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RESEARCH ARTICLE

Cluster Analysis of Competitive Advantage in Hungarian Settlements Based on their Social Innovation Potential

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ABSTRACT

The study aims to identify and analyze the social innovation potential of Hungarian settlements and its impact on their competitive advantage. The link between social innovation potential and the factors of competitive advantage can be established on the conceptual plane of sustainable value creation, which seeks to link the concept of competition to the enhancement of social well-being and prosperity in a novel way. Previous studies have yet to be identified to analyze the relationship between social innovation potential and territorial competitiveness. Our methodological approach combines two existing analytical techniques to address complex sustainability issues. The paper pays particular attention to the measurement challenges of the social innovation process as well as the impact measurement and sustainability assessment of social innovation initiatives. Our research defines a complex indicator of the social innovation potential of 3155 municipalities in Hungary. It uses the indicator to examine the extent to which key territorial processes are related to the picture defined by the indicator. In the analysis, we discuss the relationship between territorial competitiveness and social innovation potential in Hungary's municipalities, and to measure territorial disparities, we use the Hoover index. Municipalities are grouped according to their social innovation potential and its components, and the spatial pattern is determined using K-means clustering. Based on a novel cluster analysis framework, the study summarizes the numerical results identified for all municipalities in Hungary. Based on our results, four clusters can be identified for the municipalities based on social innovation potential. The social innovation potential of the municipalities and their current development situation are closely linked.

INTRODUCTION

Increasing attention is being paid to the study of social innovation potential (Krlev et al., 2014; Benedek et al., 2016; Westley and McGowan, 2017; Kocziszky and Szendi, 2018), but only a small number of concrete calculations have been made so far (Benedek et al., 2016; TEIU, 2016; Kocziszky et al., 2017). Quantifying the contribution of social innovation potential to competitiveness is a relevant challenge, and in this study we will attempt to carry out this analysis for the

municipalities in Hungary.

Based on the issues and guidelines on innovation measurement methodology (OECD, 1963; EC, 2005; Schmitz et al., 2013), the definition of measurement methodology has evolved very differently for science, technology and social innovation. While there are several methodological recommendations for measuring technical innovation (e.g. Community Innovation Survey), defining the measurement structure for social innovation is a complex task that requires an examination of the opportunities and limitations of the methodologies for measuring technical innovation. While the methodology for measuring social innovation was initially based on economic indicators (economic, labour market and social, political measures), some aspects of the concept suggest that the fundamental aim of the process is to ensure and increase well(ness), which requires a rethinking of the measurement structure (Hochgerner, 2011).

The literature review suggests that the starting point for measuring social innovation, in line with the systematic approach identified for technical innovation, is to define indicators and identify them as input, output or impact indicators (Dawson and Daniel, 2010; Carvache-Franco et al., 2018; Neumeier, 2017; DÖringrt, 2017; Szendi et al., 2018, Varga, 2021), however, there is no uniformly accepted measurement methodology in the literature (Krlev et al., 2014, Kocziszky et al., 2015, Balaton and Varga, 2017, Szendi et al., 2018; Varga, 2021). The main obstacles to defining the measurement framework are the lack of a qualitative and quantitative database and the delimitation of indicators (Schmitz et al., 2013; Innobasque, 2013; Castro Spila et al., 2016, Balaton and Varga, 2017, Szendi et al., 2018); which implies the challenge of defining an indicator system capable of measuring the multi-level social innovation process. In addition to measuring the inputs and outputs of social innovation initiatives, the focus is also on analysing the impact on society. The main objective of each of the methodologies examined is to determine the social innovation potential at macro, meso or micro level. The focus is primarily on measuring social innovation potential, which refers to the set of capabilities that facilitate the creation of social innovations (Kocziszky et al., 2015; Szendi et al., 2018; Kleverbeck et al., 2019; Nagy and Tóth, 2019; Varga et al., 2020). Measuring social innovation potential is of particular importance for territorial competitiveness at regional and local level.

Methods at meso and micro level differ both in terms of their calculation procedures and the indicators used. One of the main reasons for this is that the range of data available in the regions concerned also differs. The Social Vulnerability Index is an indicator defined in an EU FP7 project that measures social innovation by examining challenges at regional level. Castro Spila et al. (2016) identified the vulnerabilities of regions through regional challenges, whose values are captured in an index. Regional vulnerability is defined by four components and a total of 15 corresponding indicators. The Regional Social Innovation Index is an indicator defined during a pilot research project led by INNOBASQUE (Basque Innovation Agency). The three sub-indices of RESINDEX define indicators (18 in total) for each of the capabilities and factors that support the measurement of regional social innovation. The number of methods for measuring social innovation potential at the micro level for municipalities is low, but their importance has increased recently.

The micro-level method is expected to identify and assess the basic conditions (necessary factors) and capabilities of social innovation, i.e. the social innovation potential. The IndiSI project plans to test indicators (formal structure, decision-making processes, social innovativeness, business model and context indicators) defined on the basis of five thematic groups in the Rhine-Ruhr region to measure social innovation at the micro level (Kleverbeck et al., 2019), but no concrete computational results have been produced yet and the project is in the data collection phase. Bund et al. (2013), after analysing the context of the social innovation process, identified dimensions that, derived from national-level measurements, assess the social innovation capacity of organisations at the local level.

As a starting point, dimensions of entrepreneurial activity, social innovation framework conditions (resources, institutions, policies, social climate) and area-specific pillars (education, health, employment, housing, social capital and networks, political participation, environment) were identified and

potential indicators were linked to them.

In the selection of these indicators, data availability is a key criterion, which in this case means the use of municipal databases and case studies. The study has not been used as a basis for any specific calculation, but the authors indicate as a further research direction that it would be worthwhile to carry out a social innovation analysis of each territorial unit (municipality) on the basis of the proposed indicators, using municipal case studies. Szendi et al. (2018) defines the social innovation potential of municipalities by deriving from national and regional measurement methods and by taking into account the data available at the settlement level. The author includes 14 indicators along economic, social, cultural and attitudinal factors. For economic factors, the indicators include the number of NGOs and businesses, for social factors the indicators are education or unemployment rates, and for culture and attitudes the indicators are the number of cultural events.

The methodology for measuring social innovation is based on the use of different indicators at different levels. The quantity, type and weight of the indicators used to measure processes at different levels depend on the data that can be interpreted and accessed at that level (Varga, 2021). No study has been identified that quantifies the contribution of social innovation to competitiveness in the case of the relationship between social innovation potential and territorial competitiveness. In order to quantify the relationship between territorial competitiveness and social innovation in the context of municipalities, we attempt to investigate the link between the indicator of social innovation potential and the factors of competitive advantage of municipalities.

LITERATURE REVIEW

Competitiveness has been the most commonly used term in recent years (Porter and Ketels, 2003; Neary, 2006; Balaton and Varga, 2017; Brancati et al., 2021), but there is no uniformly accepted definition in the literature and there are questions about the levels of interpretability. According to some authors, competitiveness cannot be understood in terms of national economies, but can only be measured at the firm level (in Krugman and in Porter's earlier works), but later Porter (since the second half of the 1990s) and other authors (Besze, 2009) argue that the concept of competitiveness can also be applied to countries and regions. The concept of competitiveness is also receiving increasing attention from the European Union (EC, 1993; EC, 1994; EC, 2001; Leader, 2001), which has among its main objectives to increase the continent's global competitiveness, 'smart, sustainable and inclusive growth' (EC, 2014). The EU sees competitiveness as the most effective instrument for cohesion, a means to improve economic growth and employment in regions and a means to improve social well-being. The Leader programme for improving territorial competitiveness pays particular attention to social competitiveness dimension among the dimensions of territorial competitiveness. Social competitiveness is the capacity of local actors to cooperate (Leader, 2001, Setiawan and Winarna, 2022).

One of the main objectives of competitiveness studies is to promote the potential for improving living standards and well-being. Competitiveness is closely linked to innovation at organisational, regional, national and global level, and innovation has a key role to play in boosting competitiveness. Economic and scientific innovation is present in the so-called core areas, while lagging behind in the periphery triggers measures for narrowing the gap. New and timely solutions are needed for smaller communities (municipalities, regions), and social innovation provides a tool and a model for this. Social innovation tries to meet social needs that the market is not able to meet, and can therefore be an alternative solution for peripheral areas aiming to catch up to the others (Irén, 2015; Benedek et al., 2016; Kocziszky and Szendi, 2018; Irén, 2018). These solutions are either general (complex programme elements adapted from other communities) or are specific, community-led efforts that can be identified as a unique solution to support development.

Nowadays, an important role in played by social initiatives and innovations that, in addition to technical innovations, contribute to increasing the well-being (standard of living) of the community through novel solutions (Varga et al., 2020, Abadi et al., 2023). In terms of regional competitiveness, several models have been developed (Regional

Competitiveness Capacity, Competitiveness Cylinder, Competitiveness Tree or Competitiveness Pyramid Model). The pyramid model (Lengyel, 2003) interprets the measurement according to three categories (income, productivity, employment) and examines short-term economic development (immediate, underlying factors) and long-term factors (success factors). It identifies the main objective as raising living standards and the quality of life. When examining social innovation at the meso-level, emphasis is placed on identifying the competitiveness of cities. According to Lengyel (2003), macro-level analysis cannot be directly adapted when examining the competitiveness of municipalities (e.g. municipal governments are pursuing 'different policies'), but instead economic and strategic determinants (quantitative and qualitative data) need to be identified. In agreement with the literature (Lengyel, 2003; Gyula, 2001), competitiveness is understood as an umbrella concept, which refers to successful participation in competition, both for firms and for countries and regions (Lengyel, 2000). Territorial competitiveness is 'a process that takes place between territorial units and aims at increasing the well-being of the inhabitants of a region or city by promoting the development of the regional, local economy, which development some groups try to influence explicitly or, more often, implicitly through local policies in competition and rivalry with other regions' (Lengyel, 2003). A basic requirement for the analysis is that the unit of analysis must be identifiable (e.g. the EU NUTS system). The above approaches suggest that territorial competitiveness is based on increasing prosperity and well-being. Social innovation efforts are primarily aimed at solving social problems by improving well-being (and prosperity) and living standards, and can therefore be included in the measurement of competitiveness in the context of sustainable value creation.

Developing an indicator system

To measure social innovation, a set of indicators was developed based on the literature (Benedek et al., 2015, Szendi et al., 2018; Varga, 2021). The indicator system consists of three parts: input, output and impact indicators. In our study, eight indicators were included in each of the three groups. The indicators were compiled for the period up to 2020 for municipalities in Hungary (3 155 municipalities in total), with the exception of indicators from the last census in 2011. In compiling the indicator system, it was necessary to take into account that the indicators do not point in the same direction (for example, for unemployment rate, the lower the value, the more positive the situation is, while for the amount of grant paid per inhabitant, the higher the value, the more positive the situation is for social innovation). For indicators where low values represent a positive situation, the reciprocal of the indicators was calculated. For each group of indicators, the indicators were normalised in order to make data with different scales comparable. For each indicator group, the average of the normalised data was calculated. No weighting was applied in the calculations.

The resulting variable seeks to quantify the potential, or opportunity, underlying social innovation. However, this does not imply that the potential is realised in actual projects in practice that can contribute to social welfare. At local level, the realisation of social innovation may depend on many local components, which are in any case beyond the scope of this study.

The following indicators are included as input indicators:

- Number of NGOs per 10 000 inhabitants
- Number of active enterprises per 1 000 inhabitants
- Number of non-profit enterprises per 1 000 inhabitants
- Child population as a percentage of the resident population
- Number of elderly persons per 100 children
- Age-dependency ratio (children (0-14 years) and elderly population (65 and up) as a percentage of the population aged 15-64)
- Activity rate (taxpayers/population*100)
- Average number of completed years of schooling, 2011.

The following indicators are included as output indicators:

- Amount paid per capita
- Proportion of participants in public employment schemes in relation to the population aged 15-64

- Number of participants in cultural events per 1000 inhabitants
- Proportion of disadvantaged pupils
- Number of people receiving social catering per 1 000 inhabitants
- Number of people receiving home help per 1 000 inhabitants
- Unemployment rate
- Patient turnover per general practitioner and general paediatrician.

The following indicators are included as impact indicators:

- Income per capita (thousand HUF)
- Proportion of the population aged 7 and over with primary education (including those who have not completed school)
- Proportion of single person households
- Proportion of families with three or more children
- Number of registered crimes per 1000 inhabitants
- Number of places in permanent residential care facilities per 1000 inhabitants
- Percentage of taxpayers earning in the income bracket 0–1 million HUF
- Proportion of public spaces regularly cleaned.

The average of the three sets of indicators was used to calculate the complex indicator of social innovation. As a starting point, the municipalities were ranked according to the complex indicator and divided into five equal groups (quintiles) as the indicator increased (Figure 1).

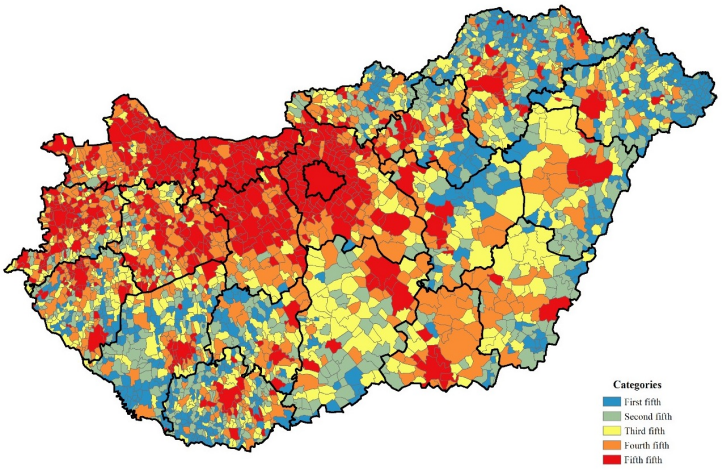

Figure 1: Complex indicator measuring social innovation in Hungary's settlements
(Source: Own edition based on HCSO data)

The magnitude of the complex indicator of social innovation potential was most influenced by the impact indicators in the majority of municipalities. In terms of the spatial picture of social innovation potential, the capital (Budapest), the Budapest agglomeration and the northern part of the Transdanubian region are in the most favourable position (in the fifth quintile), mainly joined by the cities with county status and their catchment areas. The most disadvantaged settlements are found in the peripheral and border regions of northeast and southeast Hungary, and in the settlements located near the county borders of Heves and Jász-Nagykun-Szolnok, Somogy and Tolna, and Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg counties (in the first quintile/fifth).

After the calculations, we aimed to have comparable data on the social innovation potential and its components at the level of the 19 counties of Hungary and the capital city. For this purpose, the data at the level of municipalities were weighted by the population at the end of 2020 (Table 1). Our results show that the capital and six counties have above average social innovation potential. Apart from the capital city, only Fejér, Győr-Moson-Sopron and Pest counties have both social innovation potential and its

components above the national average. The worst performers are Szabolcs-Szatmár-Bereg, Nógrád and Békés counties. For all three, the unfavourable situation is mainly caused by output indicators.

Table 1: Social innovation potential and the weighted average of its components at county level and Budapest (capital)

Category	Settlements	Population	Taxpayers	Income
Complex competitive advantage	5.2	35.9	35.2	43.0
Multi-factor competitive advantage	9.3	20.8	21.1	21.8
Single-factor competitive advantage	4.8	3.8	3.8	3.6
Single-factor competitive disadvantage	2.3	1.1	1.1	1.0
Multi-factor competitive disadvantage	19.3	11.3	11.5	10.0
Complex competitive disadvantage	59.1	27.2	27.2	20.4
National totals	100.0	100.0	100.0	100.0

The link between social innovation potential and territorial competitiveness

The spatial picture of social innovation potential presented above has been analysed in a complex way. This grouping is based on the value of the social innovation potential and its total components in relation to the rural average. In our grouping, a municipality whose social innovation potential and higher than the rural average with all three of its components also rating higher than the rural average was considered to have a complex competitive advantage. A municipality with a higher social innovation potential than the rural average, but with any two components above the rural average and one below the rural average, is considered to have a multi-factor competitive advantage. A municipality with a single-factor competitive advantage has a higher social innovation potential than the rural average, but only one of its components is above average and two are below average.

A complex competitive disadvantage is found for a municipality with both a social innovation potential and three components below the rural average. The other two categories of competitive disadvantage are modelled on the analogy above. 609 municipalities are characterised by some type of competitiveness, accounting for 19% of municipalities. Nevertheless, these municipalities account for more than 60% of the population and taxpayers, and produce almost 70% of the income on which personal income tax is based. The number of the most disadvantaged municipalities with a complex competitive disadvantage is 1 864, representing 59% of the total population. These municipalities account for 27% of the population and 27% of taxpayers in the country, but only 20% of income.

Table 2: Characteristics of settlements by competitiveness categories of social innovation potential (population, taxpayers, income), 2020, %

Category	Productivity	Income per capita
Complex competitive advantage	122.0	119.8
Multi-factor competitive advantage	102.9	104.7
Single-factor competitive advantage	94.0	94.7
Single-factor competitive disadvantage	91.6	96.1
Multi-factor competitive disadvantage	86.9	88.6
Complex competitive disadvantage	75.0	74.8
National totals	100.0	100.0

Looking at the economic situation of the municipalities, the most significant difference is in productivity, i.e. income per taxpayer. The competitiveness grouping is fully reflected here, since the more favourable the competitiveness situation of a municipality, the higher its productivity. The situation is essentially the same for income per inhabitant.

Table 3: Characteristics of municipalities by competitiveness categories of social innovation potential (productivity, income per capita), 2020, %

Category	Productivity	Income per Capita
Complex competitive advantage	122.0	119.8
Multi-factor competitive advantage	102.9	104.7
Single-factor competitive advantage	94.0	94.7
Single-factor competitive disadvantage	91.6	96.1
Multi-factor competitive disadvantage	86.9	88.6
Complex competitive disadvantage	75.0	74.8
National totals	100.0	100.0

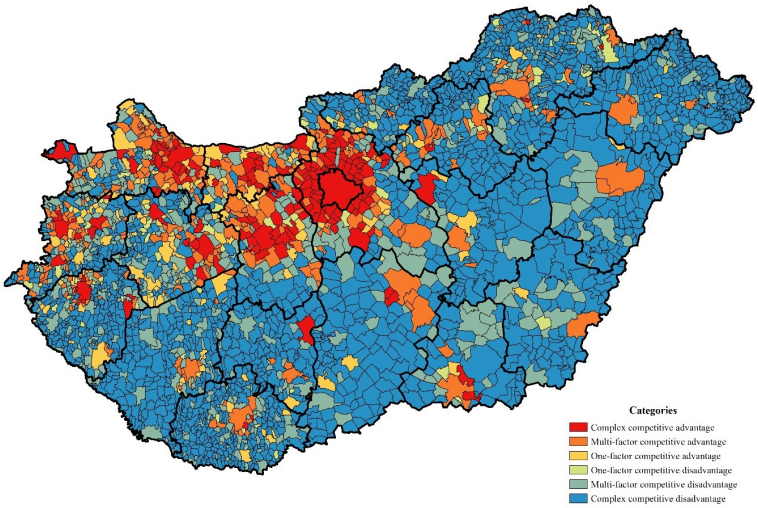

Figure 2: Competitiveness of Hungarian municipalities based on social innovation potential (Source: Own edition)

Other aspects of social innovation potential

After the calculations were carried out, our study aimed to provide comparable data on the social innovation potential and its components at the level of the 19 counties of Hungary and its capital (Budapest). For this purpose, we weighted the data at the level of municipalities by the population at the end of 2020. Our results show that the capital and six counties have above-average social innovation potential. Apart from the capital, only Fejér, Győr-Moson-Sopron and Pest counties have a higher social innovation potential and its components than the national average. The worst performers are Szabolcs-Szatmár-Bereg, Nógrád and Békés counties. For all three of them, the unfavourable situation is mainly caused by output indicators. A significant proportion of the municipalities concerned are in a situation of multiple disadvantage. We have tried to analyse their problems in terms of their capacity/potential for social innovation, highlighting the areas that make them even more peripheral socio-economically within these peripheral counties.

To measure territorial disparities we used the Hoover index, which measures the maximum vertical distance between the Lorenz curve and the diagonal (Major and Nemes Nagy, 1999).

$$H = \frac{1}{2} \cdot \sum_{i=1}^{n} |x_i - f_i| \quad \text{where } \sum f_i = \sum x_i = 100. \tag{1}$$

In the present case, xi represents the income and fi the population by municipality. The results are:

H_2000=15.0 H_2020=9.1

According to these results, in 2000 15.0% of income would have had to be reallocated between municipalities to have the same distribution as the population. By 2020, the gap with the Hungarian

population was lower, at 9.1%.

Due to their interchangeability, the aggregates in Eq. (1) are grouped according to the competitiveness of the municipalities in terms of their social innovation potential (Kincses, 2015):

$$H = \frac{1}{2} \cdot \sum_{i=1}^{n} |x_i - f_i| = \frac{1}{2} \left\{ \sum_{j=\text{complex competitive advantage}} |x_j - f_j| + \sum_{k=\text{multi-factor competitive advantage}} |x_k - f_k| + \sum_{l=\text{one-factor competitive advantage}} |x_l - f_l| + \sum_{m=\text{one-factor competitive disadvantage}} |x_m - f_m| + \sum_{n=\text{multi-factor competitive disadvantage}} |x_n - f_n| + \sum_{m=\text{complex competitive disadvantage}} |x_m - f_m| \right\} \quad (2)$$

In the period under study, the municipalities in the complex competitive advantage category accounted for the majority of territorial disparities (Figure 3). The continuous reduction of territorial disparities was only slightly delayed by the global economic crisis that hit Hungary after 2008 and by the recession caused by the COVID-19 epidemic. Municipalities in the complex competitive advantage category are responsible for 43% of territorial disparities in 2020, showing stagnation compared to 2001. In contrast, municipalities with a complex competitive disadvantage account for 38% of disparities in 2020, an increase of 1 percentage point compared to 2001. If we look at the competitive advantage categories together, we find that together they account for around 54% of the regional disparities over the whole period.

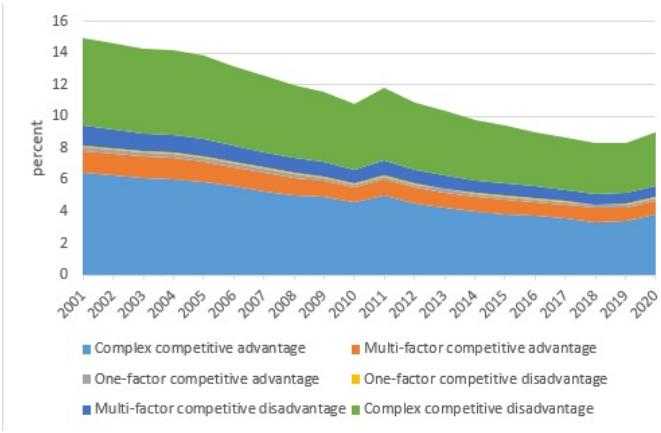

Figure 3: Evolution of territorial disparities by competitiveness category of social innovation potential, 2001–2020 (Source: Own edition)

Spatial groupings of municipalities by social innovation potential

In our work we wanted to group municipalities according to their social innovation potential and its components. We have attempted to group municipalities in order to identify spatial patterns in terms of social innovation potential. In our work, we used the ArcGIS 10.7 Grouping Analyst module to perform K Means algorithm (Figure 4). The K means algorithm assigns each element to the cluster whose centre is closest to the element. The clustering process took into account the social

innovation potential of each municipality and its input, output and impact components. After a number of experimental calculations, we found that the clustering exercise using the four clusters resulted in clearly distinguishable and spatially distinct clusters. In the calculations, the relationship between the nearest four neighbours was considered relevant.

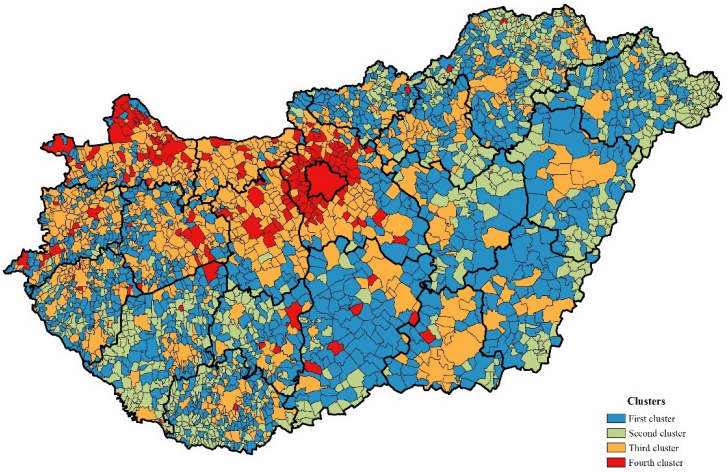

Figure 4: K Means clusters of social innovation potential and its components (Source: Own edition)

The first cluster resulting from our analysis includes 1 237 municipalities scattered throughout the country. They are characterised by being worse than average in all components of the social innovation potential. The greatest underperformance can be seen in the output indicators.

In the second group, there are 886 municipalities. The municipalities in this group are in the worst position in terms of social innovation potential and its components. The municipalities in this group are similar to those in the previous group in that the output indicators show the largest gap with the average. The role of location is important: most are in peripheral areas, either on the external borders of the country or near the internal borders of counties.

The third group consists of 866 municipalities. They are slightly below the national average in terms of social innovation potential, but in terms of the components, they are characterised by average values for input indicators and above-average values for impact indicators. For output indicators, there is also some underperformance, but it is much less than for the earlier two categories. These settlements are mainly located in the North Transdanubian region and in and around large and medium-sized towns.

Finally, 165 municipalities are included in the fourth group. The social innovation potential of these municipalities and their components are higher than the national average. Budapest and its agglomeration are included here primarily, but there are also settlements in the counties of Western and Central Transdanubia.

Next we examined some of the main characteristics of the clusters we have created. First, we analysed the population of the clusters (Figure 5).

In 2020, 39% of the population of Hungary lived in the municipalities of Cluster 3. This represents a decrease of 1 percentage point compared to 2001. The second most populous group is Cluster 4, with 33% of the country's population; this figure grew by 4 percentage points compared to 2001. In 2020, 21% of the population lived in Cluster 1 municipalities and 7% in Cluster 2; compared to 2001, the decrease in the national share is 2 and 1 percentage points, respectively. Only Cluster 4 shows an increasing population, while the others show a general trend of demographic erosion compared to 2001. An improving trend can only be observed from 2011 to 2012 for Clusters 1 and 2, after which the negative trends continued.

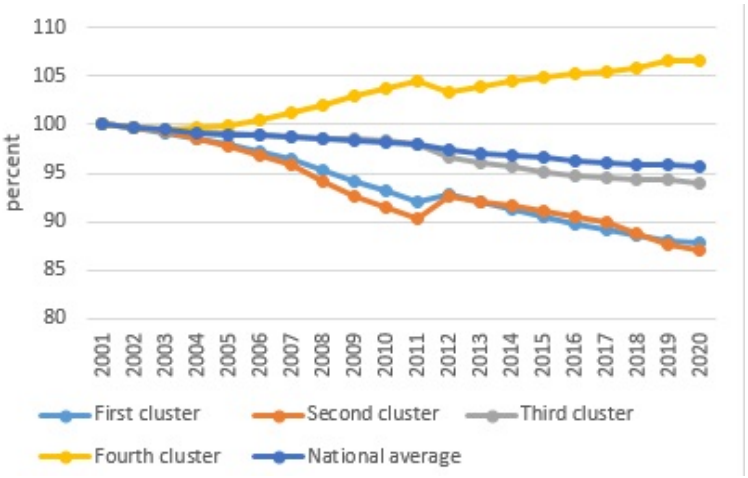

Figure 5: Population by cluster, 2001–2020 (2001=100) (Source: Own edition)

When comparing the clusters, we consider it very important to analyse employment conditions. In this respect, we are in a difficult position, as employment data at municipal level can only be obtained from the 2011 national census. Thus, we have made an estimation by looking at taxpayers as a percentage of the working age population. This yielded a comparable estimated employment rate (Figure 6).

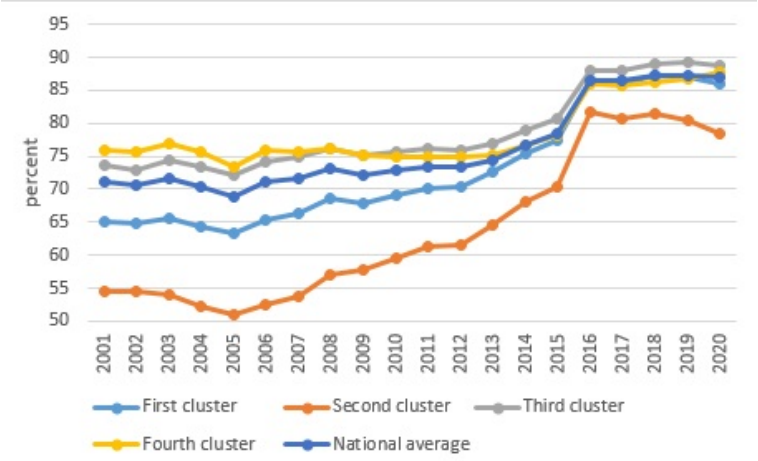

Figure 6: Estimated employment rate by cluster, 2001–2020 (Source: Own edition)

In 2020, the highest estimated employment rate is for Cluster 3 at 88.8%. Cluster 4 (87.6%) and Cluster 1 (86.1%) are only slightly below this value. Cluster 2, which is the worst performing cluster in terms of social innovation potential, has an estimated employment rate of 78.3% in 2020.

The individual clusters are basically characterised by an general increase in employment between 2001 and 2016. Thereafter, however, the cohesive trend is somewhat broken, with employment in Cluster 2 showing a negative trend, while the situation of the other clusters tends to either improve or stagnate.

The productivity of the clusters was determined by looking at the taxable income per taxpayer (Figure 7).

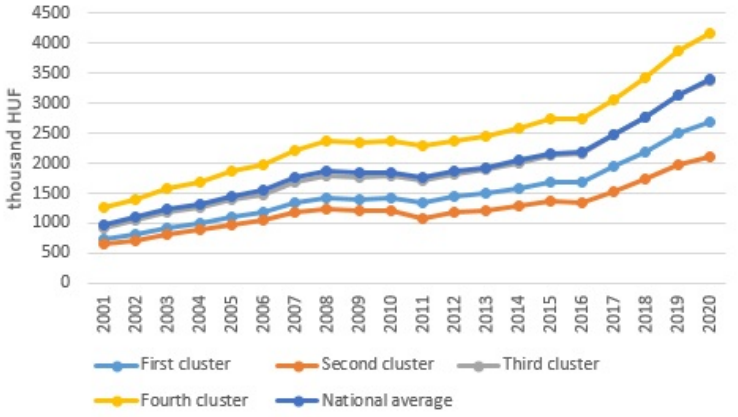

Figure 7: Productivity by cluster, 2001–2020 (Source: Own edition)

The role of social innovation potential is most notable in this context. Again, the most favourable situation is observed in the municipalities of Cluster 4, followed by Clusters 3, 1 and 2. During the period under study, the productivity of Clusters 1 and 3 improved compared to the national average, while that of Clusters 4 and 2 declined. In 2020, the productivity of Cluster 1 reached 79% of the national level, compared to 75% in 2001. Cluster 3 had a corresponding value of 99% in 2020, compared to 95% in 2001.

The decline for Cluster 4 means that it was "only" at 123% of national productivity in 2020 compared to 129% in 2001. For Cluster 2, on the other hand, the 62% in 2020 shows a slight drop compared to 66% in 2001.

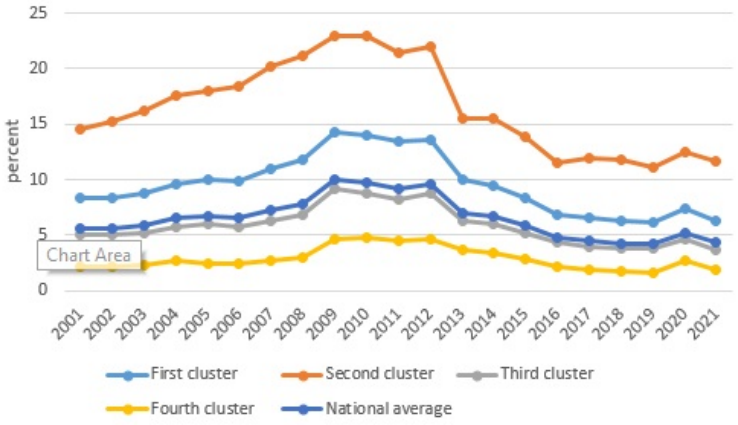

Figure 8: Unemployment rate by cluster, 2001–2020 (Source: Own edition)

Finally, we looked at the unemployment rate for each cluster (Figure 8).

Here again, the significant difference in social innovation potential is clearly reflected, with relatively well-off clusters having low unemployment rates and disadvantaged clusters having higher unemployment rates. The role of the economic crises (2008 and COVID-19) is clearly visible for all clusters, but there has been no change in positioning between clusters.

DISCUSSION

In examining the relationship between social innovation potential and territorial competitiveness, we paid particular attention to quantifying the contribution of social innovation to competitiveness in Hungarian municipalities. Long-term competitiveness is enhanced by technological progress, learning capacity and innovation capacity (Major and Nemes Nagy, 2007; Hortoványi and Balaton, 2016).

Birchenhall (1995) interprets innovation as technical progress and identifies it with a social learning process. Innovation is not an end in itself, but a pathway to competitiveness and value creation (Durand et al., 2004).

If the components of competitiveness are analysed in the light of the social innovation potential, as already presented in our previous work (Varga et al., 2020; Szendi et al., 2022), the underlying causes can be identified. In terms of population trends in the clusters we have identified, a general trend of demographic erosion can be observed between 2001 and 2020, with the exception of the group of settlements in the most favourable situation.

Based on our calculations - estimated on the basis of the latest census data (2011) - each cluster is characterised by an essentially general increase in employment between 2001 and 2016, after which the essentially coherent trend is somewhat broken, with the employment of cluster 2, with the least favourable social innovation potential, showing a negative trend, while the situation of the other clusters has tended to improve or stagnate. The productivity of clusters was defined on the basis of taxable income per taxpayer. The role of the social innovation potential is the most observable in this context. For the most advantaged cluster, productivity is almost 25% above the national average, while for the least advantaged cluster it is almost 40% below the national average. The analysis of unemployment data clearly reflects the significant difference in social innovation potential, with higher unemployment in the less favoured clusters.

Based on our research, four clusters can be identified for groups of municipalities based on social innovation potential. The social innovation potential of the municipalities and their current development situation move together, but social innovation can create a positive potential for displacement in the medium term, in line with slowly changing territorial processes. Investment in social innovation potential has a fundamental impact on competitiveness.

Limitations

This research has examined the measurement challenges of the link between social innovation potential and competitiveness at the municipal level. A limitation of the research in terms of generalizability is that our studies focused on Hungarian municipalities, where we identified social innovation as a new tool and model that offers solutions to social challenges and problems. The definition of a complex indicator at the settlement level also pointed us in new research directions. On the one hand, the general definition of the relationship between the different levels of measurement (municipality, region, country) and the linking of their measurement methods requires further investigation. The use of participatory action research as a new research method is necessary for a complex analysis (Varga, 2021; Biclar, 2022). On the other hand, the support for generating social innovation efforts requires further investigation. Further exploration of the above research directions could lead to the identification of important links that could complement the investigations carried out in the framework of this study.

CONCLUSION

Social innovation efforts are primarily aimed at solving social problems by improving well-being (and prosperity) and living standards, and can therefore be measured in terms of sustainable value creation in terms of competitiveness. No study can be identified that has quantified the contribution of social innovation to competitiveness when examining the relationship between social innovation potential and territorial competitiveness. Due to the novelty of the question and the relevance of the analysis, we considered it justified to investigate the relationship between territorial competitiveness and social innovation potential in Hungary's municipalities.

In the study, we presented our indicator system for quantifying social innovation potential and its spatial representation. We have defined county averages of social innovation potential and pointed out that the output indicators are mainly responsible for the negative situation. We pointed out that there is a very strong link between the competitiveness of municipalities and their social innovation potential. We found that complex competitive advantage municipalities have been largely responsible for regional disparities in recent years, so it is important that, in order to reduce regional disparities, and in line with the basic idea of social innovation, municipalities in less favourable situations and starting from a

poorer base should also be given opportunities to implement local development projects based on local conditions. This could be an important means of reducing territorial disparities.

We have grouped domestic municipalities into four categories according to their social innovation potential. The demographic, employment and productivity trends of these clusters are markedly different, which could be an important signal to decision-makers that spatially distinct programmes and projects better adapted to local conditions are needed for effective development, in order to ensure an efficient development policy and a balanced spatial structure.

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