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Measuring Regional Innovative Capability

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Abstract

The regional innovation environment has experienced remarkable changes in recent decades. Innovativeness at regional level is seen as a consequence of networked co-operation in a regional innovation system, which demands new kinds of regional innovation policy applications. The current article presents the network-facilitating innovation policy (NFIP) as a policy tool for promoting regional innovative capability.

The new policies are crying out for new means for evaluating changes in regional innovation systems. There have been some interesting efforts to develop adequate measures for regional innovativeness. However, there are several problems with the existing measures. There seems to be a lack of theoretical discussion on the nature of innovative capability. The fundamental problem with the existing measures of innovative capability lies in their inability to break inside the dynamics of the innovation processes, called in this paper the "black box" of the innovation processes. Moreover, it is argued that the existing measures undermine the importance of certain forms of innovations.

The present paper tries to overcome some of these problems in the context of the network-facilitating innovation policy. It outlines the framework of the Network-based Innovative Capability (NBIC) Evaluation Matrix for measuring and developing the regional innovation environment.

Key words

Regional innovative capability, innovation policy, measurement, policy evaluation

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1 Introduction

During the last two decades, a vast literature in the fields of, for instance, evolutionary and institutional economics, network theory, innovation and learning systems, as well as in sociology, has focused on the questions and challenges of the regional level of economic activity. In this literature a region is seen as an essential part of the economic coordination under the present techno-economic and socio-institutional paradigm. Accordingly, there is much influential empirical evidence that the present world includes phenomena increasing the role of regions in explaining the ongoing economic transformation.

Sustainable competitiveness is the main source for the success of an economic actor. The competitiveness of the economic actors is strongly related to their adaptability to the emerging techno-economic environment (Schienstock and Hämäläinen, 2001 citing Abramovitz, 1995 and Lipsey, 1997). The question arises as to how regions adapt to these changes and how regions find prosperous trajectories in the turbulent environment. The first question to consider, however, is whether a region is a reasonable unit to assess with terms like competitiveness. Krugman (1998) questions the whole idea of territorial competitiveness as being wrong and even dangerously misleading. However, in a vast array of literature the regional level is strongly growing in importance as a reasonable entity in assessing economic growth and socio-institutional adjustment (see, for example, Florida, 1995; Storper, 1997; Scott, 2000; Cooke *et al.,* 1997; Camagni, 2002). These theorists emphasise the meaning of the local business environment for the success of firms. Firms, being the real competitors in the global business forums are seen as strongly embedded in their territorial socio-institutional set-up (see Granovetter, 1985).

Krugman's suggestions are based foremost on the international trade theories and neoclassical growth theories. The neoclassical economic theories are based on the assumptions of efficient markets, no unemployment or unused capacity, immobility of resources and international specialisation of production based on comparative advantage (Hämäläinen, 2003; Camagni, 2002). These theories, however, do not seem to match very well with the actual world. One can, with good reason, question the suggestion of efficient markets. It is based on the assumptions of open access to the resources and rational choice. There is, however, much evidence that this is not the case in real life (see e.g. Granovetter, 1985; Nelson and Nelson, 2002). The same applies to the assumptions of nonexistent unemployment and unused capacities, as well as immobile resources.

In the search for factors of regional competitiveness in the information era, evolutionary economics and institutional economics, for example, give a somewhat different view of the economic development than the earlier mainstream theories. Actually, Nelson and Nelson (2002:

266) propose that before the modern neo-classical theory gained its dominant position in economics, much of the economic analysis was both evolutionary and institutional. Evolutionary economics was originally developed to explain the success and failure of organisations, but has been successfully applied in the regional context (see e.g. Cooke *et al.*, 1998; Boschma, 2003). According to the theoretical framework, the competitiveness of an actor depends on its ability to innovate and learn (Nelson and Winter, 1982). These sources of competitiveness have also been considered essential in a regional context (Lundvall, 1988; DePresson and Amesse, 1991). Economic development is seen as a path dependent, communicative and cumulative process that tends to be local in nature. The sources of competitiveness are determined in a non-market environment rather than in a market environment including, for example, the untraded interdependencies (Storper, 1995). These untraded interdependencies include the institutional, social, cognitive and cultural conventions being formed during history in a region. The frameworks of evolutionary and institutional economics emphasise the importance of the regional institutional settings and routines in fostering the localised, cumulative and geographically bounded collective and interactive development processes. These institutional settings include elements enabling the processes of networking, learning, innovating and leadership in the regional development network.

These developments in economic theory underline the importance of the new factors of regional competitiveness. The sustainable competitive advantage depends on absolute non-price competitiveness and soft supply-side factors in building productivity and economic growth (Hämäläinen, 2003; Camagni, 2002). Further on, the focus of forming sustainable regional competitiveness has to be shifted from macro-economic factors towards microeconomic factors (Porter, 1998: 89). This does not mean that the macroeconomic factors should be neglected, but that their importance as a primary focus has radically diminished. It does not mean, either, that the competitiveness factors of the industrial era should be totally forgotten. But relying on them in the information era would lead to a declining regional competitiveness and productivity leading to unwanted regional development. The regional competitiveness is based on regional resources and a region's socio-institutional capability to renew the resource base in an interactive and collective learning process aiming to increase regional productivity and innovativeness, as well as to produce wellbeing for the citizens of a region.

In this paper, innovation policy is seen as the most important part of competitiveness policy. The rapid techno-economic development, systemic and complex nature of innovation processes and multi-level, networked development environment are placing special demands on innovation policy activities. Innovation policies and strategies are designed and implemented in an environment, where different actors and coalitions are striving to further their interests, where there is always a great risk of lock-ins because of the natural socio-institutional inertia caused by the shift in the techno-economic paradigm (see Harmaakorpi and Niukkanen, 2002) and where

activities take place at different levels that cannot really be coordinated. Such an environment is crying out for innovation policy measures that foster the visionary, leadership, networking and learning activities in the process of designing and implementing innovation policies and strategies. These measures often need to utilise new interactive methods and new terminology to be able to create new prosperous development paths based on the potential resource configurations in a region.

The new environment places demands on innovation strategies and policies aiming to reconfigure the regional socio-institutional settings. Earlier the innovation policy has been largely equivalent to the science policy including elements of technology policy. These policies have strongly relied on resourcing scientific work as the key activity in producing innovations. However, the causality between science and innovation has proved to be weaker than expected (Schienstock and Hämäläinen, 2001) creating a demand to foster other sources of innovation. Therefore, the present paradigm demands innovation policies and strategies that focus on fostering interactive non-linear innovation processes in multi-actor innovation networks.

However, it is far from clear what practical form these new policy applications should take. The regional policy-makers lack practical methods for reforming regional innovation environments in order to respond better to the demands of the new techno-economic paradigm. In the following sections, we attempt to present a new framework for the future regional innovation policies and outline a measure for evaluating regional innovative capability focusing on the soft-side factors of regional innovativeness.

2 Network-facilitating innovation policy

The regions have changed from being objects of state-led regional policies to the subjects of competitiveness policies, with an increasing responsibility for their own success. In the new multi-level governance structure, the regions meet a new kind of process and programme-based environment (Vartiainen, 1998), where they are expected to take initiatives to build an absolute competitive advantage for themselves.

Questions of regional competitiveness policy are, however, even more disputable than those of regional competitiveness itself. Scarce regional development resources and the advantages of agglomeration economies create a need for regional specialisation. What kind of demands does this fact place on the regional competitiveness policy? Regional competitiveness relies on regional resource configurations, but how should regional policy-makers be able to choose the most potential resource configurations in which to specialise. This is the constant contradiction between the teachings of evolutionary economics and the actual need of regions to specialise.

Porter (1998: 89) argues strongly against the picking winners policies of governments, even if his main arguments refer to building successful regional agglomerations and clusters. "... the aim of cluster policy is to reinforce the development of *all* clusters. This means that a traditional cluster such as agriculture should not be abandoned; it should be upgraded. Government should not choose among clusters, because each one offers opportunities to improve productivity and support rising wages. Every cluster not only contributes directly to national productivity but also affects the productivity of *other* clusters. Not all clusters will succeed, of course, but market forces – not government decisions should determine the outcomes." Porter stresses further that most clusters form independently of government action – and sometimes in spite of it. With these suggestions Porter comes very close to the point of view taken in the evolutionary economics, which strongly emphasises the spontaneous emergence of new clusters and industries due to changing events and increasing returns (Boschma, 2003).

This discussion points to the quite different view on the scope and purposes of the regional competitiveness policies. According to this view, the main target of successful regional competitiveness policy is based on promoting productivity and innovativeness by forming institutional settings that enhance features like collective learning, social cohesion, co-operative activities and visionary processes. Thus, regional competitiveness policy is basically governance rather than government; its role should be the facilitator's rather than the governor's role. Accordingly, the policy measures used target the soft factors of competition (e.g. identity, culture, institutions) as much as the hard factors (e.g. relative wages or tax levels) (Boschma, 2003; Storper, 1997). From this point of view, regional competitiveness policies are based on a constant audit of resource configurations and their continuous reconfiguration in order to respond to the challenges caused by the changing techno-economic paradigm.

Innovations are increasingly seen as the driving force of regional competitiveness and economic growth. However, our understanding of the nature of innovation has changed during the last century. In the early approaches, innovations were seen mostly as great leaps of knowledge achieved by talented individuals or research groups. Innovations were also largely seen to be linear processes from the basic research to the market applications. Later on, the theories of innovation have emphasised that innovations typically take place in normal, co-operative social and economic activities, being incremental social and organisational changes as technological advancements as well as radical leaps. Consequently, innovations are not just the results of scientific work in a laboratory-like environment. They are typically created in networks where actors of different backgrounds are involved in the process. The science push effect as the driving force of innovations is an exception rather than a rule in these processes. A more influential source of innovations seems to be factors like the ability to interact, learn collectively and build reliable relationships between the innovating partners. Innovativeness thus depends on

the innovation network's ability to interact as much as on an individual actor's progress in a particular scientific field.

Characterising innovation as a socially and economically embedded process raises the question of the socio-institutional environment where the innovation processes are taking place. In a regional context, innovation is seen as a process embedded in a regional innovation system. A regional innovation system is understood as a system of innovation networks and institutions located within a certain geographic area, with regular and strong internal interaction that promotes the innovativeness of the region (Kostiainen, 2002: 80). Thus, a regional innovation system consists of different multi-actor innovation networks aiming to increase the innovativeness of a region. These networks have different forms defined by, for example, their origin, size, structure and objective (Harmaakorpi *et al*., 2003). However, most regional innovation networks fulfil certain typical characteristics. They are often formed of heterogeneous groups of actors including representatives of firms, universities, technology centres and development organisations.

The system approach is not only a tool for studying innovation processes, but also a conceptual framework for innovation policies and strategies (Edquist, 1997: 16). It recognises that different parts of the innovation process may become bottlenecks in the successful development of new products and processes leading to many kinds of systemic failures (Schienstock and Hämäläinen, 2001; Lundvall and Borrás, 1999). All such failures are potential targets of regional innovation policies and strategies (OECD 1998). Schienstock and Hämäläinen (2001) suggest that a system approach-based, network-facilitating, innovation policy is an appropriate way to enhance the regional innovation environment. *The network-facilitating innovation policy* pays particular attention to the communication, co-operation and networking processes among firms and support organisations aiming to tackle all areas of systematically weak performance in the regional innovation system.

By means of the network-facilitating innovation policy, the regional innovation system and its networks are developed in a way that the regional resource platform can be exploited benefiting both the private and public sectors. However, creating the regional networks is not sufficient, but attention must also be paid to the *inter-regional networking* to get all the knowledge needed in the innovation processes for the use of the regional innovation system. Regional innovation networks have to be open for the essential global information flows. An important question is how to process information between the innovation network and the outside world. It would be of crucial importance to get essential information from the outside world to enhance the collective learning process of the network. In this connection, the main issue is to assess the absorptive capacity of the innovation network (Cohen and Levinthal, 1990).

In the network-facilitating innovation policy, a central factor in promoting innovativeness is *social capital*. According to Portes (1998, 7), " [w]hereas economic capital is in people's bank accounts and human capital is inside their heads, social capital inheres in the structure of their relationships". Social capital cannot be traded, but is in practice created only because of constant co-operation. The importance of social capital in creating regional competitiveness is related to the fact that it cannot be copied or transferred from one regional innovation system to another. However, it can easily be destroyed because of the bottlenecks and problems in the network. (See Tura and Harmaakorpi 2003.)

Another component of the network-facilitating innovation policy is connected to the centrality of knowledge and learning within the regional innovation environment (c.f. Lundvall and Johnson, 1994). *Collective learning* is a process of dynamic and cumulative knowledge creation the synergy advantages of which arise from the knowledge spill-overs and increasing trust in the collective learning process. (Camagni, 1995; Nonaka and Takeuchi, 1995; Nonaka *et al*., 2000.)

Eliminating the obstacles to creativity is one of the vital elements in maintaining the innovative capability. Our society is overflowing with creativity-stifling factors against which an enriching dialogue within an innovation environment may act. (Bohm and Peat, 1992.) The regional innovation system should thus include sufficient *openness and creative tension*: one should be able to express also dissenting opinions and critical comments in the network. Without this creative tension the networks are threatened by lock-ins, closure and cliques leading to a collective fallacy.

The competitiveness gained by the existing resources is quickly getting old as the technologies and the operational environment are renewing. The regions must take care that these renewal processes can be taken into account in organisation development. It is important to promote regional dynamic capabilities to be able to renew regional resource configurations (see Teece *et al.* 1997: Eisenhardt and Martin, 2000; Harmaakorpi, 2004). The future competitiveness demands the new technologies and working methods be brought to the use of the organisations, on the one hand, and promoting the visionary capability of the organisations to become aware of these changes, on the other. The future should be looked to by means of the *resource-based future research*. (See Harmaakorpi and Uotila, forthcoming.)

The remarkable innovations are often born by accident. According to Sotarauta (2005), the growth centres are growing because there are *interfaces for coincidences*. Complexity is said to be the nourishment for the innovations. The regional innovation policy should aim at searching for innovations also on the boundaries of different technologies and industries. Thus, the purpose of the innovation policy is to create chances and interfaces for coincidences sometimes with very unorthodox configurations. In this context, an innovation system can be described as a

road network: just as the number of accidents is growing as the traffic gets denser, so innovativeness is also increasing as the traffic gets denser in the innovation system. No one can surely say where the accidents and innovations are going to happen, but it is certain that they are increasing when the traffic gets more intense. To increase this coincidence-enabling traffic is the special task of the network facilitating innovation policy.

The network facilitating innovation policy should especially:

- Create multi-actor and multi-disciplinary innovation networks for both private and public sectors and search for the sources of innovation especially from the boundaries of the disciplines.
- Create new business activity in the region especially as spin-offs of the innovation networks.
- Bring the knowledge located outside the region to the use of the local actors by means of inter-regional networking, and enhance the absorptive capacity of the innovation networks.
- Promote generating creative social capital and creative eruptions in the networks.
- Promote collective learning including managing the future knowledge, tacit knowledge and explicit knowledge.
- Promote regional dynamic capabilities; innovative, learning, networking, leadership and visionary capabilities, for instance.
- Eliminate the bottlenecks and problems lying in the networks and hindering the networking.
- Prevent the development of the regional lock-ins with an active search for new development paths by means of the resource based future research.
- To create chances and interfaces for coincidences by creating the structures, models of action and dynamics to the innovation system – "to increase traffic in the road network of the innovation system."

3 Measurement of regional innovativeness and its problems

Along with the development of the theories of innovation, there has been an intensifying interest in the measures of innovativeness. Already in 1962 Simon Kuznets observed that the greatest obstacle to understanding the economic role of technological change was a clear inability to measure it (Acs *et al.* 2002, 1069).The first systematic measures of innovativeness were developed during the 1950s and 1960s, and were typically focused on measuring R&D expenditures and other inputs of the innovation activities of the firms. Later on, the measures of the outputs of the innovation activities, especially the use of patent data, as an indicator of those activities became common. Since the work of, for example, Pavitt *et al*. (1987), the direct measures of innovations have also been considerably developed. (See e.g. Acs *et al*., 2002; Flor & Oltra, 2004; Santarelli & Piergiovanni, 1996.)

In general, there are two ways to develop the measures of innovativeness. *Output-type measures* are connected to the real results of successful utilisation of innovation capability, that is, innovations within firms and organisations. Innovations, as such, are quite hard to quantify, and usually the measurement of outputs has focused on certain expressions of successful innovations. The best-known measures of this type are intermediate output measures such as patents and licences. There are also efforts to develop direct measures of innovation output (see e.g. Acs *et al*., 2002). A major problem with these output-type measures is that they usually apply to only a few types of innovations and, even worse, only certain types of enterprises. Small enterprises, in particular, as well as service firms are underrated by these measures. (Romijn & Albaladejo, 2000, 3-4.) Moreover, intermediate output measures such as patents are problematic measures of *innovations* because they do not measure the economic value of the technologies developed (Hall *et al.,* 2001).

Input-type measures relate to the ways innovation activities are supported and resourced by firms and their institutional environment. The classical input-type measures refer to R&D expenditures or resources on training and education. There are several problems with such measures. First, input measures like R&D expenditures measure only the budgeted resources allocated to innovation-related activities (Acs *et al.* 2002, 1070). Second, they also tend to undervalue minor innovation activities and innovations of less R&D intensive sectors. Third, it is questionable whether they even measure innovativeness, or rather some internal and external support activities of innovation processes (Romijn & Albaladejo, 2000, 4).

To conclude, there are three overlying features in most of the existing measures of innovative capability and innovation activities. First, they are strongly focused on industrial and technological innovations. There are hardly any examples of the systematic development of measures for, for example, service innovations. Second, they tend to emphasise the role of research and directly research-related activities. This feature is in line with the idea of the linear innovation model, where the role of (basic) research and its direct applications in producing innovations are underlined. Third, the input-type measures are mostly focused on three general lines: explicit investments on R&D activities, the level of formal education, especially the level of higher education, and the number of high-tech industries and services. (On different measures illustrating these features, see e.g. Hagedoord & Cloodt, 2003; Archibugi & Coco, 2005.)

We believe these features and their underlying assumptions can – and should – be questioned. First, the discussion above on the nature of innovations and innovation processes stresses the variety and multidimensionality of the empirical phenomenon of innovation. Focusing on innovations in the high tech industry leaves out important forms of innovation activity. The same applies to the strong emphasis of science-based activities. In order to understand the innovativeness of enterprises, regions or nations this emphasis leads to the underrating of

incremental and practice-based innovations. Moreover, the relatively limited focus of the input-type measures points to the deeper problems in measuring innovativeness discussed below.

There seems to be a certain lack of discussion on the conceptual background of the measures of innovativeness. As far as the output-type measures of innovativeness are concerned, this is not a problem. The interest in the development of these measures of *innovation performance* has been quite extensive since the 1980s, and this development has been theoretically relatively well informed. While this is certainly an important line of research, and while there are certain critical and interesting questions, for example, on the use of multiple output indicators, we will leave this discussion mainly outside the focus of this paper. Instead, we will primarily focus on the challenges of the input-type measures, that is, measures of *innovative capability*.

The measures of innovation performance and innovative capability answer to two fundamentally different questions, which is often left unrecognised and blurred by the general term of 'innovativeness'. When looking at the innovation performance we are interested in the current innovation activity. We are trying to find out how well our economy is working right now, how it comes off in the competition between firms, regions or nations. While these measures may be either direct or indirect, they all are empirical by nature.

Innovative capability, instead, pays attention to the long-term talents of an economic actor for the fair innovation performance. The measures of innovative capability focus on abilities, powers and dispositions of an economic actor to produce innovations. Thus, the concept of innovative capability is future-oriented and dispositional by nature, referring to such qualities of an actor that may not be currently realised. These features imply that the measures of innovative capability are 'theoretical': they fundamentally measure dispositions, not denumerable, empirical phenomena. The central problem in measuring innovative capability is that this capability, innovativeness, is not directly observable or identifiable, and thus it is hardly operationalisable in itself. Because of this, we have to find non-direct, proximate measures for innovative capability. However, we need to keep in mind the dispositional nature of innovative capability itself.

It is interesting that, despite this, the theoretical background of the measures of innovative capability is often much less clear and explicated than in the case of innovation performance. The theoretical status of these input-type measures is still not very well established. The measures are often generated without much theoretical discussion about the concept of innovative capability. Of course, there are literature-based analyses of the important factors that can be expected to contribute to the innovation capability (e.g. Romijn & Albaladejo 2002). The systematic development of a coherent approach to the dimensions and components of innovative capability is, however, lacking in these discussions.

The discussion above applies, in principle, to any kind of economic actor, be they individual enterprises, networks, regions, nations or international actors. When considering the measurement of innovativeness and innovative capability of the *regions*, we find several specific challenges and problems. First, while the identification of the innovation inputs of an individual firm (e.g. its R&D expenditures) is, despite some definitional problems, quite straightforward, this does not hold true for the regions. It is far from self-evident which inputs should count as relevant for the innovativeness of a region. For example, by limiting the analysis to the firms' investments in R&D within a region, we exclude other than firm-specific inputs to the innovation activities. Second, the regional delimitation is somewhat problematic in the case of innovation processes. We may ask, for example, how it is reconciled with the global nature of innovation processes: *where* the results of these processes in fact take place. Again, it is not clear how we are able to define the correct limits of the region examined. A purely statistical definition may not do justice to the functional limits of the regional innovation activities.

Third, even the definition of innovation is more controversial in the case of the regions than in individual firms. We may delimit the innovations to be examined within an enterprise, or within a network of enterprises, based on its business idea and areas of business. Thus, if the firm acts in a certain industry, we may restrict the analysis to the innovations relevant from the point of view of this industry. When considering a whole region, this delimitation cannot be made. The innovation environment of a region consists of actors differing in their purposes, interests and ways of action. This implies that the scale and variation of the "new things" considered as innovations within a region is substantially larger.

The fundamental problem with the existing measures of innovative capability lies, however, in their inability to break inside the dynamics of the innovation processes. The input-type measures described above focus, as the name indicates, on the inputs of the innovation activities. The activities themselves, and the individual and collective capabilities needed to enhance them, remain intact. While the resources achievable to the actors in these processes, as well as their results, are extensively considered, the factors between them are still largely unstudied. We may call this *the black box of the innovation processes*.

Our argument here can be compared to the critique of neo-classical economics by institutional and evolutionary economists. According to the latter, the main problem with the neo-classical models is that, while adequate and effective within their own field, they leave the micro-dynamics of economic processes unstudied. This is the case especially when considering the non-market, non-economic elements of the economic processes: institutional settings, social norms and routines, generative effects of the micro-level interaction etc.

The notion of the black box of the innovation processes can be traced back to the developments in the theory of evaluation. The realist theory of evaluation emphasises that in order to evaluate policies and development processes one should not only ask whether the actions and interventions *have* effects, but also and above all, *what brings about* the desired effects (Pawson and Tilley, 1997). The essential purpose of evaluation is to establish whether the chosen policy, process or action model is such that it makes the success possible also under the changing circumstances. The simple description of inputs and outputs does not tell much about whether the success takes place because of the chosen model, instead of it, or purely by accident.

Correspondingly, a regional innovation policy can be described as a "theory" of the relevant means for supporting the regional actors to produce innovations. The correctness and long-term success of the policy as a theory can be evaluated perhaps after some years. Thus, it is critical to be able to monitor, evaluate and redirect the policy in the short run. The evaluation has to be able to answer whether the innovation policy has *potential* to finally affect the competitiveness: does it enhance the formation of such structures and ways of action that may give birth to the long-term development of innovativeness.

Thus, a comprehensive evaluation of the regional innovation policy consists of two main elements:

1. Evaluation of the functioning of the regional innovation environment by examining the inputs as well as internal organisation and dynamics of the innovation environment.
2. Evaluation of the short-term results and long-term effects of the innovation policy.

The conceptual framework of the evaluation of regional innovative capability is presented in Figure 1. The three boxes at the bottom of the figure represent the components of the evaluation of the functioning of the regional innovation environment; the four topmost refer to the evaluation of its results and effects.

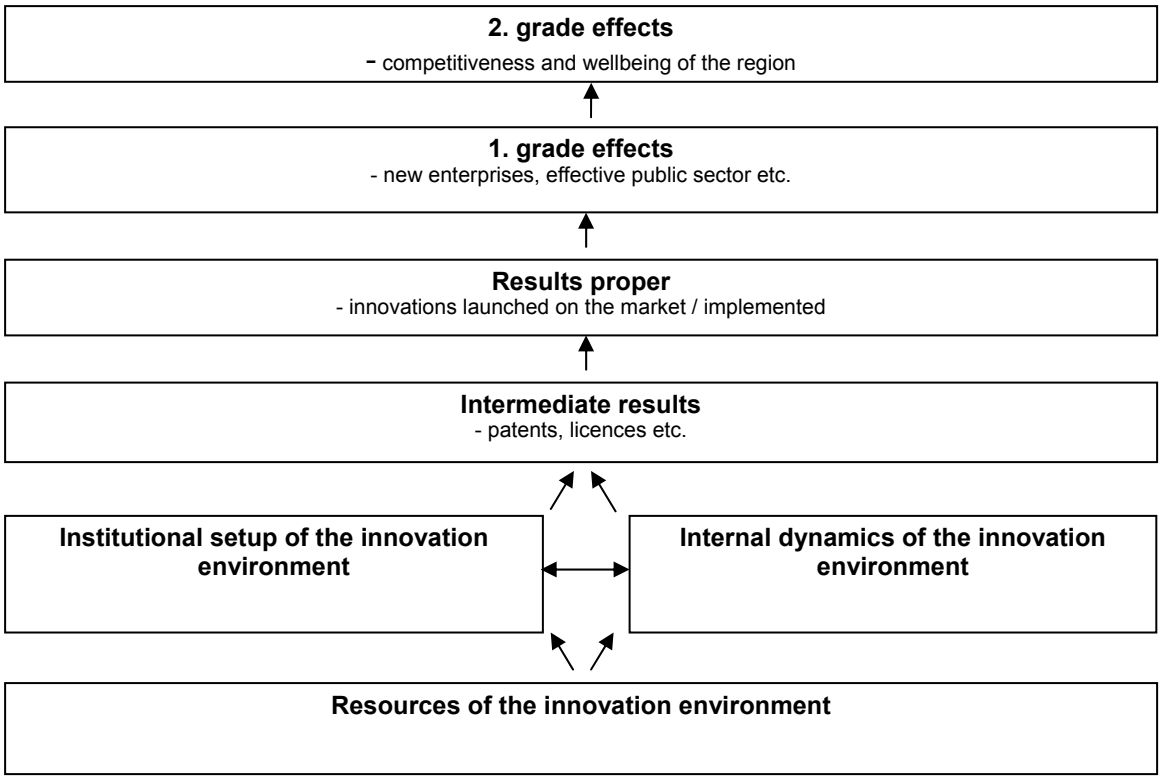

Figure 1. The conceptual framework for the evaluation of regional innovative capability.

The evaluation of the functioning includes three components, corresponding to the inputs of the innovation environment, its internal organisation and the social dynamics within the environment. These three components, forming the basis of the evaluation model developed in the next section, are called *resources, institutional setup* and *internal dynamics* of the regional innovation environment. The first component resembles – with some extensions – the conventional analysis of the innovation inputs. However, it is important to keep in mind that this component is a theoretical construction based on the analysis of the capabilities needed in innovation activities. The last two components answer to the problem of the black box, the former from the structural point of view, and the latter from the point of view of social norms, interaction and learning.

The evaluation of the results and effects resembles the standard approaches of the outputs of the innovation activities. In our framework, two separations have been made in order to clarify the output side of the evaluation framework. The intermediate results as patents and licences have been separated from the results proper, that is, innovations that have been launched on the market or implemented to the production processes, public services etc. Moreover, the first and second grade effects have been separated. The former refers to the innovation-based growth of enterprises, development of public sector and birth of start-ups; the latter refers to the general effects of innovation activities for the whole region. These components, while included in our general conceptual framework, fall outside our evaluation matrix presented in the next section.

4 Framework of the Network-based Innovative Capability (NBIC) Evaluation Matrix

In this section, we will present a preliminary framework for measuring regional innovative capability. The framework is aimed at solving some of the problems and challenges described in Section 3. We will try to develop a multidimensional matrix that, on the one hand, is applicable to different kinds of innovation activities, not just to technology and research intensive activities, and on the other, is explicitly a measure of innovative *capability*. In particularly, it is directed towards the better understanding of the black box of the innovation processes. In this paper, we will only describe the basic ideas and assumptions underlying the framework; the development of the specific measures will be finished later.

We will call our framework *the Network-based Innovative Capability (NBIC) evaluation matrix*. This concept has at least four defining parts that should be understood before applying the matrix. First, to call the framework "network-based" means that it is based on certain theoretical and practical ideas of the nature of innovation and innovation processes. These ideas are briefly described in Sections 1 to 3 of this paper. The framework is "scaled" to develop such innovation policies that are at least implicitly based on the theoretical principles of network-facilitating innovation policy. It is important to keep in mind that if the purposes and assumptions of a given innovation policy differ radically from this, NBIC cannot be used in the evaluation of the *functioning* of this policy. However, it might well question the *validity* of the given policy.

Second, while we call NBIC an *evaluation* matrix, it is important to realise that the NBIC matrix is primarily a deep-level, *internal* tool for regions to follow up, evaluate and develop their innovation policy. It is not intended to be applied in comparison between regions, nor is it a tool for a quick check of the success of regional innovation policies. In short, it is a tool for policy development. Third, NBIC is intended to measure only the innovative capability of a region, not its innovation performance. It should not be applied as a tool for evaluating how firms and organisations in a region have in general succeeded in their innovation activities.

Finally, NBIC is a three-dimensional matrix with a maximum of 36 cells. The dimensions are aimed at grasping the conceptual basis of regional innovative capability discussed above. The matrix is developed as a coherent whole that adequately describes the innovative capability only if it is taken as such. However, nothing in the matrix permits its partial application, because it might appear, from the perspective of the regional developers and politicians, relatively complex and labour-consuming as a whole. For example, it is possible to focus only on the organisation of a regional innovation environment and thus limit the measures to 12.

With the three dimensions of the matrix and their ten (3+3+4) sub-dimensions we aim to develop a comprehensive, multidimensional indicator set for the measurement of regional innovative capability. The whole NBIC matrix specified at the level of sub-dimensions is presented in Table 1. The indicator set is still in the developmental phase, and thus we will not be able to present it here in detail. The set to be developed will include both quantitative and qualitative measures. Some of the data needed can be normally collected from statistical and other existing material, but part of the matrix will require the collection of new data, for example, by developing an applicable barometer. The matrix will include, for example, indicators of the following kind:

- public support of innovative and creative initiatives and activities,
- attitudes towards entrepreneurship,
- partaking in national and international R&D networks,
- innovation networks surpassing the organisational and sectoral limits,
- the casting and organising of the mediator organisations,
- intensity and leadership of the innovation networks,
- ability to connect the specialised expertise to the innovation processes and
- the structures for the collective learning processes.

		Structural capital	Social capital	Cultural capital	Intellectual capital
Resources	Openness / creativity				
	Knowledge / expertise				
	Operationalisation capability				
Institutional setup	Openness / creativity				
	Knowledge / expertise				
	Operationalisation capability				
Internal dynamics	Openness / creativity				
	Knowledge / expertise				
	Operationalisation capability				

Table 1. Network-based Innovative Capability Evaluation Matrix.

In short, the three dimensions of the matrix are explained in the following.

1. The elements structuring the regional innovation environment

These elements define the general "shape" or appearance of the functioning of the innovation environment. They describe the general features supporting and enhancing innovation activities in a region. This dimension includes three sub-elements:

- *Resources* attainable to the actors in the regional innovation environment, including both material and immaterial resources, both regional and interregional resources, and both innovation-specific and more general resources utilisable in innovation activities.
- *Institutional setup* of the regional innovation environment, including the relevant actors, their mutual relationships, and their organisation and roles in the innovation environment.
- *Internal dynamics* of the regional innovation environment, including the questions of, for example,leadership, norms, collective learning, as well as internal and external openness of the innovation environment.

2. The conceptual elements of innovative capability

These elements define what is in fact meant by innovative capability. They describe the core of the concept of innovative capability: what kind of features it consists of, what kind of features should a region have in order to be innovative. Based on the earlier discussion on the concept, we define innovative capability via three sub-dimensions:

- *Openness* or *creativity* refers to the inventive nature of innovation: it has to include an element of newness. The sub-dimension of openness/creativity intends to capture those capabilities needed to transcend the existing technological, processual, social and service solutions and search for new possibilities.
- *Knowledge* or *expertise* refers to the intellectual and scientific nature of innovation. Innovation requires an adequate level of information and knowledge achievable in innovation processes. This sub-dimension aims to describe the capabilities to acquire the knowledge needed in innovation.
- *Operationalisation capability* is connected to the common idea of innovation as a commercialised invention. In order to be an innovation, an invention has to be somehow launched on the market, implemented to the existing processes or practices, or developed into a new kind of process or practice. Operationalisation does not thus necessarily mean commercialisation in the narrow sense of the word, but also includes other ways to apply inventions and new information. This sub-dimension describes the capabilities to seek, find and introduce usable applications by exploiting the achievable knowledge base.

3. The levels of social reality in play in the regional innovation environment

These levels define the ontological nature or quality of different innovative capabilities needed in the innovation environment. They describe what kind of elements of social reality are to be

analysed in order to understand the innovation activities comprehensively. In this context, we define these levels as different forms of capital, in order to take into account the nature of these levels as sources of action capabilities of the actors. (See also our discussion on social capital, Tura and Harmaakorpi, 2003). The forms of capital constituting the four sub-levels of this dimension are the following:

- *Structural capital* consists of the material and institutional level of the regional innovation environment, referring both to the financial resources and investments, and to the structural features of the innovation environment;
- Social capital refers to the possession of social relationships and membership in collectives and networks, and to the resources that derive from these relationships and memberships;
- Cultural capital refers to such individual and collective orientations towards elements of the innovation environment that may be called 'innovation culture', and also to the cultural abilities of the actors to operate in the innovation environment and master its rules and practices;
- Intellectual capital includes the abilities and competencies of the relevant individual actors and their aggregates, scientific and technological competencies of the region, as well as the collective structures for supporting and developing the former.

5 Concluding remarks

In this paper we tried, at least preliminarily, to show that the existing measures of innovativeness have several theoretical and practical shortages, especially when considered from the point of view of the so called network-facilitating innovation policy. In order to apply the measures not only in an *ex post facto* evaluation but also in the on-going development of the regional innovation policies, it is necessary to find measures that break inside the black box of the innovation processes. The general conceptual framework developed in this paper tries to open this black box by paying attention to the components of the internal structure and dynamics of the regional innovation environment. Building on this conceptual analysis, we introduced a new framework for measuring regional innovative capability, called the Network-based Innovative Capability (NBIC) evaluation matrix.

From the point of view of the regional innovation policies, there are at least two implications our paper points to. First, our discussion challenges the model of innovation policy based on the idea of picking the winners. Rather, the pivotal role of regional innovation policy as a facilitator of innovation activities is to increase the "coincidence-enabling traffic" of the regional innovation environment. This role – which is at the same time more modest and more ambitious than in the competing model of picking the winners – should also be reflected in the measures of the functioning of the innovation environment.

Second, in order to monitor, evaluate and redirect the innovation policy the policy developers must be able to focus on the development of relatively permanent capabilities of the actors in the regional innovation environment, not just on the performance of the environment. Sometimes this might require, in the short run, subordinating the latter to the former.

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