

Uyarra, Elvira

Working Paper

What is evolutionary about regional systems of innovation? Implications for regional policy

Manchester Business School Working Paper, No. 565

Provided in Cooperation with:

Manchester Business School, The University of Manchester

Suggested Citation: Uyarra, Elvira (2008) : What is evolutionary about regional systems of innovation? Implications for regional policy, Manchester Business School Working Paper, No. 565, The University of Manchester, Manchester Business School, Manchester

This Version is available at:

<http://hdl.handle.net/10419/50714>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Working Paper Series

What is Evolutionary about 'Regional Systems of Innovation'? Implications for Regional Policy

Elvira Uyarra

Manchester Business School Working Paper No 565

Manchester Business School

Copyright © 2008, Uyarra. All rights reserved.
Do not quote or cite without permission from the author.

Manchester Business School
The University of Manchester
Booth Street West
Manchester M15 6PB

+44(0)161 306 1320
<http://www.mbs.ac.uk/research/workingpapers/>

ISSN 0954-7401

The working papers are produced by The University of Manchester - Manchester Business School and are to be circulated for discussion purposes only. Their contents should be considered to be preliminary. The papers are expected to be published in due course, in a revised form and should not be quoted without the authors' permission.

Author(s) and affiliation

Elvira Uyarra
Institute of Innovation Research-Manchester Business School
The University of Manchester
Harold Hankins Building, Booth Street West
Manchester M13 9PL, UK
Elvira.uyarra@mbs.ac.uk

Abstract

The literature on Regional Systems of Innovation (RSI) has produced an extensive body of research in recent years and has been used widely as a framework for the design and implementation of policies in a variety of regional contexts. However, certain lack of clarity remains in relation to the defining elements and the dynamics of RSI. This lack of clarity is motivated by the fact that the concept of RSI is influenced by a number of theories and approaches, and in particular institutional, systemic and evolutionary approaches to innovation and learning. As a result of this mix of influences, the concept of RSI can result in different and even conflicting theoretical assumptions and policy rationales. To overcome these shortcomings it is necessary to revisit and adequately incorporate evolutionary ideas in regional systems of innovation.

Keywords

regional systems of innovation, regional policy, innovation policy, evolutionary economics, institutions

How to quote or cite this document

Uyarra, E (2008). What is evolutionary about 'Regional Systems of Innovation'? Implications for regional policy. *Manchester Business School Working Paper, Number 565*, available: <http://www.mbs.ac.uk/research/workingpapers/>

What is evolutionary about 'Regional Systems of Innovation'? Implications for regional policy

Elvira Uyarra

Institute of Innovation Research, University of Manchester, Harold Hankins Building, Booth Street West, Manchester M13 9QH, UK

Phone: + 44 (0) 161 2757055

Fax: + 44 (0) 161 2757055

Elvira.uyarra@mbs.ac.uk

Abstract: The literature on Regional Systems of Innovation (RSI) has produced an extensive body of research in recent years and has been used widely as a framework for the design and implementation of policies in a variety of regional contexts. However, certain lack of clarity remains in relation to the defining elements and the dynamics of RSI, which make it difficult to operationalise and properly articulate the concept for policy purposes. This lack of clarity is motivated by the fact that the concept of RSI is influenced by a number of theories and approaches, in particular institutional, systemic and evolutionary approaches to innovation and learning. As a result of this mix of influences, the concept of RSI derive different and even conflicting theoretical assumptions and policy rationales. The paper advocates a more coherent evolutionary articulation of regional systems and a better understanding of the complexity surrounding policy processes.

Key words: regional systems of innovation, regional policy, innovation policy, evolutionary economics, institutions

1. Introduction

The literature on regional systems of innovation (RSI) (see e.g. Cooke et al, 1997; Braczyk et al, 1998; Howells, 1999, Doloreux, 2002) has produced an extensive body of research in the last decade (Carlsson, 2005). Though there has been an interest on the study of national systems of innovation since the 1980s, the term 'regional innovation system' came into use in the early 1990s. At its origins, the rationale of the term was to point out the need for systemic network relationships for innovation at the regional level (for a review of the concept origins see Cooke, 2001). Since then not only has research in this field grown exponentially, but its conclusions have also been used widely as a framework for the design and implementation of policies in a variety of regional and national contexts. The widespread application of the term for policy design is evidenced by the fact that a large number of regions in Central and Eastern Europe have designed innovation strategies aimed at nurturing regional innovation systems in their territories, for example via their participation in the European Commission-funded RIS/RITTS¹ initiatives. An interest in the application of the concept for policy making can also

¹ The Regional Innovation and Technology Transfer Strategies and Infrastructure (RITTS, funded by DG Enterprise) and Regional Innovation Strategy (RIS, funded by DG Regional Policy), were launched in 1994, followed by further developments including the RIS-NAC programme, to encourage the transfer of experience from RIS/RITTS regions to partners in accession countries and new member states.

be observed in traditionally very centralised countries such as South Korea (Chung, 2006) as a way of redefining their national innovation policies. These ideas have then penetrated policy action widely across different regional and local settings.

However, certain ambiguity or conceptual vagueness surrounds the notion of RSI. Legendijk (1999) identified two broad interpretations of RSI in the literature, namely as subsystems of national or sector-based systems presenting particular spatial features or as smaller-scale versions of national systems. The former interpretation is often expressed via bottom-up, localised knowledge spillovers and their impact on the geographical concentration of innovation (see e.g. Breschi and Malerba, 1997). The latter portrays regions as endowed with agency via renewed forms of economic governance, allowing top-down coordination of economic processes at the meso level, between the national level (regarded as a distant level of governance) and the cluster level of firms. The regional innovation system would be understood in this context as the regional institutional infrastructure supporting innovation, or in other words as a “geographically defined, administratively supported arrangement of innovative networks and institutions that interact regularly and strongly to enhance the innovative outputs of firms in the region” (Cooke and Schienstock, 2000; p.273-274).

Different interpretations of RSI make it difficult to operationalise and properly articulate the concept for policy purposes. And as pointed out by Nelson and Winter (1982; p.372) “the ability of a theory to illuminate policy issues ought to be a principal criterion by which to judge its merit”. As the idea of regional systems of innovation is increasingly used for the articulation of regional policies, the clarification of a number of elements of current approaches becomes imperative. At present, despite the richness and sophistication of some descriptive analysis of regional systems, we believe that a gap needs to be bridged between these and prescriptive articulation of policies and strategies.

This paper specifically focuses on a number of arguments or dilemmas regarding the conceptualisation of RSI, and links them to the substantive theories informing RSI approaches. These dilemmas relate to the understanding of: the meso or even micro specific configurations characterising RSIs, the multi-level dynamics of the governance of innovation (of markets, knowledge, and policy decision-making), the diversity of context-specific development trajectories, and the evolutionary dynamics of change and adaptation of regions. These dilemmas often lead to problems in the policy realm, for the lack of clarity and conceptual vagueness of RSI translate poorly or even misleadingly into policy articulations. Issues of whether, how, why, where and when to intervene through policy action do not find a straightforward answer in the RSI literature. These problems lead us to infer a certain ‘exhaustion’ of the current understanding of RSIs, and the need for new frameworks. The paper further argues that recent departures in evolutionary economic geography help us to better understand the evolutionary, diverse, and multi-level dimensions of regional systems, but still fall short in understanding policy design and policy implementation.

The paper is organised as follows: first, the theoretical perspectives underpinning the RSI concept are addressed. Secondly, the paper turns to elaborating a number of dilemmas around the conceptualisation and policy articulation of RSI, prior to

exploring the understanding of some of these dilemmas under and evolutionary perspective. The final section addresses an issue which tends to be missing in the literature, namely the lack of understanding of policy making processes in a context of multi-level, multi-actor governance.

2. Origin of RSI concept

An appreciation of the key dimensions and uses in policy-making of regional systems of innovation requires a proper understanding of the underlying theoretical foundations of the concept. Whilst RSI is a relatively new concept, its theoretical foundations are to be found in previous contributions in economic geography dealing with the regional scaling of economic processes, and more recently in systemic and evolutionary approaches to innovation and learning. In particular, the agenda and theoretical development of RSIs links the literatures on regional science with evolutionary economics (Metcalf, 1995; Nelson and Winter, 1982), economics of innovation (Dosi 1988; Kline and Rosenberg 1986), theories of interactive learning (Lundvall 1992) and institutional economics (Edquist and Johnson 1997). The RSI approach is also influenced by views of regional competences inherited from developments of the resource-based view of the firm (Penrose, 1959).

Within economic geography, the influence stems from theoretical work emphasising the importance of cultural and institutional factors, specific regional or local identities, localised learning processes and unique regional assets and competences as features allegedly inherent to successful regions. The importance of social and cultural factors for agglomeration was early on highlighted by the literature on Marshallian industrial districts (see e.g. Pyke et al, 1990) and the innovative milieu perspective (Aydalot, 1986; Camagni, 1991). The stress in these literature fields is on dynamic networks of SMEs, a shared innovative culture, strong horizontal cooperation, skilled workforce, a dense infrastructure of supportive institutions operating in proximity and an active regional government.

Emphasizing the importance of knowledge and learning at the local level, the 'learning region' approach and related research on the geography of innovation (Morgan, 1997; Maskell and Malmberg, 1999, Asheim, 1996), investigated the geographical dimensions or consequences of tacit knowledge. While codified knowledge can be easily exchanged and communicated, tacit knowledge is embedded in the know-how and practices of workers, i.e. it is 'stickier' and geographically immobile. The corollary is that the increasing importance of tacit knowledge to achieve and maintain competitiveness renders proximity more important because it is through interpersonal, face-to-face contacts and the development of personal relations based on trust that tacit knowledge can be more readily shared (Cooke and Morgan, 1998; Morgan, 1997; Storper, 1997, Maskell and Malmberg, 1999). Besides proximity and collocation, regional and local socio-cultural conditions, in the form of inter-firm and organization networking, availability of local scientific and managerial support, i.e. the presence of a certain 'institutional thickness' (Amin and Thrift, 1995), would also contribute to the sharing of tacit knowledge and therefore to the emergence of dynamic collective learning processes (Keeble et al, 1999).

Other authors similarly insist on the importance of developing location-specific competitive advantage, i.e. one that is embedded in regional and local cultures and

thus impossible to copy or replicate (Storper, 1997, Maskell and Malmberg, 1999), and reflect the idea of the region developing certain core 'competences' (Lawson, 1999), which are tacit, unique and difficult to replicate elsewhere. The ability of regions to compete is linked to these unique assets, and geographical proximity is essential to share and nurture them. More recently, the so-called 'regional knowledge capabilities' approach (Cooke, 2005) revolves around the idea of dynamic capabilities present at the regional level which help stimulate knowledge transfer.

The foundations of RSI approaches are also closely connected to a more general literature on systems of innovation (Freeman, 1995; Lundvall, 1992; Nelson, 1993; Edquist, 1997), which is in turn rooted in evolutionary and institutional economics (Edquist 1997). National systems of innovation (NSI) approaches view innovation as systemic and dynamic, emerging from interactive learning processes among firms and other organisations (such as universities, business support, research centres etc). Proponents of the concepts of national and regional systems of innovation argue that differences in economic and technological performance across countries or regions cannot be explained in terms of strategies and performance of firms alone. Key explanatory factors are the combinations of institutions involved - and their interactions -, which determine the processes of accumulation of capital and technology. That is, innovative performance varies depending on "institutional differences in the mode of importing, improving, developing and diffusing new technologies, products and processes" (Freeman, 1995; p.20). RSI approaches see regions, rather than nations, as the most meaningful unit of economic interest, particularly when they present distinct administrative structures to support innovation and developed industrial clusters, for some of the "basic characteristics which distinguish a state can sometimes be distinctive in certain regions" (Cooke et al, 1997; p.479).

The influence of evolutionary economics on (regional and national) system approaches has been explicitly acknowledged (Cooke et al., 1997). Characteristic features of evolutionary approaches include the consideration of firms, and their routines, as the main unit of analysis, the path-dependent nature of economic development; the emergence and diffusion of economic and institutional novelty; the dynamics of adaptation to changing economic, technological and institutional environments; and the notion of spontaneous order emerging as an unintended consequence of individual (market driven) economic and social actions (Boschma and Frenken, 2006). Although there is a fair degree of overlapping between institutional and evolutionary ideas in systems of innovation literature, and often are used interchangeably, Boschma and Frenken (2006) establish a clear differentiation between the two approaches. Whilst systems of innovation approaches have a strong focus on the institutional setting of a particular country/region and the way it influences actors and networks involved in the innovation process, evolutionary approaches take networks and sectors as key units of analysis and look at their characteristics and specific evolution, including how institutions have co-evolved with the emergence of a new sector. The coevolution of economic, institutional, and technological forces is considered, and this in turn will shape knowledge sharing processes (whether in geographical proximity or at a distance), industrial dynamics and supporting structures. As will be demonstrated below, these differences are not unimportant, and what is more they derive very different policy implications (Laranja et al, 2008).

3. Mix of rationales and key dilemmas

Carlsson et al (2002) have highlighted a number of analytical and methodological issues arising from various innovation system concepts (national, regional, sectoral, or technological), namely the consideration of the appropriate level of analysis, the components and actors constituting a system and their attributes, the key relationships within the system, and the measurement of the system's performance. Regional system approaches have themselves been challenged in relation to both the analytical articulation and the normative deployment of the RSI concept. On the one hand, analytical or conceptual problems arise in relation to the portrayal of regions in the RSI literature, a perceived neglect of external networks and institutions, and an alleged failure to address questions of adaptation and renewal of regions (Morgan, 2004). These studies have also been seen as unable to reconcile the top-down and bottom up dimensions of localised innovation processes (Howells, 1999, 2005; Iammarino, 2005). On the other hand, concerns have been expressed on the way the notion of regional systems of innovation has been turned into a policy concept (De Bruijn and Lagendijk, 2005). Whereas Morgan (2004, p.873) admits that some scholars of RSI may be to blame for "a tendency to collapse levels of abstraction into simple narratives to render them digestible for politicians and policy-makers", other authors have been straightforwardly dismissive of these approaches as being policy-led (Lovering, 1999). Further, policy makers and the wider 'regional development industry' are also perceived as responsible for bridging the gap between abstraction and prescription, matching particular political agendas (Lovering, 1999; Lagendijk and Cornford, 2000). The final section of this paper further elaborates the issue of policy evolution and the translation of abstract ideas into policy practice.

While accepting the conceptual and normative value of the concept, we would nevertheless argue that some of the dilemmas or critiques mentioned above are the result of the mix of theoretical propositions influencing RSIs. The different conceptual approaches informing RSI approaches (as reviewed in the previous section) adopt more dynamic or more static approaches, fall under different methodological paradigms (e.g. institutional, evolutionary, etc.), and use different levels of analysis (more micro, more meso, etc.). They also present different policy rationales according to the different phenomena they are trying to explain (explanandum) and the aspects that explain them (explanans), and share different visions on the role of policies and the policy making process. Further, they share different conceptualisations of space, and different considerations as to the most adequate level at which to design and implement policies (Laranja et al, 2008). As a result of this combination of theoretical approaches, there is not a clear implicit normative rationale when studying RSI but a mix of rationales (Doloreux, 2002). As De Bruijn and Lagendijk (2005; p.1155) point out, "there appear to be as many, explicit or implicit, 'ideal models' of RISs as there are policy applications". Thus despite the richness of the concept, it somewhat provides a rather confusing picture for policy makers, which do not find answers to key questions such as how to identify and pin down RSIs, whether and how their emergence can be influenced by policy action, and at which level of intervention should this be tackled and by which means. We contend that revisiting the evolutionary foundations of RSI may be a good approach to shed light on some of these problems as well as to help translate these into policy recommendations. The next sections address some of these critiques in more detail.

3.1. Ubiquity vs. scarcity of regional systems of innovation

One frequent critique of regional systems of innovation and related concepts (learning regions, etc.) refers to a lack of clarity or ‘fuzziness’ (Markusen, 2003), which renders the operationalisation and even the empirical validation of the concepts problematic. The disagreement over the presence or absence of a RSI in all regions echoes a similar debate in the NSI literature (Sharif, 2006).

According to some researchers, all regions have some kind of regional innovation system (Bunnell and Coe, 2001). Others have however questioned the existence of a truly ‘regional’ system of innovation in certain regions. Riba and Leydesdorff (2001), for example, conclude that there is not enough evidence to actually claim the existence of a ‘regional system of innovation’ in the case of Catalonia. A similar conclusion is put forward by Sanz et al (2001), for the case of Madrid. Concerns can also be found around the usage of the RSI concept in the study of peripheral regions, rural areas, and of declining economies (Asheim and Isaksen, 2002; Doloreux, 2002). Cooke (2001) claims that the existence of a RSI is a special case, a rare event. Evangelista et al (2002), in their study of Italian regions based on CIS data, similarly conclude that it is very rare to find the necessary ingredients to identify a regional system of innovation. The European commission funded REGIS project (Cooke et al, 2000) identified only four regions out of 11—Wales, Baden-Württemberg, Basque country and Styria—that could fit the characteristics of RSI. A strict reading of the literature would however suggest that the only three regions that could be considered true regional innovation systems are Silicon Valley, Emilia-Romagna, and Baden-Württemberg (Doloreux and Parto, 2005).

The RSI approach is thus unable to address the fundamental question of how one ‘knows’ a regional innovation system when one sees one (Doloreux and Parto, 2005; p.143). According to Iammarino (2005), this should not lead us to reject the concept of RSI, but rather suggests a need to be cautious about replicating and reproducing an ‘ideal’ type of RSIs and to look for improved methods to test the validity of the concept. The danger here is twofold: either to apply the term to extremely varied cases to the point that it becomes meaningless, or to adopt a definition so narrow that it pre-empts most regions but a few exemplars from being considered regional systems. Cooke (1998) distinguishes between ‘operational’ and ‘conceptual’ innovation systems. Whilst an operational system refers to a real phenomenon, a conceptual system represents a logical abstraction or a theoretical construct. This conceptual system, it is argued, should not only allow a flexible interpretation of the many different operational types a RSI can adopt, but also enable one to distinguish between RSIs and non-RSIs. Thus the conceptual RSI does not necessarily represent the totality of a real phenomenon and the ‘operational’ RSI does not need to obey to a strict definition of RSI (Cooke, 1998). In the policy realm however, this is likely to contribute to increased confusion, with regional policy-makers pointlessly questioning whether their regions are truly systems of innovation, whatever operational types they fit into, rather than actively trying to improve their innovative potential irrespective of them being seen as ‘ideal’ RSI.

3.2. *Top-down vs. bottom up characterisation of systems*

Besides the interpretive flexibility of the RSI concept and the associated problems of empirical validation, there is a related critique that points to a national, top-down bias of the RSI concept, which renders it unable to capture regional-specific actors and relationships. As mentioned in the introduction, the RSI concept comprises a bottom up dimension, given by the regional scaling of innovation and learning processes (due to agglomeration effects of networks of innovating firms in certain sectors), and a top-down one, embodied in the key role played by certain regional institutional and governance structures.

Howells (1999) identifies the top-down characteristics of RSI as being e.g. the role of the public sector and public policy, the institutional framework, the institutional set-up of the financial sector; the industrial structure and intensity and organization of R&D activities (both private and public), and the degree of openness of the system. Cooke (2001) lists the conditions characterising higher innovation system potential as comprising: at an infrastructural level, issues such as autonomous taxing and spending, influence on infrastructure, and university-industry strategy; and at a superstructural level, institutional aspects such as a cooperative culture, and consensus, organisational aspects such as an harmonious labour relations at the firm level and inclusivity, networking and consultation at the policy level. Bottom up characteristics of RSI, on the other hand, would include localised patterns of communication, search and scanning processes, localised invention and learning patterns, knowledge sharing and localised innovation capabilities and performance (Howells, 1999).

Iammarino (2005) argues that a top-down, macro-to-micro, ‘Listian’ view dominates when analysing RSIs, whereby the features frequently characterising national innovation systems are mapped onto the regional level, thus paying insufficient attention to the actors, bottom-up relationships and learning processes operating at a sub-national scale. This tendency to identify and to transpose the elements characterising a national system at the regional level is likely to lead to regional policies being national policies ‘writ small’ rather than reflecting bottom-up localised learning processes. This top down translation can be observed in the tendency of many regions to replicate national-level institutional configurations (of venture capital, university industry links, intermediary agencies, formal structures of research promotion and coordination) and policy mixes at the regional level².

This bias renders RSI approaches unable to construct an adequate link between the macro or meso perspective and the micro-level diversity of firms’ innovation processes. Whilst micro-agent change leads to macro system evolution, it is clear that the whole is not the sum of its parts (Iammarino, 2005). Werker and Athreye (2004) differentiate between the micro and meso approaches explaining regional innovation (and thus influencing RSI approaches). Micro-approaches are more agent-centred, and concentrate on an explanation of the entrepreneurial behaviour of innovative firms that give rise to knowledge creation and diffusion inside firms and within the region. Some micro-approaches also concentrate on the characteristics of the region influencing innovative activities, such as the shared

² As noted by the OECD (2007: 26) in relation to regional policy in Spain, a situation that can lead to “wasteful duplication, lack of synergy and overlap or even conflict of objectives”.

culture or specific set of rules present in industrial districts literature. The meso level of analysis adopted in regional systems of innovation, clusters and in learning region approaches in turn aims to better understand the structural elements manifested in the institutional set-up as well as the regional and industrial systems, which translate the micro-, i.e. the individual structure, in to the macro-i.e. the overall structure (Werker and Athreye, 2004).

The RSI approach is then concerned with explaining the structural elements of the region leading to innovation, and less so with the innovative behaviour or agents, even though this element helps us to understand the structural elements of the region (Werker and Athreye, 2004). It is not explained how firms react to changes in the systems of innovation and how firms benefit and use the available knowledge, that is, the differential use by firms of their national or regional systems. Localised, bottom up processes of learning and knowledge accumulation (Howells, 1999) take secondary importance in the analysis. This failure translates into the treatment of firms as an 'abstract' and 'homogeneous' entity, assuming a downward and unidirectional influence of the institutional configuration over actors' innovative behaviour. Due to the unique and specific nature of firms' competences however, no two firms innovate in the same way and benefit equally from knowledge spillovers. At the level of policy design, firms are implicitly considered to be mere demanders of support, automatically responding to incentives from the supply side, thus underplaying the bottom-up influence of firms -and users of innovation more broadly - on the system's configuration and even on the articulation of policies (Uyarra, 2007).

A number of authors have suggested the adoption of an evolutionary approach integrating a micro to macro view (Iammarino, 2005, Dopfer et al, 2004, Boschma and Frenken, 2006). According to Boschma and Frenken (2006) evolutionary approaches try to explain regional growth differences from micro-histories of firms that operate in territorial contexts and the spatial evolution of industries and networks at the meso-level of the economy.

This evolutionary reading of localised innovation processes allows the incorporation of bottom-down dimensions as pointed out by Howells (1999). Evolutionary approaches view differences in firm behaviour as the driver of economic change and thus reject the idea of a 'representative' firm (Metcalf, 1995). In the presence of bounded rationality, firm behaviour is guided by routines by which they create, and adapt to, novelty through learning. Routines are understood as decision rules, or regular and predictable behavioural patterns of firms (Nelson and Winter, 1982, p.14). Due to the increasing complexity and uncertainty of innovation processes, firms are likely to draw on acquired knowledge and routines and search locally for markets and technologies firms have become familiar with in the past (Boschma, 2004). Geographical proximity aids firms in the search of collaborative partners of new, more sophisticated, technology or equipment. This localised innovation search and scanning is particularly important for small firms, who find it advantageous to locate in "information rich' and contact intensive innovation agglomerations" (Howells, 1999, p.83). Local networks of small firms may well then be due to resource limitations or of firms serving a largely localised market, rather than the top-down influence of the 'local' institutional setting (Freel, 2003). Further, the increasingly broad range of constituent technologies and knowledge bases

characterising innovative products and processes entails a much greater need for communication between complementary sources of knowledge (Coombs and Metcalfe, 1998; Antonelli, 2000). Proximity can support these patterns of localised collective learning through the sharing of complementary assets, such as the interaction with users and consumers (Howells, 1999).

Finally, localised patterns of innovation capabilities and performance (Howells, 1999) refer to dynamic advantages due to a concentration of innovative capabilities. Firms located in innovative localities would find more advantageous conditions to develop innovations than other firms located in less innovative areas (Baptista and Swann, 1998). This quasi-fixity of geographical patterns of industrial activities and their evolution over time can be linked to the evolutionary concept of path-dependency (David, 1985; Arthur, 1989). Martin and Sunley (2006; p.427) note that the location of new industries may depend less on random choice and more on place-context specific factors, such as previous industrial histories and local economic structures, since “as economic history shows, there are some areas and regions that have repeatedly been the site of path-forming innovations or new industrial sectors”.

In this context, localised mechanisms of knowledge creation and sharing are complex and varied and will depend on institutional, organisational and technological elements acting at the micro, meso and macro levels. These include the topographical allocation of incentives and institutions for innovation, the technological trajectories and their associated path-dependent geographies, and the geographical implications of the formation of corporate dynamic capabilities through intra-firm and inter-organisational forms of learning.

3.3. Analytical vs. normative perspectives

Besides the positive consideration of acceptance or rejection of the existence of a RSI (i.e. whether we are referring to a poorly functioning RSI or to the absence of a system) and the analytical micro to macro determinants of systems, different theoretical approaches also differ in the extent to which they are normative in character, i.e. suggesting clear ‘policy principles’, or more analytical and explanatory, based on empirical analysis of real situations of regions without formulating policy advice (Hassink, 2005). Indeed, from earlier, more analytical and less normative studies of specific regional cases, the emphasis has shifted in recent times towards a purposive view of the region as able to change its own destiny via dedicated policies nurturing the unique competences of the region. System approaches tend to presume that the flows and interactions of the system, its components, its coherence and possible dysfunctions can be acted upon, constructed and institutionally coordinated (Laranja et al, 2008).

This ‘normative turn’ is translated in an increasing number of regions’ aspirations to become regional innovation systems in a variety of regional settings, despite the ‘fuzziness’ of the concept. Hommen and Doloreux (2003) note that whilst academic studies often give up on formulating policy advice, this is not the case for regional and national authorities, which have adopted the concept of RSI with great enthusiasm. In so doing, RSI is transformed into a kind of ideal model applicable to all regions, including less successful regions (De Bruijn and Legendijk, 2005). This is in line with Laranja et al’s (2008) suggestion that some of the most influential theoretical ideas in policy circles are precisely those which

offer most interpretive flexibility. A good illustration of this tendency is cluster theory, to which policy makers have tended to appeal as a panacea for resolving all regional economic ills (Sugden et al, 2006).

Contrary to this implicit optimism, recent arguments from evolutionary economic geography show greater caution by stressing that policy makers' ability to influence and direct the evolution of economies is strongly limited (Moreau, 2004). In evolutionary terms, policy implications are not simple or straightforward, and evolutionary thinking would even provide arguments for non-intervention (Dalum et al, 1992). Lambooy and Boschma (2001) consider that, whilst policy makers do have a role to play, one key difficulty resides in determining the degrees of freedom policy makers have to influence the future development of regions in an evolutionary context (Lambooy and Boschma, 2001). This is in line with David's (1987) narrow window dilemma, i.e. the brief period in which policy makers may be able to influence a dynamic economic system. This would be considered an intermediate argument between optimistic accounts on the ability of policy makers to plan or coordinate RSI and the positions that view regions as passive subjects to global processes of change. According to Cooke (2005) the latter fall short in explaining the uneven geography of innovation, i.e. why some locations perform better in terms of exploiting knowledge spillovers, which is likely to be influenced by purposeful action at the level of the region.

3.4. Regions as 'islands' vs. open systems

An additional dilemma or critique of the conceptualisation of RSI relates to a perceived neglect of the multi-level dynamics characterising the governance of innovation (of markets, corporate governance, knowledge and policy decision-making). As mentioned earlier, RSI approaches tend to see innovation processes as emerging from regionally embedded, institutionally supported, networks of actors. A RSI would be in place if and when the regional production structure (the 'knowledge exploitation subsystem') and the regional support infrastructure (the 'knowledge generation subsystem') are systematically engaged in interactive learning (Cooke, 2001). Innovation is therefore considered not only a social process of interaction but also a spatially constructed one, whereby knowledge is transferred mainly through intra- regional channels (Pellegrin, 2007; Autio, 1998). Further, the attention is generally on the spatial-relational aspects of these knowledge sharing networks, whilst issues surrounding the structure and composition of these networks are relatively neglected (Oerlemans et al, 2007; Frenken et al, 2007). At the core of this debate is also a potential mismatch between the different spatial attributes associated with the bottom up and the top-down views of systems, e.g. between the economic spaces of innovation (assumed to form regional networks of interaction) and the governance level at which to support them.

The pervasiveness and perceived merits of localised interactions for innovation seem to have provided the arguments to justify the regional level as the best context for the implementation of innovation strategies and the promotion of network and cluster type instruments. Indeed, a 'paradigm shift' in regional development policies has been observed (Bachtler and Yuill, 2001), from a more centralised form of intervention to a predominantly decentralised one, based on integrated regional development plans and strategies designed and delivered by

partnerships of regional and local actors. Regional innovation strategies would in turn include various mechanisms for the promotion of regional networks, such as research-business collaboration, support for hi-tech spin-offs and start-ups, and cluster policies (Landabaso and Mouton, 2002).

The policy emphasis on promoting internal connectivity within regional systems (between regional supply and demand of innovation) has been challenged as embodying a too closed or self-contained, rather than open, view of regional innovation systems (Charles et al, 2000), for it implicitly assumes that the sources for regional development are not only *endogenous* but also mainly *indigenous*. This seeming neglect of extra-regional sources of knowledge is contrasted with other views that stress the need for firms to be connected to globally distributed knowledge networks complementing local sources of technological knowledge. These accounts (see e.g. Legendijk and Oinas, 2005; Bunnell and Coe, 2001; Mackinnon et al, 2002; Bathelt et al, 2004) have argued against adopting an overly compartmentalised conceptualisation of the region. Regions are clearly not “isolated islands in a wider economy” but often closely linked to networks at other spatial levels (Staber, 1996; p.301). Global connectivity becomes particularly important against a backdrop of rapid technological change, increased complexity of knowledge production and intense international competition. In this context, multinational corporations (MNCs) act as conduits of cross regional knowledge sharing, as pointed out by Cantwell and Iammarino (2003). MNCs, they argue, present lower locational inertia when compared to indigenous firms and are more attracted by sources of knowledge and cluster-based spillovers present in certain regional poles of technological activity. This notwithstanding, Cooke (2005) warns against considering space as a hierarchical nesting within a globalised ‘scalar envelope’. Such consideration, he argues, represents a too linear and top-down view of the hierarchical power of higher scales of corporate and policy governance on the regions (see also Morgan, 2004). These authors advocate a relational rather than a containerised use of the term ‘regional’, which see the region as ‘a nexus of processes’ (Cooke and Morgan, 1998). Hassink (2005) further argues that the use of the terms ‘local’ or ‘regional’ systems should not mean that the actors and networks of the system are dominantly local, but rather that frames of reference and action for system institutionalisation and development are defined in local terms.

Despite evidence of increasing internationalisation of innovation, and increasing importance of global innovation networks, the internationalisation or openness of innovation systems is less well understood (Carlsson, 2006). Openness is indeed relevant for sectors such as biotechnology, which cannot rely exclusively on regional—or even national—competencies. Belussi et al (2007), in their study of the biotechnology sector in Italy, observed a shift towards an ‘open’ regional system of innovation, benefiting from the coupling effects of local embeddedness of networks between firms and public research organisations and external-to-the-region research networks and knowledge sources—a process akin to the co-existence of high levels of buzz and many pipelines in outward-looking clusters as described by Bathelt et al (2004). Connected firms may not necessarily be co-located, and the influence of proximities other than physical (cognitive, organizational, social and institutional) may be at work (Freel, 2003, Oerlemans et al, 2001; Boschma, 2005). Moodysson et al (2008), for instance, note that those sectors characterised by analytical synthetic knowledge bases (such as mechanical

engineering), tend to be more sensitive to geographical proximity effects—thus favouring local collaboration—than those where analytical knowledge base is dominant, such as biotechnology.

Beyond the spatial nature of knowledge networks, the issue of variety underpinning the composition of these networks and its influence on innovation and growth have been given relatively little attention. This translates into a tendency for policy to support localised knowledge interactions within narrowly-defined clusters of productive specialisation, overlooking possible cross-fertilisation effects across sectors. The benefits (or otherwise) of locally embedded networks for innovation within and across sectors have been linked to the benefits of different types of external economies and the evolutionary notion of variety. External economies have traditionally been differentiated between: *localisation* economies arising from co-location of firms within the same industries, *urbanisation* economies arising from urban size and density, and *Jacobs* externalities resulting from the presence of a variety of sectors in a given territory. Frenken et al (2007) extend the latter concept of variety to distinguish between related and unrelated variety. Whereas related variety reflects complementarities of knowledge bases and competences, unrelated variety refers to the portfolio effect of diverse, unrelated, activities. Using data at the NUTS 3 level in the Netherlands for 1996–2002, they found a positive effect of related variety in stimulating employment creation, whilst unrelated variety would make regional labour markets less vulnerable to external shocks in demand. Specialization, on the other hand, was likely to increase the risk of higher unemployment and a slowdown in growth rates in the event of external shocks.

One key policy implication of the concept of related variety is the need to move away from sectoral-spatial approaches of targeting clusters (and thus avoiding the ‘picking winners’ risk of selecting the wrong activities), and towards fostering knowledge spillovers between related sectors. Platform policies, structured on the basis of shared and complementary knowledge bases and competences, the promotion of spin-off companies and the encouragement of labour mobility are arguably good mechanisms for attaining greater related variety (Asheim et al, 2007). Extra-regional links can also be a source of related variety, as demonstrated by Boschma and Iammarino (2008). Using export and import data of Italian provinces for the period 1995–2003, they found that being connected *per se* is not sufficient to influence regional economic growth. Rather, they found evidence of inter-sectoral learning arising from extra-regional links with related sectors, as opposed to sectors the region specialises in. It can therefore be inferred that diversified regions, presenting a variety of generic competences and open to extra local related links would be more likely to adapt to changing conditions and would be less susceptible to lock-in effects.

The promotion of greater openness of RSI necessitates a reconsideration of not just relevant policies and instruments (such as those mentioned above) but also of the articulation of policy governance. This includes better joined-up policies that could elicit related variety, away from the current division of policies into vertical ‘silos’. Fittingly, it also demands better multi-level policy coordination. In contrast to common depictions of regional innovation systems as somehow self-sufficient, the top-down steering and facilitation of systems cannot rely entirely on the regional policy space (De Bruijn and Lagendijk, 2005). Regional innovation

systems are by definition incomplete, in that many, if not most, of the relevant networks, components and functions for innovation in regional firms are extra-regional and, correspondingly, ‘the probability that local ties can offer all complementary resources is low’ (Oerlemans et al., 2001; p. 4). That is not to say that they are not important. Rather, it means that not only are the interactions within the economic value chain multi-scalar, but also the articulation of policies takes place ‘among nested governments at several territorial tiers’ (Marks, 1993; p.392). Policy design is influenced by and done in coordination with various nodes of decision making at higher (and lower) levels of governance. The influence of national policies can even be in conflict with regional policy objectives. The analysis of the openness of regional innovation systems thus requires a consideration of both the relevant networks for innovation and the institutional frameworks supporting these links, including the multi-level governance of innovation policy.

3.5. Dynamic adaptation vs. policy transfer

At another level, RSI analyses have been attacked on the basis of a ‘tendency to provide snapshots of successful regions’ (MacKinnon et al, 2002) and neglect dynamic processes of adaptation. Observed cases have emerged in a particular ‘time-space context’ and are the outcomes or ‘emergent properties’ of contingent historical processes, hence cannot be transferred to other sites without taking into account the “specificity of regional trajectories underpinning the identified success” (Smith et al, 2001: p.132). A common tendency has been however for policy makers to try and replicate models that proved to be successful in a particular region (Hospers and Beugelsdijk, 2002).

There is clearly a lack of any ‘ideal model’ of innovation policy, due to regional innovation systems exhibiting very different barriers to innovation (Tödting and Tripl, 2005). The heterogeneity of firms, technologies and selection environments demands policies that are adapted to specific times, places and circumstances. A number of studies have attempted to characterise and compare the existing diversity of regional systems of innovation, highlighting their commonalities and particularities, and identifying the key determinants, linkages and processes and constructing typologies out of the key identified dimensions characterising RSIs. Typologies have been constructed according to different factors, such as regional endowments and institutional/governance modes, internationalisation of regional firms, dominant knowledge basis, level of economic development, regional embeddedness, etc. (e.g. Braczyk et al, 1998; Asheim and Isaksen, 2002; Tödting and Tripl, 2005; Doloreux, 2002; Moodyson et al, 2008). However existing typologies tend to be quite static and not reflect the role of policies in the regions. More often than not, regional benchmarking (and thus the advancement of policy lessons) is carried out with regions whose development has in no way been influenced by regional innovation policy. A region may owe its success to the effects of a particular national policy, or to no policy at all.

Comparisons also tend to focus on a number of (top-down) characteristics, such as the aforementioned institutional and organisational set up of the region in order to identify key elements, which can explain regional advantage and success. This is however often translated in inventory-like descriptions of regional systems, with a tendency to focus on a static landscape of actors and institutions, rather than of

functions, roles and relationships. This over-emphasis on a limited set of institutions at the expense of the functions performed by them may encourage policy makers to focus too much on the creation of new actors and institutions to play new roles, neglecting the roles existing actors and institutions currently play or could be well-placed to play. Often overlooked are also the complexity of institutions and their evolution in historical time (Howells, 2005; Doloreux and Parto, 2005). Institutional settings are largely historically determined and country specific, so that the variety of institutional landscapes depicted in descriptive studies make it “difficult to decide which institutional differences are ‘noise’ and which are relevant or explanatory” (Radosevic, 1998; p.79).

Compared to more static institutional approaches to regional innovation, evolutionary approaches are more concerned with the dynamic mechanisms leading to uneven convergence or divergence over time (Boschma and Frenken, 2006). They aim at explaining adaptation of regions and persistent, path-dependent disparities in growth rates. In this context, regions’ long-term economic processes of structural change depend on the dynamic interrelations between actors and their selection environment (shaped by market and non-market conditions, such as the prevalent set of values, norms and beliefs) (Lambooy and Boschma, 2001).

This is all the more important when policy implications are to be drawn: regional policy—at local, national and supranational (EU) level—has to be based on a deep understanding of how historical trajectories affect change (Lambooy and Boschma, 2001). This is consistent with the policies aimed at promoting related variety described earlier. Rather than starting from scratch or copying from best practice, policy makers need to take existing regional competences and specialisation as building blocks while broadening the economic base of the region through encouraging linkages between related activities (Frenken et al, 2007).

4. Issues surrounding policy articulation and the ‘black-boxing’ of policies

The previous sections have described a number of conceptual issues that prevent the appropriate use of RSI as policy tool. In order to overcome this problem, Iammarino (2005) argues for an integration of the different (bottom-up and top-down) views of RSI into a coherent evolutionary understanding of the innovation dynamics of regions. An emerging evolutionary economic geography agenda (Lambooy and Boschma, 2001) further derive some relevant implications for the articulation of regional policies as suggested in the previous section, notably the promotion of policies directed towards increasing related variety in regional economies.

What seems to be missing in these approaches is an adequate understanding of policy making processes, with an ensuing tendency to ‘black-box’ policies and the policy process. Innovation scholars tend to suggest what policy makers ought to do (normative analysis), whilst being generally less concerned with what policy makers actually do (Wohlgemuth, 2002). Consequently, when giving policy recommendations, they implicitly assume an unproblematic and straightforward translation of these into the formulation of regional innovation policies. A similar concern is echoed by Witt (2003), who notes how eager economist are to offer

policy proposals, without giving much thought to their impact on actual policy making. They tend to misjudge what is feasible in politics, with the result that policy advice often lacks applicability and is not followed (Slembeck, 1997).

Policy recommendations are based on an evolutionary understanding of the economy, but not of the political process, which is treated as a 'given' or as a 'benign black box' (Kay, 2006; Lyall, 2007). The (often implicit) understanding of policy processes is at best instrumental and technocratic, centred around the equilibrium-oriented, comparative-static methodology (Witt, 2003). Simplified assumptions about the motivation and abilities of government agencies would preclude better-informed advice. In a nutshell, a key assumption is that of a single, rational and technocratic decision-maker, who is able to "engineer some desirable state of affairs in the economy by choosing from a 'tool box' of policy measures" (Witt, 2003; p.86).

The rationality assumption sees the government, like the market, "simply as an institution for aggregating or balancing individual demands for public policies" (Mueller, 1989; p.247). This has been challenged by a contrasting argument on the bounded rationality and imperfect information held by policy makers and the adaptive learning—rather than optimizing—behaviour of decision makers (Metcalf, 1995; Mytelka and Smith, 2002). It is also implicitly assumed that decision-makers do not pursue any interests of their own, ignoring the influence power games and the pursuit of self interest may have in policy outcomes (Mueller, 1989). Further, much of the existing literature on the rationales for science, technology and innovation policy deals almost exclusively with 'derived theoretical rationales' whilst generally ignoring the role of ideas in the actual policy process (Laranja et al, 2008). As Koch (2005) notes, there are neither ready-made problems out there waiting to be identified, nor ready-made solutions to these problems, but rather a complex process whereby an *economic problem*, eventually becomes identified as a *problem of economic policy*.

Slembeck (1997) proposes a cognitive-evolutionary approach to policy making process (see also Koch, 2005). The political process presented consists of four phases or filters at three levels (individual, collective and constitutional), from the collective mobilisation of 'problems' perceived by individuals, to its collective interpretation, i.e. their conversion into political issues or commonly accepted basis for action (definition of problems, and evaluation and legitimation of goals and potential solutions). This is followed by a process of formal decision making, either by bureaucratic procedures in the case of routine cases or other political decision mechanism in novel cases. The final stage is implementation of measures. In each stage, a number of barriers can arise causing certain 'problems' to be filtered out. As a consequence a number of them may not be solved. At the three levels of the political process the mechanisms of evolution (variation, selection and preservation) are active and feeding back to the various stages. Thus there is no simple sequential model of the political process, because of "multiple sources of causation, feedback, and the sheer complexity of what is going on" (John, 2003; p.483).

In this process policy makers' behaviour is guided by cognitive structures incorporating preferences and beliefs, which would influence the perception and interpretation of information, and in turn be influenced by social interaction

(Slembeck, 1997). In contrast to the view of a single, monolithic, policy maker, policy decisions emerge out of a complex interplay of many actors across different levels of policy, including non-state actors such as firms, non-governmental organisations, professions and other actors, engaged in a collective process of negotiation and compromise.

Selection pressures (from government, legislation, media, policy networks, etc) placed on policy solutions imply that there is a policy window in which certain ideas and policies are accepted while others are rejected (Kingdon, 1984). Thus at any point in time there will be competing ideas and solutions to policy problems (Kerr, 2002). This may help explain why, whilst trying to tackle similar perceived economic issues (e.g. innovation system failures), the policy solutions employed to address them may be very different across regions. Key in the choice of particular policy problems is also, according to Kingdon (1984), the role of policy (or political) *entrepreneurs*, a figure not too dissimilar to the Schumpeterian entrepreneur in the market place, who have a particular interest in the success of the policy. A number of authors have noted a striking neglect of agency in the regional development literature (Markusen, 2003), and more specifically of the role of leadership in regional development (Sotarauta, 2007). The role of policy entrepreneurs in regional leadership could be a relevant addition to recent conceptual developments in evolutionary economic geography.

Finally, policy analysis tends to be fragmented, static and instrumental, somehow assuming that policy instruments are perfectly interchangeable (Slembeck, 1997). They are however mutually interdependent and do not occur in isolation from other policies at different levels. Interactions happen across policy domains, between instruments, across levels of governance but also across time. Innovation policy would then need to be seen as a ‘whole’, a policy system, or a policy mix, in other words a “complex, composite variable consisting of many interrelated elements” (Kay, 2006;p.10). These interactions are dynamic and path-dependent, for policies are adopted not on a *tabula rasa*, but in a context of pre-existing policy mixes and institutional frameworks which have been shaped through successive policy changes. Past policy decisions would constrain the range of options available for current decision makers (Kay, 2006). A corollary of this is that each use of a policy instrument intervenes at a certain moment in a continuous stream of possibly several evolutions that both condition and constrain the evolution of a given instrument, and will be influenced by it (Pelikan, 2003). Thus when formulating policies, regions need not only to take the knowledge and institutional base of the region as starting point but also consider existing policy mixes and past policy history, for they will enable or constrain new policy goals.

5. Conclusion

This paper puts forward a number of arguments or critiques of RSI that prevent their appropriate use as policy tool. These concern, first, the lack of adequate understanding of meso or even micro specific configurations characterising RSIs and differentiating them from National Systems of innovation. This ‘Listian’ view often leads to regional policies being national policies writ small. Second, a lack of understanding of the multi-level dynamics of the governance of innovation (of markets, knowledge, and policy decision-making), thus leading regions to act as ‘islands’ in their policy articulation and focus on internal connectivity thus ignoring the multiple geographies of knowledge networks. Third, a neglect of the

diversity and context specificity of regions translates in a tendency to draw policy advice from ex-post generalisations of a limited catalogue of successful cases. Fourth, a static bias present in most analyses prevents a proper understanding of the dynamics of change and adaptation of regions, and the need to adapt policies accordingly.

In this paper, we argue, in the line of previous contribution of Iammarino (2005) and recent developments of evolutionary economic geography, that insights from evolutionary economics need to be better reflected in a more coherent theoretical articulation of regional systems. In addition, this emerging agenda should further incorporate aspects related to policy formation and evolution, as opposed to the present tendency to 'black box' policy processes. Evolutionary approaches to regional policy need to develop a more sophisticated and nuanced understanding of the dynamics and limits of policy making and policy actors, and the increased complexity of policy making in a situation of multi-level, multi-actor governance.

Acknowledgements: An earlier version of this paper benefited from comments by the participants of the 'Regions in Focus' International Conference, 2nd-5th April 2007, Lisbon, Portugal. The author is also grateful to Kieron Flanagan and Davide Consoli for their constructive suggestions. The paper has also benefited from the collaborative work of the ERISP network within the EC-funded PRIME Network of Excellence. The usual disclaimer applies.

References

- Amin, A. and Thrift, N. (1995) 'Globalisation, institutional 'thickness' and the local economy'. In P. Healey, S. Cameron, S. Davoudi, S. Graham y A. Madani-Pour (eds.), *Managing cities: the new urban context*. John Wiley&Sons Ltd. 91-108
- Antonelli, C. (2000) 'Collective knowledge communication and innovation: the evidence of technological districts'. *Regional Studies*, vol 34.6. pp.535-547
- Arthur, W., (1989) *Competing technologies, increasing returns and lock-in by historical events*'. *The Economic Journal* 99, 116-131.
- Asheim, B. (1996) *Industrial districts as 'learning regions': a condition of prosperity?* *European Planning Studies*, vol. 1., Issue 4, p379.
- Asheim, B. and Isaksen, A. (2002) *Regional Innovation Systems: The Integration of Local Sticky and Global Ubiquitous Knowledge*. *The Journal of Technology Transfer* Vol.27, Number 1, Pages 77-86
- Asheim, B., Boschma, R. and Cooke, P. (2007) *Constructing regional advantage: Platform policies based on related variety and differentiated knowledge bases*. *Papers in Evolutionary Economic Geography* #07.09, Utrecht University
- Autio, E. (1998) *Evaluation of RTD in regional systems of innovation* *European Planning Studies*, 6, 131-140.
- Aydalot, P. (1986) *Milieux Innovateurs en Europe*, Paris: Economica.
- Bachtler, J. and Yuill, D. (2001) *Policies and Strategies for Regional Development: A Shift in Paradigm*. *Regional and Industrial Policy Research Paper*, no.46. University of Strathclyde.
- Baptista, R. and Swann, P. (1998) *Do firms in clusters innovate more?* *Research Policy* 27 pp.525-540.
- 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.
- Belussi, F. and Sammarra, A., 2007. *Learning at the boundaries in an 'open Regional Innovation System': a focus on firms' innovation strategies in the Emilia Romagna life science industry*. University of Padova, mimeo.
- Boschma, R. (2004). *Competitiveness of Regions from an Evolutionary Perspective*. *Regional studies* vol:38, iss:9, pg:1001-1014.
- Boschma, R. (2005) 'Proximity and Innovation: A Critical Assessment'. *Regional Studies* vol:39 iss:1 p.61-74.
- Boschma, R. and Frenken, K. (2006) 'Why is economic geography not an evolutionary science? Towards an evolutionary economic geography' *Journal of economic geography* vol:6 iss:3 pg:273

- Boschma, R. and Iammarino, S. (2008) Related variety, trade variety and regional growth in Italy. *Papers in Evolutionary Economic Geography* #08.02, Utrecht University
- Braczyk, H., Cooke, P. y Heinderinch, M., eds. (1998) *Regional Innovation Systems*, London:University College Press.
- Breschi, S., Malerba, F., 1997. Sectoral innovation systems: Technological Regimes, Schumpeterian Dynamics, and Spatial Boundaries. In: Edquist, C. (Ed.), *Systems of Innovation: Technologies, Institutions and Organisations*. Pinter, London.
- Bunnell, TG and Coe, NM (2001) Spaces and scales of innovation. *Progress in Human Geography* 25(4), pp. 569-589.
- Camagni, R (1991) (ed.) *Innovation networks*. London: Belhaven.
- Cantwell, J.A. and Iammarino, S., 2003. *Multinational Corporations and European Regional Systems of Innovation*. London and New York: Routledge.
- Carlsson, B. (2005) *Innovation Systems: a Survey of the Literature from a Schumpeterian Perspective* In H. Hanusch and A. Pyka (eds.) *The Elgar Companion to Neo-Schumpeterian Economics*, Cheltenham, Edward Elgar.
- Carlsson, B. Jacobsson, S. Holménb, M. Rickne A. (2002) Innovation systems: analytical and methodological issues *Research Policy* 31, 233–245
- Carlsson, B., 2006. Internationalisation of innovation systems: a survey of the literature. *Research Policy* 35, 56-67.
- Charles, D.; Nauwelaers, C.; Mouton, B.; Bradley, D. (2000) *Assessment of the Regional Innovation and Technology Transfer Strategies and infrastructures (RITTS) scheme*. Final Evaluation report. European Commission, Brussels.
- Chung, H. (2006) *A Study on the Creative National Innovation System in South Korea: Focusing on the Improvement of Regional innovation Capability toward Balanced National Development*. Unpublished MSc dissertation, Manchester Business School, Manchester.
- Cooke, P, Boekholt, P, Tödtling, F. (2000) *The governance of innovation in Europe : regional perspectives on global competitiveness*. London ; New York : Pinter, 2000.
- Cooke, P. (1998): Introduction: origin of the concept. Chap. 1. in H.-J.Braczyk; P. Cooke; M. Heinderich, *Regional innovation systems*. London: UCL Press, pp.2-25.
- Cooke, P. (2001) *Regional Innovation Systems, Clusters, and the Knowledge Economy Industrial and Corporate Change* , vol:10 iss:4 pp.945-974.
- Cooke, P. (2005) Regionally asymmetric knowledge capabilities and open innovation: Exploring ‘Globalisation 2’ – A new model of industry organization. *Research Policy*, 34 (8), 1128-1149.
- Cooke, P. and Morgan, K. (1998). *The associational Economy: Firms, Regions and Innovation*. Oxford: Oxford University Press.
- Cooke, P. and Schienstock, G. (2000) *Structural Competitiveness and Learning Regions Journal Enterprise and Innovation Management Studies Issue Volume 1, Number 3/September 1, 2000 Pages 265-280*
- Cooke, P., Gomez Uranga, M. and Etxebarria, G. (1997) *Regional Innovation Systems: Institutional and organisational dimensions’ Research Policy* 26 (1997) 475-491.
- Coombs, R. and Metcalfe, S. (1998) ‘Distributed capabilities and the governance of the firm’. CRIC discussion paper, n°16. University of Manchester.
- Dalum, B., Johnson, B. and Lundvall, B., 1992. Public policy in the learning society. In: Lundvall, B., Editor, , 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, Pinter, London.
- Dalum, B., Johnson, B. and Lundvall, B., 1992. Public policy in the learning society. In: Lundvall, B., Ed. (1992)
- David, P. (1987). Some new standards for the economics of standardization in the information age, in Dasgupta, P. and Stoneman, P. (eds), *Economic Policy and Technological Performance*, Cambridge, Cambridge University Press
- David, P., (1985). Clio and the Economics of QWERTY. *The American economic review* vol.75, 2, 332.
- De Bruijn, P. and A. Lagendijk (2005). Regional innovation systems in the Lisbon strategy. *European Planning Studies* 13(8): 1153-1172.
- Doloreux, D (2002). What we should know about regional systems of innovation *Technology in Society* 24 pp. 243-263.
- Doloreux, D. and Parto, S. (2005) *Regional Innovation Systems: Current Discourse and Unresolved Issues. Technology in society* vol:27 iss:2 pg:133
- Dopfer, K Foster, J Potts, J (2004) Micro-meso-macro. *Journal of evolutionary economics* vol:14 iss:3 pg:263
- Dosi, G. (1988) The nature of the innovative process. In: Dosi et al. (eds.) *Technical Change and Economic Theory*. London: Pinter.

- Edquist, C. (1997) (ed.) *Systems of Innovation: Technologies, Institutions and Organisations*. London: Pinter.
- Edquist, C. And Johnson, B. (1997) *Institutions and organisations in systems of innovation* . In: C. Edquist (ed.) (1997) pp.41-63.
- Evangelista, R., Iammarino, S., Mastrostefano, V., Silvani, A. (2002) *Looking for regional systems of innovation: evidence from the Italian innovation survey*. *Regional Studies* v36 i2 p173(14)
- Freel, M. S. (2003). 'Sectoral patterns of small firm innovation, networking and proximity' *Research Policy* 32(5): 751-770.
- Freeman, C. (1995) *The 'National System of Innovation' in historical perspective* . *Cambridge Journal of Economics*, 19, 5-24.
- Frenken K., Van Oort F. and Verburg T. (2007) *Related variety, unrelated variety and regional economic growth*. *Regional Studies* 41, 685-697
- Hassink, R. (2005) 'How to Unlock Regional Economies from Path Dependency? From Learning Region to Learning Cluster'. *European Planning Studies* Vol. 13, No. 4, June 2005
- Hommen, L. and Doloreux, D. (2003) *Is the Regional Innovation System Concept at the End of Its Life Cycle? Paper presented for the conference 'Innovation in Europe: Dynamics, Institutions and Values'* ,Denmark, 8th -9th May, 2003
- Hospers, G. and Beugelsdijk, S. (2002) *Regional Cluster Policies: Learning by Comparing?* *Kyklos*, vol. 55, issue 3, p 381.
- Howells, J. (1999) *Regional systems of innovation?* In: D. Archibugi, J. Howells And J. Michie (eds.) *Innovation policy in a global economy*. pp. 67-93. Cambridge: Cambridge university press .
- Howells, J. (2005) *Innovation and regional economic development: a matter of perspective*. *Research policy* vol:34 iss:8 pg:1220.
- Iammarino, S. (2005) *An evolutionary integrated view of Regional Systems of Innovation: Concepts, measures and historical perspectives*. *European planning studies* vol:13 iss:4 pg:497
- John, P. (2003) *Is There Life After Policy Streams, Advocacy Coalitions, and Punctuations: Using Evolutionary Theory to Explain Policy Change?* *Policy Studies Journal* Vol. 31 Iss. 4, 481 - 498
- Kay, A. (2006) *The Dynamics of Public Policy*. Cheltenham: Edward Elgar.
- Keeble, D., Lawson, C., Moore, B. And Wilkinson, F. (1999) *Collective learning processes, networking and 'institutional thickness in the Cambridge Region*. *Regional Studies*, vol.33.4, pp.319-332.
- Kerr, P. (2002). *Saved from extinction: evolutionary theorising, politics and the state*. *The British Journal of Politics and International Relations* 4(2): 330-358.
- Kingdom, J. (1984) *Agendas, Alternatives and Public Policies*. New York: Longham.
- Kline, S. and Rosenberg, N. (1986) *An overview of innovation*. Reprinted in: C. Edquist and M. McKelvey (2000) (Eds.) *Systems of Innovation : Growth, Competitiveness and Employment*. Elgar Reference Collection.
- Koch, L. (2005) *Economic Policy—A Process of Communication*, in Dopfer (ed.) *Economics, Evolution and the State*. Cheltenham: Edward Elgar.
- Legendijk, A and Oinas, P (2005) *Proximity, External Relations, and Local Economic Development*, in: Arnoud Legendijk and Päivi Oinas, *Proximity, Distance and Diversity, Issues on Economic Interaction and Local Development*, Ashgate, 2005, 3-22
- Legendijk, A. (1999). *Good practices in SME Cluster initiatives. Lessons from the 'Core' regions and beyond*. Research Report. Centre for Urban and Regional Development Studies, University of Newcastle Upon Tyne
- Legendijk, A., Cornford, J., 2000. *Regional institutions and knowledge – tracking new forms of regional development policy*. *Geoforum* 31, 209-218.
- Lambooy, J.G., Boschma, R.A. (2001) *Evolutionary economics and regional policy*. *The Annals of Regional Science*. Vol. 35, Number 1 Pages 113-131
- Landabaso, M. and Mouton, B. (2002) *Towards new regional innovation policies: 8 years of European experience through innovative actions*. in van Geenhuizen, M.; Gibson, D. and Heitor, M. (eds.): *Regional Development and Conditions for Innovation in the Network Society*, Lisbon, Quorum Books, 2002
- Laranja, M., Uyerra, E. and Flanagan, K. (2008) *Policies for science, technology and innovation: Translating rationales into regional policies in a multi-level setting*. *Research Policy* Vol.37, Is.5, 823-835
- Lawson, C. (1999) *Towards a competence theory of the region*. *Cambridge Journal of Economics* 23, 151-66.
- Lovering, J. (1999) *Theory Led by Policy: The Inadequacies of the 'New Regionalism' (Illustrated from the Case of Wales)*. *International Journal for Urban and Regional Research*, vol. 23 no.2 June 1999 p. 379-395

- Lundvall, B.A. (1992) (ed.) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London: Pinter.
- Lyall, C. (2007) Changing boundaries: the role of policy networks in the multi-level governance of science and innovation in Scotland. *Science and Public Policy* 34(1): 3-14.
- MacKinnon, D., Cumbers, A. and Chapman, K. (2002) Learning, innovation and regional development: a critical appraisal of recent debates. *Progress in Human Geography* 26,3 pp. 293–311
- Marks, G. (1993) Structural policy and multilevel governance in the EC', in A.W. Cafruny and G.C. Rosenthal (eds), *The State of the European Community, Vol. 2: The Maastricht Debates and Beyond*, Harlow: Longman, pp. 391–410.
- Markusen, A. (2003) Fuzzy Concepts, Scanty Evidence, Policy Distance: The Case for Rigour and Policy Relevance in Critical Regional Studies. *Regional studies* 37(6): 701.
- Martin, R. and Sunley, P., 2006. Path dependence and regional economic evolution. *Journal of Economic Geography*. Vol. 6, 4, pp. 395–437
- Maskell, P. and Malmberg, A. (1999) Localised learning and industrial competitiveness. *Cambridge Journal of Economics* 23, 167–185
- Metcalfe, J.S. (1995) Technology systems and technology policy in an evolutionary framework. *Cambridge Journal of Economics*,19, pp.25-46.
- Moodysson, J. Coenen, L. and Asheim, B. (2008) Explaining spatial patterns of innovation: analytical and synthetic modes of knowledge creation in the Medicon Valley life-science cluster. *Environment and Planning A* 2008, volume 40, 1040-1056
- Moreau, R. (2004) The role of the state in evolutionary economics. *Cambridge Journal of Economics* 28, 847-874.
- Morgan, K. (1997): The learning region: Institutions, innovation and regional renewal. *Regional Studies* 31 (5), 491-503.
- Morgan, K. (2004) Sustainable regions: governance, innovation and scale. *Journal European Planning Studies* Vol. 12, iss. 6/ Pages 871-889
- Mueller, D. (1989) *Public choice II*. Cambridge: Cambridge University Press.
- Mytelka, L. and Smith, K. (2002) Policy Learning and Innovation Theory: An Interactive and Co-Evolving Process. *Research Policy*, 14:23, pp. 1-13
- Nelson, R and Winter, S. (1982) *An Evolutionary Theory of Economic Change*. Cambridge: Belknap.
- Nelson, R. (ed.) (1993) *National innovation systems: a comparative analysis*. New York: Oxford University Press.
- OECD (2007) *R&D and Innovation in Spain: Improving the Policy Mix*. Paris:OECD.
- Oerlemans, L., Meeus, M., Boekema, F., 2001. Firm clustering and innovation: determinants and effects. *Papers in Regional Science* 80, 337–356.
- Oerlemans, L.A.G., Meeus, M.T.H., & Kenis, P.N. (2007). *Regional Innovation Networks*. In R.P.J.H. Rutten & F.W.M Boekema (Eds.), *The Learning Region: Foundations, state of the art, future* (pp. 160-183). Cheltenham: Edward Elgar.
- Pelikan, P. (2003) Why economic policies need comprehensive evolutionary analysis, in Pelikan, P. and Wegner, G. (eds.) *The evolutionary Analysis of Economic Policy*. Cheltenham: Edward Elgar.
- Pellegrin, J. (2007) Regional Innovation Strategies in the EU or a Regionalized EU Innovation Strategy? *Innovation: The European Journal of Social Science Research*, 20:3,203 — 221
- Penrose, E. (1959) *The theory of the growth of the firm*. - Oxford : Basil Blackwell.
- Pyke, F., Becattini, G. and Sengenberger, W. (eds) (1990) *Industrial Districts and Inter-Firm Cooperation in Italy*. Geneva: International Institute for Labour Studies.
- Radosevic, S. (1998) Defining Systems of Innovation: A Methodological Discussion. *Technology in Society*, 20, pp.75-86.
- Riba, M. and Leydesdorff, L. (2001) Why Catalonia cannot be considered as a Regional Innovation System. *Scientometrics* 50 (2) (2001) 215-240.
- Sanz Menéndez, L., Cruz, M. and Romero, M. (2001) 'Recursos, intereses y difusión de modelos para la política regional de I+D: La Comunidad de Madrid', M. Olazaran and M. Gómez Uranga, (eds.) *Sistemas regionales de Innovación*, Bilbao: Servicio Editorial Universidad del País Vasco.
- Sharif, N. (2006) Emergence and Development of the National Innovation Systems Approach. *Research Policy* 35, no.5: 745-766.
- Slembeck, T. (1997) The Formation of Economic Policy: A Cognitive-Evolutionary Approach to Policy-Making. *Constitutional Political Economy* 8(3): 225-254.
- Smith, A., Rainnie, A. and Dunford, M. (2001) Regional trajectories and uneven development in the 'New Europe': Rethinking territorial success and inequality. In, Wallace, H. (ed.) *Interlocking*

- Dimensions of European Integration (One Europe or Several?). Basingstoke, UK, Palgrave Macmillan, 122-144.
- Sotarauta, M. 2007. Leadership in Promotion of Regional Development - An Empirical Analysis of Power and Influence Tactics in the Finnish Regional Development Activity. University of Tampere. Research Unit For Urban and Regional Development Studies. Tampere. Sente-Working papers 12/2007.
- Staber, U. (1996) Accounting for variations in the performance of Industrial Districts: The case of Baden-Wurttemberg. *International Journal of Urban and Regional Research* 20, 299–315.
- Storper, M. (1997) *The Regional world: Territorial development in a global economy*. New York: Guilford.
- Sugden, R., Wei, P. and Wilson, J.R. (2006) Clusters, governance and the development of local economies: a framework for case studies in Pitelis, C., Sugden, R., Wilson, J.R. (2006) *Clusters and Globalisation: The development of Urban and Regional Economies*. Cheltenham: Edward Elgar.
- Todtling, F. and Trippl, M. (2005) One size fits all? Towards a differentiated regional innovation policy approach *Research Policy* 34 (2005) 1203–1219
- Uyarra, E. (2007) Knowledge, Diversity and Regional Innovation Policies. *Innovation: The European Journal of Social Science Research*, vol.20 iss.3. pp. 243 – 261.
- Werker, C. and Athreye, S. (2004) Marshalls disciples: knowledge and innovation driving regional economic development and growth. *Journal of Evolutionary Economics* Vol.14, no.5: 505-523
- Witt, U. (2003). Economic policy making in evolutionary perspective. *Journal of Evolutionary Economics* 13(2): 77-94.
- Wohlgemuth, M. (2002). Evolutionary Approaches to Politics. *Kyklos* 55(2): 223-246.