

Generating and Measuring Regional Social Innovation

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SUMMARY

Innovation is one of the determining factors of economic output. The actors of economics have long recognized that in regions where there is a lack of economic and natural science innovation, social innovation can be a compensating factor. This recent research presents a methodology for measuring social innovation potential (index) and defines a knowledge engineering system that helps to generate such innovations. This can be applicable to defining the intervention axis along which social innovation potential can be increased.

Keywords: social innovation potential, knowledge engineering

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INTRODUCTION

The national and international scholarly community is paying growing attention to the examination of the conditions and effects of innovation, as is shown by the yearly increase in the number of publications. The reason for the interest is clear: innovation has a key role among the determining factors of economic performance (output) and competitiveness (Ewers-Brenck 1992, EC 2001, EC 2002, EC 2005). Empirical analyses have shown that there is a significant correlation between a given settlement's or region's economic and innovation potential; the more innovative territories have higher performance than the regions lacking in innovation. It is also true inversely: the locations with relatively higher operating costs can only be competitive if they can produce products and services with high value added (Camagni 1995, Clar et al. 2001).

It is not by chance that in the last two decades the European Union has changed its innovation policy (mainly because of the decline in its world economic competitiveness). As a result of this, as well as new aims,

new tools and methods have also appeared which will help to foster the "European innovation climate" (EC 2010). A critical objective of the territorial (subnational) level is to create a regional research and technology policy that conforms to the local capabilities and that has a close connection to the decentralization efforts of the European Union. So a need has been identified for the transmission and spatial visualization of the central concepts in generating spatial innovation processes.

It is well known that the neoclassical (and related) theories consider market interventions to be harmful and undesirable. In contrast, Keynes and his followers (post-Keynesians) have contested the regulating power of "the invisible hand" from the beginning, and emphasised the need for interventions. The question of whether intervention is reasonable is constantly recurring in the practices of the European Union. The economic policy of the EU are partly neoliberal (for example, in trade policy, competition policy, etc.) and partly Keynesian (for example, in agricultural policy, cohesion policy, R&D&I policy, etc.). This is a special Janus-faced dichotomy. There are many arguments for each side. On the one hand we fear for the competitiveness of the EU, and on the

other hand (because of the increasing social inequalities) we worry about the increasing social tension.

Recognising the danger of larger social gaps, the EU considers the issue of social cohesion as a common policy. The main goals are to maintain social peace and avoid exclusion (EC, 1992; EC, 1993). The results are not rather ambiguous; hence, in spite of creating the European Cohesion Fund and European Social Fund, poverty and lack of social inclusion remain an everyday problem (EP, 2006). Moreover, because of the new member states of the EU, the spatial inequalities have increased (Table 1).

Table 1
Share of regions with GDP per capita above the EU average and below the 75% threshold

year	number of NUTS2 regions	number of regions with GDP/capita above the EU average	number of regions with GDP/capita below the 75% limit
1999 (EU15)	214	128 (60%)	22 (10%)
2005 (EU27)	271	129 (47%)	69 (25%)

Source: Eurostat

There is a similar tendency also in Hungary. While in the core regions the R&D expenditure is higher than the average, the catch up process of the peripheral areas is supported by R&D expenditure only to a lesser extent.

Thus, there is a correlation between the economic output and the innovation potential of a given region. But also the concept of innovation (the search for new and recent solutions) has to be interpreted more broadly than before. The European Union, in concordance with social changes, is paying greater attention to the context of social innovation. This can be underlined by the fact that in the last two decades several related research institutes (for example the Netherlands Centre for Social Innovation, Rotterdam; Zentrum für Soziale Innovation, Vienna; Centre for Social Innovation, Malmö University, etc.) and projects (for example TEPSIE – The Theoretical, Empirical and Policy Foundations for Building Social Innovation in Europe; INNOV-Care-Innovative Patient-Centred Approach for Social Care Provision to Complex Conditions; Soziale Innovation in Deutschland, etc.) have been established or funded.

AIM AND METHODOLOGY OF THE RESEARCH

The European Union has redefined its traditional research and technology policy (Autio 1998, Braczyk et al. 1998, Cook – di Marchi 2002). As a result of this, the target system was modified and structural changes were made in the methodology of planning and monitoring and also in the institutional structure of the innovation policy.

The conditions for getting resources were broadened. In the last two decades the definition of innovation has become more complex. Nowadays innovation is a broader notion than earlier: it is the complex process of recognizing novelty, and novel products and launching them on the market (EC 1995, Egger 2014).

The science policy aims of European integration were actually defined by the Lisbon summit in March 2000 and then modified in 2005. The aim is no less than making the Union “the most competitive and dynamic knowledge-based economy in the world,” a process which creates more and better workplaces, and strengthens the social cohesion of the member states. This aim cannot be reached without the so-called “knowledge triangle” (education, research and innovation).

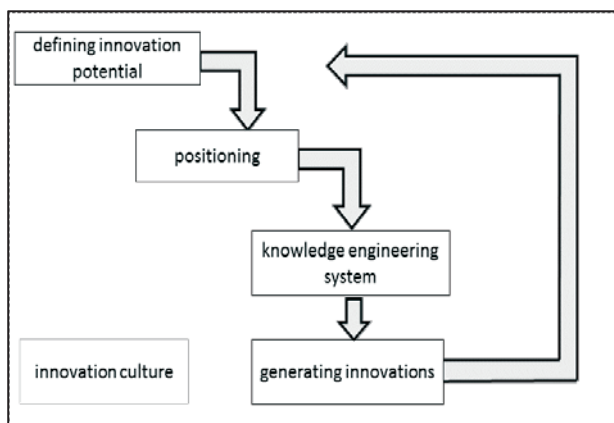
The Lisbon strategy’s pretentious objectives were not reached. It was clear already in 2004 that the actions of the Lisbon strategy (although it had produced results) had low efficiency (most of the aims were not fulfilled, and it was impossible to reach the goals for 2010). The Lisbon strategy was one-sided: almost the whole concentrated on the conditions for and tools of industrial and economic development. The practical issues of economic development (that the economy should move towards knowledge-based sectors, which produce more added value) did not get appropriate emphasis. The Lisbon program ignored the eastern expansion of the EU (in 2004 and 2007 new member states joined the EU, including some with weak innovation situations, for example Romania and Bulgaria). Although “more and better jobs and greater social cohesion” were among the objectives, social innovation was not included in the tools for implementation. The strategy paid attention only to the technical and economic components of innovation. To reach stable social results it is not enough to concentrate only on these factors (for example environmental policy or sustainable development), because without the social adoption of the new solutions (for example the negative effects of “shock therapy” in our region) it is not possible to achieve harmonious development.

In the EU the social problems are expected to continue recurring because of both inner factors (increasing income inequalities, aging, etc.) and external reasons (for example, migration waves). The problems can scarcely be solved with one-time fiscal interventions and occasional projects.

Economic and scientific innovations are clustered spatially and also by sector, as is proven by international statistics (Pfirrmann 1991, Benko 1998). Factors such as qualifications and the characteristics of educational and cultural institutions play an important role in this clustering. This results in the core regions being in a more beneficial situation, while it is more difficult for the peripheral territories to catch up. Because of this, there is a need for a paradigm shift. Besides R&D activity in engineering and the natural sciences, which requires ever more expenditure, there is a need for new and up-to-date solutions that are adequate to handle the social and

economic problems of small communities (settlements, territories). In the disadvantaged (peripheral) communities job creation and social integration are complex tasks, which are scarcely feasible without the active cooperation of the stakeholders.

The aims of our research are to set up a methodology that can measure social innovation potential, and to define the operating conditions and frames of a decision supporting system that can help to generate social innovations. This can contribute to solving the problems and increase the stakeholders' well-being (Figure 1).



Source: own compilation

Figure 1. Aim of the research

NOTION OF SOCIAL INNOVATION

We stand now at the beginning of a trend shift, which has two main causes. First, there has been a focus shift as an effect of the transition from an industrial society to a knowledge and service orientated society. Second, it is a natural need of the peripheral settlements and communities to catch up to the rest of society, and local ideas and recent initiatives can significantly contribute to this process.

About two decades ago a new notion appeared in the literature: social innovation (Howaldt & Schwarz, 2010). The explanation for this that there is ever more need for the expansion of innovative areas in addition to the former areas of engineering, natural science and economic based innovations.

Social innovation has no uniformly accepted definition because of its recent character. Some authors emphasize the community's well-being, others the new and recent solutions for social problems. These can be summarized by the following quotations.

"The combination or modification of available immaterial (cultural) elements to create new products" (Ogburn 1957, p. 168).

"Recent solutions to solve human problems" (Whyte 1982, p. 2).

"Sum of new and recent solutions which support the objectives and help to handle the problems better and

which are due to the change-supporting new organizational forms, new regulations and new life styles" (Zapf 1989, p. 177).

"Social innovation is an initiative coming from a given community whose aim is to transform their own situation" (Gillwald 2000, p. 1).

"The social innovations are sum of activities, which help to improve the social connections and governmental structures, and help the collective participation" (Moulaert et al. 2013, p.3).

"The social innovations are such ideas (products, services and models) which fulfil social needs (in a more effective way than other methods) and parallel create new social relationships or cooperation" (EC, 2014. p. 4.).

In our interpretation (considering also the above mentioned definitions) social innovation gives a new or recent answer to a given community's problems with the aim to improve the well-being of the community. Social innovation potential is the sum of potential abilities which help in the creation of social innovations.

However, it would be an error to restrict the range of social problems to living or existential problems. Problems can appear in different forms depending on space, time, and income relations, etc. (Table 2).

Table 2
Potential problems arising from needs

	hierarchy of needs	potential problems
↓	physiological needs	➤ environmental contamination (water, air, etc.) ➤ malnutrition, etc.
	security needs	➤ risks to property ➤ addiction (drug, alcohol, etc.) ➤ workplace, meeting basic needs ➤ risk to human life, etc.
	love/ belonging	➤ loneliness ➤ exclusion, etc.
	self-esteem, self-actualization	➤ lack of vitality, creativity ➤ lack of trustworthiness, etc.

Source: own compilation

The significance of social innovation is becoming stronger in the life of communities, though engineering, natural science and economic based innovation is also necessary. The two types collectively enable the wealth and well-being of a given community (Figure 2).

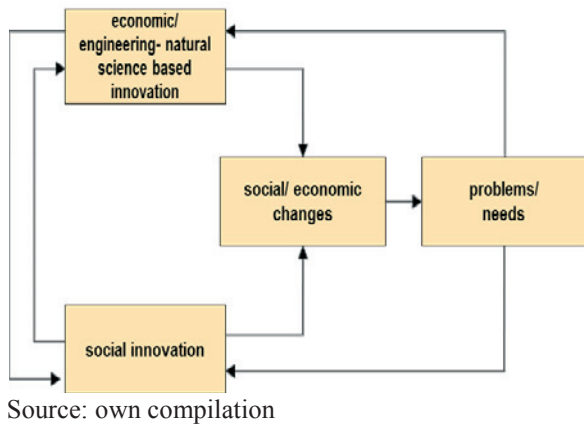
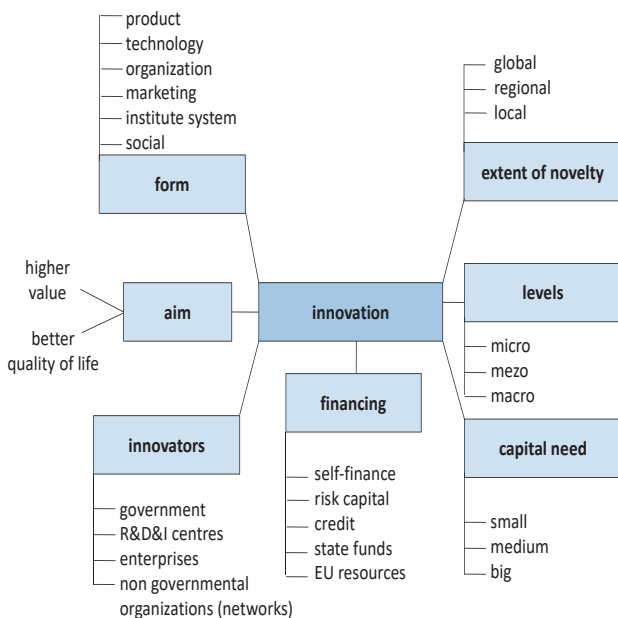


Figure 2. Embeddedness of social innovation

Social innovation and economic innovation are strongly connected. Economic innovation (in Schumpeter’s words) provides the “creator destruction”, but the change is not automatic. It has to go together with a change in social relations (Ogburg 1964, p. 23). The effects of social innovation can contribute primarily to improvement in the quality of life for people living in peripheral settlements/territories and for disadvantaged social groups. But social innovation alone is presumably not enough to progress from a relatively underdeveloped club to a more developed one. The strong connection between social and natural science innovation can be indicated with the following typological similarity (Figure 3).



Source: own compilation

Figure 3. Typology of innovation

Aim of social innovation

Significant differences between the social and economic innovation can be found primarily in the aims

and capital needs of innovation. The aim of social innovation is to secure a better quality of life, which can be reached by increasing employment rates and by improving security and environmental conditions.

Social innovators

Social innovation affects every stakeholder of the society (households, NGOs, the business sector, local and state government). In this aspect it has more participants than “traditional” (natural science) innovation.

Levels of social innovation

Social innovation can be defined also at micro (enterprises), mezo (settlement, micro region, county) and macro (national) levels.

Financing of social innovation

There are basically three different resources (self-financing, state funds and EU resources) to finance social innovations. In its Europe 2020 strategy (which is the continuation of the Lisbon strategy), the EU secures financial resources for improving social innovation capabilities. The basic objective of the program is the implementation of the Lisbon strategic aims: improving the member states’ R&D activity and reaching a 3% R&D expenditure in the share of GDP by 2020. The Horizon 2020 investment package also supports this objective, which emphasizes social innovation more than earlier. (This is due to the recognition that global competition only depends on the competitiveness of products and technologies.)

The budget of Horizon 2020 supports six fields:

- handling social challenges,
- supporting the European Institute of Innovation and Technology,
- social science research,
- operation of the Euratom program,
- programs which help to improve the EU’s competitiveness and help to create jobs,
- developing strategic sectors.

MEASURING SOCIAL INNOVATION

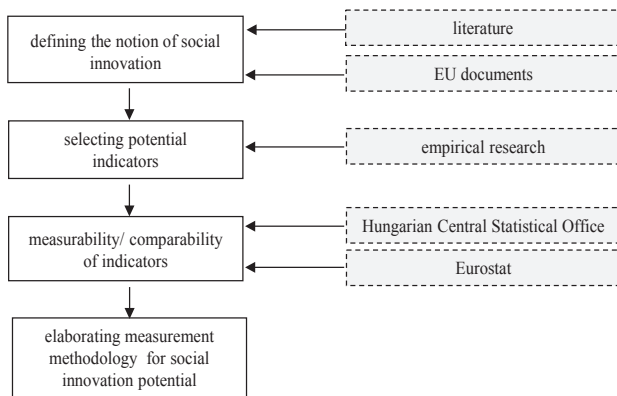
There are three main questions when measuring social innovation (the need for this is not new, appearing first in the beginning of the 1960s; see the Frascati Manual, 1963, OECD 1994, Inzelt 1996):

- Which factors generate (indicate) new and recent solutions?
- How can the indicators be measured?
- What effects do the input indicators have on the economy’s output?

As a result of research measurement methodology of economic innovations and of the natural science R&D outputs was created (Müller et al. 1996, EC 1996). Compared to this, the literature concerning social

innovation measurement is more modest. In our research we attempt to cover it in the following steps (Figure 4):

- definition of the input and output indicators related to social innovation, and defining the direct and indirect relations existing among them;
- examining the measurability of the indicators,
- calculating the given settlement’s or territory’s social innovation potential, and examining the results’ comparability in space and time. This is in connection with the macro-social and micro level (enterprises or institutes) innovation, so we also apply the aspect of co-evolution in our examination (Child et al. 1987; Lewin et al. 1999).



Source: own compilation

Figure 4. Measurement of social innovation

INDICATORS OF SOCIAL INNOVATION, CONNECTION AMONG THE INDICATORS

The first stage of the research was to search for an answer to the question “what should be measured?”. The task is complex, first, because this question has appeared only indirectly in the literature (Evangelista et al. 2000, FOREN 2001), and second, because there is a need for selection due to the number and measurability of the existing indicators.

Generally the connection between the input (x_i) and output (y_i) indicators can be described as follows:

$$y_i = \alpha w_i + u \quad w_i = \beta x_i + \varepsilon$$

where x_i is the input indicator, w_i the innovation potential, y_i output indicators, α and β are constants, and u, ε are residuals. Thus the social innovation capability is the force which can transform the input indicators into output indicators (Bund et al. 2013).

Input Indicators

The possible input indicators are in connection with the institutional system, location factors, human conditions, and the activity of the community or examined settlement (Table 3).

Table 3
Input indicators

No.	factors	indicators	source
1.	institutional system (I)	<ul style="list-style-type: none"> ➤ number of NGOs (I2) ➤ number of cooperating partners (I1) 	Hungarian Central Statistical Office (HCSO) local government
2.	location factors (T)	<ul style="list-style-type: none"> ➤ density of social enterprises (T1) ➤ number of non-profit enterprises (T2) 	HCSO HCSO
3.	human conditions (H)	<ul style="list-style-type: none"> ➤ age structure (H1) ➤ activity rate (H2) ➤ educational qualifications (H3) 	HCSO Labour Office HCSO
4.	activity (A)	<ul style="list-style-type: none"> ➤ grant application activity (A1) ➤ social activity (A2) 	TEIR local government

Source: own compilation

a. Institutional system

National and international experience has proven that there is a strong correlation between the number of the institutions (local governmental, charity, and market based organizations) and the social innovation strategy, and social situation (social catering, elderly day care, domestic help) (Whyte 1989; Gillwald 2000).

b. Location factors

The density of enterprises, the employment ability, the R&D concentration (for example, the sum of R&D expenditures, employment in R&D, and number of patent applications) affect the economic and social situation (Kocziszky 2004).

c. Human conditions

The age structure, the activity rate and educational qualifications have a significant effect on the economic, cultural, social and health situation.

d. Activity

There is a correlation between a given territory’s grant application activity and its absorption capacity (Kocziszky 2004; Howaldt & Schwarz 2010).

Output Indicators

We have identified in our model four groups of output indicators (economic, cultural, social and health) (Table 4).

Table 4
Possible output indicators

No.	factors	indicators	source
1.	economic (G)	<ul style="list-style-type: none"> ➤ G₁: number of grants won (annual) ➤ G₂: amount of funds drawn upon (Ft/year) ➤ G₃: number of local products ➤ G₄: number of social cooperatives ➤ G₅: number of public employees 	TEIR primary research local government enterprise register local government
2.	cultural (K)	<ul style="list-style-type: none"> ➤ K₁: number of traditional events ➤ K₂: number of traditional organizations 	local government local government
3.	social (Sz)	<ul style="list-style-type: none"> ➤ Sz₁: number of segregated areas ➤ Sz₂: number of people living in segregated areas ➤ Sz₃: number of people receiving social benefits ➤ Sz₄: unemployment rate 	TEIR TEIR local government HCSO
4.	health (E)	<ul style="list-style-type: none"> ➤ E₁: number of people suffering from chronic diseases ➤ E₂: number of people with addictions 	HCSO HCSO

Source: own compilation

Table 5
Potential logical connections between the input and output indicators

Output Input	G ₁	G ₂	G ₃	G ₄	G ₅	K ₁	K ₂	Sz ₁	Sz ₂	Sz ₃	Sz ₄	E ₁	E ₂
I ₁	X	X	X	X	X	X	X					X	X
I ₂	X	X	X	X	X	X	X	X	X		X		
T ₁	X	X	X	X	X	X	X	X	X	X	X	X	X
T ₂	X	X	X	X	X	X	X	X	X		X		
H ₁										X	X	X	X
H ₂								X	X	X	X	X	X
H ₃	X	X	X	X	X	X	X	X	X				
A ₁	X	X	X		X	X	X	X	X				
A ₂					X			X	X	X	X	X	X

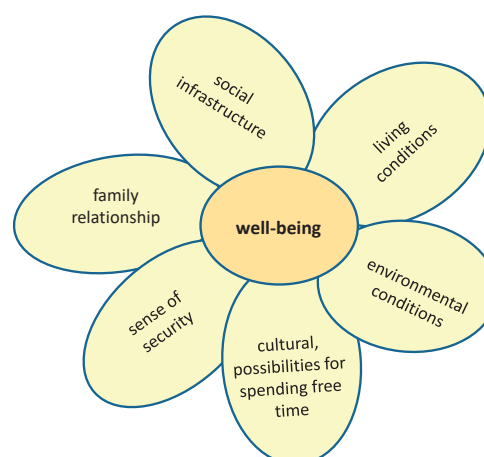
Source: own compilation

The strength of the correlation between the input and output indicators depends on the settlement (Table 5).

Impact Indicators

Higher innovation potential improves the living conditions of a given settlement's inhabitants, and thus their well-being, but this is not equivalent with what we call welfare. While welfare pays attention only to income, well-being takes other factors into account beside material needs (Figure 5): these include

- human conditions,
- physical and emotional security,
- self-esteem, competence level of the individuals,
- relational needs, family relationship (belonging to a community),
- social infrastructure, and
- environmental conditions.



Source: own compilation

Figure 5. Sunflower of material and non-material resources

The monitoring of change in well-being is justified, because material welfare and satisfaction are not synonyms.

The impact appears in at least six fields (Table 6).

Table 6
Impact indicators

No.	factors	indicators	source
1.	social conditions	<ul style="list-style-type: none"> ➤ income ➤ life expectancy at birth ➤ educational attainment 	HCSO HCSO HCSO
2.	family relationship	<ul style="list-style-type: none"> ➤ share of single-person households ➤ share of big families 	HCSO HCSO
3.	sense of security	<ul style="list-style-type: none"> ➤ number of registered crimes ➤ detection rate 	Hungarian Police Headquarters Hungarian Police Headquarters
4.	social infrastructure	<ul style="list-style-type: none"> ➤ social infrastructure 	local government
5.	living conditions	<ul style="list-style-type: none"> ➤ poverty index 	HCSO
6.	environmental conditions	<ul style="list-style-type: none"> ➤ ecological footprint 	HCSO

Source: own compilation

CALCULATION OF THE INDEX

The measurement of innovation and innovation potential and the calculation of the innovation index had a central role in our research. This does not mean, however, that we apply only quantitative methods. Qualitative methods are also used, for example interviews with the relevant stakeholders of the micro-regions (for example, the mayors of settlements or cities, representatives of NGOs, employees of chambers of commerce). As well as in data collection, we use several aspects in parallel in data processing (in addition to the factor and cluster analysis, also the interpretation of the phenomena). We purposely use triangulation in the selection of aspects and methods (Balaton 2007).

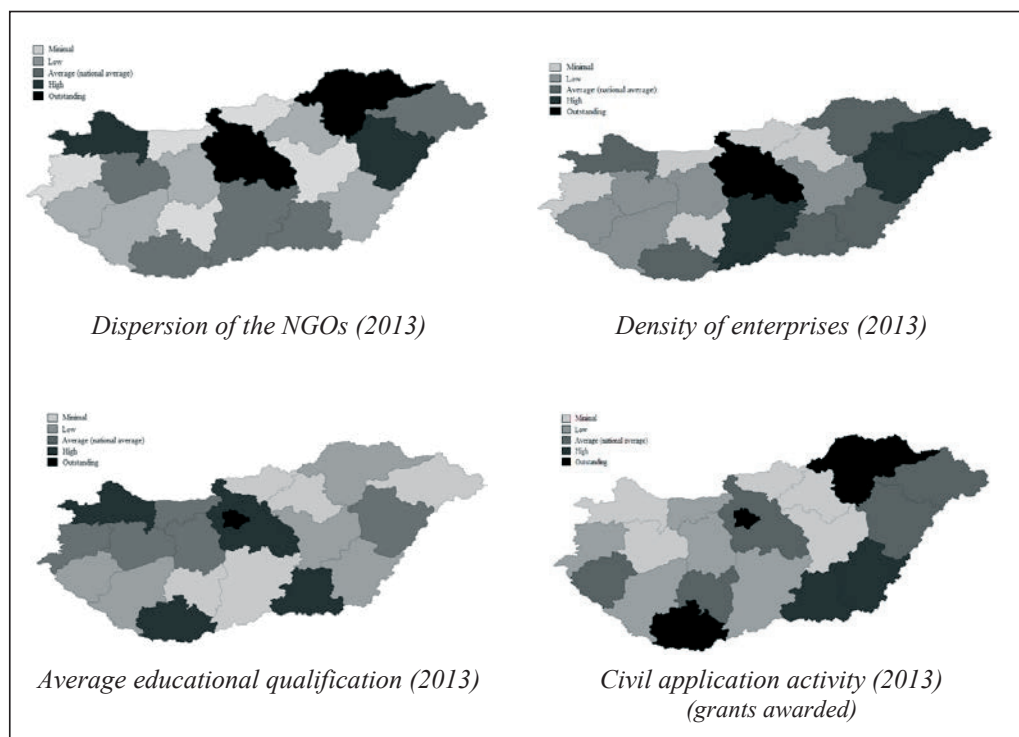
The social innovation potential can be a new or recent answer to a given settlement's or area's problems. It is presumable that in the case of higher potential well-being effects will increase with the decrease in the severity of problems. The potential can be calculated for a particular settlement, but it is practical to create rankings or clusters of the settlements.

a) Preliminary explorative factor analysis. Its aim is to create a smaller number of independent factors from the highly correlating data.

- b) Defining the distance between the elements. (To use the notion of Mahalanobis distance the database has to fulfil some preconditions, which is often not true for databases applied for cluster analysis.)
- c) Excluding variables which are in high correlation with each other. If there is a high correlation (above 0.9) between two indicators, it is reasonable to decide to exclude them from the initial database. The content of a variable that has a high correlation with another variable will be redundant. The exclusion of highly correlating variables is a good solution to avoid distortional effects.
- d) Defining the number of clusters.

SOCIAL INNOVATION POTENTIAL OF HUNGARY

We carried out a social innovation potential analysis for the 19 NUTS3 counties of Hungary for the time period of 2007 to 2013. Our database was based on the data of the Hungarian Central Statistical Office and the TEIR database (Figure 6).



Source: own compilation

Figure 6. Input indicators

Table 7
Correlation between the input and output indicators (2013)

Output Input	G ₁	G ₂	G ₃	G ₄	G ₅	K ₁	K ₂	Sz ₁	Sz ₂	Sz ₃	Sz ₄	E ₁	E ₂
I ₁	0.997	0.990	-	0.958	0.847	0.67	0.71	-	-	-	-	0.963	0.915
I ₂	0.67	0.71	0.73	0.81	0.67	0.72	0.76	0.49	0.79	0.81	-	-	-
T ₁	0.989	0.982	-	0.954	0.843	-	-	-	-	-	0.38	0.957	0.896
T ₂	0.997	0.991	-	0.958	0.843	-	-	-	-	-	0.2	0.963	0.913
H ₁	-0.26	-0.30	-	-0.02	-0.15	-	-	-	-	-	0.36	-0.06	0.749
H ₂	0.287	0.270	-	0.079	0.147	-	-	-	-	-	0.14	0.168	0.78
H ₃	0.653	0.621	-	0.243	0.213	-	-	-	-	-	0.46	0.468	0.53
A ₁	0.89	0.91	0.61	0.59	0.91	-	-	-	-	-	-	-	-

Source: own compilation

The correlation of the examined input indicators is strong (Table 7).

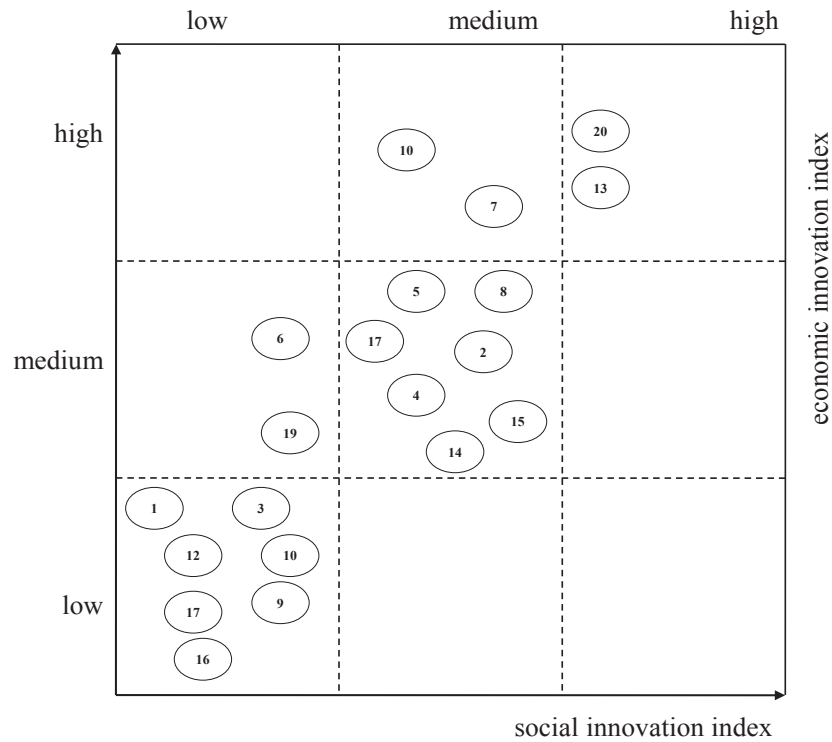
G₁, G₂, G₃, G₄, G₅, K₁, K₂, Sz₁, Sz₂, Sz₃, Sz₄, E₁, E₂, I₁, I₂, T₁, T₂: data from 2013 (Hungarian Central Statistical Office: Dissemination database, TEIR, National Employment Service, and Széchenyi2020 data)
H₁, H₂, H₃: Census data 2011.

H₁ age structure: share of elderly people in the population indicator

H₃ educational qualifications: share of people above 25 years of age with higher education degree.

Results

In terms of their social and economic innovation potential, the Hungarian NUTS3 territories can be grouped into four clusters (Figure 7).



Legend:

- | | |
|----------------------------|--------------------------|
| 1. Baranya | 2. Bács-Kiskun |
| 3. Békés | 4. Borsod-Abaúj-Zemplén |
| 5. Csongrád | 6. Fejér |
| 7. Győr-Moson-Sopron | 8. Hajdú-Bihar |
| 9. Heves | 10. Jász-Nagykun-Szolnok |
| 11. Komárom-Esztergom | 12. Nógrád |
| 13. Pest | 14. Somogy |
| 15. Szabolcs-Szatmár-Bereg | 16. Tolna |
| 17. Vas | 18. Veszprém |
| 19. Zala | 20. Budapest |

Source: own compilation

Figure 7. Hungarian NUTS3 level economic and social innovation potential

Clusters show that there is weak social innovation in the territories with low economic innovation.

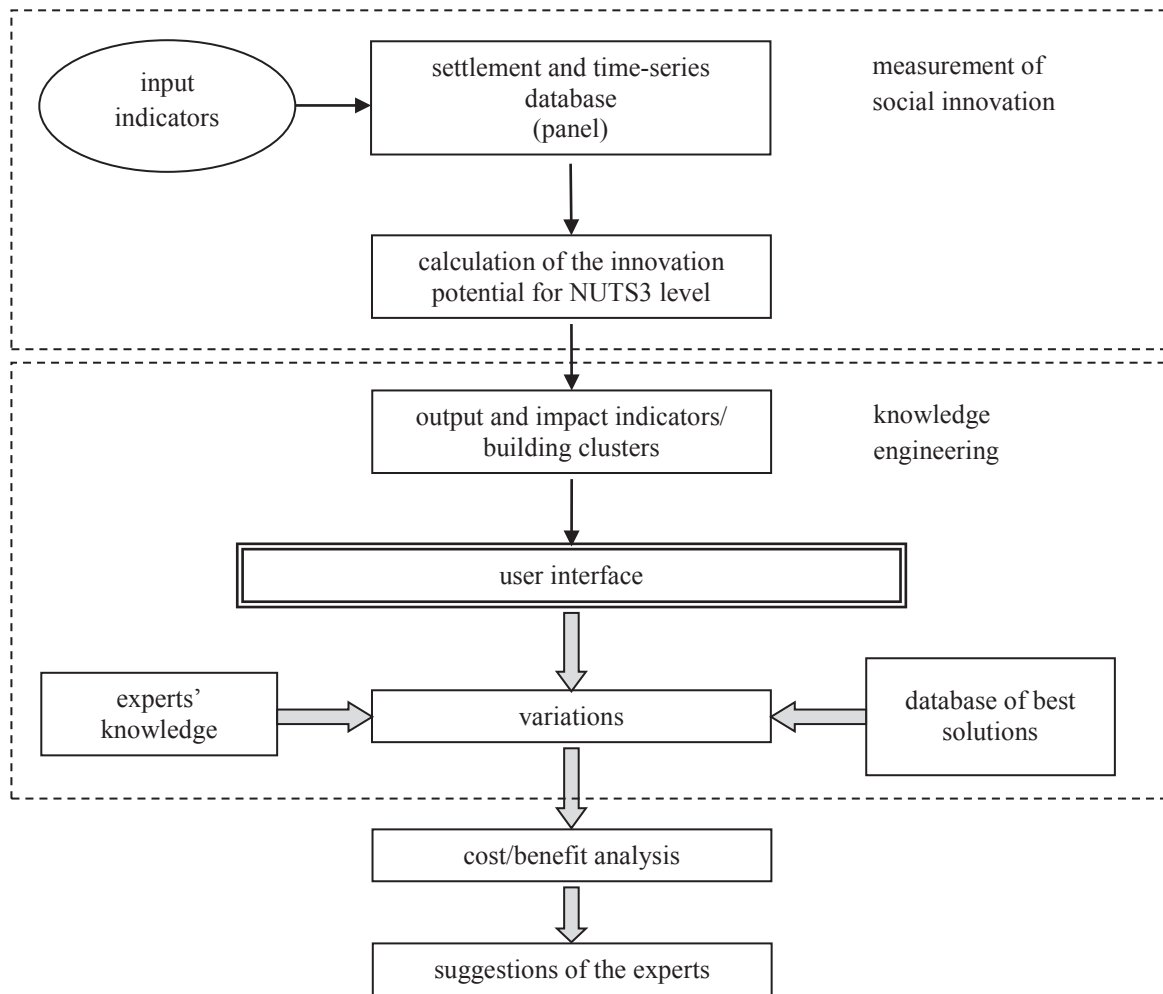
NOTION, STRUCTURE AND TYPOLOGY OF KNOWLEDGE ENGINEERING

According to the literature, knowledge engineering is a kind of program which is appropriate because of its analytical ability to determine (and weight) problems, and it suggests a possible solution from the previously fixed variations. This system supports the recovery of the “best solution” with the use of a “knowledge bank” during the problem solving process. It is a useful helper in decision preparation.

The research concerning (or establishing) the structure and operation of knowledge engineering (Expert System, Expertensystem) started in the mid-1950s (analysing artificial intelligence) (Puppe 1991). Significant changes in the research took place in the 1970s, when many researchers took interest in the elaboration of the knowledge-based system.

The suggested knowledge-engineering system has two main parts (Figure 8):

- a. a user interface that makes it possible to query, group and compare data (for example, based on settlement, year, etc.), and to define and visualize the calculation results and changes;
- b. evaluation by peer review.



Source: own compilation

Figure 8. Structure of social innovation knowledge engineering

The experts provide consultation as partners with the system. They can make their suggestions concerning the improvement of social innovation based on their knowledge, preparedness, and knowledge of the literature (database of best solutions).

- The generation and management of social innovation are expensive, as is the case for other types of innovation.
- There is a need for (yearly) monitoring of resource usage.

It is no accident that the European Union has built the support of social innovation into the objectives of the 2014-2020 programming period. Nowadays the representatives of local and territorial economic policy pay less attention to social innovation than would be ideal; they consider it as a “have to do” task, and they examine only the available EU funds which concern this topic. However, social innovation represents the surplus existing in the community, which can contribute to the self-solving of a settlement’s problems. The measurement and monitoring of social innovation can help to increase this kind of activity, and can contribute to defining directions for the desired interventions.

CONCLUSIONS

In recent years there has been a paradigm shift in innovation research. The characteristics of the forming new innovation paradigm are the following:

- The significance of the social innovation is no smaller than that of economic and natural science innovation.
- Economic and natural science innovations reinforce some social problems, which can be answered only with the help of social innovation.
- Because of this, there is a need for a strong symbiosis between social and engineering/natural sciences innovations.

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