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Conference Paper

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50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Bajmócy, Zoltán; Málovics, György; Gébert, Judit (2010) : Innovation performance of regions. What is to be measured?, 50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:
https://hdl.handle.net/10419/119129

Innovation Performance of Regions: What is to be measured?

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In present paper we attempt to review the informational basis of innovation performance measurement from a welfare perspective. Although the measurement of regional innovation performance represents a well established research area, the way this issue is usually addressed in the literature still raises several questions. We argue that the set of information that is excluded from the evaluation may have large importance.

We provide an empirical analysis on a Hungarian data set, which is carried out at subregional level, and attempts to link territorial innovation performance to the well-being of local residents. We use a non-traditional informational basis, that diverges from the usual one with respect to the level of territorial aggregation of the data and the aspect from which innovation performance is judged (considered to be effective or desirable).

Both theoretical and methodological challenges emerge when trying to interpret and measure well-being and innovation performance at this very low level of territorial aggregation. Present paper aims to be a small step in contributing to handle these challenges. We conclude that the way innovation performance is usually captured does not provide sufficient information for policy making.

Keywords: regional innovation performance, well-being, subregional analysis, Hungary
JEL: I31, O31, O38, R11, R58

1. Introduction

In today's "knowledge-based" or "learning-based" economy, which is characterized by accelerating changes, learning capabilities have gained huge importance (*Lundvall* 2002). Due to learning and innovation capacities, companies and their home regions are hard to imitate, are able to gain unique resources, which also contribute to their advantages against competition (*Storper* 1997).

Therefore it is even more important both for theorists as well as economic policy-makers to understand the innovation capacities of regions, present these in figures and find ways to enhance those. This can be lead back basically to two main processes (*Koschatzky* 2005): on one side, regions and localized areas put a stronger emphasis on innovation activity in their development strategies, on the other hand spatial aspects are getting more widely

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recognized in formerly disinterested innovation policy, e.g. by determining that efficient interventions are more likely to occur on a sub-national, regional level.

The enhancement of innovation capacities aims at gaining a competitive advantage over other regions. This covers at least two considerations. Innovation activity is usually (but not inevitably [1]) manifested in growing productivity, which is described by *Solow* (1957) as the most important factor of economic growth. On the other hand, regions considered successful in these days all show a strong innovation capacity. Spatial innovation models known in regional science are practically attempts to determine the factors behind success (*Moulaert–Sekia* 2003, *Lagendijk* 2006).

This strengthening of innovation capacity has become a main goal of economic policy. Measuring innovation capacities in regions supports the planning process of such policies: on one hand by providing a comparison to others, on the other hand showing relative strengths and weaknesses. It is a very important question to determine measuring methods for innovation capacity, since this has a major impact on later actions.

Similarly to all measuring and evaluation schemes, measuring innovation capacity can be described by its *information base*: what information is considered for and excluded from the analysis. Nobel-prize laureate *Amartya Sen* (2003) emphasizes that excluding information is a crucial and inevitable part of every methodology.

This study aims at examining into the information base of measuring regional innovation capacity. *We try to revisit the usual approaches' information base from the aspect of welfare*, with special emphasis on excluded information. Practically this is about answering two questions. What information we are providing policy-makers with, when determining the innovation capacity of a certain region (what is measured)? Is a higher innovation capacity automatically interlinked with higher welfare (is it true that the improvement of innovation capacity ought to be the main intervention purpose)?

In chapter 2 we outline the basic elements of the usual informational basis of interpreting and measuring regional innovation performance. In chapter 3 we provide a revision of this informational basis from a welfare perspective. Than we carry out an empirical analysis on a Hungarian data set at subregional level. Chapter 4 displays methodology, chapter 5 results. We give summary and conclusions at chapter 6.

[1] There are several occasions when an innovation is introduced on the micro level, but does not lead to growing TFP on the macro (spatial) level. A most obvious situation could happen when the innovation is not dispersed. It may even happen that the innovation does not result in growing productivity within the company (the innovation was induced by resource replacement necessity or regulatory compliance needs, etc.). The innovator may be expelling a competitor from the market which had similar productivity characteristics or may be losing market share despite its innovation activity.

2. Information base for measuring innovation capacity

In this section we are going to stress that measuring innovation capacity in praxis is implicitly or explicitly equivalent with evaluating the efficiency of the innovation system. Efficiency in this regards means the ability of the innovation system to contribute to the acceleration of technology change and thus to economic growth in the given region. Therefore we shall examine the interpretation of innovation capacity in the first section, and turn our attention towards efficiency in the second part of this study.

2.1. Innovation capacity as the efficiency of the innovation system

Regional innovation capacity can be described best by applying the concepts of innovation's spatial characteristics as discussed in regional science. It is important, however, that these ideas are based on varying theoretical foundations, thus are less sophisticated or precise in their use of definitions related to these scientific disciplines (*Lagendijk* 2006). Therefore it cannot be said that there are universally accepted approaches for interpreting innovation capacities of regions. More typically there is a partial overlap in concepts, which, however, in some places with significant contradictions. There are, however, certain points that can be considered a framework for interpreting regional innovation capacity.

These can be traced in the way of thinking about the innovation process. In regards of interpretations of innovation capacity, it should be expectable that these offer a synthesis of innovation theory and the results of regional innovation research. An in-depth review of related literature would exceed the constraints of this study, therefore we shall concentrate only on stressing a few cornerstones:

- The central element of the innovation process is considered to be the motion of *interactive learning* (*Lundvall et al* 2002). In Granovetter's (1985) interpretation the interactions between actors are described by a sort of social embeddings, i.e. a series of factors derived from historical and social roots.
- Factors influencing the innovation process are location- and time-specific, thus creating a unique system in space and time for each innovation process taking place in a different location at a different point of time (*Rothwell* 1994, *Nelson–Rosenberg* 1993, *Lundvall et al* 2002, *Edquist* 2005).

- The quest for new solutions and their application is *significantly influenced by former social and economic decisions* (*Arthur* 1989, 1990) as well as historically established structures: the technological paradigm (*Dosi* 1982) or regime (*Nelson – Winter* 1982).
- Innovation is not a series of consecutive epochs (of which each could be treated as a separate entity), and where the last step would be the introduction of an innovation. It is much more like a circular flow with several feedback points, where innovation may occur at any stage (*Rothwell* 1994, *Havas* 1998, *Hronszky* 2005).

Innovation is a layer of interactions between its actors. It is not an isolated activity of its actors, but also an integral part of a region's innovation capacity. The success of an innovation process is also influenced by a range of other factors, which are exogenous to enterprises, while – at least partially – endogenous for the region. In regards of regional innovation capacity this leads to the fact that certain factors should also be considered, which are not linked directly to enterprises, but have an impact on the results of their innovation activity. It is about linking micro-level innovation and spatial, macro-level technological change to each other.

How would it be possible to determine those factors, which have an influence on the outcome of the innovation activity of these actors and how these factors are formed? In order to gain a better understanding of the aforementioned question, one should consider the *literature of innovation systems* as these research programs focus exactly on the questions formulated before. This discipline shows a wide range of potentially influencing factors, the way these are systematically linked to each other and their being location- and time-specific. (*Nelson* 1993, *Inzelt* 1998, *Lundvall et al* 2002, *Carlsson et al* 2002, *Edquist* 2005, *Edquist – Johnsson* 2005).

This approach is supported by regional science, since it draws one's attention to the fact that innovation is not only a process taking place in space but also influenced by spatial circumstances in an endogenous manner (*Storper* 1997, *Ács et al* 2000, *Asheim–Gertler* 2005). Spatial location (proximity, agglomeration) of these actors is an imperatively important part of innovation (*Varga* 2009). On the other hand it was discovered that the innovation capacity of spatial units is best investigated into on a subnational level, because:

- There is an obvious difference among the innovation capacities of different regions (*Hollanders* 2006, *Hollanders et al* 2009).

- Regions tend to specialize (*Porter* 1999, *Lengyel* 2003), therefore certain sectors may achieve a relatively high importance. As industries tend to show characteristic (and strongly differing) innovation schemes (*Malerba* 2002, *Breschi–Malerba* 2005), regional innovation schemes are unique as well.
- Knowledge streaming is a process with spatial features. On one hand, knowledge and technology transfer often requires recurring personal interaction and spatial proximity (*Lengyel* 2004, *Varga* 2009); on the other hand, these processes take place in a context of local routines (*Bercovitz – Feldman* 2006).
- Operation of influencing policies and institutions is partially in regional domain (*Cooke* 2004).

Since regional innovation systems and concepts are based on innovation system theories and regional science at a time, they may be well used for interpreting spatial innovation capacity. This is strengthened even further by the fact that it differs significantly from the spatial innovation model (SIM) of regional science. SIM models intend to explain the success of a certain region by grabbing the spatial kind of the innovation process[2]. They mainly intend to find the *reason for innovative regions being that successful.*

Therefore SIM models only provide a limited toolset for interpreting spatial innovation capacity. The factors enumerated are not broadly availably in every region, therefore these cannot be considered for comparison. On the other hand successful examples of one region are not automatically bound to be successful in an other one. The concept of regional innovation systems (RIR) enables us to establish another interpretation[3]. In this model, regional innovation capacity is traced back to elements that are more or less available in every region; differences mainly result – in a slightly simplified interpretation – from varying performance and the density of interactions between these elements (*Doloreux* 2002, *Tödtling–Trippl* 2005).

Based on these guidelines, a quite general and well usable (but not perfect) definition of innovation capacity may be established. In this framework, the *innovation capacity of spatial units* is: *interpreted as the efficiency of a set of factors included in the innovation process and having an influence on the same, together considered as the regional innovation system.*

[2] These are described in detail by *Moulaert – Sekia* (2003), *Lagendijk* (2006) and in Hungarian by *Dőry* (2005).
[3] We have to stress that this is only one interpretation of RIS. We may also consider an RIS if the majority of its elements is present and there are intense local interactions between these (*Asheim – Coenen* 2005, *Doloreux – Parto* 2005, *Cooke* 2004, *Uyarra* 2009).

2.2. Defining efficiency

In case the innovation capacity of a region is interpreted as the efficiency of its innovation system, it becomes crucial to define the term efficiency. Innovation literature highlights that – due to its uniqueness and historically evolved structure – there is no optimum innovation system, efficiency can only be interpreted in comparison (*Niosi* 2002). There are various kinds of efficiency: self-efficiency of actors / functions (how these are able to meet their organizational mission), efficiency of actors / functions compared to similar functions of other systems, as well as the comparability of the entire system to another system. The latter one is quite cumbersome, since we have to answer the question of expectations towards an innovation system and its functions.

Innovation literature answers this question by stating this aim as acceleration of technology change and supporting economic growth. As said by *Carlsson et al* (2002): „the function of an innovation system is to generate, diffuse and utilize technology" (p. 235.). Obviously most authors do not have such a clear view about efficiency, but in view of paradigmatic roots this becomes self-evident.

Papers of innovation systems were mainly released in order to understand varying growth opportunities of countries (*Nelson–Rosenberg* 1993, *Lundvall* 1992). They attempted to establish a mental framework in which a comprehension of varying technology-change capacities may be established. Translating this into the language of growth theory, the innovation system concept may be interpreted as an attempt to endogenize TFP growth.

This shows up very clearly in *practical measuring attempts*. To support this claim, [4]nine multi-regional measuring attempts and a complex indicator were reviewed, where subsections enabled one to compare regions.

These measuring approaches used a total of 209 indicators. We summarized (seeking out indicators with similar content) and grouped these based primarily on *Tödtling and Trippl*'s (2005) regional innovation system model (*Table 1*). The indicators used can be applied very well to the concept of the innovation system, mainly expressing the basic elements of the innovation system in figures.

[4] European Innovation Scoreboard's (EIS) Comprehensive Innovation Index (EIS 2007, 2008), European Trend Chart on Innovation's Service Sector Innovation Index (Kanerva et al 2006) and EXIS' Comprehensive Index (Arundel-Hollanders 2005), Florida-Tingali's (2004) European Creativity Index, World Bank's "Knowledge Economy Index" (WB 2008) and Porter and Stern's (2003) National Innovation Capacity Index. Afterwards studies focusing on lower spatial aggregation levels are considered: European Regional Innovation Scoreboard's (*Hollanders 2006, Hollanders et al 2009*) index, *Csizmadia and Rechnitzer's* (2005) study on the innovation capacity of major domestic cities and *Kocziszky*'s (2004) study on the innovation capacity of micro-regions in Northern Hungary.

It is also interesting that the comprehensive indices of several measuring attempts are directly linked to the region's growth capability (*Porter–Stern* 2003, *EIS* 2009, *Hollanders* 2006). Thus the efficiency criterion derived implicitly from theory is also confirmed.

Table 1: Information base of the reviewed measuring attempts

Subsystem	Areas measured	Typical indicators	Number of indicators
Knowledge generation	Publicly financed knowledge-generation input indicators	R&D indicators, number of researchers, leading professors, members of the academy	10
	Interim performance of the knowledge-generating subsystem	Publications, patents (EPO, USPTO), trademarks, design samples	9
Knowledge exploitation	Innovation outputs of the private sector	BERD, innovation expenses, intellectual property owned by businesses, training of employees, investments into new technology, innovation-centred business strategy	20
	Corporate innovation activity	Proportion of companies performing different forms of innovation (product, process, marketing, organizational / new for the company, new for the market / efficiency increasing), proportion of innovative companies in processing industries / services	14
	Micro-level effects	Revenue from new products, value added as a percentage of income	4
	Macro-level effects	Technology balance, corporate renewal pulse, royalty payments, proportion of knowledge-intensive sectors in the economy (processing industries / services)	12
Innovation background infrastructure	Human resources	Participation in education, life-long learning, population with tertiary education, population with diplomas in natural and engineering sciences, proportion of the creative class, availability of prepared labour force as a competitive disadvantage	24
	ICT infrastructure	Internet and phone penetration	7
	Innovation-supporting local climate and sophisticated local demand	Degree of sophistication in regards of local demand, open-minded consumers, tolerance, missing consumer feedback as a competitive disadvantage	9
	Capital	Amount of credits, amount of venture capital, availability of financing as a competitive disadvantage	6
	Background requirements for retaining creative labor force	Cultural and entertainment facilities	5
Relations	Relations between publicly and privately financed knowledge generation	Common publications, university-industry cooperation, companies considering the university as an important source of information	4
	Interactive learning and corporate cooperation	Corporate innovation cooperation, external knowledge sources (competitors, customers, suppliers), degree of clusterization	14
Policy	Policy	Efficiency of policies, proportion of subsidized companies, number of subsidy forms available, redundant governmental expenses, simple incorporation procedures	15

Source: own illustration

3. A welfare-based review of the information base

The innovation capacity (an efficient innovation system) consequently contributes to the acceleration of technological change. The expected welfare effect of this is the growth of the region’s economic performance. From a welfare point of view this efficiency criterion has two very important characteristics. First it emphasizes those effects of technological change that are directed towards economic performance. Second it views even these effects only

aggregated: how does economic performance as a whole change as a result of technological change. *The information base of the conventional evaluation can thus be characterized by the exclusion of this information*.

3.1. The significance of the excluded information

The above analysed information are by no means unimportant when doing a welfare evaluation. This is because a technological change necessarily modifies the functioning of society and that in a way which may bring changes in welfare[5]. Moreover the enhanced economic output can also be evaluated differently from a welfare point of view depending on what changes it brings in the allocation.

Already one of the first results in innovation-research points out the complexity of technological change. *Schumpeter* (1950) talks of creative destruction: novelties evolving in the economy dismantle the old structures and build a new one. Additionally, not only the economic structure transforms, but the infrastructural environment, the social relations, lobbying mechanisms and the economic-environmental relationship co-evolves with it (*Polányi* 1944, *Kemp et al* 1998, *Witt* 2003). One result of the process of this creative destruction is that – at least in the short run – innovation always makes someone loose. Furthermore we can reasonably assume that winners and losers are spatially distinct.

Another important consequence is the constant need to adjust to the intense change on the side of the concerned parties. When this change speeds up (and this is what the growing innovation capacity generally means) society as a whole, or parts of it may not be able to meet this need.

Nonetheless we do not have reason to doubt the existence of a connection between intense technological change and the characteristics facilitating quick adjustment. An important factor influencing technological change is for example the presence of an easily convertible human resource with a strong ability to learn. Obviously the concentration of such human capital in a given region can greatly enhance the adaptability. This in turn suggests that regions with stronger innovation capacity also have stronger adaptability.

For this reason it sounds reasonable to talk about the rate of technological change in a given environment instead of this rate in general. For a given region, or a given segment of

[5] In reality the relationships of technical change are even more broad: beside social relations it also transforms the economy-environment context. Even though we do not consider this aspect in this study, it has to be mentioned that impacts on environment can also have (in the present, but even more in the future) welfare effects.

society it is the rate of technological change compared to its own adaptability which is important. This leads to the conclusion, that *innovation capacity (and the desirability of its increase) can not be judged without prior knowledge on the welfare situation.*

If we rephrase the concept of creative destruction according to *Amartya Sen* (2003), we can conclude, that technological change constantly creates new opportunities while dismisses existing ones. In connection with factors determining welfare *Sen* (2003) emphasizes, that an increase in the set of feasible opportunities is itself an important element of welfare. At the same time we have to separate the set of potential choices (in theory no one keeps me from choosing among these) and the effectively feasible choices (I actually can choose any of these).

A fundamental question now is how new and lost opportunities relate to each other, what opportunities are lost and whether the newly arisen opportunities are in fact feasible.

Saviotti (2005) argues with reference to Pasinetti that if we assume constant number of goods in an economy and saturation for each of them with time, than increased productivity due to technological change will result in the redundancy of part of the labour force. Constant employment is only possible through the production of new goods. That is, if we do not see a drop in the employment we can assume that the number of goods available in the economy has increased. To support his argument he mentions the increasing diversity of goods in international trade.

This theory, however, only predicts the increase in the diversity of goods traded through the market, whereas it is possible that prior extra-market opportunities of satisfying certain needs have disappeared. The above reasoning also does not imply that the number of technological methods needed to produce the goods available on the market should necessarily increase. It can not be unambiguously stated that technological change results in the increase of possible choices in whole (and in every given region).

The most important question in connection with the *lost opportunities* is whether they can be substituted for the new opportunities. Assuming the possibility to compare (for example in monetary terms) opportunities the created new feasible opportunities should be more valuable than the lost opportunities. Even this is questionable to be realized. If an employee has non-convertible knowledge then new opportunities may not mean a real alternative to her compared to her lost job.

If we do not accept the assumption that opportunities are directly comparable, we have an even more complex situation. If visits to a suburban forest enter strongly into someone’s welfare calculations, than felling the trees to build a new supermarket dismisses an

opportunity which may not seem to be substitutable for anything. If technological change deprives us of opportunities that are not substitutable (eg. the taste of home-made cookies or healthy living conditions), than welfare (well-being) can drop significantly irrespective of the new opportunities.

Newly created opportunities can also raise questions. If the consumers face the rich variety of new opportunities, which they can not in fact choose (to use Sen's terminology, due to the lack of their positive freedom to do so), their sense of welfare will decrease (even though their actual consumption may remain unchanged). By learning of the existence of the new opportunities the lack of discontent (previously she did not even realize she had such needs) ceases.

Finally we recite a reasoning rooted in sociology. *Beck* (2003) shows through his "risk society" concept that along the technological change we constantly introduce new risks as well. The impacts of any technological change can not all be perfectly foreseen. Evolutionary economics talks of positive feedback mechanisms (*Arthur* 1989, 1990, *Nelson* 1995), philosophy of technology talk about the wide set of influencing factors and their systematic interconnection (*Ropolyi* 2004), and *Beck* (2003) talks about reflexivity: a new technological discovery changes the environment in which it was discovered, and thereby its own possible effects too. Many of the current technological discoveries were developed to solve such (mostly not foreseen) problems caused by earlier discoveries.

We can rightfully assume that new technological discoveries will have effects that cannot be identified in advance. A further problem is that these modernization risks are based on a causal interpretation, and are created within the (scientific) knowledge related to them. This way their recognition (the acknowledgement of their very existence) and the search for solutions is itself heavily influenced by social processes and institutions. So what opportunities the different members of society have to recognize these risks is in itself very important.

A further important aspect is how strongly the distribution of risks is connected to the distribution of goods. We can suppose that some of the risks – after their realization – can be treated to some degree. Our ability to reduce the risk can depend on the level of income, so groups or regions of lesser income have to face a greater proportion of the created risks while at the same time receiving a smaller proportion of the produced goods.

It is even because of great-scale technologies and potentially catastrophic risks (like nuclear power plants, emission of gases causing acid rain) that a whole society or the whole

world becomes one risk community. This in itself is such a novel phenomenon which can act towards the breaking up of conventional society relations.

The conventional information base of evaluation therefore excludes much important information from a welfare point of view. Certainly we could go on enumerating further arguments beside the above mentioned (like the impact of the productivity change on the number of work opportunities), but we already can draw two very important conclusions: First, that *the effects of change are not independent of the region's current (welfare) situation* (like adaptability and existing disparities). Second, that *the welfare evaluation of technological change will not necessarily lead to the same conclusion as a conventional evaluation*.

3.2 Value choices during the evaluation

Before we start to demonstrate the above conclusions based on empirical data it is necessary to return to the chosen efficiency criterion once again. We do not want to argue that the usual evaluation criterion is inadequate, only that it rests upon a different choice of values than the welfare approach we propose.

If the objective of the innovation policy is accelerating the rate of technological change in a way that it generates economic growth (independent of its welfare effects), than information provided by conventional valuation is adequate. Yet politicians have good reasons to treat other aspects valuable too, like the welfare of local residents or sustainability.

What we are going to show is, that *some choice of values is necessary during the analysis*. The only case it would not be necessary was if technological change would progress according to its own laws and would be an autonomous progress independent of us, having a predetermined path (from less developed technologies towards more developed ones).

In our opinion, however, technological change is not the least characterized by the above. There is not a "more developed" or "better" technology in general, these can only be judged in certain dimensions and in a given context. Philosophy of technology shows in depth that technological knowledge is not generally valid but situation-dependent knowledge (*Ropolyi* 2004). This also implies that the use of a given technological method becomes meaningful in that exact situation. Technological methods are organically connected; they

presume each other's existence.[6] If any small number of these connecting parts are missing, then the technology can not be implemented in its given form. Evolutionary economic reflects on this problem by identifying physical and social technology (*Nelson* 2002). Physical technology means (the knowledge of) the method of producing a good or service independent of the division of labour, whereas social technology means the methods of the division of labour and coordination[7]. A method that works efficiently in a given context may not be so efficient or even may not work at all in another context. In a world with no gas stations a combustion engine car can hardly be considered a "more developed technology" than the horse-drawn cart.

Evolutionary economics also shows that even if a more advanced technology as such would exist, technological change would not necessarily bring about its general diffusion (*Arthur* 1989, 1990, *Kemp et al* 1998). Furthermore, the change is not deterministic (*Nelson* 1995). Considering a technology as appropriate, or even accepting the technological knowledge it is based on as true is not happening according to objective criteria, but is socially constructed (*Pinch-Bijker* 2005).

Based on the above we *think that an analysing stance is needed either explicitly or implicitly* and that it is more fortunate for the analysers to make this previously chosen aspect transparent and point it out. This way our definition for innovation capacity can be phrased as following. The innovation capacity of a region can be interpreted as the efficiency of its innovation system, where efficiency can mean its contribution to

- the pace of technological change, or
- the rate of economic growth, or
- the well-being of the residents of the region, or
- sustainability etc.

3.3 The interpretation of welfare

The efficiency criterion of the present study centres on the welfare of the local residents. Welfare in itself is, however, a very complex notion allowing a quite broad range of interpretations, so we consider it absolutely necessary to make our usage of the term clear. As

[6] The professional knowledge of a carpenter (of how to make a chair, for example) can only be implemented, if he can buy screws and nails in the shop, if he can charge the battery of his drill etc. Without these the technology of making a chair is useless in its usual form.

[7] Using the terminology of the New Institutional Economics it is the rules of the game, the method of control or the low transaction cost way of producing.

we have already mentioned, the most general aspect used recently by the evaluation of the effects of technological change is its contribution to economic growth. The reason why this economic growth-centred thinking influences scientific research also in this field is that the formal welfare-theories it is rooted in, like the preference-utilitarianism and material utilitarianism (*Dasgupta* 2001, *Hunt* 2002) are still predominant in contemporary welfare economics (*Sen-Williams* 1996).

Yet economic growth-centred thinking is heavily criticised at least from two aspects. One is in connection with the underlying paradigm of preference-utilitarianism and material utilitarianism (*Hausmann-McPherson* 1997). A general characteristic of substantive approaches in contrast with the criticised formal theories (like utilitarianism) is that they define exactly what has intrinsic value for the people.

One of the three most influential substantive welfare theories of the 20th century is the theory of primary goods (*Rawls* 1997). According to this welfare has to be measured in social goods that are the means for a person to live a whole life in society. In Rawls's view, these primary goods are: liberty, law, power, opportunity, income, wealth and the social foundations of self-esteem (*Rawls* 1997). Disposing over one's liberty is of primary importance among these. A second influential substantive theory is the *capability approach* (*Sen* 2003). Capability means here the degree of actual freedom enjoyed by people. The most important difference from Rawls's theory is that capability does no only cover the tools to attain welfare, but relevant personal traits also that determine to what degree a person is able to use his or her primary goods to attain his or her goals. Among the capabilities liberty enjoyed by people has an emphasised significance which is not only a means of welfare, but also its end (*Nussbaum* 2002). The third such theory is the *happiness-theory* (*Layard* 2007)[8] in connection with economic psychology. It states we can not prove that economic growth would contribute further to welfare (happiness) beyond a certain level, which makes a welfare-centred reconsideration of the material utilitarianism necessary.

The second group of criticism (in close connection with the previous group) criticises economic growth-biased thinking – explicitly or implicitly – because of its too narrow information base (*Sen* 2003, *Van den Berg* 2007, *Daly-Cobb* 1989, *Layard* 2007). According to this the indicators measuring economic growth and therefore also the scientific research

[8] It should be noted here, that this theory can not be definitely categorized along the formal-substantive line. On the one hand it is formal (utilitarian) in the sense that as a goal it also views a state of society characterised be the highest possible happiness (as result). On the other hand it is also substantive in the sense that it looks for elements of intrinsic value to attain this state.

and social-political decision making based on those disregard some factors which in fact are important for the welfare of society.

We stand on the side of the substantive theories. In order to operationalize the notions suggested by these theories we consider Alkire's *dimension* concept to be appropriate. A dimension is a component of welfare from a specific aspect (*Alkire* 2002). A dimension is thus a point of view which sheds light on a specific part of welfare. It follows from this, that no single dimension can adequately describe welfare by itself, and that dimensions can sometimes be overlapping (some indicators important to determine welfare can in theory be classified under more dimensions). Based on the above welfare theories we worked out the dimensions below, that characterise our welfare interpretation (table 2.), and these are the factors we are going to heed in our empirical analysis.

Table 2: Theoretical dimensions of welfare

Name of dimension	Description and content of dimension
Material goods	Most welfare theories agree that people need material goods and that these goods are indispensable part of welfare. The issue of income inequalities also belong to this dimension: according to the theory of primary goods, in an optimal society everybody have an identical share of the necessary assets, and the more the actual situation diverges from this ideal, the less favourable it is. The importance of just distribution is emphasised both by the capability approach and the happiness-theory.
Liberty rights	Rawls and Sen both assign a high importance to the fundamental human liberty rights: „First, the basic liberties as given by a list, for example: freedom of thought and liberty of conscience; freedom of association; and the freedom defined by the liberty and integrity of the person, as well as by the rule of law; and finally the political liberties;" (*Rawls* 1982, p.162).
Physical well-being	In almost every list of primary goods (e.g.: *Narayan et al* 2000, or *Cummins* 1996), and also in the capability approach the physical well-being of a person is of prominence (*Nussbaum* 2002). This dimension contains food and water in quantity and quality absolutely necessary for life, basic hygienic conditions, lodging and last but not least health.
Family ties/friendships	Priority objective in the happiness theory (*Layard* 2007), also appearing in the lists of primary goods (*Narayan et al* 2000). Its importance is explained in the literature by humans being essentially social animal and needs to nurture connections to other humans.
Quality of environment	It is not high priority factor anywhere, only the capability approach takes it into account: starting with whether one has the opportunity to make excursions through the air quality of one's dwelling place to the risk the opportunities of the next generation (*Dasgupta* 2001 – this is not a capability approach reference).
Spare time activities	„games" as components of human welfare can be found on more of the compiled lists of primary goods (eg. *Nussbaum* 2000). This dimension also contains one's capacity to decide freely about the usage of one's spare time and to have a wide variety of choices: whether one wants to go the theatre, a library or a movie, or join a sports club or a non-governmental organisation.
Work	Layard during his happiness research concludes, that work is one of the keys to human happiness (*Layard* 2007). Rarely found explicitly in the theory of primary goods, the capability approach emphasises that one should have the opportunity to work, receive income in return an be a useful part of society (*Sen* 2003). Rawls talks about responsibility and the freedom of choosing an employment in connection with work (Rawls 1982).
Forms of social providence	This dimension rests basically on the capability approach. This covers those opportunities which a person or a smaller community like a family could not by itself procure but society as a whole can provide these, and can offer wider range of opportunities to people (*Sen* 2003). This is basically a very wide category. We interpret this as a kind of complementary to the other dimensions, and classify here those social services that do not belong to any other category, but society provides them organised either top-down or bottom-up. These include nursery school, public parks and public buildings, health care and civil order.
Education	Only an indirect part in welfare. We do not find it on any list of primary goods, still it is of vital importance in broadening human capability: better educated people have more opportunities, produce more added value, can achieve higher incomes and according to a Hungarian research, also happier (*Lelkes* 2003).
Accessibility of information	This dimension also comes from the capability approach: if someone wants to take his opportunities, he need to acquire information how he can do so. He might look for a new job, choose a suitable hobby, learn of what is happening in the world around him, and can live a more whole life (*Sen* 2003).
Basics of social self-esteem	This dimension originates from Rawls, who himself refers to Adam Smith in connection with it: people need to have certain goods in order to be accepted by society, even if these goods are not strictly goods of sustenance. These goods are defined by the culture of the society, but can not be detached from welfare. In today's allegedly developed societies such goods are cell phones or appropriate clothing.

Source: own compilation

The efficiency definition we use in our analysis focuses on the welfare of the local residents. Our view of welfare is based fundamentally in substantive as opposed to formal (most notably the predominant material utilitarianistic) welfare interpretations. We build on this attempting to theoretically reconsider the conventional information base of innovation measurement, and our empirical analysis to be presented in the following chapters also rest on this interpretation.

4. Methodology

In our empirical analysis we attempted to answer the question, whether the mapping of the welfare situation in fact provides such information that can not be gained from usual

evaluations, but still are important for innovation policy decisions. The units of analysis were the 174 LAU-1 subregions of Hungary, our data refer to 2008.[9]

Although several achievements of regional science suggest that innovation is a local phenomena, innovation processes have local features, practical measurement attempts hardly go beyond the regional level. Carrying out our analysis at subregional level certainly affects informational basis in itself. The low level of territorial aggregation allows us to gain information on sub-regional (local) processes, while it results in a decreased complexity because of the narrower set of available data.

With identical methodology we carried out two distinct analyses. First, we attempted to adapt the usual approach of innovation measurement to subregional level. In other words we measured subregional innovation performance on the usual informational basis. Second, we measured the welfare situation of subregions. Then we linked (confronted) the results of the two analyses.

The dimensions we tried to capture were the theoretical categories provided by table 1. for innovation performance and table 2. for welfare measurement. We carried out these analyses by using complex indicator sets. The general weakness of such approaches are the subjective selection and weighting of the indicators. We tried to abate these weaknesses by adapting the method of *Lukovics* and *Kovács* (2008), developed for competitiveness measurement.

Two very serious burdens arose when trying to transplant to subregional level the indicators that are offered by theoretical categories and former measurement approaches. First, not all the indicators make sense at subregional level, that are anyway adequate at regional or national level. Several indicators that have essential importance at national level does not differentiate between subregions. For example the innovation policy indicators belong to this set, since in Hungary almost all the decisions related to innovation policy are passed at national level.

The second basic problem is data availability. A number of indicators that are widely used in innovation analyses are only availably at national or regional level. The set of indicators that were directly available was very narrow. To overcome this problem we attempted to create indicators by own collection on the one hand[10]. On the other hand certain indicators that are normally published at regional or national level, but collected at municipal

[9] We used the latest available data where the 2008 figure was not available.
[10] For example the number or patent or trademark applications.

level were aggregated to subregional level by the Hungarian Central Statistical Office for the purpose of our analysis.

As a result we could create an *initial indicator set*, which consisted of 43 indicators in case of innovation performance and 58 in case of welfare. We created specific and proportional indicators than used standardization to ensure comparability. Then the *final set of indicators*[11] that were actually used for the analyses were created by a multi-step method.

The indicators were assigned to the theoretical dimensions. Then within each dimensions we ran factor analysis (by using principal component method). In case of welfare measurement it was necessary to discompose certain dimensions, because we expected from the principal components to keep at least 70% of the original information.

By these means we created 4 dimensions and 10 factors in case of innovation performance measurement, and 11 dimensions and 23 factors in case of welfare measurement (*Table 3*). The selection of variable occurred within this method (thus objectively within the method):

- On the one hand we selected out indicators with a very low communality values (below 0,3).
- On the other hand we created the factors in such a way that their eigenvalues should be above 1, the remaining information content should be more than 70%, and each indicator should be unambiguously tied to one factor (correlation with a given factor should be at least two times stronger than with any other factors).

Thus the final set of indicators consisted of 32 indicators in case of innovation performance and 47 in case of welfare measurement. We utilized *three kinds of outputs*. The first set of outputs were the *factor values* themselves. The second set of output were the dimensions. Dimension values were not created from the factors values, but directly from the indicators that belong to the dimension by a weighting method. Factor analysis provides communality values for each indicator, which eventually indicates the extent to which the given indicator was taken into account through the creation of the hypothetic variable. Therefore this is weighting provided by the method itself. Hence, *dimension value* is the weighted average of pertinent indicator-values, where the weights are the square roots of communalities.

[11] The initial and final sets of indicators are displayed at *appendix 1*. and *2.*

Table 3: Levels of measurement

Summary index	Dimension	Factor
Measurement of the innovation performance		
Subregional summary innovation index (SRSI)	Knowledge creation (KC)	Knowledge creating institutions
		Government R&D activity
	Knowledge exploitation (KE)	Knowledge intensive business activity
		Corporate R&D activity
		High-tech manufacturing
	Innovation background infrastructure (BI)	Presence of creative labour force
		Cultural opportunities (services)
		Entrepreneurial activity
	Links (LINK)	External orientation
		Relational portfolio
Measurement of well-being		
No summary index created	Material well-being	Income-poverty situation
		Income distribution situation
	Physical well-being	Malignant tumour diseases
		Other long term diseases
	Culture	Cultural opportunities
		Cinemas
		Museums
	Recreation services	Access to recreation services
		Quality of recreation services
	Labour opportunities (positive freedom to have a job)	Unemployment
	Forms of social care – basic forms	Sewage system
		Other basic household public services
		Access to postal services
	Forms of social care – basic health services	Access to basic health services
		Access to hospitals
	Forms of social care – child care	Quality of kindergartens
		Access to day care and kindergarten
		Endangered people under age
	Forms of social care – basic educational services	Access to primary education
		Quality of primary education
	Security	Crime level
		Traffic security
	Education (positive freedom to become highly skilled)	Opportunities for taking part in education

Source: own illustration

Third, we created a summary index of innovation performance: the subregional summary innovation index (SRSI). This was created directly from the 32 indicators of the

final indicator set analogously to the creation of dimension-values. With respect to subregional welfare we did not create a summary index. We consider welfare to be such a complex concepts that can not be reduced to one final value (or not worth).

5. Results

Summary innovation performance its dimensions and also the dimensions of welfare show strong spatial inequalities at subregional level. Since we used cross-section data we could not analyze directly the effects of innovation performance on the welfare situation. We rather focused on the correspondence between the innovation and welfare situation.

We analyzed the correspondence of the innovation performance and welfare situation by computing partial correlations (*Table 4.*). We controlled for population, since innovation performance is strongly correlated to it. Our results indicate complex relations between innovation performance and the welfare situation.

Table 4: Correspondence between innovation performance and welfare situation (partial correlation results)

	SRSI	KC	KE	BI	LINK
MATERIAL WELFARE (INVERSE)	-0,416	-0,128	-0,406	-0,316	-0,535
PHYSICAL WELL-BEING (INVERSE)	-0,308	-0,147	-0,328	-0,284	-0,183
CULTURAL SERVICES	0,334	0,202	0,180	0,53	0,151
RECREATIONAL SERVICES	0,072	0,037	0,076	0,139	-0,046
LABOUR OPPORTUNITIES (INVERSE)	-0,533	-0,213	-0,530	-0,469	-0,491
SOCIAL CARE – BASIC FORMS	0,450	0,265	0,486	0,349	0,264
SOCIAL CARE – HEALTH SERVICES	0,262	0,204	0,340	0,120	0,006
SOCIAL CARE – CHILD CARE	0,315	0,118	0,296	0,302	0,302
SOCIAL CARE – BASIC EDUCATION	-0,057	-0,111	-0,039	-0,017	0,038
SECURITY (INVERSE)	0,184	0,128	0,148	0,144	0,154
EDUCATIONAL OPPORTUNITIES	0,707	0,433	0,623	0,671	0,461

Source: own illustration
Note: Controlled for population. Inverse means that the higher dimension-value indicates worse situation.

The most important statement that can be made is that the innovation performance correlates only to few welfare dimensions. The correspondence is medium or weak even in these cases. In line with the expectations a stronger innovation performance goes together with higher material welfare, but still the correspondence is medium. The highest correlation values refer to the dimensions “labour opportunities” and “educational opportunities”, which latter is not surprising, since it was taken into account as a factor of innovation performance.

We found only one dimension where the relation is negative (but weak, although significant): the higher innovation performance goes together with a worse security situation.

Out of the dimensions of the innovation performance "knowledge exploitation" and "link" shows the strongest correlation to material welfare, which is in line with the theoretical considerations. But in case of "labour opportunities" and "educational opportunities" the relation rather based on the other two dimensions: "knowledge creation" and "innovation background infrastructure".

It is important to control whether these results hold also for large and low populated subregions separately. Theoretical considerations suggest that innovation performance is strongly influenced by the absolute concentration of the activities (Varga 2009), but our methodology eliminated the differences between subregions in this respect.

While the overall picture is fairly the same in case of the small subregions, the correlations are weaker in case of the larger ones. In that latter case the correspondence between innovation performance and material welfare disappears (*Table 5*.).

Table 5: Correspondence between innovation performance and welfare situation in case of the larger subregions (partial correlation results)

	KIK	**KC**	**KE**	**BI**	**LINK**
MATERIAL WELFARE (INVERSE)	-0,113	0,142	-0,213	-0,158	-0,597
PHYSICAL WELL-BEING (INVERSE)	-0,267	-0,141	-0,316	-0,18	-0,31
CULTURAL SERVICES	0,587	0,5	0,323	0,72	0,225
RECREATIONAL SERVICES	0,1	0,087	0,038	0,271	-0,162
LABOUR OPPORTUNITIES (INVERSE)	-0,228	-0,103	-0,26	0,082	-0,727
SOCIAL CARE – BASIC FORMS	0,304	0,129	0,341	0,124	0,658
SOCIAL CARE – HEALTH SERVICES	0,121	0,104	0,35	-0,141	-0,106
SOCIAL CARE – CHILD CARE	0,321	0,209	0,414	0,186	0,198
SOCIAL CARE – BASIC EDUCATION	0,208	0,089	0,184	0,252	0,259
SECURITY (INVERSE)	-0,132	-0,017	-0,154	-0,123	-0,302
EDUCATIONAL OPPORTUNITIES	0,827	0,732	0,565	0,861	0,247

Source: own illustration
Note: Controlled for population. A subregion is considered to be large if its population is more than 100.000 or the population of it centre is more than 50.000.

These results draw attention to the fact that the relation of innovation performance and welfare cannot be treated schematically. Actually welfare is a complex category that is much wider than the utilitarian interpretation of material welfare. Although better innovation performance characteristically infer better material welfare, labour and educational opportunities, it does not provide information on the other dimensions. Even in those cases where we found correlation, the tie is medium. This means that there are several regions

where larger innovation performance is not accompanied by better material welfare. On the top of these we found a welfare dimension (security) where the relation in converse.

We must emphasize that the material welfare dimension we used in our analysis in a complex category in itself. Beside the usual measure of aggregate material wealth it also contains information on poverty rate and income inequalities. Accordingly, it is expedient to further analyse this dimension. It also gives us a chance to control if we managed to adapt the usual informational basis to a subregional level. In this case a strong correlation is expected between the usual measure of material wealth and the innovation performance.

Table 6: Correspondence between innovation performance and material welfare (partial correlation results)

	SRSI	**KC**	**KE**	**BI**	**LINK**
MATERIAL WELFARE (INVERSE)	-0,416	-0,128	-0,406	-0,316	-0,535
Total inland incomes per capita	0,736	0,325	0,759	0,626	0,608
Subregional Gini index	0,456	0,293	0,531	0,383	0,109
Poverty rate	-0,526	-0,209	-0,552	-0,383	-0,547

Source: own illustration
Note: Computed for all subregions. Controlled for population.

The in depth analysis of this one welfare dimension reveals very interesting phenomena. The three indicators of this behave quite differently. Total incomes (a usual indicator of material wealth) is strongly correlated to SRSI and especially to the knowledge exploitation ability. The expected relation can be thus displayed.

The correlation is medium and negative in case of the poverty rate, which means that higher innovation performance infers lower poverty rate. But the relation between innovation performance (knowledge exploitation) and income inequalities is converse. *The relation between material welfare and innovation performance is thus complex*, it is added up by contradictory processes. While higher incomes and lower poverty rate influences welfare positively, higher income inequalities worsen the welfare situation.

The correlation results also indicate that the revealed relations are not general rules. There exist a number of subregions, where higher innovation performance does not go together with higher incomes, lower poverty rate (or larger inequalities). Accordingly *different innovation-welfare patterns can be identified.*

To summarize our results we can say that the mapping of innovation performance (by using a usual informational basis) *provides certain information on the welfare situation, but not too much*. Nowise enough to underpin innovation policy interventions. We gain very

limited information on most of the welfare dimensions, however the effects of change can bring changes in these dimensions.

While technological change is characteristically faster at subregions where material welfare is higher, its not true for many of the areas, which might cause serious adaptation problems. But problems may also arise in larger income regions, because higher innovation performance seems to infer larger income inequalities.

6. Summary and conclusions

In present paper we reviewed the usual informational basis of innovation performance measurement from a welfare perspective. We interpreted welfare in a complex way, which is rooted in the conventions of substantive welfare theories.

We showed that the judgement criterion normally used by innovation performance evaluation exclude relevant information from a welfare perspective. Since theoretical considerations suggest that technological change affects welfare complexly (also those dimensions are affected which are excluded from the usual judgments), innovation measurement does not necessarily provide sufficient information for policy makers.

We emphasized that the mapping of the welfare situation of a region is important to create adequate policy, since the effects of technological change may depend on this situation. Therefore the usual criteria of evaluation, namely “better innovation performance is desirable at all circumstances” is too simplified.

We carried out an empirical analysis on a Hungarian database at subregional level to analyse whether the mapping of the welfare situation provide additional information for innovation policy indeed.

The low territorial aggregation level of the analysis was quite challenging. While it enabled us to reveal important subregional phenomena, it certainly resulted in the loss of complexity to a certain extant (due to data availability difficulties). Still some important statements could be made.

Innovation performance has a very complex relationship with welfare, which is added up by different, sometimes contradictory components. Our examinations are not decisive in this sense but suggest, that

- Fostering the efficiency of innovation systems can occur in different ways (in a welfare perspective). Different welfare-innovation patterns may exist.

- In different regions the effects may be different (depending in the welfare situation). The same thrive to strengthen innovation performance may result in a welfare gain in certain regions and welfare loss in other regions.

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Appendix 1: The indicator set of measuring subregional innovation performance

	NUMERATOR	REFERENCE YEAR	DENOMINATOR
	Knowledge creation (KC)		
1	Government R&D expenditures	2008	1 000 inhabitants
2	Basic research expenditures	2008	1 000 inhabitants
3	Number of scientists with PhD	2008	10 000 inhabitants
4	Number of teaching staff of higher education institutions (by location of headquarters))	2008	10 000 inhabitants
5	Number of teaching staff of higher education institutions (by place of education)	2008	10 000 inhabitants
6	Number of graduating students (by place of education)	2008	10 000 inhabitants
7	Number of students attending tertiary education (by place of education)	2008	1 000 inhabitants
8	Number of full time bachelor and master students (by place of education)	2008	1 000 inhabitants
	Knowledge exploitation (KE)		
9	Number of home patent applications	2006-2009	10 000 inhabitants
10	Number of home trademark applications	2006-2009	10 000 inhabitants
11	Corporate R&D expenditures	2008	1 000 inhabitants
12	Applied research expenditures	2008	1 000 inhabitants
13	Experimental development expenditures	2008	1 000 inhabitants
14	Number of partnerships at high and medium tech manufacturing	2008	Total number of partnerships
15	Number of partnerships at high tech KIBS	2008	Total number of partnerships
16	Number of partnerships at KIMS	2008	Total number of partnerships
17	Number of partnerships at KIFS	2008	Total number of partnerships
18	Number of sole proprietorships at high and medium tech manufacturing	2008	Total number of sole proprietorships
19	Number of sole proprietorships at high tech KIBS	2008	Total number of sole proprietorships
20	Number of sole proprietorships at KIMS	2008	Total number of sole proprietorships
21	Number of sole proprietorships at KIFS	2008	Total number of sole proprietorships
	Innovation background infrastructure (BI)		
22	Number of newly registered partnerships	2006-2008	Total number of partnerships
23	Speed of enterprise circulation (number of entrees and exits)	2006-2008	Total number of partnerships
24	Number of newly registered sole proprietorships	2006-2008	Total number of sole proprietorships
25	Speed of sole proprietors circulation (number of entries and exits)	2006-2008	Total number of sole proprietorships
26	Number of registered full time sole proprietors	2008	1000 inhabitants
27	Number of population with maximum primary education (inverse indicator, subtracted from 100%)	2008	Population aged 18-24
28	Number of employees with tertiary education	2001	Number of employed
29	Number of white collar worker in leading positions	2001	Number of employed
30	Number of inhabitants with tertiary education	2001	Population aged 7 or above
31	Number of broad band internet subscribers	2004	1 000 inhabitants
32	Number of ISDN lines	2008	1 000 inhabitants
33	Number of cultural events	2008	1 000 inhabitants
34	Number of cultural centres	2008	1 000 inhabitants
35	Registered members of pubic libraries	2008	1 000 inhabitants
36	Number of cinema visits	2008	1 000 inhabitants
37	Number of museum visitors	2008	1 000 inhabitants
	Links (LINK)		
38	Intensity of external links (Number of co-inventorships related to the subregion)	2006-2009	Total number of co-inventorships
39	Diversity of external links (number of subregions that have co-inventorship links with the given subregion)	2006-2009	
40	Number of majorly or exclusively foreign-owned companies	2007	10 000 inhabitants
41	Net turnover of majorly or exclusively foreign-owned companies	2007	Total turnover of companies
42	Total staff of majorly or exclusively foreign-owned companies	2007	Total staff of companies
43	Net turnover from export sales	2008	Total net turnover of companies

Note: Gray background indicates that the given indicator was selected out.

Abbreviations: KIBS: knowledge-intensive business services, KIMS: knowledge-intensive market services, KIFS: knowledge-intensive financial services.

Appendix 2: The indicator set of measuring subregional welfare situation

	NUMERATOR	REFERENCE YEAR	DENOMINATOR
	Material welfare		
1	Inland incomes	2007	Population of the subregion
2	Poverty rate (Number of inhabitants with incomes less than the 60% of the compulsory minimum wage)	2007	Number of personal tax payers
3	Subregional Gini index*	2007	
	Physical well-being		
4	Malignant tumours of lungs and bronchial tubes	2008	100 000 inhabitants
5	Malignant tumours	2008	100 000 inhabitants
6	Diseases of the respiratory system	2008	100 000 inhabitants
7	Diseases of the digestive system	2008	100 000 inhabitants
8	Malignant breath tumours	2008	100 000 inhabitants
9	Diseases of circulatory system	2008	100 000 inhabitants
10	Infant mortality (Infant death)	2008	1 000 births
	Cultural services		
11	Seating capacity of cinemas	2008	100 000 inhabitants
12	Number of cinema performances	2008	100 000 inhabitants
13	Number of museums	2008	100 000 inhabitants
14	Number of museum exhibitions	2008	100 000 inhabitants
15	Number of procreative cultural communities	2008	100 000 inhabitants
16	Number of regular cultural activities	2008	100 000 inhabitants
17	Number of municipalities with cultural institutions	2008	Number of municipalities in the subregion
18	Number of municipalities with public library	2008	Number of municipalities in the subregion
19	Number of cultural institutions	2008	100 000 inhabitants
	Recreation services		
20	Number of municipalities with sport halls, sport grounds	2008	Number of municipalities in the subregion
21	Number of municipalities with bath / swimming pool	2008	Number of municipalities in the subregion
22	Number of playgrounds, sport grounds and picnic area	2008	100 000 inhabitants
23	Surface of playgrounds, sport grounds and picnic areas	2008	1 000 inhabitants
	Labour opportunities		
24	Number of persons seeking employment over 180 days	2008	Population aged 15-59
	Forms of social care - Basic forms		
25	Number of flats connected to public drainage	2008	Number of flats in the subregion
26	Number of municipalities having public sewage disposal	2008	Number of municipalities in the subregion
27	Number of flats connected to drinking water system	2008	Number of flats in the subregion
28	Number of flats involved into regular waste collection	2008	Number of flats in the subregion
29	Number of municipalities with post office(s)	2008	Number of municipalities in the subregion
30	Number of inhabitants involved in water delivery because of unsatisfactory quality of drinking water from the aspect of public health	2008	10 000 inhabitants
31	Number of public wells	2008	1 000 km2 within municipality boundaries
	Forms of social care - health		
32	Number of municipalities with family doctor	2008	Number of municipalities in the subregion
33	Number of municipalities having outpatient medical attendance	2008	Number of municipalities in the subregion
34	Number of municipalities with pharmacy	2008	Number of municipalities in the subregion
35	Number of functioning hospital beds	2008	100 000 inhabitants
36	Number of family doctor services	2008	100 000 inhabitants
37	Number of paediatrician services	2008	100 000 inhabitants between age 0-17
38	Number of pharmacies	2008	100 000 inhabitants

Note: Gray background indicates that the given indicator was selected out.

Appendix 2 (cont): The indicator set of measuring subregional welfare situation

	NUMERATOR	REFERENCE YEAR	DENOMINATOR
	Forms of social care - child care		
39	Number of spaces in kindergartens (including special education)	2008	1 000 children of kindergarten age
40	Number of kindergarten education (including special education)	2008	1 000 children of kindergarten age
41	Number of municipalities with kindergartens	2008	Number of municipalities in the subregion
42	Number of municipalities with day care	2008	Number of municipalities in the subregion
43	Number of children (from age 0-17) placed under child protection	2008	Number of children from age 0 to 17
44	Number of endangered children (from age 0 to 17)	2008	Number of children from age 0 to 18
45	Number of children applied for day care but rejected because the lack of day care places	2008	1 000 children of day care age
	Forms of social care - basic education		
46	Number of municipalities with primary school	2008	Number of municipalities in the subregion
47	Number of primary schools (including special education)	2008	1 000 children of primafy school age
48	Number of primary school classes (including special education)	2008	1 000 children of primafy school age
49	Number of full-time educators (including special education)	2008	1 000 children of primafy school age
50	Number of computers in primary schools (including special education)	2008	1 000 children of primafy school age
	Forms of social care - security		
51	Number of assaults	2008	100 000 inhabitatnts
52	Known prosecution crimes	2008	1 000 inhabitants
53	Accidents caused by vehicles	2008	100 000 inhabitatnts
54	Number of casualties and bad road accidents	2008	100 000 inhabitatnts
55	Number of people badly injured or died in road accidents	2008	100 000 inhabitatnts
	Education		
56	Average number of finished classes among inhabitants older than 7 years	2001	
57	Number of inhabitants who did not finish first class in primary school	2001	Inhabitants older than 7 years
58	Number of inhabitants having maximum elementary qualfication	2001	Inhabotants from age 18 to 24

Note: Gray background indicates that the given indicator was selected out.