

## REGIONAL ECONOMIC SYSTEMS: COMPETITIVENESS AND INNOVATIVE DEVELOPMENT

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**Abstract.** The evolutionary theories and the focus on innovation in endogenous growth theory have made the innovative process central to any economic growth investigation. This paper is aimed to evaluate the regional disparities of socio-economic development in different Lithuanian counties, taking into account the impact of innovation level. The concept of competitiveness in this paper is similar to the concept of sustainable development. The regional disparities as intra-country analysis were evaluated by calculating the indexes. The regional competitiveness was defined as the ability to maintain a competitive position among other similar regions according to the differences in economic, social and environmental conditions.

**Keywords:** innovation, region, competitiveness, regional development.

**Jel classification:** O18, O31, R11

### 1. Introduction

Sustainable regional development is often measured by the competitiveness of regional approaches and methods. Evaluation of competitiveness is a difficult and complex process.

The evolutionary theories and the focus on innovation in endogenous growth theory (starting with Romer 1990) have made the innovative process central to any economic growth investigation (Fratesi 2009). Countries worldwide have increasingly come to the realization that innovation drives long-term economic growth and quality of life improvement and have therefore made innovation a central component of their economic development strategies (Ezell 2011).

This paper is aimed to evaluate the regional disparities of socio-economic development in different Lithuanian counties, taking into account the impact of innovation level.

In this article the concept of competitiveness is similar to the concept of sustainable development. It is obvious, that competitiveness is a multifaceted phenomenon that includes not only economic but also social, cultural, environmental aspects. In this case, the index calculation is the best way to assess the competitiveness, as it is taken to balance the individual elements of the environmental impact on regional competitiveness.

The ranking according to the sustainable development regions was evaluated by calculating the indexes (assessment of an artificial instrument,

which consists of sub-indicators and analyzed on the basis by which the objects can be ranked). There are some imperfections of different indexes.

Most of the indexes are very subjective; the soft data make up about 50 % of all data. The soft data are used even in the case, when the hard data are available, and this choice is not explained. Sometimes the weight of different criteria is without theoretical proofs. To evaluate the indexes, very often obsolete statistical data are used and to evaluate definite index very different statistical sources are used. Not all criteria, which are used at the national level, are possible to find out at the regional level (Judrupa, Šenfelde 2008).

In order to avoid such inaccuracy the new methodology was set up and the index based on the following steps: a theoretical justification for the selection of data (moreover, interpolation of missing data), data normalization, calculation the weights for the data and aggregation of the sub-indicators. According to the data of the Department of Statistics and the NPA more than 30 indicators were selected, which were aggregated into 7 sub-indicators (culture and sport, environmental quality, human capital, social environment, economic activities, infrastructure, innovation).

The paper is organized as follows: Section 2 illustrates the theory and the literature review, which helps to identify key determinants of regional competitiveness. Section 3 describes the methodology used. It includes selection of the de-

terminants of regional competitiveness, describes data normalization process, granting of weights. The results are shown in Section 4. The innovation level and level of competitiveness as sustainable development in different Lithuanian counties were presented. Section 5 concludes the paper with research findings.

**2. Principles and methods of regional competitiveness' evaluation**

Competitiveness of the underlying reference point factors is often different, as well as different definitions and regional typologies and characteristics. Moreover, there are many factors that determine the competitiveness of regions that need to be taken into account, in order to assess the competitive advantages of the region. Due to these reasons, most of competitiveness assessment methods can be only relatively, but not completely accurate (Bruneckienė 2010). Therefore, there are lots of various methods to evaluate the competitiveness of regions, but most of them have a national-level analysis.

According to Ž. Simanavičienė *et al.* (2007), the amount of theoretical and empirical studies in regional competitiveness context is increasing, but there is no common definition which could represent the methodological framework for analyzing and evaluating this field. Relying on the examination of the authors' chosen countries competitiveness assessment models, one can identify the methodological principles to be used for evaluation of regional competitiveness.

**Table 1.** Methodological aspects of evaluation of the regional competitiveness (Source: created by authors, based on Porter 1998; Rugman *et al.* 1993; Moon *et al.* 1995; Moon 2006; Bruneckienė 2008; Simanavičienė 2007)

| <i>Model/author(s)</i>                                    | <i>Methodological principles</i>  |
|---|---|
| Porter's Diamond Model (Porter 1998)                      | To justify methodologically and structure the determinants of regional competitiveness.   |
| Double diamond model (Rugman <i>et al.</i> 1993)          | The international aspect is included in the assessment of the competitiveness of regions. Competitiveness evaluation model tailored to the specifics of the region. |
| The nine-factor model (Cho 1994)                          | The importance of the human factor in regional competitiveness.   |
| Competitiveness Cycle model (Porter 1998; Cho, Moon 1998) | Regional competitiveness evaluation among similarly developed regions.  |

According to this table, the main methodological principles in these theories are:

- The importance of separation of basic factors that determine regional competitiveness.
- On the basis of the economic theory of regional competitiveness theme analysis, R. Martin (2005) identifies the following key determinants of regional competitiveness:
  - productive capital (by economic and business structure, type and degree of specialization in the region);
  - human capital (labor skills and qualifications);
  - creative capital (education, innovation and entrepreneurship);
  - infrastructure (heavy and light, public and private);
  - social-institutional capital (business networks, associations' business scale and orientation, public organizations);
  - cultural resources (quantity and quality of cultural institutions).

To sum up, regional competitiveness is defined as the ability to maintain a competitive position in the international market and among other similar regions. Nevertheless, it is important to draw attention to the specifics of each region, the definition of regional competitiveness as the ability to compete successfully among regions leads to a condition in which can be compared regions according to the same economic, social and environmental conditions.

Regional competitiveness assessment may be inappropriate and incomplete, if nobody pays attention to the dynamics of competitiveness and the pace of change. It is important not only to determine the competitive region position in a given year, but also to assess the competitive dynamics and pace of change. To prove this, R. Martin (2005) demonstrated the fact that if in region GDP per capita grows 2 percent one year and 3 percent next year, it doesn't mean the enhancing of region competitiveness while the national economy grew by 1 percent during the first year and 5 percent next year.

It was also noted that regional competitiveness can be assessed not only by examination of the different environments, but also by a number of different areas, factors or indicators. Thus, in the most common methods of evaluation of the competitiveness can be found:

- *one indicator* – the method of partial assesses of competitiveness.
- *a single index* – the method of multi-evaluation assesses of competitiveness.

According to the most authors' opinion, the best tool of assessing the competitiveness of the

regions is the index calculation. Index is defined as a specific area quantitative and qualitative evaluation of an artificial instrument, which consists of sub-indicators and analyzed on the basis of the objects can be ranked (Bruneckienė, Činčikaitė 2009)

Calculation of the index serves clear and reliable information and the need to support certain political decision-making at regional level. Indexes are used to assess, monitor and report progress in the region. Moreover, index provides a better organization and use of information, gives an opportunity to compare in time and area.

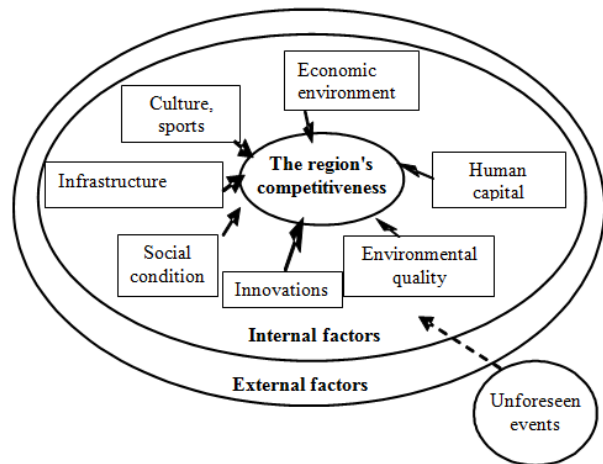
According to J. Kondyli (2010), each index calculation for a particular purpose can be regarded as a model when creating an index based on the following steps: a theoretical justification for the selection of data (interpolation of missing data), data normalization, calculation the weights for the data and aggregation of the sub-indicators.

**3. Methodology**

**3.1. Selection of the determinants of regional competitiveness**

The criteria of region competitiveness can be assessed by various factors, taking into account the goals and tasks formulated. Some authors give more attention to macro-economic environment in order to assess competitiveness, other - in business performance or in “intangible” factors: creativity, tolerance levels, etc. (Martin 2003; Gardiner *et al.* 2004; Bruneckienė 2010; Paliulis, Činčikaitė 2011).

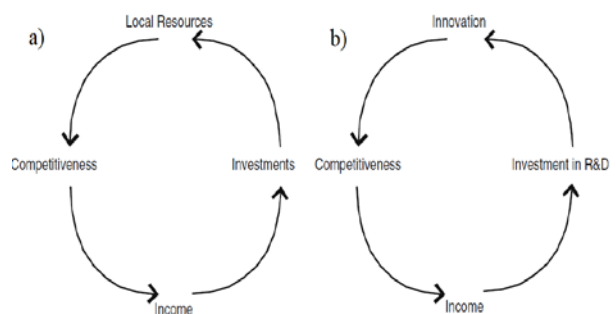
Assessing the competitiveness of regions in this article, it was decided to take on the Lithuanian National Sustainable Development Strategy (LNSDS) emphasis on balanced regional development (Nutarimas 2003; VIDAUS 2011). Therefore, indicators that determine the competitiveness of regions were selected on the basis of Latvian authors (Judrupa 2011), according to the ranking suit of Latvia’s regions competitiveness. Such a choice was made as the indicators were in accordance with the principles set out by the theoretical analysis of regional competitiveness, importance of sustainable development by country and regional level. This Latvia’s example seems to be the most appropriate for indexes that make up the sub-indicators to be found from the database of the Lithuanian Statistics Department (LSD). Thus, the region’s competitiveness determinants are presented below in Fig. 1.



**Fig.1.** Factors determining the competitiveness of the region (Source: created by authors, based on Judrupa 2011; Judrupa, Šenfelde 2008)

Region’s competitiveness mostly depends on internal factors: the economic environment, social conditions, human capital, environmental quality, innovation, infrastructure, culture and sports.

The competitiveness of a region is the result of the good working of two virtuous mechanisms. First (Fig. 2a), there is the more traditional circle of the accumulation of local resources (infrastructure, services, etc.); these have positive effects on competitiveness, and in this way a larger monetary output can be produced and part of this reinvested into the accumulation of local resources. The second circle (Fig. 2b) is less traditional and represents knowledge and innovation: by innovating, the system is able to generate technology continuously and, in this way, remains competitive in the markets; competitiveness generates value added which can be reinvested in learning and R&D, and hence allows the innovative process to continue.



**Fig.2.** Two virtuous circles at the base of regional competitiveness (Source: Fratesi 2009)

Innovations, small and large, have been catalysts for bigger changes, such as tying people to land, land ownership, population growth, specialization and social hierarchy, wealth and prestige acquisition, colonization of agriculturally marginal land, increases in production, trade and exchange,

urbanization and, ultimately, the rise of the state and our own modern world (Van der Veen 2010).

However, competitiveness of the region is also affected by external factors (national policies, political stability, country's membership in various international organizations) as well as any unforeseen events, such as natural disasters, etc.

Greater sub-indicators number entering into the final index allows a better understanding of each region's success or backwardness in each of the areas. As pointed out by J. Kondyli (2010), an important aspect of the indicator is the possibility of indicator's breaking into separate parts. This fragmentation leads to a better understanding separate regions' condition in different fields and make specific findings or contribute to more effective decision-making of regional development.

For each of the factors influencing the region's competitiveness were assigned descriptive indicators: culture and sports unit was assigned to four variables (characterized by recreational and cultural development), quality of the environment block was assigned to four indicators (focus on water and air pollution and natural resources); innovative unit – to three indicators (information technology, R&D and investment support), human capital unit – to five indicators (described in higher education level and demographic change), the social environment unit – to seven indicators (health, housing quality, material wealth, social burden, public safety, social exclusion, the level of budget revenues), economic activity unit – to five indicators (openness to international trade, attracting investment, enterprise competitiveness, agriculture, tourist attraction), infrastructure unit – to two indicators describing the transport infrastructure. The number of indicators that were broken down by administrative territory was selected according to the LSD availability.

It is worth noting that many authors the innovation development and deployment unit's indicators recognize as critical factors in region's development, thus the data for these indicators was scrupulously collected and organized. All data was used from 2003–2009 years period. So last year for which the index is calculated is 2009. Such a time series of data selected according to data availability. In case of missing time series value, this value is determined using the average value method, unknown value equivalent to the average preceding and following values. Moreover, the extrapolation method was used in order to find the value of an indicator beyond the limits of the available sample.

### 3.2. Data normalization

As stated by Bruneckienė (2009), the most suitable data normalizing methods for the regional competitiveness assessment is standard deviation from the average or the distance between the minimum and maximum values. These methods do not cause problems. Difficulties could emerge when the data is normalized by the distance from the average method or the distance from the leader of the group method. In this case one region's backwardness from the leader by one factor or one region's strong excess or shortfall from the average may cause a significant influence on the final result. Thus, the data normalizing method by the distance between the minimum and maximum values was chosen in this study. This method was also used in Ukraine for evaluating the level of living standards (Shyshkin 2008) and in Romania to evaluate regional competitiveness (Mereuță *et al.* 2007). This normalization method is also used in the calculation of the United Nations development program's Human development indices (UNDP 2007). The essential advantage of this method is the inter-regional comparability of a particular variable in  $t$  period. This method allows to assess the positive and negative impacts on competitiveness factors. Using (1) and (2) formulas, the original data is rearranged so that the later aggregation of data into sub-indicators would not change the essential effect to the final index of competitiveness (positive effect – a direct correlation, negative effect – an inverse correlation).

$$Z_{ijt} = \frac{X_{ijt} - X_{\min}}{X_{\max} - X_{\min}}, \quad (1)$$

where:

$Z_{ijt}$  – normalized  $i$  indicator's value of the  $j$  region at time  $t$ ,

$X_{ijt}$  –  $i$  indicator's initial value of the  $j$  region at time  $t$ ,

$X_{\min}$  – the minimum value of  $i$  indicator at time  $t$  for all regions,

$X_{\max}$  – the maximum value of  $i$  indicator at time  $t$  for all regions.

This formula is designed to normalize the indicators that contribute to sustainable development: relationship between the indicator and sustainable development is direct. Next formula is used for variables that are considered to slow the development of sustainable regional development (e.g. unemployment, the number of criminal activities per one police officer, etc.). In this way, the maximum value has a negative meaning, and the minimum – positive:

$$Z_{ijt} = 1 - \left( \frac{X_{ijt} - X_{\min}}{X_{\max} - X_{\min}} \right), \quad (2)$$

With such data normalization all  $i$  indicators at time  $t$  in all regions get values from the interval  $[0, 1]$ . Thus, in each indicator case, there is a region that gets value  $\{1\}$  at time  $t$  and there's a region which has a minimum value of the indicator  $\{0\}$ .

### 3.3. Granting of weights and the final index calculation

The next step is setting the weights of indicators and sub-indicators in each of the described units, in order to aggregate them into a final index. Commonly used methods of weights assigning based on expert assessments (Judrupa 2008; Viasone 2008) or on assignment of equal weights to all component parts of the final index (Kondyli 2010; Houvari *et al.* 2001; Mereuță 2007; Snieška, Bruneckeinė 2009). In order to avoid subjectivity, as the weights would be determined according to the expert assessments, for all units within indicators and sub-indicators were given the same weight. In addition, it is worth remembering that, in calculating the index of competitiveness an important goal is to consider not only economic but also social, ecological, cultural, infrastructure and human capital regional development, to take into account the region's sustainable development.

Summing up, 31 indicators are divided into seven units (sub-indicators). Each of these units of indicators are the same weight. The final regional competitiveness index is formed from the seven sub-indicators, which are considered to have the same relative weight in the final index calculation. Thus, all sub-indicators are calculated as the non-weighted average of the indicators making up the unit (3):

$$I_{jtk} = \frac{\sum_{i=1}^n (Z_{ijt})}{n}, \quad (3)$$

where:

$I_{jtk}$  –  $k$  unit value of  $j$  region in period  $t$ ,  
 $n$  – the number of indicators in  $k$  unit,  $i=[1;n]$ .

The final index is calculated as the non-weighted average of the seven sub-indicators (4):

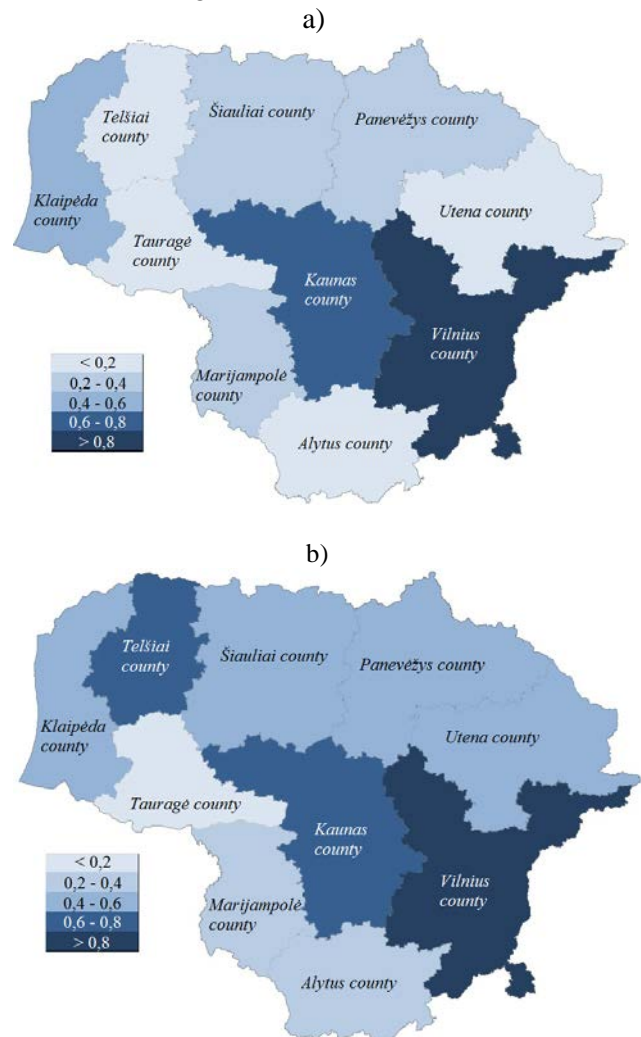
$$I_{jt} = \frac{\sum_{k=1}^7 I_{jtk}}{7}, \quad (4)$$

where:

$I_{jt}$  – the final index value of  $j$  region in the period  $t$ ,  
 $k$  – the number of units (sub-indicators),  
 $k=[1;7]$ .

## 4. Results

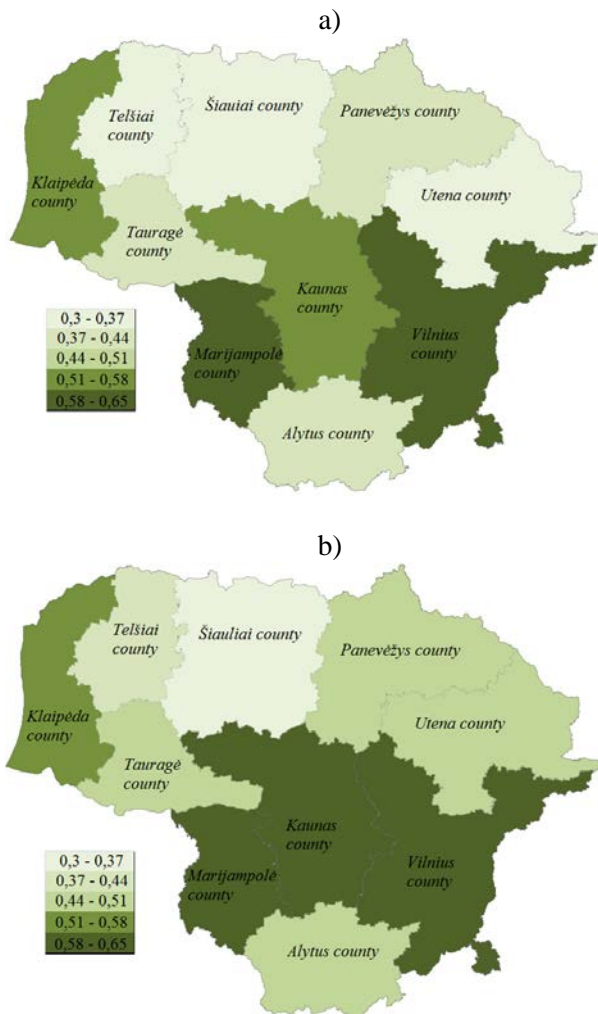
After all necessary steps to calculate the index and by using ArcMap application Lithuanian county maps by the level of innovation were created (Fig. 3). Fig. 3a shows the innovation level in Lithuanian counties in 2003, Fig. 3b – in 2009. As seen in a legend of Figure 3, the values of innovation index were divided into 5 intervals from the lowest to the highest.



**Fig.3.** Level of innovativeness in different Lithuanian counties a) year 2003, b) year 2009 (Source: created by authors 2011).

The level of innovation in 2009 get more uniform comparing to 2003 (smaller counties have become more innovative). If the year of 2003 was conventionally expected by statistical data, as the biggest counties were more innovative, meanwhile, in 2009, there is strong change in the level

of innovation in some small counties, such as Telšiai or Utena. Such changes describe a better development of innovation in all Lithuanian counties. This sub-indicator has a sufficient influence to a sustainable development across counties. Thus, it is important to analyze, how other factors (indicators of units) influenced the competitiveness as sustainable development level in different counties of Lithuania (Fig. 4). Fig. 4a shows the level of competitiveness as sustainable development in Lithuanian counties in 2003, Fig. 4b – in 2009. The same as in a previous figure the values of final comparable indexes were divided into 5 intervals from the lowest to the highest.



**Fig.4.** Level of competitiveness in different Lithuanian counties a) year 2003, b) year 2009 (Source: created by authors 2011).

The maps of competitiveness level shows the similar tendencies as for innovation unit indicators as for all other indicators. The small counties of Lithuania became more competitive, that means the more sustainable development from 2003. But there are some points, which show that the growth rate of some indicators was slower than the growth

rate of innovation indicators, which led to a lower achievement of competitiveness level overall.

Telšiai county is distinguished with a small growth rate in the level of competitiveness from 2003 till 2009, meanwhile, the growth rate of innovation level was intense. A similar situation is observed with the Šiauliai district.

According the cluster analysis made by Brunekienė and Kilijonienė (2011) the similar results were obtained. Vilnius county belonged to the group of the most competitive regions, Klaipėda and Kaunas - to the group of competitive regions, Telsiai, Šiauliai, Alytus, Panevezys, Marijampole – to the group of average competitive regions, Utena – slightly competitive regions, Taurage – not competitive regions.

The combination of regional competitiveness index and cluster analysis makes the background for formulation and evaluation the effectiveness of competitive strategies of regions (Brunekienė, Kilijonienė 2011).

It should be stressed, that city-regions need to be understood as part of wider economic systems, networks and resource flows, rather than as self-contained units. This means that the strength of external business connections and the efficiency of external communications and transport links are important, as well as national and international policies and the changing structure of external markets. In addition, city-regions appear to obtain a competitive advantage from the size and diversity of concentrated economic activity, which improves access to markets, suppliers, collaborators and a large labour pool (Turok 2004).

To sum up, it can be said that the trend of innovation indicators change in Lithuania had not only a positive impact on sustainable development, but also led other eco-social indicators to the similar trends, that stresses the importance of innovation. According to a fact, that competitiveness is still not uniform across counties of Lithuania, the bigger innovation level will be set in smaller counties with remote districts, the faster sustainable development as directly as through other factors will be reached among Lithuanian counties.

## 5. Conclusions

Competitiveness of the region should be assessed in relation to the sustainable development context, including the economic, social, ecological, human resource, cultural, infrastructure and innovation factors.

Assessment results are more sensitive to the chosen valuation methodology in less competitive Lithuanian counties.

Innovation development in different Lithuanian counties, has improved the indicators of those regions where the innovation level was quite low.

According to a summarized index, covering innovation development and other competitiveness' factors, innovation has been inadequate and do not outweigh other factors affecting regional competitiveness in Lithuania.

Regional competitiveness rating helps to determine the effectiveness of regional development strategy.

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