasingly clear now that policymakers need to go beyond and to take into account the ways in which territorial networks and the global economy generate linkages beyond the local, regional or national context. Ongoing globalization processes have produced extensive global value chains (Gereffi and Korzeniewicz 1990; van Assche, *this volume*), global production networks (Henderson et al. 2001) and even global destruction networks (Herod et al., *this volume*) that do no longer rely on one distinct set of localized competencies. Instead, they combine diverse research, production and marketing competencies from different parts of the world.

This generates great challenges for managing innovation across cultural, social and political boundaries and requires both the development of new and the extension of existing transnational relations (Henn and Bathelt, *this volume*; Giuliani, *this volume*; Lundvall, *this volume*), as well as

the establishment of new local relations to be able to integrate these diverse knowledge spaces (Cohendet and Simon, *this volume*). On the one hand, it is the mandate and responsibility of policymakers to govern innovation in certain places (Feldman and Lowe, *this volume*) and of firms to manage corporate innovation (Dosi et al., *this volume*) in order to generate optimal conditions for processes of creativity and knowledge generation. On the other hand, this requires extending policy tools beyond localized corporate contexts and developing what could be referred to as a multilevel relational policy which extends to the transnational level (Amin 2004; Bathelt and Glückler 2011; Faulconbridge, *this volume*; Lagendijk, *this volume*) and requires new policy approaches at the industry-community level to tap into creative processes that were not integrated before (Cohendet and Simon, *this volume*). Again, it is not a routine step to extend policy frames in this kind of way beyond legitimized action spaces and may generate competition between governance regimes beyond their assigned territories.

The new trends in creativity and innovation discussed in this volume require policy and governance approaches that go beyond the provision of monetary stimuli and the generation of cost-efficient corporate environments. They may require at least partial removal of policy from direct economic intervention, control and hierarchical top-down relations. Things like more democratic and sustainable governance and ‘governance from below’ could be introduced to create alternative policy frames – but much research is necessary to explore such uncharted policy territory. While we are far away from having a clear idea of how such policy environments should be structured and organized, important elements will include the active forging of networks between actors, continuous support of existing networks, and active mediation between various actor groups at a different scale and scope and across jurisdictions in order to solve coordination problems and generate sustainable innovation settings. Research endeavors need to go beyond national, regional and corporate policy domains. They should also remain open to ways how industries can position and structure themselves through intermediary bodies, such as associations and public-private partnerships, in such a form that the latter can act as collective knowledge aggregators and processors which enhance the innovation potential of the industry and absorptive capacity of their members.

Final Remarks

The arguments developed in this chapter – and indeed throughout the entire edited volume – suggest that understanding innovation requires interdisciplinary explanations and the application of different methods at various levels. Because of the complex nature of the subject, we cannot expect that a single discipline is in the position to provide all the answers to the questions we have raised. In fact, our analysis clearly shows that innovation research is a field of enquiry beyond and across disciplinary boundaries and will require even more integrated endeavors in the future. While this volume aims to provide answers to many of the problems and challenges outlined above, our knowledge regarding these processes is incomplete due to the very nature of and uncertainty associated with innovation. We can offer only a limited glimpse at this complex phenomenon at a given point in time. Many of the questions raised have to remain unanswered for now, but will provide enough scope for new research projects on innovation, knowledge creation and governance in the future.

We wish to emphasize that this edited volume presents a unique collection of chapters that systematically analyze and address the challenges, problems and gaps in innovation research. Not only do the chapters summarize the state-of-the-art in innovation research, but they also present original research and develop new agendas and approaches which may facilitate a resolution to some of the challenges, thus opening and describing pathways for future research. As such, this edited volume goes far beyond simply presenting an overview of innovation research; it aims to help students, scholars, managers and policymakers in the field of innovation, to develop new understandings of and insights into the characteristics, processes and consequences of knowledge creation and innovation and to drive new lines of enquiry.

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