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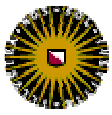


Utrecht University
Urban & Regional research centre Utrecht

Beyond clusters:
Fostering innovation through a differentiated and combined network approach

Evert-Jan Visser and Oedzge Atzema
Utrecht University, Faculty of Geosciences, Section of Economic Geography
Corresponding author: e.visser@geo.uu.nl

Abstract

Over the past decades, economic and innovation policy across Europe moved in the direction of creating regional clusters of related firms and institutions. Creating clusters through public policy is risky, complex and costly, however. Moreover, it is not necessary to rely on clusters to stimulate innovation. A differentiated and combined network approach to enhancing innovation and stimulating economic growth may be more efficient and effective, especially though not exclusively in regions lacking clusters. The challenge of such a policy is to mitigate the bottlenecks associated with 'global pipeline', 'local buzz' and 'stand alone' strategies used by innovative firms (cf. Bathelt et al. 2004; Atzema & Visser 2005b), and to combine these strategies with a view to their complementarity in terms of knowledge effects. Private and semi-public brokers will be key in the evolving policy, as timely organizational change is crucial for continued innovation, while brokers also need to mitigate governance problems. This requires region-specific knowledge in terms of sectors, life cycles, institutional and socio-cultural factors, and yields spatially differentiated and differentiating adjustment strategies. The role of public policy is to assist in recruiting, provide start-up funding and monitor brokers. With this, policy moves towards a decentralized, process-based, region-specific, spatially diverging and multi-level system of innovation that is geared towards the evolving innovation strategies of firms.

Key words: innovation policy, clusters, networks, governance, regionalization

Jel codes: R11, R58, O12, O31, O38

1. Introduction

Regional policy focused on stimulating innovation is relatively new, yet widespread in Europe and other parts of the world. Over the past decades, the focus of this policy shifted towards stimulating learning and innovation processes at the regional level, with the aim to promote regional economic growth. The rationale of this approach goes back to research suggesting that learning and innovation are interactive processes (Lundvall 1988, Nooteboom 2000) that appear to be confined to specific regional settings (see e.g. Camagni 1991; Becattini 1990; Cooke 2001; Asheim 1996). The regional approach to innovation has, however, become especially popular as a result of the work of the Harvard economist Michael Porter (1990, 1998, 2000), who triggered attention for so-called regional clusters of related sectors and industries, with a view to raising productivity, innovativeness and competitiveness in general.

This paper describes the evolution of regional economic and innovation policy in Europe, summarizes a number of problems with regional cluster-oriented policies, and asks what type of innovation policy is appropriate in the case of regions lacking clusters (which may be the situation in most European regions) and of those relatively rare cases of regions lodging vibrant clusters. The paper argues that a more efficient and effective innovation policy may be based on a differentiated and combined network approach to stimulating innovation. It thus develops a *plea* for a policy that is geared towards different types of innovation behaviour of firms, and which addresses the bottlenecks associated with each of these types (differentiation), while connecting them with a view to passing through the different stages of knowledge development (combination). This plea is inspired by recent empirical work on the innovation strategies of firms in the Utrecht, Gooi & Eemland region in the Netherlands (see Atzema & Visser 2005b), which is an example of a region lacking clusters and hiding innovation potential in other ways. Next, it builds on Bathelt's et al. (2004) ideas regarding the spatiality of knowledge creation, especially their observation that 'recent cluster policies are so predisposed toward local networking that the importance of external, trans-local communication is overlooked' (ibid., p. 49). Other sources of literature (e.g. on business strategy, innovation, evolution, clusters, services, and globalization) also inspired us while writing the below plea.

The paper is structured as follows. Section 2 sketches the evolution of regional economic and innovation policy in Europe. Section 3 derives a series of problems with regional cluster-based innovation policies from several sources of literature. Section 4 describes three stylized innovation strategies of firms, including bottlenecks and shortcomings of each strategy. Section 5 asks whether and what type of policy is appropriate considering these bottlenecks and shortcomings. Section 6 considers the spatial scale at which the emerging policy alternative should develop, and asks to what extent regional differences are important. Section 7 summarizes the main findings.

2: Evolution of regional economic and innovation policy in Europe

The origins of regional economic and innovation policy go back to 1980s, when Keynesian regional policies lost ground during the economic crisis of 1979-1982. Supply-side oriented innovation policies initially focused on attracting innovative firms, and then shifted towards the creation of regional milieus and innovation systems, in line with the idea that innovation is a non-linear process (Rosenberg 1982), that the road from invention to a successful innovation is full of uncertainty, that constant monitoring and feedback is thus required, and that both internal and external sources are useful in this respect. Next, researchers suggested that learning and innovation are interactive processes (Lundvall 1988) are confined to specific regional settings (see e.g. Camagni 1991; Becattini 1990; Cooke 2001; Asheim 1996). Innovative firms were increasingly seen as 'learning organisations embedded within a broader institutional context' (Mytelka & Smith 2002, p. 1472), inducing Freeman and Lundvall to launch the 'innovation system' concept (see Carlsson 2006). Due to its empirical content, policymakers welcomed this approach, especially in the OECD, the EU and the UN, where small groups of researchers were commissioned the task of elaborating and operationalising the concept (Mytelka & Smith 2002, p. 1476).

The regional approach to enhancing economic growth and innovation has also become popular as a result of the work of the Harvard economist Michael Porter (1990, 1998, 2000), who triggered attention for so-called clusters with a view to raising productivity, innovativeness and competitiveness. According to Porter, clusters involve groups of firms operating in related branches of industry at the level of final products, raw materials, equipment, machinery and services, i.e., competitors, users and producers of intermediary and final products, and producers of complementary goods and services. These firms benefit from functional and technological interactions beyond mere input-output transactions. In fact, interactions occur between four sets of factors that constitute Porter's 'competitive diamond': firm strategy, structure and rivalry; factor input conditions; demand conditions; and related and supporting industries. The more developed and intense the interactions between these factors and the actors involved, the greater will be the productivity, innovativeness and export growth of the firms and sectors concerned. Although Porter (1990, p. 156-57) mentioned the importance of geographical concentration of firms to enhance the working of clusters, he did not explicitly include a spatial dimension in his original cluster definition. Later, he did, writing that "the enduring competitive advantages in a global economy are often heavily localised, arising from concentrations of highly specialised skills and knowledge, institutions, rivalry, related businesses, and sophisticated customers" (1998, p. 5). Hence, Porter (1998, p. 197) defined clusters as 'geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also co-operate'.

In line with the above insights, regional economic and innovation policy in Europe started focusing on the promotion of regional clusters and a regional atmosphere stimulating entrepreneurship, collective learning, the social prestige and acceptance of innovation (Park 2001). In this context, clusters refer to networks of innovative firms and supporting institutions, which are thought to develop at the local or regional level and then to extend towards the global level, which is different from the original meaning of the cluster concept as a long-term process of geographical concentration of firms in related activities, i.e., a sectoral agglomeration in which spatial proximity yields external economies in factor, production and transaction costs as well as information spillovers (see e.g. Marshall 1890). In the emerging policy context, clusters equate with collaborative networks, and the role of policy is to facilitate network formation to stimulate knowledge interaction within the region as well as with actors crossing regional borders.

This last element coincides with research findings that innovative firms often consider the world for new knowledge, depend on global markets, technology and skilled workers elsewhere, and that innovation processes increasingly surpass national borders as a result of enhanced cross-border technology transfer via technology-intensive trade, an increasing number of international strategic technology alliances, multinational companies pushing on the transnational organization of R&D, and the involvement of marketing, manufacturing and R&D units of firms in innovation processes (Kuhlman & Edler 2003). Carlsson (2006) observes that R&D activities internationalize, as they are largely conducted within firms, i.e. in international yet intra-firm corporate networks. These activities augment home-base technological

competence, while increasing differences between headquarters and subsidiaries in terms of technological competences, science-based activities and core competencies.

So, trans-local, inter-national and even intra-firm interactions are important for innovation, and cluster policies in principle allow for this. In practice, however, regional policymakers seem to be tempted to emphasize regional interactions as a way of stimulating learning and innovation processes, creating regional clusters and promoting regional economic growth. It appears that Porter's cluster approach to innovation has become most influential among policy-makers (see e.g. Roelandt & Den Hertog 1999; Boekholt & Roelandt 2000; Den Hertog, Bergman & Charles 2001; Observatory of European SMEs 2002; Sölvell, Lindqvist & Ketels 2003). Hospers (2005, p. 452) in fact notes that "everywhere in Europe, policy-makers aim for (..) the creation of 'high-tech clusters', especially in information-, bio- and nanotechnology". Sölvell, Lindqvist & Ketels (2003, p. 10) report that in Europe, USA, New Zealand and Australia alone, more than 500 regional cluster initiatives have been undertaken. Elsewhere, policy trends are similar (see e.g. ECLAC 2005 for Latin America). Porter's influence is also felt in the Netherlands, where the central government took various measures to stimulate innovation, among which the creation of a number of so-called knowledge centres, which receive priority funding for R&D, and the listing of a few regional centres of innovation that are believed to have the highest potential to contribute to the realization of the national innovation agenda (Ministry of Economic Affairs, 2004).

3: Problems with a regional cluster-based innovation policy

Martin and Sunley (2003) and more recently Asheim et al. (2006) criticized Porter's approach to clustering for bringing along a number of serious conceptual, theoretical and methodological problems. We build on this criticism and add to it by using several strands of literature to derive five risks and problems with a regional cluster-based policy to stimulate innovation.

A first problem with regional cluster-based policies is the *risk of strategic failure*, which we derive from the innovation literature (see e.g. Nooteboom 2000 and 2004). Innovation is unpredictable in terms of both processes and outcomes. Hence, it is difficult to select *ex ante* the firms, technologies and industries that will be involved in the creation of novelty, and thus will be the winners in a near or more distant future. Innovation is a highly uncertain process that is characterized by a lot of trial and error, apparent success and unexpected failure, ongoing corrections and fine-tuning in the light of evolving market and technology developments, and sometimes light at the end of the tunnel in the form of a successful new product. There is no problem with this, as long as actors in the context of markets make different bets about the future and invest in different directions, after which a process of selection leads to the survival of some innovations, and the death of all other ventures. The problem is relevant, however, once public decision-makers enter the stage, selecting *ex ante* what they think will be winners in the future. Public mistakes tend to be more large-scale in nature, and will have to be paid by taxpayers, whereas private mistakes imply a loss to certain individuals only—those who made the wrong choices. Private decision-making thus appears to be superior in terms of spreading the risk of innovation failures. It may also be superior in terms of the quality of decision-making, considering the often political nature of public decision-making.

A second problem is the *risk of collective failure*, which can be derived from literature on business strategy (see e.g. Porter 1985). Aiming at stimulating innovation in their region, policymakers tend to copy the success of well-known high-tech regional clusters elsewhere, for example Silicon Valley in California (USA), Bavaria (Germany), Sophia-Antipolis (France) and Oulu (Finland) (Hospers 2005). These days, everyone seems to want a bio- or nanotechnology cluster, or an ICT, multimedia, life sciences, (alternative) energy or other type of high-tech cluster. This tendency of imitation in industrial, innovation and cluster policy runs the risk of overinvestment, producing excess capacity and competition on costs in stead of innovation. Jacobs and Lankhuizen (2006, p. 247) note that Porter (1990, 1998, 2000) called upon governments to focus on particular and traditional competitive strengths, not to imitate the success of others. It seems that this message did not come across.

A third problem is *the problem of complexity*, which can be derived from the literature on clusters, services and evolutionary economic geography. The cluster literature suggests that clustering refers to diverse, complex, endogenous, embedded, long-term and historical processes taking place in specific regional contexts (see e.g. Gordon and McCann 2000, Visser and Boschma 2004, Asheim et al 2006; see also annex 1). Next, many regions do not have clusters—and thus will have to start from scratch, while the literature on service industries and innovation suggests that these activities hardly cluster (see e.g. Bilderbeek et al. 1998). Brenner's (2004) work on German clusters suggests that it may be hard, if not impossible, to create and develop clusters. Clustering is due to local self-augmenting processes (LSAPs) that increase entry and/or lower exit rates.[1] In turn, a higher entry and/or lower exit rates may result from start-ups (due to more spin-offs and/or better access to venture capital in a cluster), relocation, and incumbent growth (which may be due to enhanced innovation and/or cost reductions, which in turn can result from pure spillovers, intra-cluster cooperation, and human capital accumulation). There are four conditions to obtain LSAPs, however: positive feedback between actors within or across firm populations and/or with local conditions; this positive feedback should increase more than linearly with the size of factors; the time frame of a factor and changes in the firm population should be the same; and the process should be local. The upshot is that not all factors and causal relationships between factors suggested in the cluster literature fulfil these conditions (for an overview, see Brenner 2004, p. 42-55). So, we do not yet know what causes the genesis and growth of clusters. Given this uncertainty, we can hardly predict the outcomes of a cluster policy, and policymakers have a hard time selecting effective measures. Furthermore, one has to bear in mind that LSAPs constitute the necessary conditions for clustering, while industry-specific and regional conditions are the sufficient conditions. Not all industries have the characteristics favouring clustering, and where it occurs, it is not always caused by the same mechanisms. Regional conditions refer to exogenous factors, historical and stochastic events (e.g. the arrival of pioneers, certain actions of leader firms) and the strength of particular LSAPs. In hindsight, it may be possible to explain why in certain regions clusters developed. Beforehand, however, it is hard to say whether or not one will emerge: where, when and how fast. Evolutionary economic geographic literature (see Boschma & Frenken 2006) states that it may be a matter of chance that in a certain region a certain threshold value is reached, and that some kind of self-augmenting process starts playing its part, so that clustering takes place in that region, and not in another. In any case, more research is required to answer the questions if, when,

where, and how clusters develop. Until then, policymakers creating clusters are gambling.

A fourth, and in the context of this paper very important problem that drives our aim to formulate an alternative innovation policy at the regional level, are the *high opportunity costs* of cluster-based policies. This problem can be derived from literature on globalization of innovation systems (see e.g. Bathelt et al. 2004; Simmie 2004 and 2006; Carlsson 2006). This literature stresses the international dimension and spatial differentiation of different steps in the knowledge acquisition, learning and innovation process, with inter-firm alliances and knowledge trades increasingly taking place at the international level up to a global scale. By fostering 'local buzz'—strengthening regional ties, contact and identity in clusters, one may thus well overlook other business efforts to innovate, e.g. constructing 'global pipelines'—seeking and combining international knowledge with one's own, and 'standing alone'—relying on internal knowledge resources for innovation (Bathelt et al. 2004; Atzema & Visser 2005b). Each of these strategies that firms use to learn and innovate may run into specific problems, requiring different policy measures. A policy focus on stimulating 'local buzz' in clusters may thus well go at the expense of explicit attention for the bottlenecks arising with other business strategies to innovate. Next, it may miss out on possibilities for synergy between different strategies that businesses use for innovation (we will explain the last point in Section 5). So, the problem of high opportunity costs of cluster-based policies consists of overlooking bottlenecks associated with other business strategies to innovate, and missing out on synergy based on the complementarity of these strategies in the light of the different stages of innovation processes. [2]

The above four problems may apply to national and regional economies, no matter if these lodge innovative clusters (see e.g. Paniccia 2006), not any more (see e.g. Grabher 1993), or not at all (as is e.g. the case of the Utrecht, Gooi & Eemland region in The Netherlands; see Atzema and Visser 2005b).[3] Many EU regions may be characterized by a diversified economy, an increasing service sector, and/or the presence of so-called knowledge workers (see Raspe and Van Oort 2006), but no other innovation indicator calling these regions an innovative 'hot spot'. In these regions, innovation may largely go unnoticed, as it may show up in a variety of sectors, industries and activities. Next, the nature of innovation in these regions may make it hard to detect, e.g. non-technical and combined forms of innovation occurring 'downstream' in value chains, where suppliers connect a new product or process with clients and their markets, inducing organizational change within and across firms so as to adapt, learn and compete faster and better (for a methodology to detect innovation and bottlenecks in such regions, see Atzema and Visser 2005b). Another group of EU regions depend on a few sectors, which may lag behind for several reasons: structural change, industry life-cycles (and all the related factors of international competition, outsourcing, off-shoring and exit) or changes in demand. In these regions, it is also important not to focus on clusters per se but to consider a more differentiated approach, as every bit of innovative strength should be cherished, mobilised and exploited.

4: Innovation strategies of firms

We may describe three innovation strategy types in terms of the stages of innovation as well as the sources of knowledge used during these stages (see table 1). Note that firms may well use a mix of these strategy types, but they often do so with a certain emphasis (see e.g. Atzema and Visser 2005b).

Table 1 about here

The stages of innovation are based on Rutten (2002), whose four-stage approach has been expanded with a pre-invention phase, in line with a model on knowledge development developed by Nooteboom (2000). So, we distinguish between a pre-invention stage (search, trial & error, and other ways of exploration), invention (looking for new ideas and knowledge), developing a product prototype, adaptation to market conditions and other (often technical and regulatory) requirements, and launching/marketing the new product.

In 'stand-alone' strategies, learning during these stages is based on internal mechanisms (that are usually untraded): learning-by-doing (which yields an effect of experience), learning-by-using (which refers to an effect of expertise), learning-by-experimenting (which is an effect of curiosity), and learning-by-monitoring (which requires system feedback). In other words, firms using stand-alone strategies rely on trial & error (in daily practice: doing and using), and search on the basis of work-floor experiments, internal R&D, or teams and task forces.

In a 'local buzz' strategy, firms use accidental and purposeful, informal and formal, personal and business, as well as short-term and long-term contacts with local actors, such as research institutes, universities, competitors, suppliers, clients, etc. The strategy comprises learning-by-interacting with local trading partners (traded interdependencies) and/or on pure spillovers and informal interactions (untraded interdependencies). The traded interdependencies include interactions with upstream suppliers, downstream customers, diagonal service providers, but also with specialists who are hired or borrowed from other organizations, for limited time periods. In the untraded category, learning-by-spillovers includes 'horizontal observation' of tacit knowledge as well as monitoring and selection of best practices in competitor firms; learning-by-informal interaction includes advice regarding the production process (what, how and how much to make), but also joint problem recognition: awareness raising, interpreting external signals, and sense making; learning-by-cooperation in local networks also includes mutual advice and joint problem recognition, but here the process may go a step further including joint problem solving by collective investments in training, R&D, innovation, internationalisation, marketing, infrastructure, etc (see e.g. Visser and De Langen 2006).

More in general, Bathelt et al. (2004) define local buzz as "the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region". It can be a process requiring no investment at all from the side of participants, turning it into a passive advantage and possibly a liability for firms (due to lack of renewal, outside inputs and creativity, see Visser 1996; Nadvi and Schmitz 1999), but the process may also improve in terms of quality, however, if and when multiple ties are relevant (with

friends, agents, mentors and business partners) and different information and communication modes are used (e.g. chatting, gossip, negotiation, and intensive dialogue over specific problems).

The third strategy type in table 1 is that of firms seeking and combining external, trans-local and international knowledge with their own. In these cases, firms construct 'global pipelines', making e.g. use of Internet sources, seminars, research magazines, academic contacts, resource persons in research institutes, global inter-firm alliances, and discussions with suppliers, clients and competitors elsewhere. 'Global pipeline' strategies thus comprise learning-by-interacting with trading parties located elsewhere in the world (traded interdependencies, including the same type of actors as above, in 'local buzz' strategies) and learning-by-cooperation in networks, with firms involved in the same branch (competitors), chain (suppliers and buyers) or a related industry (diagonal linkages), and/or with academics, consultants and other 'strange ducks' (which may be untraded interdependencies).

It was already noted that firms may use a mix of these strategy types, albeit with a certain emphasis.[4] So, firms applying a stand-alone strategy may occasionally use a complementary external source of knowledge, e.g. during the invention or marketing stage of innovation, but mostly rely on internal sources of knowledge throughout the process. The implication of this is that there may not only be bottlenecks associated with each of the above strategies, i.e. internal deficiencies such as high risk, insufficient skills, lack of partners, etc., but also shortcomings related with an insufficient scope of the strategy regarding the innovation process. Below, we deal with both bottlenecks and shortcomings.

Firms employing 'stand alone' strategies may have difficulties in combining the task of survival—based on an efficient exploitation of existing knowledge, and development—based on innovation requiring an effective exploration of new knowledge (Nooteboom 2000). This point may more relevant for small firms, due to resource constraints (Visser 1996). Next, market and technology contexts change fast, leaving stand-alone firms with turbulence that they can barely track and trace. Related with this, they fear making wrong decisions while fine-tuning aspects of the innovation process and thus need to confront Camagni's (1991) risks of dynamic uncertainty, while at the same time lacking sufficient internal capacity to monitor, evaluate and adjust those decisions. Finally, stand-alone firms may lack strategic insight and dynamic capabilities in the sense of the capacity to foresee the benefits and have trust in the utility and necessity of innovation, and to convince opponents within the firm. Hence, stand-aloners may end up stuck in the middle between past and future, somewhere between well-proven practices and routines and promising but uncertain novelties. Here, external knowledge sources may help, e.g. supplier platforms, competitors or advisors, but the nature of the firm using stand-alone strategies is that they do not use these sources.

Firms employing 'global pipeline' strategies access diverse sources of knowledge at a global scale and thus enhance relative cognitive distance, which is a precondition for effective inter-firm learning (Nooteboom et al. 2005). Yet, they subsequently require possibilities for 'face2face' dialogue to assimilate, filter, adapt, exploit and apply the newly acquired knowledge in different (local) markets. This may be organized on a frequent basis within regions, involving nearby firms. Yet, this is only feasible when

the quality of local partners is sufficiently high, in terms of their absorptive capacity and skills to develop prototypes and/or marketable products. Otherwise, firms employing 'global pipelines' will recur to less frequent contacts with suitable partners elsewhere, and/or they aim at substituting smart ICT solutions for 'face2face' interaction, however imperfect that still may be.

Finally, firms employing 'local buzz' strategies may have the advantage that familiarity breeds trust, which enables interaction, but familiarity at the same time reduces the novelty value of local knowledge sources: a problem of insufficient cognitive distance (Nooteboom 2006). This may yield local networks of a highly social nature (where people meet for the sake of meeting: reinforcement of status and power, to have a sense of belonginess), where short-term mindedness reigns at the expense of long-term strategic issues, and with a mainly local membership, whereas outsiders could well enrich the local buzz circling around. The problem of insufficient cognitive distance is especially acute in some types of clusters (see Visser 1996 and 2000), where passive advantages of pure spillovers have a high share in the local buzz spinning around at high speed, but with limited relevance, as it may be outdated and it is accessible to everyone present in the cluster (i.e. making no competitive difference). In regions, there may be a lack of strategic vision, policymakers with leadership, and/or an atmosphere that not exactly stresses the urgency and importance of innovation. In short, a 'community argument' (cf. Hirschman 1970) is missing, dealing with the following questions: why must I innovate, when and why is external interaction helpful, and when and why should I do so at different levels: local, trans-local, global?

5: A new approach to innovation policy

The preceding sections contain arguments pushing and pulling away from a mere regional cluster-based approach to innovation, with the associated risks and high costs operating as push factors, and the importance and shortcomings of two other innovation strategies operating as pull factors. We propose that a differentiated and combined network approach to stimulating innovation is not only a necessity, but also more effective, in regions with or without clusters. Such an approach has two objectives: (a) paying attention to the specific bottlenecks associated with each type of innovation strategy, i.e., *differentiating* policies; and (b) linking different strategies and the associated networks with a view to their complementarity regarding innovation processes, i.e., *combining* networks.

The rationale of this approach is, firstly, that not paying attention to the bottlenecks associated with different innovation strategies of firms is costly, not only for the firms involved and their workers, but also for regions, as firms may more easily leave once markets and clients require them to do so. Secondly, firms involved in 'global pipelines', 'local buzz' and 'stand alone' processes not only may but even should contribute and complement each others innovation efforts. We can explain this using Nooteboom's (2000) cycle of discovery, which deals with the two main knowledge activities of exploiting existing knowledge and exploring new knowledge (see figure 1). The cycle deals with the problem of whether and how the efficient exploitation of existing knowledge can be combined with the effective exploration of new knowledge. Are people necessarily prone to inertia when deepening, in exploitation, their understanding of a certain type of knowledge? Can they make the timely shift

towards knowledge activities that serve exploratory purposes? Is, in exploration, the risk of chaos so high that actors often fail to make it to a coherent novelty that can successfully be exploited in markets? Nooteboom used cognitive science and learning theory to solve this problem, deriving several stages of knowledge development that may follow each other, although not necessarily exactly in order of appearance.

Figure 1 about here

Here, we do not explain the different stages (see e.g. Nooteboom 2000; Visser and Boschma 2004) but focus on their implications for the current argument that the three types of learning strategies of innovative firms have complementary effects for knowledge development. One point to keep in mind is that knowledge is inherently dynamic, because it entails different cognitive activities and because transitions from one activity to another is what matters for ongoing learning and innovation. A second point is that these transitions require timely organizational change. Exploration, for example, requires open, frequent but short-lived interactions in dense, flexible and decentralized networks, which may develop both within and beyond firms, at a local or regional level in the case of young, growing and vibrant clusters, and, in the case of a poor quality of local buzz and a high feasibility of non-local networks, at trans-local levels, although the latter may go at the expense of a high frequency of contact as well as short-lived and casual encounters in dense populations characterised by a lot of interaction flexibility. Exploitation requires well-defined, infrequent but more long-term interactions in well-structured, relatively stable and centralized networks, which may evolve in mature clusters coordinated by hub firms, global value chains orchestrated by multinational companies, and/or intra-firm systems based on corporate rules (Nooteboom 2006). So, network interactions are important—a point widely recognized in the literature, but the structure and spatial scale of networking matter even more, while timely changes in these characteristics appear to enable newly required steps in the development of knowledge.

These two points help to specify the goal of the second part of the proposed policy, i.e. combining innovation strategies of firms. This is to avoid two 'competence traps': lock-in and chaos. So, while much of the cluster literature focuses on lock-in (see e.g. Visser and Boschma 2004), in fact two problems are relevant, not one. Clustering may lower transaction and switching costs based on experience, expertise, social networks, economic density and geographical proximity. This cost advantage can be more than offset by a relatively high degree of cognitive proximity, yielding a high risk of lock-in in certain clustering processes. Trans-local networks, on the other hand, may have the advantage of widening cognitive scope and enhancing the potential for cross-firm learning, but also bring along the second problem: the risk of chaos—insufficient understandability and a lack of possibilities to assimilate, filter and adjust new knowledge. This is why a timely transition in the structure and spatial scale of networks matters more than a focus on either clusters or networks per se. Both localization and globalization of inter-firm linkages may be required, depending on the past history, current bottlenecks and learning requirements in an industry. The available 'local buzz' may run out of steam, and local trust and familiarity may lead to a lack of relevance of the interactions, in which case the construction of cross-border pipelines helps to build frustration and motivation for change, and to differentiate and reciprocate one's knowledge with that of cognitively distant sources (globalization). Vice versa, knowledge acquired from cognitively distant sources in

international networks may be out-of-context, inappropriate and/or a bit ununderstandable, thus requiring consolidation in local networks (localization). Finally, 'stand alone' strategies can only last in combination with selective inputs from outside sources, which may boost the time-to-market (efficiency) and market fit (effectiveness) of internal innovations.

So, to avoid competence traps, organizational change is required. This, however, yields governance problems to be solved. Again, we refer to other work (see e.g. Williamson 1985 and 2000; Nooteboom 2002; and Visser and De Langen 2006) for an overview of the literature of governance and transaction costs. Here, we stress that the two types of relational risk (dependence and the associated risk of 'hold-up', and the risk of unwanted 'spillover' of sensitive knowledge) also show up in the dynamic setting of innovation networks and learning-by-interaction, due to specific investments that are required to bridge cognitive distance[5] (Nooteboom 2000). This yields switching and dynamic transaction costs (Nooteboom 2000, 2002). Hence, actors may get stuck in unproductive relationships (to recoup previous investments), networks (because of specific social knowledge) or a region (due to shared understandings and moral criteria). Unwanted spillover is also a problem in a setting of innovation networks, depending on the degree of tacitness of knowledge, the absorptive capacity of the actors involved, and the extent of cognitive distance. Low levels of tacitness, high absorptive capacity, and lack of cognitive distance yield a high risk of unwanted spillover (Nooteboom 2006).

Dynamic transaction costs may hinder innovation especially because actors may find it hard to predict the *benefits* of network innovation, which often show up after some time and which are thus uncertain. So, it is not so much the occurrence of these costs, but mostly the elapse of time between effort and costs incurred (at the start of a new type of relationship) and reward and benefits (showing up later) that causes trouble (Visser and Lambooy 2005). Uncertainty is pervasive. Next, accurate judgments of the collective and individual benefits of changes in the network organization requires sufficient awareness of all actors regarding the different cost types that can be reduced, along with aspects of competitiveness that can be improved. Disruptions may be the result of partiality (considering only some, not all costs associated with a certain process), self-centredness (considering only one's own, but not the costs accruing to and born by other parties), past business experience (routines, well-proven business practices) and past linkage experience (distrust, power). The upshot here is that, in a dynamic context of innovation, the goal of governance is not only to reduce dynamic transaction costs, but also to stimulate learning about how to make an accurate assessment of the benefits of transitions in the structure and spatial scale of networks, against a background of a broad and deep understanding of the shortcomings and bottlenecks of current knowledge activities.

Considering the complexity of this task, the key actors in the evolving policy alternative will in our view be private (or semi-public) brokers or intermediaries (see Van Lente et al. 2003), who have the required social, technical, organizational, historical and institutional knowledge about entrepreneurs, firms, business activities and the relevant market and technology context. Their main task is to stimulate and enable timely transitions in the structure and spatial scale of intra and inter-firm networks. This can be done by raising awareness about the shortcomings of present organizational and cognitive routines and the potential for improvement, and by

reducing transaction costs associated with changes in the structure and/or spatial scale of networks meant to stimulate learning and innovation. A role for public policy lies in the recruitment, the training, the provision of start-up funding, and the monitoring of brokers. Below, we explain these points.

Regarding transaction costs, brokers can help by assisting in the *ex ante* quality determination of prospective partners; the management of the relational risks of dependence and unwanted spillover; and the management of the risks of conservatism (making sure that partners will develop, learn and change as foreseen and required, without falling back into old and proven routines at the operational, tactical and strategic level) and credibility (*ex post* quality determination, mitigating the problem of so-called 'credence goods' that one can hardly evaluate the utility of a product, e.g. alliance innovation, even after consumption). Managing the last two risks entails ongoing awareness-raising regarding the benefits of innovation and organizational change, while ensuring steps to realize these benefits. This goes beyond the six transaction-cost related roles of brokers specified by Nooteboom (1999), which deal with the risks of dependence and spillover.

The above is complex and sensitive work—reason why we suggest that brokers be private (or semi-public) actors with a long-standing social and technical experience in the field, and a high level of personal integrity and trustworthiness. Public actors can not run the risk of failure in either one of the above governance tasks. In stead, public actors may assist in the recruitment, the training, the provision of start-up funding, and the monitoring of brokers. Candidates for brokering positions are experienced persons who have worked for pioneer and/or leader firms, innovation centres, training institutes, consultancy firms, business associations and/or semi-public agencies. The only way to find brokers is to set up a recruitment procedure. Depending on personal qualities, track record, expertise and some initial insight in the brokering tasks, they can be hired and subsequently trained. This training is important, as the people hired for broker positions have relevant experience and know-how, but may miss the knowledge to apply these assets in the above directions. Monitoring is crucial, as brokers occupy central positions in changing networks; they can give preferential treatment to certain parties, receiving a reward in return (corruption), and they can make mistakes (Nooteboom 1997). Finally, public start-up funding is important, as initial trust between firms and brokers is likely to be insufficient to ensure private funding. Lack of previous experience and trust in the knowledge resources, competences and intentions of brokers is a market failure that may be mitigated by public intervention. Public funding is justified considering the positive externalities of future (yet uncertain) network innovations. It should decrease over time, however, as actors involved in network innovations gain experience, witness dynamic transaction cost reductions and may enjoy increased benefits after some time. Hence, one can expect them to start contributing financially to a mechanism that helps them change cognitive, organizational and technological routines in a timely manner, containing the associated costs and ensuring that the expected benefits are realized.

6: Regionalization?

The above proposal offers a course between the extremes of undifferentiated national policy and a total focus on cluster-building, and thus moves away from a strictly national and from an all too regionalized innovation policy. The policy alternative

proposed here leads towards a more *decentralized, process-based, region-specific, spatially diverging, and multi-level system of innovation*. Below, we explain the reasons for these changes.

Decentralization is required, avoiding an *a priori* and top-down selection of locations and sectors that are thought to be the innovation champions of tomorrow, i.e. to mitigate the risk of strategic failure (see section 3). Next, system failures, such as 'organizational thinness' in peripheral regions (Tödtling and Trippl 2005), can best be tackled at a decentral policymaking level (Boschma 2006). In line with this, innovation policy should not start from scratch but reinforce ongoing processes of knowledge acquisition and learning within or between firms at different spatial levels. These efforts, notwithstanding their bottlenecks and shortcomings (see section 4), should be the backbone for policy measures aiming to solve these problems. A decentralized innovation policy should thus be process-based, in stead of aiming at specific outcomes (Nooteboom 2004). A helpful factor in this regard is the build-up of trust, after some time, on the demand and supply side of brokering services. Good experience enables a shift in funding from public to private, and from central to decentral sources.

A related point is that innovation policy should be region-specific. Boschma and Lambooy (1999) observed that it is the regional history that determines available outcomes and policy. This refers to culture, institutions, social relations, organization, cognition and technology. Brokers—the key actors in the above policy proposal, require region-specific knowledge to play their part in the co-evolution of institutional and social change on the one hand, and organizational, cognitive and economic change on the other. To reduce the governance problems associated with organizational and cognitive change and to ensure that these changes are effective by enhancing the dynamic capabilities of the actors involved, brokers require a deep understanding of the regional history: the origins, growth, successes, failures, shortcomings and bottlenecks of past and evolving institutional, social, organizational, cognitive, technological and economic practices. As a result, brokers are likely to adopt region-specific approaches to mitigating shortcomings and bottlenecks and combining firm-level strategies with a view to stimulating innovation.

This will also yield different outcomes in terms of the spatial evolution of firms, intra and inter-firm networks, and clusters. In other words, the ways in which brokers deal with governance and competence problems not only differ across regions (e.g. peripheral, old industrial and fragmented metropolitan regions, see Tödtling and Tripp 2005), but also affect the spatial-organizational adjustment paths required for continued innovation. In one case, hyperconcentration will be the result of relocation and innovation strategies of firms; in another case, a cluster in one country may have to seek international co-operation with a cluster elsewhere to offset certain weaknesses; in a third case, clustered firms may off shore some activities, specializing in other functions and/or changing production techniques within the cluster; in still another case, firms may seek new roles and other positions in global value chains to solve their competitive problems. The point is that in each of these cases produces different outcomes in terms of the spatial evolution of economic and innovative activity in firms, intra and inter-firm networks, and clusters. Put simply, there is spatial divergence in the development path of different firms, industries and clusters.

The above also implies that a multi-region system of innovation emerges, as firms interact with other firms and actors across regional borders. Such is important feedback for policymakers, who may seek inter-regional co-operation whenever they pursue the policy objective of embedding innovative firms. The 'region' that is relevant for innovation is determined by ongoing innovation behaviour of firms on the one hand, and the evolving work of brokers on the other. Both are likely to cross the borders of existing administrative regions, inducing inter-regional co-operation and policy coordination.

7: Conclusion

In this paper, we observed an increasing emphasis in regional economic and innovation policy on cluster-building, even though many regions do not have clusters and clustering is not feasible in all industries and sectors. Next, while many policymakers aim at creating new clusters, this seems to be a highly complex task, if at all possible, considering the necessary and sufficient conditions for clustering, and the thus uncertainty about factors explaining the emergence and growth of clusters. Thirdly, many cluster initiatives unfold at the level of administrative regions, whereas innovation strategies of firms are diverse in terms of the use of internal and external resources and the spatial scale at which they seek, explore and exploit external knowledge. Finally, it is paradoxical that innovation policy is often based on an *ex ante* selection of new technologies, industries, clusters and places that are thought to be winners in the future, whereas innovation is almost by definition an unforeseen event. Who had thought that the Russian sputnik would spur a reaction in US politics and the military that would only a few decades later lead to the arrival and widespread acceptance and use of the Internet? The military played its role by demanding and creating a decentralized, flexible and robust communication structure connecting then still large computers; academic research later played its role by ensuring open access of the emerging World Wide Web, including the creation of electronic communication (nowadays known as 'e-mail'); commercial companies played their part by adding content: news, games, music, books, opinions, etc. These developments and contributions were not at all foreseen.

To avoid the above risks, problems and paradoxes, we propose in this paper an alternative policy that is geared towards the evolving innovation strategies of firms, in stead of specific territories. This policy, which differentiates between different types of innovation strategies of firms and aims at combining their efforts with a view to continued organizational change and ongoing innovation, is feasible and often also necessary in the case of regions with or without clusters. In stead of focusing on outputs through the *ex ante* selection of technologies, industries, clusters and regions, it is better to facilitate processes that may, in unexpected manners, lead to innovation, i.e. *ex post*. These processes develop at different spatial scales, from the local up to the very global level. The cycle of discovery helps to understand the organizational changes, in terms of the structure and spatial scale of intra and inter-firm networks, required for continued innovation. Private (or semi-public) brokers are the key actors in the proposed alternative innovation policy. They help internally and/or locally oriented firms respectively to externalise and globalise, and vice versa; they help externally and/or globally oriented firms respectively to localize and internalize. More specifically, their role is to reduce dynamic transaction costs associated with these organizational changes, but also to realise the benefits of open innovation in network

contexts by addressing problems of conservatism and credibility that withhold firms to embark on the road of organizational changes required for ongoing innovation. With this, we may move away from a strictly national or all too regional innovation policy, towards a decentralized, process-based, region-specific, spatially diverging, and multi-level system of innovation.

Endnotes:

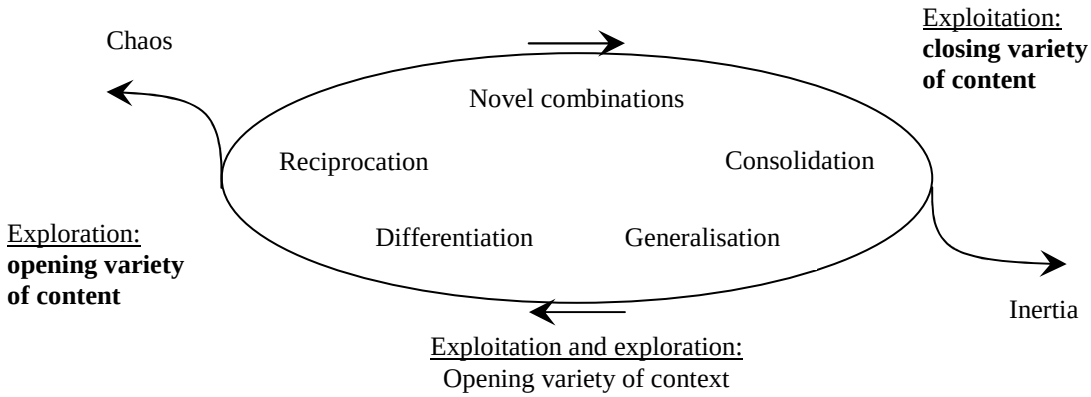
1. Please note that we separate the cluster from the network concept, defining clusters as 'geographical concentrations of firms involved in the same of similar activities, which may, but need not specialize, subcontract and co-operate with one another', and networks as 'a set of strategic, purposeful, preferential, sometimes repetitive and usually co-operative interactions between actors, which may, but need not operate in close vicinity' (Visser and Boschma 2004, p. 801). There are different explanations for clustering in the sense of a long-term and endogenous process of geographical concentration (see annex 1). Clusters—in the sense of geographical concentrations, are out there, or they are not, which is radically different from the position of some 'cluster enthusiasts' who put 'the promotional cart before the analytic horse', believing that 'the detailed structure and workings of a cluster will become obvious soon enough once we begin to think about an activity in cluster terms' (Martin and Sunley 2003).
2. Another source of opportunity costs is the lack of balance, within and across regions, of an all too strict focus on clusters. Not only does this increase the dependence of regions on the performance of cluster(s), implying enhanced vulnerability of the regional economy towards external shocks in specific markets (oral communication with Ulrich Witt, 1 December 2006; for a recent example see Van Dooren 2006; for a more extensive discussion of this problem, see Frenken et al. 2007), but it also contributes to growing inequality within and between regions and in terms of innovation, economic growth and prosperity, which be a threat to stability in certain societies, as we have seen in developing nations (Todaro 2000, Visser 1996) and currently in the Russian Federation and China.
3. The Utrecht, Gooi & Eemland region has got a few specializations, but this does not mean that cluster processes (in the sense of Brenner 2004) are on their way. The four identified clusters in Media, Business Services, IT consultancy and Chemical subsectors are embryonic in at least two ways: (a) low concentration and specialization ratios, oscillating between 1,25 and 3 (which is low compared with Italian clusters, see Capello and Faggian 2005); and (b) weak statistical relations with several innovation indicators (Atzema and Visser 2005b, p. 40-51).
4. The choice between, to combine or to exclude local, global or stand-alone strategies is likely to be path and context-dependent, including differences across sectors, the phase of an industry or technology in the life cycle, institutional settings and socio-cultural factors.
5. These investments entail: a) informing other actors about one's 'mental model' (North 1994) and knowledge routines; b) explaining how and why one has arrived at this model; c) understanding alternative models and explanations.

Table 1: three innovation strategy types

Source of knowledge \ Stage of innovation			Pre-invention (reciprocation)	Invention (creating novelty)	Development (consolidation)	Adaptation (consolidation, generalization)	Marketing (differen-tiation)
Internal			Stand alone strategy				
External	Local	Traded	Local buzz strategy				
		Untraded					
	Global	Traded	Global pipeline stategy				
		Untraded					

Source: elaborated by the authors on the basis of annex 2
Note: in practice, firms may use a mix of these strategy types, causing a less elegant shape of the ellipses in the table. However, firms also emphasize one strategy—reason why the three strategies in the table are drawn as regular ellipses.

Figure 1: A cycle of discovery



Source: Nooteboom 2000

Annex 1: Variety of clusters

Cluster type	Concentration logic	Business effects
Local formation	Location decision based on a common and *dominant location factor*	Static: e.g. transport costs ↓
Local industry	Market imperfections enhance the importance of the well-known Marshallian *external economies*: a local pool of specialized labor, the enhanced supply of accessible specialized services and infrastructure, and information 'spillovers'. These economies especially help small firms to survive and grow	Static: transport, transformation (production), and Coasian search costs ↓
Local complex	*Specialization*, outsourcing of non-core activities, and co-operation for static purposes (e.g. joint problem-solving for quality management; information exchange for logistic cost/service optimization) enhance the competitiveness of internationally operating firms	Static: logistic, transformation, and Williamsonian transaction costs ↓ Flexibility and quality ↑
Local alliance	*Inter-firm co-operation* reduces costs but also promotes information exchange, as well as interactive and collective learning, thus enhancing the competitiveness of firms operating in distant markets. A high quality of local governance based on institutional (contracts, norms, values) and relational (social ties, empathy, reputation) embeddedness facilitates joint actions and collective investments by mitigating the associated coordination problems.	Static: emphasis on transaction cost reduction. Dynamic effects: 1st and 2nd order learning ↑
Local milieu	*Co-evolution* of local networks, (capital, labor and product) markets, institutions and policy. This enhances the scope of co-operation in the cluster, including public and semi-public bodies. There is also more openness and flexibility of specialists, teams and networks, as well as a variety of organizational forms in and beyond the cluster, inducing the combination of local 'buzz' and global 'pipelines' and a constant renewal of cognitive distance, leading to ongoing innovation.	Static: as in complexes and alliances. Dynamic: ongoing 2nd order learning

Source: compiled by the authors on the basis of Capello 1999; Gordon and McCann 2000; Visser and Boschma 2004; Atzema and Visser 2005a; among many other literature sources.

Annex 2: Sources of innovation

	Internal to the firm	**External to the firm**	
		Intraregional	Extraregional
Traded	*Not applicable* (no trade occurs within firms)	*Learning-by-interacting with local trading parties:* - upstream, with suppliers of necessary input - downstream, with customers - in diagonal linkages with suppliers of complementary input - Learning-by-borrowing/hiring specialists for limited time periods	*Learning-by-interacting with global trading parties:* - upstream, with suppliers of necessary input - downstream, with global buyers - in diagonal linkages with suppliers of complementary input
Untraded	*Learning based on internal activities:* - learning-by-doing (effect of experience), - learning-by-using (effect of expertise), - learning-by-experimenting (effect of curiosity), and - learning-by-monitoring (system feedback).	*Learning-by-spillovers:* - 'horizontal observation' of tacit knowledge, and - monitoring and selection of best practices *Learning-by-informal interaction:* - horizontal advice: what, how, how much to make - joint problem recognition: awareness raising, interpreting external signals, sense making *Learning-by-cooperation in local networks:* - advice and joint problem recognition as above, and - joint problem solving: investment in training, R&D, innovation, internationalisation, marketing, infrastructure, etc.	*Learning-by-cooperation in international networks*: - exchange of information, ideas and knowledge in 'communities of practice' comprising: - homogeneous actors: firms involved in the same branch (competitors), chain (suppliers, buyers) or cluster (diagonal linkages) - heterogeneous actors: academics, consultants, 'strange ducks'

Source: compiled by the authors on the basis of Malecki 1997, Nooteboom 1992, Storper 1995, Visser 1996

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