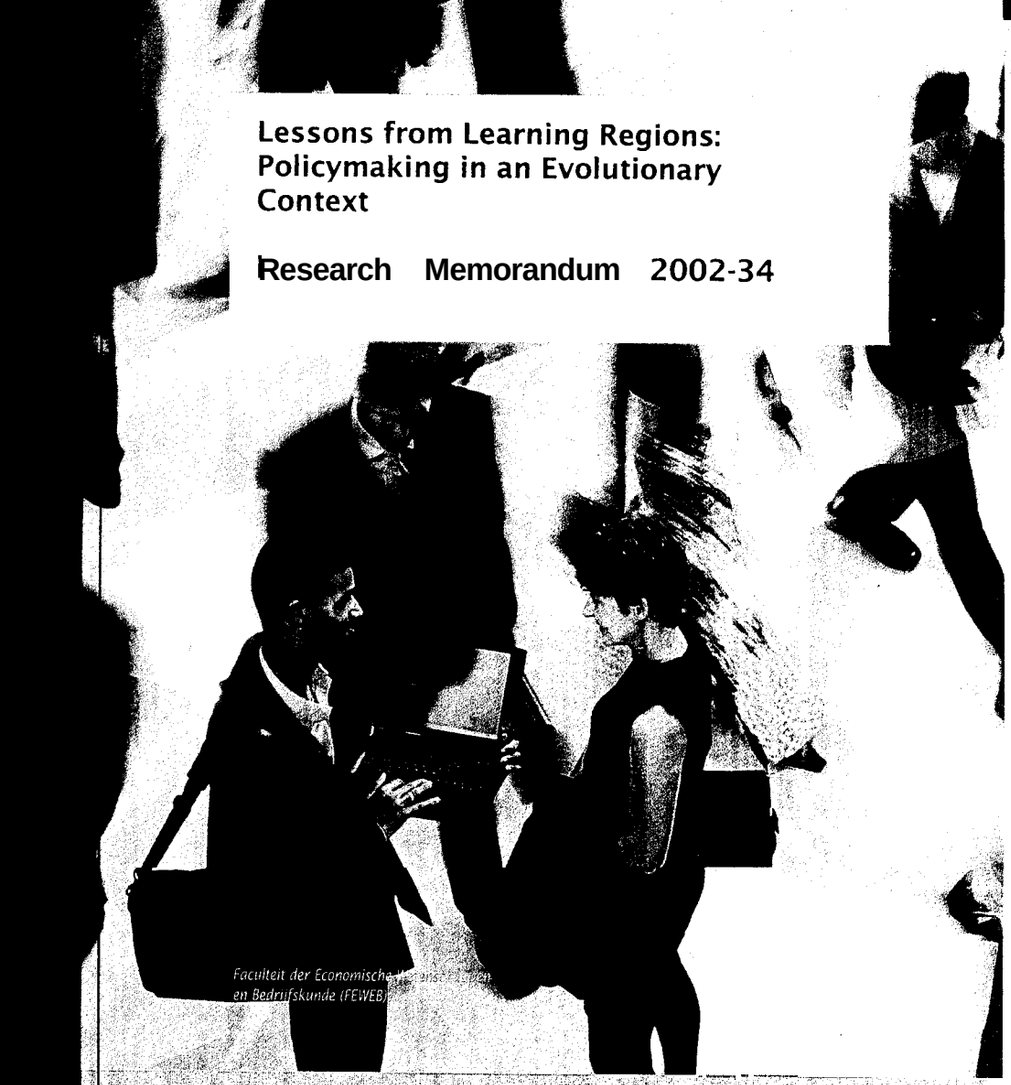
Lessons from Learning Regions: Policymaking in an Evolutionary Context

Research Memorandum 2002-34



Faculteit der Economische Wetenschappen en Bedrijfskunde (FEWEB)

Vrije Universiteit amsterdam

Faculty of Economica and Business Administration

Lessons from Learning Regions: Policymaking in an Evolutionary Context

Research Memorandum 2002-34

Marina van Geenhuizen
Peter Nij kamp

Lessons from Learning Regions: Policymaking in an Evolutionary Context

MARINA VAN GEENHUIZEN* AND PETER NIJKAMP**

*Faculty of Technology, Policy and Management, Delft University of Technology, PO Box 5015, 2600GA Delft, The Netherlands

** Department of Economics and Management Sciences, Free University, de Boelelaan 1105, 1081HV Amsterdam

This paper serves to clarify conditions that hamper the leaming capability of regional (local) actors and to identify how this capability can be improved, given a number of distinct evolutionary constraints. First, we discuss policymaking in an evolutionary context. This is followed by an analysis of circumstances that hamper the design of leaming policies by govemments, including shortages in conceptualisation and empirical research of the learning region paradigm. The focus of the paper then moves to some broad lessons that can be drawn at the strategic level and at the project level for regional (urban) policymakers. Finally, the paper discusses the dilemma of incremental change versus system change - or co-evolution versus co-revolution - to improve the leaming capability of regions or cities.

Leaming capability, leaming regions (cities), networks, policy design, evolutionary development

PN064MvG

INTRODUCTION

Since the early 1990s concepts of leaming regions, smart cities, creative cities, etc. have received increased attention among regional economists, economic geographers and regional policymakers. This development marks the recognition that factors determining economic growth of regions (cities) are increasingly intangible, like institutions and culture, and increasingly mobile, like capital, codified knowledge, and partly human capital. It also marks the recognition that innovation by companies is not a linear process, running from invention and commercialisation to market introduction, but a cyclic and interactive process within networks of many different actors. In this view on innovation emphasis is increasingly put on diversity of the networks and boundary-spanning activity of the network actors.

The attention for leaming regions also reflects the awareness that improving the regional economy is a medium- to long-term process, particularly a process based on the willingness and consensus among regional actors involved. Leaming in this context not only means to adapt to new circumstances, like a stronger competition, but also to reflect critically on the own institutions and leaming processes. In policies for leaming regions, a crucial place is given to leaming in regional (local) networks. In an ideal situation, these networks consists of loosely coupled relations that enable openness and integration, and create perspectives for action. Thus, the quality of the relations matters. In a negative case, networks become conservative and inward-oriented preventing any action, or they become subject to confusion leading to high transaction costs and inefficient adaptation (see also NIJKAMP et al., 2002).

Seminal work underlying the leaming regions paradigm was done by AYDALOT (1986), CAMAGNI (1991), MAILLAT (1991), and some others, while the paradigm was fertilised from different angles in regional studies, like studies of national innovation systems, studies of regional technology complexes, including knowledge spillovers, Post Fordism and clusters, studies on local institutions in global markets, and studies of regional technology

policy (e.g. MORGAN, 1997; COOKE, 1998). First, the focus was relatively narrow in investigating innovative behaviour of companies in a network setting. Later, the focus has broadened to include sustainability as a leading value alongside innovation and competitiveness (e.g. MASKELL and MALMBERG, 1999; GEENHUIZEN and RATTI, 2001). This broadening also increased the complexity in understanding leaming regions, creative cities, etc.

Despite its popularity, the paradigm of leaming regions has remained poorly conceptualised, and poorly tested in empirical studies. This holds for innovation by companies and for policy leaming by regional (local) actors, and is one of the main reasons why current policymaking faces difficulties in drawing lessons from leaming regions. A poor conceptualisation is also true for the development of leaming regions over time (e.g. BOEKEMA et al., 2000). A conceptual framework that can be used, is given by evolutionary economics. We adopt this framework in this paper, because it allows for explanation of qualitative change, radical uncertainty, and variation between organisations and technology, and provides notions for understanding policymaking under such circumstances (SAVIOTTI, 1997; BERGH and FETCHENHAUER, 2001).

This paper serves to clarify conditions under which the leaming capability of regional (local) actors is hampered and under which conditions this capability can be improved. Accordingly, the paper is structured into six parts. Following this introduction, there is a brief discussion of evolutionary conditions that set limits to policymaking (section 2). This is followed by an outline of critical conditions for leaming and difficulties in the design of leaming policies (section 3), particularly shortages in conceptualisation and empirical research of the leaming regions paradigm (section 4). In a fifth part, broad lessons are drawn for improving the design of policies to enhance the capability to learn, addressed to regional

(urban) policymaking organisations (section 5). The paper concludes with the dilemma of incremental change versus system change to improve the leaming capability (section 6).

With regard to the territoria1 unit of analysis we take both regions and (smaller) metropolitan areas into consideration, and avoid to link exclusively with localised production systems. As the perspective of this paper is on policymaking, it is necessary to realise that most localised production systems do not coincide with regional or urban policymaking units.

POLICYMAKING IN AN EVOLUTIONARY CONTEXT

According to modem evolutionary views on social phenomena, all organisations – be-it govemments, companies, non-profit institutions, etc. – suffer from bounded rationality in their adaptation to extemal changes. Bounded rationality rests on the inability of actors to collect all relevant information and to process this information adequately in a decision-making process. For govemments this limited rationality causes in fact a limited potential for policymaking. In this context, it is increasingly acknowledged that there is co-evolution of regional (local) govemments together with the organisations in their territory (BERGH and FETCHENHAUER, 2001). Govemments and policies change as a part of and in interaction with these organisations. A second point is that most leaming leads to incremental adjustment of organisations. Such pattems are reinforced by the phenomenon of sunk costs and the related phenomenon of increased returns. Thus, if once one route (investment, strategy or policy) has been taken, it is less likely that altemative routes are adopted, even if these are theoretically more attractive. Leaming is thus strongly path-dependent (GRABHER, 1993; ARTHUR, 1994). Only in a few cases, leaming leads to the use of untried possibilities and completely novel behaviour causing a new development trajectory. An ideal situation that prevents path-dependency would be one in which regional (urban) actors are permanently critical on their own institutions and institutional arrangements underlying leaming, and

continuously feed back (forward) to preserve this attitude. This capability is also named adaptability (e.g. BENZ and FÜRST, 2002) or, ahematively, resilience (see REGGIANI and NIJKAMP, 2002).

Given bounded rationality and path-dependency as "rules", the efficiency of regional (urban) policymaking as independent (top-down) steering seems relatively small. This awareness has led to a greater reluctance in imposing policymaking and has favoured the introduction of participatory forms of policymaking and steering on nehvorks. In this context, the evolutionary idea of self-organisation has been forwarded. In self-organisation actors adapt themselves autonomously to new situations, including their networks. Accordingly, new types of policymaking acknowledge the importance of interdependent networks, voluntary co-operation of relevant network actors, and new process design that matches with specific situations and needs for flexibility (BRUIJN and HEUVELHOF, 2000).

DIFFICULTIES IN DESIGNING LEARNING POLICIES

Leaming forms a basic element in evolutionary views on regional (urban) development, because it provides the input for adaptation of actors and networks to changes in their extemal environment, such as an increased competition from other regions or a collapse of a dominant industrial activity. Leaming can be created using different sources, such as trial and error, repetition, borrowing from others (copying), and reflection on own routines (MASKELL and MALMBERG, 1999; HASSINK and LAGENDIJK, 2001). In order to be effective and not stuck in path-dependency or lock-in situations, leaming by regional (urban) govemments, companies and other organisations needs to satisfy various critical conditions, as displayed in Table l (e.g. SENGE, 1994; HEALY, 1997; HERTOG and HUIZENGA, 1997; MORGAN, 1997; JIN and STOUGH, 1998). One of these conditions is trust behveen the actors in a network. Trust can be seen as the mutual confidence that no party in an exchange will exploit

the vulnerability of the other, and as such it facilitates a smooth information flow and co-operation within the network. Trust is often mentioned together with reciprocity, the latter meaning the mutual understanding that a given action will be retumed in kind. Two other conditions are openness and integration; these determine the way new information is gained, handled and absorbed in the organisation, e.g. using system thinking in understanding problems and using critical reflection on the own performance and underlying institutions, eventually leading to institutional change. Openness and integration can only be achieved if the leaming networks are loosely coupled. This means that each network actor can adapt to a certain degree without affecting the entire network. It also means the maintenance of different individual capacities in the network, which reinforces the sensing power towards the extemal environment and potentials to generate novel solutions (e.g. GRABHER and STARK, 1997; BRUIJN and HEUVELHOF, 2000).

[tab | about here]

If we focus on the leaming capability of regions (cities) including the above conditions, it can be concluded that the design of learning policies by regional (urban) govemments is comprehensive and complex by nature. A number of factors can be advanced to explain this situation (MORGAN, 1997; JIN and STOUGH, 1998; GEENHUIZEN and NIJKAMP, 1998, 1999; BENZ and FÜRST, 2002). These will now concisely be presented here.

First, we witness often a *multi-actor situation in policymaking. The* qualification of a multi-actor situation refers to the fact that many different actors are involved in the leaming system, like universities and higher educational institutes, research institutes, consultant firms and think tanks, supplier firms, customers, transfer institutes, brokers in network contacts, venture capita1 firms, and various govemments. These actors often have diverse and

sometimes conflicting interests, whereas some of them perform different roles simultaneously. Complexity from the multi-actor situation is the more true if the leaming is concemed with sustainability issues. A general trend is also the move of actors to participate in an increasing number of networks to support their different roles (e.g. ETZKOVITZ, 2002). To increase efficiency in leaming these networks tend to be non-hierarchical and highly open in extemal relationships. In such a situation it is rather difficult and time-consuming for policymakers to identify the most relevant networks, to create consensus, commitment and reciprocity, and to gain sufficient support for particular policy decisions.

In the past few years, we have seen ***a gradual change in the context and orientation of learning***, contributing to complexity. There has been a shift from hierarchical, disciplinary and division of labour-based knowledge production to a mode in which research problems are set across disciplinary boundaries, with a strong focus on application and with new benchmark criteria such as flexibility and response time (GIBBONS et al., 1994; NOWOTNY et al., 2001). At the same time, the number of actors involved is increasing outside universities and established research centres, with a growing emphasis on teams (consortia) working on a temporary (project) basis. Particularly in the case of science, there is also a higher democratic content and an increasing need for legitimating and public responsibility of science. As a consequence of all this, there is a trend for knowledge creation to become more volatile within fast shifting network configurations, and to become more uncertain and complex.

Complexity in policymaking also follows from the specific policy (management) framework of leaming, because it is ***multilevel and (preferably) multi-sector***. Multilevel means that (policy) decisions are taken at different spatial levels, from local to global, leading to situations in which decisions at higher levels influence conditions at lower levels. A multilevel situation also means the impact from policies in adjacent regions (cities) at the same level. A multi-sector situation means the need for involvement of many different sectors

(departments) in an integrated policymaking for leaming, including e.g. education, housing policy, labour market policy, telecommunication policy, town planning and architecture, and policy for arts and culture. However, it is difftcult to satisfy this need, because policymaking institutes are traditionally organised on a mono-disciplinary basis and policymakers have often a mono-disciplinary background, such that their problem perception and frame of reference are somewhat biased (one-sided) which hampers an integrated system approach. It is also difficult in these circumstances to create conditions that favour reflective openness among regional (urban) actors, including policymakers themselves.

A further complicating factor in policymaking is the fact that, despite the many actors involved and despite a serious situation, there is *seldom a "problem owner"* for the task of improving learning capability. This means that there is no clearly defined actor to push the issue of leaming into the policy arena in a systematic and coherent way. As a result, a sense of urgency which is needed to activate actors and have them committed to improve the situation, is often missing. Moreover, leaming policies have *a* "handicap" in the policy arena because they only yield results in the medium- to long-term. Thus, when seeking support for learning policies, there tends to be competition from those socio-economie policies that yield immediate and clearly visible results, like job creation schemes and physical infrastructure improvement.

A final point that needs to be mentioned is that policymaking for leaming is hampered by a shortage of conceptual and empirical knowledge derived from solid research. The knowledge that is available is often fragmentary and misses a systemic view. Although particular policy strategies can cope with uncertainty from a shortage of system knowledge, policymaking organisations themselves are often not sufficiently equipped (staffed) to adopt such strategies. The knowledge gaps will be discussed in the next section.

SHORTAGES IN CONCEPTUALISATION AND EMPIRICAL RESEARCH

Despite the popularity of the leaming regions paradigm, various key processes of this paradigm are poorly conceptualised. We mention the most important of them. The crucial mode of leaming in the paradigm is conceived of as localised leaming with transfer of tacit knowledge and maintenance of trustful relationships as key processes. Localised leaming is, however, poorly conceptualised in terms of the need for proximity and the relation with leaming over distance. There is also no differentiation between types of leaming involved, e.g. technological and organisational (e.g. OINAS, 2001). Also, conceptualisations of how leaming networks develop over time are sparse, in terms of e.g. openness, network co-operation, innovative output and sustainable development. There may be weakly leaming regions, not yet successful in innovation and sustainability, but improving in the next future; and there may be regions that have leamed successfully in the recent past but are now captured in negative processes that cause a decrease of innovation and sustainability; however, the dynamic aspect of leaming and its influence on economic performance of regions (cities) over time have been modelled only in a few cases. After some initial attempts (e.g. BRAMANTI and SENN, 1997; CAMAGNI and RABELOTTI, 1997; RATTI, 1997), modelling of long-term development of regions from a leaming perspective is now increasing (e.g. BERTUGLIA et al., 1999; ACS et al., 2002; REGGIANI and NIJKAMP, 2002). However, conceptualisations of the way localised leaming contributes to a stronger competitiveness (performance) of companies at the micro level and of how regional (local) networks contribute to a better policy leaming and better performance of regions (cities) remain sparse (BENZ and FÜRST, 2002).

With regard to empirical research, there is a shortage of studies that allow for comparison and empirical testing. There are many good case-studies of regions but few comparative studies based on a common research design, e.g. including similar types of regions, similar definitions and indicators, similar time-periods, etc. With similar types of

regions we mean regions endowed with broadly similar natura1 resources, with comparable levels of urbanisation, etc. There is also a shortage of causal modelling approaches in empirical research. This means that many causa1 factors are forwarded as relevant for learning and innovation, but their relative importance remains obscure. A point that worries is that some empirical research suggests the absence of localised relations where these could be expected, while other research indicates a reduced viability of companies located in close proximity of other companies (e.g. STABER, 2001). Results like these could have been used to approach the learning region as a differentiated phenomenon, but attempts to such an approach are sparse to date.

The above circumstances not only cause a limited system understanding (cause and effect relationships), but also a modest and perhaps biased problem diagnosis in policymaking for leaming and a limited insight into adequate policy measures given particular system conditions. In addition to a shortage of conceptual and empirical testing, a few important areas have been largely overlooked, i.e. the role of "soft" aspects of infrastructures and the role of financial systems. In the remaining section we will briefly illustrate why these areas deserve more attention in studies of learning regions.

It is a basic assumption of much regional economic analysis that the competitiveness of the regional (urban) economy depends partly on infrastructures located in the area and connecting that area with the larger world. However, from the viewpoint of leaming sparse attention has been paid to the design and management of infrastructures and innovative developments in these aspects that support the regional economy. Leaming and innovative solutions, like new network concepts, a robust legislation and flexible arrangements, are necessary because of important new trends, including convergence of infrastructures, e.g. of transportation systems and information infrastructure; an increased use of information technology (IT) in all layers of conventional infrastructures, like of water, energy and waste

removal; a re-positioning of public and private roles leading to new organisational pattems and application of new modes of competition and regulatory arrangements; the need for flexibility, and adaptability of infrastmctures, and – for a limited number of infrastructures – a trend for decentralised operation like in energy provision and waste water treatment (THISSEN and HERDER, 2002). In a learning region's approach the application of innovative design and management (operational and strategic) of infrastructures would be questioned, including factors that hamper and factors that enhance the application of innovations. In addition, the question would be raised as to how innovative design and management of infrastructures contribute to a better performance of regions (cities).

In various studies of leaming regions, the tïnancial sector is briefly discussed as part of the regional innovation system (e.g. BRAMANTI and SENN, 1997; BRACZYK et al. 1998). There are only a few studies in which the focus is explicitly on the financial sector as a key factor in innovation in a regional context (e.g. LERNER, 2001; ANTONELLI and QUERE, 2002; POWELL et al., 2002). In the latter studies it is acknowledged that in many high-technology fields leaming activity includes long-lasting and very expensive development and testing programs, like for new (smart) materials, biotechnology, and laser technology. Accordingly, tïnancial actors are as important as scientific actors and play prominent roles in the relevant networks. Due to the fact that high-risk investment is involved, tïnancial actors leam and innovate in dealing with high risks, both inside the organisation and in interaction with their clients. Such processes may lead to a redesign of financial products like venture capital and services surrounding initial public offerings (IPO's). On the other hand, financial markets play a key role as filters and screeners of newly established companies and new business ideas. Loans, initial public offerings, etc. are only provided if specialised experts have expressed a positive assessment on the venture. From a learning region's perspective,

relevant questions would address the match between supply and demand of financial services, including implications for the performance of high-technology companies.

LESSONS FOR POLICYMAKING TO INCREASE THE LEARNING CAPABILITY

Although it is very popular to discuss leaming regions, studies of policymaking for leaming regions are sparse. Their number is however increasing, e.g. based on experiences in the European Union innovation programmes (Regional Innovation Strategy, Regional Innovation and Technology Transfer Strategies and Infrastructures). The lessons to be presented here are drawn from a variety of sources, i.e. comparative regional studies (e.g. HASSINK and LAGENDIJK, 2001; LANDABASSO and MOUTON, 2003), from historica1 analysis (e.g. HALL, 2000) and from case studies of individual companies (e.g. SENGE, 1994; HERTOG and HUIZENGA, 1997).

One lesson tells US that not all favourable conditions can be shaped by policies. For example, almost all creative cities in history were undergoing rapid and radical economic and social transformation, introducing new forms of organisation and production. Another salient feature is the steady flow of migrants from adjacent areas, but also from a distance bringing cultural diversity and new competence into the city (HALL, 2000).

Other lessons van be addressed to policymakers because they have a role to play. The lessons that call for policymaking on the *strategic level* and for certain roles for regional (urban) govemments are summarised in Table 2. As previously mentioned, at this stage of the research it is impossible to give a rating of importance to the different critical conditions. Further, it needs to be realised that govemments as parts of the leaming networks can shift roles and exchange them with private actors in the network. As an example we take the critical conditions of the networks to preserve openness and integration, i.e. autonomy, loose coupling, heterogene@ and equality of actors in the networks. Such structural conditions

cannot be brought about automatically and ovemight. It requires the consistent management of networks over a considerable period of time. Managers of networks are often found in intennediary organisations like the chamber of commerce, or in universities. However, if the territoria1 size of the networks coincide with regional or urban administrations it stands to reason that govemment agencies perform the role of network managers, like in Germany the regional districts (BENZ and FÜRST, 2002). What seems exclusive for govemment agencies are roles that ensure that leaming networks function effectively and remain oriented to publicly endorsed goals.

[Tab 2 here]

Different from the past, the success of policies cannot be evaluated merely in terms of goals achieved, cost efficiency, etc. Behaviourally and process-oriented criteria need to be added to measure other desirable policy outcomes, like the strengthening of the regional research and technology development, and the creation of a bottom-up and transparent policymaking process.

On the *project level* we may identify measures that enhance creative thinking and, if innovative solutions are found, to provide action perspectives. Measures that enhance creativity include to add a number of creative people (unconventional thinkers) to the organisation, to put a high premium on creativity, and to add some staff members oriented towards new trends in the outside world ("gatekeepers"). Serendipity may be promoted by arranging the meeting of people that normally do not see each other (e.g. arts and science). On a more practica1 level serendipity may be stimulated by daily management styles that enable to pose questions like: why is this development a success and the other not, and what happens if we turn a routine upside down (like starting with the end and starting broad instead of

narrow), and what happens if the organisational structure changes fundamentally, like from vertical to horizontal, and from linear to circular?

A further set of measures follows from the need to support action-oriented nehvorks that are committed to bring innovative ideas towards reality. There are different models for supporting such networks outside the command-and-control regulatory tradition (RIP et al, 1995). We may briefly introduce two of them that matches with the critical conditions on the strategic level, i.e. strategic niche management (SNM) and public entrepreneurship networks (PEN) (e.g. LAWS et al., 2001). The former has a focus on the development of a viable technology and questions what protection is necessary from the govemment to foster experimentation that yields technologies with viable prospects in the market. Thus, it takes the market as an evolutionary environment. The PEN model has a stronger focus on societal leaming and the development process itself, and views the govemment as a direct participant in this process using different roles. In addition, PEN focuses on the ecology of roles, like a pioneer and mediator, supporting the development network.

We may conclude with the observation that the above lessons for policymaking reflect the critical conditions for leaming, as indicated in Table 1. It is geared towards the creation of commitment, consensus, and trust, to openness and integration and it is action-oriented. In fact, it is far away from traditional, command-and-control types of policymaking. After all the latter types of policymaking would not have matched with the networks that are favourable to learning.

FROM CO-EVOLUTION TO CO-REVOLUTION?

It is a policy dilemma whether the above conditions need to be brought about incrementally or as a set of radical, long-term and comprehensive system changes, in other words, a system innovation. This dilemma is particularly true for regions (cities) that leam at low levels but

fail to improve, and for regions that learn at good levels but tend to fall back. Bringing about a system innovation requires, however, specific kinds of policymaking, i.e. transition management. In transition management, various key characteristics of the leaming system need to be profoundly transfonned. Therefore it needs a long-term view, dealing with concomitant uncertainty, and a high degree of integration between the different policy areas and concomitant measures (e.g. ROTMANS, 2002). In current policy relationships in Europe and North America it is not possible to impose system changes from above because of resistance from actors that prefer to preserve the current situation, and because of lack of knowledge of the system. Rather, a series of experiments on long-term perspectives may be carried out, from which the most promising ones are selected in a bottom-up process in order to be realised partly driven by self-organisation (e.g. STACEY, 1992). What seems important is that policy measures precisely impact on those networks actors (factors) that reverse unfavourable processes and accelerate favourable developments, in other words to prevent a downtum and accelerate an upturn in leaming and concomitant innovation.

Aside from a lack of knowledge about tuming points, we face a couple of practica1 obstacles. First, the staff of regional (local) policy agencies needs to be qualified for such activities, which is often not the case. Secondly, innovative experiments do not fit the current policy culture which is based on goal-efftciency and accountability. These obstacles perfectly indicate the need for policymaking agencies to quickly become a leaming organisation by themselves. In addition, there are research questions that need to be clarified urgently. These questions can be summarised as follows. What causes a reversal of trends in learning systems and how can this be identified? How can once achieved adaptability (resilience) be preserved? Which policy options are available to enhance a desirable reversal of trends ▪ preventing a downtum, causing an upturn ▪ and to enhance desirable acceleration, preferably within the context of modem network-based policymaking? What counter forces may be expected

aiming at prevention (delay) of systemic change? What are wise strategies to "fight" the actors involved, e.g. can such actors be incorporated in the transition process in a positive way? What is the role of the public and the private sector in "co-revolution"?

We cannot be conclusive about what is the best for a region; there is no best practice, but a number of good practices. What the latter have in common and what contributes to many of the previously indicated strategies and operational measures is a key role for Human Resource Management at the regional (urban) level. Qualification of staff and high professional levels are crucial in bringing about system changes using experimentation and certain degrees of self-organisation. These are also crucial in causing a sufftcient level of creativity and alertness in the daily operations of policymaking organisations. Thus, Human Resource Management does not merely mean to increase educational levels. For policymaking organisations it also includes changing the mind-sets, e.g. improving lateral thinking to cross organisational boundaries, increasing abilities to signal new trends, to deal with uncertainty in a creative way, and to act as a process manager of transition. It seems that co-revolution in improving leaming capability is still far away from most current situations, not at least because of the huge educational tasks, the still weak structural position of leaming policies, and the many questions that need to be clarified.

References

ACS, Z.J., GROOT, H.L.F. de, and NIJKAMP, P. (2002) *The Emergence of the Knowledge Economy, A* Regional *Perspective*. Springer, Berlin.

ANTONELLI, C. and QUERE, M. (2002) The Govemance of Interactive Leaming within Innovation Systems, *Urban Studies, 39* (5/6), 1051-1063.

ARTHUR, B. *(1994) Increasing Returns and Path Dependence in the Economy.* University of Michigan Press, Ann Arbor.

AYDALOT, P. (1986) *Milieux innovateurs en Europe.* GREMI., Paris

BENZ, A. and FÜRST, D. (2002) Policy Leaming in Regional Networks, *European Urban and Regional Studies, 9* (1), 2 1-35.

BERGH, J, van den, and FETCHENHAUER, D. (2001) *Leaving the rational model: evolutionary explanation of behaviour and socio-economie institutions.* NWO, The Hague.

BERTUGLIA, C.S, BIANCHI,G., and MELA, A. (Eds) *The City and its Sciences,* Springer, Heidelberg.

BOEKEMA, F., MORGAN. K., BAKKERS, S. and RUITEN, R. (Eds) *(2000) Knowledge, Innovation and Economic Growth. The Theoty and Practice of Leaming Regions.* Edward Elgar, Cheltenham.

BRACZYK, H-J. **and** HEIDENREICH, M. (1998) Regional govemance structures in a globalized world, in BRACZYK, H-J., COOKE, P., and HEIDENREICH, M. (Eds) *Regional Innovation Systems. The role of governances in a globalized world,* pp. 414-440. UCL Press, London.

BRACZYK, H-J., COOKE, P., and HEIDENREICH, M. (Eds) (1998) *Regional Innovation Systems, The role of governances in a globalized world.* UCL Press, London.

BRAMANTI, A. and SENN, L. (1997) Understanding Structural Changes and Laws of Motion of Milieux: A Study on North-Western Lombardy, in RATTI, R., BRAMANTI, A.

and GORDON, R. (Eds) *The Dynamics* of *Innovative Regions*. The GREMI Approach, pp. 139-163, Ashgate, Aldershot.

BRUIJN, H. de, and HEWELHOF, E. ten (2000) *Networks and Decision Making*. Lemma, Utrecht.

CAMAGNI, R. (ed) (1991) *Innovation networks: spatial perspectives*. Pinter (Belhaven), London.

CAMAGNI, R. and RABELOTTI, R. (1997) Footwear Production Systems in ltaly: A Dynamic Comparative Analysis, in RATTI, R., BRAMANTI, A. and GORDON, R. (eds) The *Dynamics of Innovative Regions. The GREMI Approuch*, pp. 140-163. Ashgate, Aldershot.

COOKE, P. (1998) lntroduction: origins of the concept, in BRACZYK, H-J., COOKE, P. and HEIDENREICH, M. (eds) *Regional Innovution Systems. The role of governances in a globulized world*, pp. 2-25. UCL Press, London.

ETZKOVITZ, H. (2002) lncubation of incubators: innovation as a triple helix of university-industry-govemment networks. *Science and Public Policy 29* (2), 115-128.

GEENHUIZEN, M. van, and NIJKAMP, P. (1998) lmproving the knowledge capability of cities: the case of Mainport Rotterdam. *International Journal of Technology Management*, Vol. 1S (6/7), 691-709.

GEENHUIZEN, M. van, and NIJKAMP, P. (2000) Regional Policy beyond 2000: Leaming as Device. *European Spatial Research and Policy*, Vol. 6 (2), 7-20.

GEENHUIZEN, M. van, and NIJKAMP, P. (2001) The Leaming Capabilities of Regions: Conceptual Policies and Pattems, in BOEKEMA, F., MORGAN, K., BAKKERS, S. and RUTTEN, R. (Eds) *Knowledge, Innovution und Economic Growth. The Theory und Practice of Learning Regions*, pp. 38-56. Edward Elgar, Cheltenham.

GEENHUIZEN, M. van, and RATTI, R. (Eds) (2001) *Gaining Advantage from Open Borders. An Active Space Approach to Regional Development.* Ashgate, Aldershot.

GIBBONS, M., LIMOGES, C., NOWOTNY, H., SCHWARZMAN, S., SCOTT, P. and TROW, M. (1994) *The New Production of Knowledge; The Dynamics of Science and Research in Contemporary Societies.* Sage, London.

GRABHER, G. (1993) The weakness of strong ties: the lock-in of regional development in the Ruhr area, in GRABHER, G. (ed) *The Embedded Firm; On the Socioeconomics of Industrial Networks*, pp. 255-277. Routledge, London.

GRABHER, G. and STARK, D. (1997) Organizing diversity: evolutionary theory, network analysis, and post socialism, *Regional Studies, 3* 1 (5), *533-544.*

HALL, P. (2000) Innovative Cities, in BARNIER, M. (ed) *Structural Change in Europe. Innovative Cities and Regions,* pp. 31-35. Hagbarth Publications, Bollschweil.

HASSINK, R., and LAGENDIJK, A. (2001) The dilemmas of interregional institutional leaming. *Environment and Planning C: Government and Policy,* 19, 65-84.

HEALY, P., (1997) *Collaborative Planning: Shaping Places in Fragmented Societies.* Macmillan, London.

HERTOG, F. den, and HUIZENGA, E. *(1991) The knowledge factor. Competing as a knowledge-based firm* (in Dutch). Kluwer, Bedrijfsinformatie, Deventer.

JIN, D. J. and STOUGH, R. (1998) Leaming and learning capability in the Fordist and post-Fordist age: an integrative framework, *Environment and Planning A, 30, 1255-1278.*

KAUFMANN, A. and TÖDTLING, F. (2001) Science-industry interaction in the process of innovation: the importance of boundary-crossing between systems. *Research Policy 30,* 791-804.

LANDABASO, M. and MOUTON, B. (2003) Towards a different regional innovation policy: eight years of European experience through the European Regional Development Fund innovative actions, in GEENHUIZEN, M. van, GIBSON, D. and HEITOR, M. (Eds)

Innovation and Regional Development in the Network Society. Quorum Books, Greenwood Publishing (forthcoming).

LAMBOOY, J. (2002) Knowledge and Urban Economic Development: An Evolutionary Perspective, *Urban Studies, 39* (5/6), 1019-1035.

LAWS, D., SUSSKIND, L., ABRAMS, J., ANDERSON, J., CHAPMAN, G., RUBENSTEIN, E., and VADGAMA, J. (2001) *Public Entrepreneurship Nehvorks*. MIT, Environmental Technology and Public Policy Program and Department of Urban Studies and Planning, Cambridge.

LERNER, J. (2001) *The Money of Invention*. Harvard Business School Press, Boston (MA).

MALECKI, E.J. and OINAS, P. (1999). *Making Connections: Technological Learning and Regional Economic Change*. Ashgate, Aldershot.

MAILLAT, D. (1991) Local dynamism, milieu and innovative enterprises, in BROTCHIE, J., BATTY, M., HALL, P., and NEWTON, P. (Eds) *Cities of the 21st century*, pp. 265-274. Longman, Harlow.

MASKELL, P. and MALMBERG, A. (1999) Localised leaming and industrial competitiveness, *Cambridge Journal of Economics, 25,* 167-185.

METCALFE, J.S. (1995) Technology systems and technology policy in an evolutionary framework. *Cambridge Journal of Economics,* 19, 25-46.

MORGAN, K. (1997) The learning region: Institutions, innovation and regional renewal. *Regional Studies, 3* 1 (5), 49 1-503.

NIJKAMP,P., GROOT, H.F.L. de, and LINDERS, G.J. (2002) Economic Development, Institutions and Trust, in BOSCHMA, R. and KLOOSTERMAN, R. (Eds) *Technological Change and Regional Development.* Kluwer, Dordrecht (forthcoming).

NOWOTNY, H., SCOTT, P. and GIBBONS, M. (2001) *Re-Thinking Science, Knowledge and the Public in an Age of Uncertainty*. Polity Press, Cambridge.

OINAS, P. (2000) Distance and Learning: Does Proximity Matter? In: BOEKEMA, F., MORGAN, K., BAKKERS, S. and RUITEN, R. (Eds) *Knowledge, Innovation and Economic Growth. The Theory and Practice of Leaming Regions,* pp. 57-69. Edward Elgar, Cheltenham.

POWELL, W.W., KOPUT, K.W., BOWIE, J.I. and SMITH-DOERR, L. (2002) The Spatial Clustering of Science and Capital: Accounting for Biotech Firm-Venture Capital Relationships, *Regional Studies, 36* (3), 291-305.

RATTI, R. (1997) L'espace régional actif: une réponse paradigmatique des régionalistes au débat local-global, *Revue dëconomie regionale et urbaine, 4,525544.*

REGGIANI, A., and NIJKAMP, P. (2002) Resilience, An Evolutionary Approach to Spatial Economic Systems, *Networks and Spatial Economics, 2 (3) 2* 11-229.

RIP, A., MISA, T.J. and SCHOT, J. (1995) *Managing Technology in Society.* Pinter, London/New York.

ROTMANS, J. (2002) Experiments with societal change, in Kasteren, J. (ed) *Sustainable Technology. Development* (in Dutch), pp. 14-17. Natuur & Techniek (Veen Magazines), Amsterdam.

RUTTEN, R., BAKKERS, S., and BOEKEMA, F. (2000) The Analysis of Leaming Regions: Conclusions and a Research Agenda. In: BOEKEMA, F., MORGAN. K., BAKKERS, S. and RUITEN, R. (eds) *Knowledge, Innovation and Economic Growth. The Theory and Practice of Learning Regions,* pp. 245-258. Edward Elgar, Cheltenham.

SAVIOTTI, P.P (1997) Innovation systems and evolutionary theories, in EDQUIST, C. (ed) *Systems of Innovation. Technologies, Institutions and Organizations,* pp. 180-199. Pinter, London-Washington.

SENGE, P.M. (1994) *The Fifth Discipline. The Art & Practice of The Learning Society. New* York: Currency Doubleday.

STACEY, R.D. (1992) *Managing the Unknowable*. Jossey Bass, San Francisco.

STABER, U. (2001) Spatial Proximity and Firm Survival in a Declining Industrial District: The Case of Knitwear Firms in Baden-Württemberg, *Regional Studies, 35* (4), 329-341.

THISSEN, W.A.H., and HERDER, P.M. (Eds) (2002) *Critical Infrastructures - State of the Art in Research and Application.* Dordrecht: Kluwer (forthcoming).

WALKER, W.E., RAHMAN, S.A., and CAVE, J. (2001) Adaptive policies, policy analysis and policy-making, *European Journal of Operational Research,* 128, 282-289.

Table 1 Critical conditions for learning in a network ("ideal" situation)

Conditions	Explanation
Consensus and Commitment	Actors involved have a sense of a mission, and support shared ambitions and visions
Trust	Trust is basic for information exchange and co-operation
Openness	There is communication and absorption of new information
	There is reflective openness to critically view own performance, leaming and underlying institutions
	Situations are being created that facilitate serendipity
Integration	There is interactive leaming in and between networks
	Problems are viewed through system thinking, including modelling but also experimentation and evaluation
Action-orientation	The new knowledge is applied through action

Table 2 Lessons at the strategic level of policymaking snd concomitant government roles

Conditions for f Learning	Critical Conditions on the Strategic Level	Potential Roles of Regional (Urban) Governments
Consensus and Commitment Trust	Bottom-up approaches Existence of trust Reliance on self-organisation Policy design under amendment (participation)	Animator to increase consensus and commitment Catalyst of new missions and shared ambitions Creator of trust Facilitator of participation in policy design
Openness and ntegration	Autonomous networks Loosely coupled networks Heterogeneity of participants Open (egalitarian) structures Conditions to increase serendipity Conditions to prevent path dependency	Network manager to improve network structures Mediator to connect networks Gatekeeper of new trends Watcher of system dynamics Facilitator of serendipity Facilitator of sensing processes and monitoring (reflective openness)
Action-rientation	Conditions to link innovations with action	Catalyst of action Facilitator of action-networks
General	Conditions that improve efficiency and preserve orientation to public goals	Monitoring to ensure efficiency Monitoring to ensure orientation