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SYSTEM OF INDICATORS FOR ASSESSING VULNERABILITY OF REGIONS ON FUTURE DEVELOPMENT CHALLENGES: THE CASE OF DEVELOPMENT REGIONS IN SLOVENIA

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ABSTRACT

System of Indicators for Assessing Vulnerability of Regions on Future Development Challenges: The Case Of Development Regions in Slovenia

The European Commission in 2008 in its working document Regions 2020: An Assessment of Future Challenges for EU regions identified challenges that EU regions might face in the coming years. First and foremost, these are the challenges of globalization, demographic change, climate change and the challenges associated with energy supply. On the basis of the report, we designed a system of factors and indicators which could be used to evaluate the vulnerability of regions to future development challenges. We tested this approach in the case of development regions in Slovenia. Results of the analysis show that the proposed approach is an appropriate professional basis for preparation of regional development programs.

KEY WORDS

Regional development, development challenges, system of indicators, vulnerability of regions, development regions, Slovenia

1.Introduction

When preparing regional development programs, the first methodological step is to define development situation in regions and development trends. Later, an insight into the possible future orientations of regions is needed, while planning is an activity that is directed to the future (Friedman 1987). The transition from the understanding of the past and contemporary development to defining future development challenges is an integral part of the planning process. After analyzing the situation and development trends in regions and assessment of that situation and development trends follows the definition of spatial development options that relate to the spatial conditions, potentials and limitations of regions. These include not only the current situation and processes, but also relate to possible future conditions that are more or less predictable and can be evaluated by quantitative or qualitative or a combination of both methods (Černe 2005).

In the context of a strategic approach to planning this activity relates to the identification of internal and external conditions (Černe 2005). Analysis of the internal development of endogenous features and potentials (strengths and weaknesses) is faced with the opportunities and threats coming from the outside world (Kocziszky 2009). This involves an analysis of development factors that will significantly affect the future development of the regions. Planning therefore covers both: it addresses the current development problems as well as to prepare for future challenges. Definition of future development challenges is therefore a prerequisite for the proper formulation of visions of regional development, developmental policies and their implementations in the context of regional development programs (Kušar 2015).

Future development challenges are usually summarized through a set of categories that are linking new development trends and open questions about the current development with the future. Their formulation is strongly related to the theoretical approach used for evaluating regional development problems and potentials. Sustainable development approaches highlight the impact of climate change, poverty, social and developmental inequalities, food, water and energy security (Gelsdorf 2015; Population Challenges ... 2015; Sustainable ... 2015), while economic-oriented approaches highlight questions on globalization, accessibility, climate change, natural resources and energy supply, social changes and governance (Facing the future ... 2015; Polycentric regions 2015).

The discourse on future development challenges was especially strong at the dawn of a new millennium, mainly in the first decade of the 21st century when an important part of references used in this article originated (Espon 2015; Polycentric regions 2015; Population Challenges ... 2015).

From that time the European commission's Regions 2020: An Assessment of Future Challenges for EU Regions (2008) originates as well. In the document as the main future challenges globalization, demographic change, climate change and the challenges in ensuring the energy were exposed. Evaluation of future challenges of regions in the European Union have been using projections and simulations and scenarios conducted at NUTS 2 level. For every challenge index has been calculated that enables comparisons between regions, as well as synthetic score which highlights the intensity of a specific development challenge (Regions 2008). Specific future challenges were evaluated on ESPON 2013 Applied Research platform: ReRisk (energy), ATTREG, FOCI, TIGER (globalization), DEMIFER (demography) and ECR2 (financial and economic crisis) (Espon 2015).

Consideration of future development challenges in ESPON projects and the European Commission's Regions 2020 based on the projections on larger spatial units (NUTS 2). For promoting balanced regional development are largely used spatial units on NUTS 3 level. Lowering the level of territorial units reduces the availability of data which enable the creation of such projections and analysis. At the same time the methodology of analysis and evaluation of future development challenges should be adapted in a way that enables creation of less complex expert bases for the design of development programs in the regions. The purpose of this paper is therefore to establish a system of indicators which could be used to evaluate the regional structure and development trends in regions in terms of exposure of regions to selected future development challenges (globalization, demographic change, climate change and energy challenge) and, consequently, to assess the vulnerability of regions to selected future development challenges.

The objectives of the research are methodological and substantive (in the case of development regions in Slovenia):

- to identify the factors that define selected development challenges;
- to develop a system of indicators for the evaluation of future development challenges and identify vulnerability of the regions on the future development challenges;
- to use the system of indicators for analysis of the vulnerability of the development regions in Slovenia;
- to provide a synthesis assessment of the vulnerability of development regions in Slovenia on selected development challenges.

2. Methodology

2.1. Factors defining future development challenges of regions

The system of factors and indicators for evaluating future development challenges originates on description of four future challenges for regions done by the European Commission and published in *Regions 2020: An Assessment of Future Challenges for EU Regions* (2008): globalization, demographic change, climate change, energy challenge.

Globalization. Globalization has enabled today's way of life and standard of living. But it asks for continuing structural adjustment of regions. Competition on a global scale brings special challenges to regions characterized by labor-intensive economic activities, as the price of labor and the total price of the products are cheaper in the newly industrialized countries. Due to difficulties expected in developing a knowledge society in these regions, the development situation will be getting even worse. Development advantages have mainly regions with high human and social capital; their products, processes and management innovation continuously adapt to accelerating changes (Regions 2020 … 2008).

Table 1: Factors defining future development challenges of regions: globalization.

Elements influencing vulnerability to globalization	**Factors**
Human capital	participation in tertiary education
Human and social capital	education and productivity of workers
Structural transformation	inclusion in the labour market
Competition from newly industrialized countries	activities with high and low value added
Knowledge society	research and innovation activities

Source: Adapted from Regions 2020 … 2008.

Demographic change. The European Union faces three interrelated demographic processes. Economic, social and medical advances have made it possible that the people are living longer, but birth rates falling at the same time. Demographic projections indicate that these two processes will continue, which will result in a gradual reduction in the number of inhabitants, with particular problematic reduction of the number of economically active population (Regions 2020 ... 2008). Demographic trends may be partly changed by a more intensive immigration from regions and countries with lower economic and/or the security situation, but the impact of the process is ambiguous.

Table 2: Factors defining future development challenges of regions: demographic change.

Elements influencing vulnerability to globalization	**Factors**
Low birth rates	Fertility
Emigration form least developed regions	Emigration
Reduction of the number of population	Overall population growth
Reduction of the number of economically active population	Working-age population
Population is living longer; low birth rate	Aging of population

Source: Adapted from Regions 2020 … 2008.

Climate change. Climate change will lead to an increase in long-term annual average temperatures and changes in precipitation regime. Coastal areas will be affected by rising sea levels and, consequently, increased erosion. Short-term effects of climate change can be seen in increasing incidence of extreme weather events (storms, drought, hot summers). The consequences of climate change will have an impact on vulnerable economic activities, especially agriculture, energy production and tourism (Regions 2020 ... 2008).

Table 3: Factors defining future development challenges of regions: climate change.

Elements influencing vulnerability to globalization	**Factors**
Short-term climate change effects	Extreme weather events
Impact on vulnerable economic activities	Most vulnerable economic activities to climate change
Expected impact of climate change	Evaluation of the expected impact of climate change
Preparation on expected climate change	Adaptation to climate change

Source: Adapted from Regions 2020 … 2008.

Energy challenge. Secure supply of energy of a reasonable price and low environmental impact are gaining their importance. The European Union is seeking to reduce its dependence on imported (fossil) energy and to develop towards a low carbon society mainly through increasing the energy efficiency with new knowledge in the field and the use of modern technology. The regional dimension of this challenge includes three elements: energy supply, consumption and its efficiency, and carbon dioxide emissions generated by the production and consumption of energy. Price and availability of energy are important as well.

Table 4: Factors defining future development challenges of regions: energy challenge.

Elements influencing vulnerability to globalization	**Factors**
Reduction of dependence on imported energy sources	Renewable energy sources
Consumption of energy	Personal motorization
Consumption of energy	Energy-intensive economic activities
Use of modern technology	Investments in energy efficiency

Source: Adapted from Regions 2020 … 2008.

2.2.System of indicators for assessing vulnerability of regions on future development challenges

European Commission Report on the evaluation of the future challenges of regions in the European Union is based on the calculation of the composite index of vulnerability for each particular challenge: globalization vulnerability index, demographic vulnerability index, the index of vulnerability to climate change and the vulnerability index for energy challenge. The variables used for their calculation are the result of scenarios and projections for 2020. Index values range from 0 to 100. The higher the index value, the more the region is exposed to a particular challenge.

Due to the limitations of data availability at regional level, particularly of the projections we propose a new system of indicators for evaluating the vulnerability of regions. The selection of indicators is adapted to the availability of socioeconomic data. This approach to data collection has an ambition that every region at some stage in the planning process or the method of preparation of expert bases, regional development programs or implementing documents could assess the exposure of the region to future development challenges themselves without the need to prepare expensive and sophisticated expertise.

Table 5: Factors defining future development challenges of regions and indicators for assessing vulnerability of regions.

Future challenges	Factors	Indicators
Globalization	1. Participation in tertiary education 2. Education and productivity of workers 3. Inclusion in the labour market 4. Activities with high and low value added 5. Research and innovation activities	1. Share of population aged 20-24 enrolled in tertiary education 2. Share of employed population with tertiary education 3. Employment rate 4. Share of gross value added of "problematic" activities [1)] 5. Gross domestic expenditure on research and development (percentage of GDP)
Demographic change	1. Fertility 2. Emigration 3. Overall population growth 4. Working-age population 5. Aging of population	1. Natural increase per 1000 population 2. Net migration per 1000 inhabitants 3. Total increase per 1000 population 4. Share of population aged 15-64 5. Old age dependency ratio
Climate change	1. Extreme weather events 2. Most vulnerable economic activities to climate change 3. Evaluation of the expected impact of climate change 4. Adaptation to climate change	1. Estimated damage caused by natural disasters - share in GDP 2. Share of gross value added of "problematic" activities 3. Value of investments in air and climate protection per capita (in EUR) 4. Qualitative evaluation of the impact of climate change (temperature, precipitation)
Energy challenges	1. Renewable energy sources 2. Personal motorization 3. Energy-intensive economic activities 4. Investments in energy efficiency	1. Possibilities of using renewable energy sources 2. Number of cars per 1,000 inhabitants. 3. Share of gross value added of "problematic" activities 4. Amount of subsidies for energy efficiency per capita (in EUR)

Source: Adapted from Kušar 2015.

Notes:
1) Problematic activities: Agriculture, forestry and fishing (A), Mining and quarrying (B), Manufacturing (C), Electricity, gas, steam and air conditioning supply (D), Water supply, sewage, waste water management and remediation activities (E), Construction (F)
2) dejavnosti Agriculture, forestry and fishing (A), Mining and quarrying (B), Electricity, gas, steam and air conditioning supply (D), Water supply, sewage, waste water management and remediation activities (E), Wholesale and retail trade, repair of motor vehicles and motorcycles (G), Transportation and storage (H), Accommodation and food service activities (I)
3) dejavnosti Manufacturing (C), Construction (F), Wholesale and retail trade, repair of motor vehicles and motorcycles (G), Transportation and storage (H), Accommodation and food service activities (I)

2.3. Comparative analysis

Values for each indicator need to be standardized and ranked. The next step was calculating the sum of ranks that defines the relative position of each region on individual challenge as a starting point for comparison of regions with each other. A similar approach to the study of the relative development situation of regions has been used in other studies, for example at defining the development situation of the Gorenjska statistical region (Kušar and Černe 2014), as well as at the assessment of development opportunities of Slovenian statistical regions in Regional Development Strategy of Slovenia (Strategija … 2001).

Final evaluation of the vulnerability of development regions to future development challenges was done by second ranking (ranking of regions for each development challenge according to their sum of ranks) and calculating another sum of ranks of all development challenges.

2.4. Case study: Development regions in Slovenia

Development regions are the basic functional territorial unit of regional policy. They are spatial units with specific combination of settlement, economic, infrastructure and natural systems and where stakeholders participate the formation of regional development strategies (Zakon … 2011).

As Slovenia does not have provinces as a second level of local self-government, are for the delineation of development regions (with minor territorial differences) used NUTS 3 territorial units named statistical regions (12 units). Although regions used in the case study are by their nature administrative-territorial units, they cover rounded geographical areas and represent functional areas of regional centers.

Figure 1: Statistical regions (NUTS 3) in Slovenia

Socioeconomic data used in the analysis of the vulnerability of regions on the future development challenges come mainly from databases of the Statistical Office of the Republic of Slovenia and relate mainly to the year 2013 and the extend of statistical regions before some minor changes on 1. 1. 2015. In addition, the following sources were used: Institute of Macroeconomic Analysis and Development (estimated damage of natural disasters), Dvoršek (2015) (qualitative evaluation of trends in temperatures and precipitation for the period 1961-1990 and the medium projection for 2050), Gumilar (2008) (possibilities for use of renewable energy sources in Slovenia) and the Eco Fund (2015) (subsidies for energy efficiency).

Table 6: Basic geographical characteristics of development/statistical regions in Slovenia (2013).

Region	No. of pop.	Aging index	GDP/cap.	Basic geographical characteristics
Pomurska	118,022	141	11,858	Geographical position deteriorates the economic position; strong role of agriculture; development of tourism
Podravska	323,238	137	14,390	Second largest region according to economic power; electricity production (hydro power-plants); deindustrialization process
Koroška	72,100	121	13,850	Peripheral position; highest share of innovation active enterprises
Savinjska	260, 217	113	15,769	Diverse landscape; lignite deposits; development of tourism
Zasavska	43,502	144	10,941	Peripheral position despite its central position; strong deindustrialization process (manufacturing, mining)
Spodnjeposavska	70,211	125	15,181	Electricity production (nuclear/hydro/thermal); close to Croatia/Zagreb
Jugovzhodna Slovenija	142,509	105	16,552	Largest region; diverse landscape; developmental duality; some large manufacturing companies
Osrednjeslovenska	541,718	106	24,647	Core; central position; capital; good traffic connections; 40 % of national GDP
Gorenjska	203,984	112	14,923	Alpine landscape; development of tourism; lagging behind past development
Notranjsko-kraška	52,382	121	12,232	Karst phenomena; lowest population density; strongly dependent on activities from Osrednjeslovenska region
Goriška	119,002	132	15,782	Diverse landscape; connections with Italy; some innovative companies
Obalno-kraška	111,936	135	17,133	Coastal region; port; development of tourism; gate-way region; high importance of service activities

Source: SORS 2015; Slovene Regions in Figures 2014 2016.

3. Vulnerability of development regions in Slovenia to future development challenges

Globalization. The most vulnerable regions in Slovenia in terms of globalization is Zasavska region with the sum of ranks 46. Despite this assessment Zasavska region does not rank among the most vulnerable regions in Slovenia at the individual indicators, but mostly at the beginning of the last

quarter of regions. Zasavska region is followed by Spodnjeposavska and Pomurska regions, which show the highest vulnerability in the field of the education of workers compared to other development regions in Slovenia (rank 11 and 12). The total development vulnerability of Spodnjeposavska region to globalization is lower due to the relatively high proportion of students in the age group 20-24 years (rank 5), while Pomurska region has a low share of gross value added of "problematic" economic activities with low productivity level (rank 5), but this is not the result of favorable economic conditions in the region but a consequence of intensive deindustrialisation in the traditional industries before the year 2013.

Table 7: Vulnerability of development regions in Slovenia: globalization.

Development region	1	2	3	4	5	Sum of ranks
Zasavska	9	8	10	9	10	46
Spodnjeposavska	5	11	6	11	12	45
Pomurska	7	12	12	5	8	44
Koroška	2	10	9	10	11	42
Podravska	11	6	11	3	7	38
Obalno-kraška	10	3	8	1	9	31
Jugovzhodna Slovenija	6	7	4	12	1	30
Savinjska	3	9	5	8	5	30
Notranjsko-kraška	4	5	1	7	6	23
Goriška	1	4	7	6	3	21
Gorenjska	8	2	2	4	4	20
Osrednjeslovenska	12	1	3	2	2	20

Notes:
1 - share of population aged 20-24 enrolled in tertiary education
2 - share of employed population with tertiary education
3 - employment rate
4 - share of gross value added of "problematic" activities
5 - gross domestic expenditure on research and development (percentage of GDP)

With a slightly lower sum of ranks follow Gorenjska and Podravska region (42 and 38). The first half of the development regions in Slovenia that are more vulnerable to globalization challenges is concluded by Obalno-kraška region. This region has in terms of GDP per capita relatively favorable development position, but according to the sum of ranks it is placed lower, mainly due to low participation in tertiary education (rank 10) and a relatively low share of expenditure on R & D (rank 9). Least vulnerable regions to challenges of globalization are Goriška, Gorenjska and Osrednjeslovenska region. Although well ranked, they also have their drawbacks. In particular, this applies to Gorenjska region, which according to the share of population aged 20-24

enrolled in tertiary education falls on the 8th rank, even more markedly, this is the case for Osrednjeslovenska region, which in this indicator ranks the highest place (rank 12).

Demographic change. According to the vulnerability to demographic changes, region in Slovenia can be divided into three groups.

In the first group there are three demographically most vulnerable regions: Zasavska, Goriška and Pomurska. All three regions are experiencing natural decrease (with the exception of Goriška), depopulation, intensive decline in the total population, low share of the working age population (people aged 15 to 64 years - with the exception of Zasavska region) and a high coefficient of age dependency, or the unfavorable ratio between the population over the age of 64 years and working age population (with the exception of Pomurska region).

Table 8: Vulnerability of development regions in Slovenia: demographic change.

Development regions	1	2	3	4	5	Sum of ranks
Zasavska	11	12	12	8	11	54
Goriška	7	10	9	12	12	50
Pomurska	12	9	10	9	7	47
Koroška	8	11	11	2	4	36
Savinjska	5	6	7	10	8	36
Gorenjska	2	8	5	11	6	32
Spodnjeposavska	9	7	8	5	3	32
Podravska	10	3	4	4	10	31
Jugovzhodna Slovenija	3	5	6	6	1	21
Obalno-kraška	6	1	2	7	2	18
Notranjsko-kraška	4	4	3	1	5	17
Osrednjeslovenska	1	2	1	3	9	16

Notes:
1 - natural increase per 1000 population
2 - net migration per 1000 inhabitants
3 - total increase per 1000 population
4 - share of population aged 15-64
5 - old age dependency ratio

In the second group, there are five regions with very heterogeneous demographic characteristics. Some indicators show favorable structure, while others were ranked worse.

The lowest vulnerability to anticipated demographic changes have Jugovzhodna Slovenija, Obalno-kraška, Notranjsko-kraška and Osrednjeslovenska regions. Jugovzhodna Slovenija has a relatively favorable

age structure, while it has a positive natural increase and a relatively young population (rank 1). Obalno-kraška region has become markedly immigration region (rank 1), well is placed according to the total growth and the old age dependency coefficient (both indicators rank 2) as well. The next region is Notranjsko-kraška, which has a particularly favorable structure in the share of population aged 15 to 64 years. Osrednjeslovenska region is less vulnerable to future demographic challenges, but it is already showing experiencing aging of its population (rank 9 at the old age dependency coefficient).

Climate change. The most vulnerable development region in Slovenia to climate change is Spodnjeposavska region. At two indicators it is placed in the higher rank: the damage caused by natural disasters and the role of economic activity, which will be by the expected climate changes hit the hardest, namely agriculture, tourism and energy production. The next three regions (Pomurska, Notranjsko-kraška and Goriška) also exhibit a relatively high vulnerability to climate change, but the causes for such a classification are different: in the Pomurska region the vulnerability increases rank at indicator natural disasters (rank 12), Notranjsko-kraška region has low investment in the protection of air and climate (rank 11) and Goriška region shows high impact of climate change and low investment in the protection of air and climate, as well.

Table 9: Vulnerability of development regions in Slovenia: climate change.

Development region	1	2	3	4	Sum of ranks
Spodnjeposavska	11	12	8	10,5	41,5
Pomurska	12	8	9	2,5	31,5
Notranjsko-kraška	3	9	11	8	31
Goriška	6	4	10	10,5	30,5
Obalno-kraška	5	11	3	8	27
Podravska	10	2	7	8	27
Zasavska	2	6	12	6	26
Jugovzhodna Slovenija	7	1	5	12	25
Savinjska	9	10	1	4,5	24,5
Gorenjska	4	7	4	2,5	17,5
Koroška	8	5	2	1	16
Osrednjeslovenska	1	3	6	4,5	14,5

Notes:
1 - estimated damage caused by natural disasters - share in GDP
2 - share of gross value added of "problematic" activities
3 - value of investments in air and climate protection per capita (in EUR)
4 - qualitative evaluation of the impact of climate change (temperature, precipitation)

Least vulnerable to climate change are Gorenjska, Koroška and Osrednjeslovenska regions. For Gorenjska region a relatively smaller impact of climate change is expected. Koroška region has been favorably evaluated in all indicators except for the estimated damage of natural disasters (rank 8). Koroška region has on the other hand one of the highest investments in air and climate protection (rank 2) and relatively minor impact of future changes in temperature and precipitation regime is expected. Osrednjeslovenska region has the lowest sum of ranks (14.5). Problematical seems just relatively low level of investments in air and climate protection per capita (rank 6).

Energy challenge. On the basis of the indicators analyzed the greatest vulnerability to energy challenges show Obalno-kraška region, Jugovzhodna Slovenija, Notranjsko-kraška region and Savinjska region, mainly due to low investment in better energy efficiency. Slightly better were those regions ranked according to good possibilities for using renewable energy, among them especially Jugovzhodna slovenija (rank 3) and Savinjska region (rank 6).

Table 10: Vulnerability of development regions in Slovenia: energy challenge.

Development region	1	2	3	4	Sum of ranks
Obalno-kraška	8	11	7	12	38
Jugovzhodna Slovenija	3	8	12	11	34
Notranjsko-kraška	12	10	9	3	34
Savinjska	6	6	10	10	32
Koroška	10	4	8	7	29
Goriška	1	12	5	9	27
Gorenjska	5	7	11	2	25
Pomurska	7	3	6	5	21
Osrednjeslovenska	9	5	2	4	20
Spodnjeposavska	2	9	1	8	20
Zasavska	11	1	4	1	17
Podravska	4	2	3	6	15

Notes:
1 - possibilities of using renewable energy sources
2 - number of cars per 1,000 inhabitants.
3 - share of gross value added of "problematic" activities
4 - amount of subsidies for energy efficiency per capita (in EUR)

Given the energy challenges precede Zasavska and Podravska regions. Zasavska region could be ranked in last place with the lowest sum of ranks, if having better possiblities to use renewable energy sources. Rank 11 characterizes region being strongly depend on the import of energy, which means greater vulnerability to stable and affordable accessibility to energy.

4. Synthesis assessment of the vulnerability of development regions in Slovenia

Based on the chosen approach to study vulnerability of development regions in Slovenia to four fundamental development challenges of regions defined by the European Commission, we found out that the most vulnerable development region in Slovenia is Pomurska region. The sum of ranks put it in the last place, but at any development challenge it is not ranked in the highest rank (rank 12). For the challenges associated with globalization and demographic change it was ranked at the beginning of the last third of regions (rank 10), while for the challenges associated with ensuring adequate energy supplies it is among least vulnerable regions (rank 5).

According to the sum of ranks the next two most vulnerable regions are Spodnjeposavska and Zasavska regions. They are ranked 10.5 in spite of very low vulnerability in the field of energy challenge (rank 3 and 2) differ depending on the vulnerability with regard to demographic challenges (in a more favorable dev, but they strongly differ at demographic change factors.

Goriška and Obalno-kraška region share the same rank. Both regions have many similar geographic and developmental characteristics, but the vulnerability to development challenges despite equal sum of ranks (30) are quite different. Goriška region stands out in comparison with Obalno-kraška region in the area of demographic challenges (rank 11), while Obalno-kraška region has high vulnerability in the energy sector (rank 12), mainly due to high personal motorization and low energy efficiency investments.

Table 11: Vulnerability of development regions in Slovenia.

Development region	1	2	3	4	Sum of ranks	Final rank
Pomurska	10	10	11	5	36	12
Spodnjeposavska	11	6	12	3	32	10,5
Zasavska	12	12	6	2	32	10,5
Goriška	3	11	9	7	30	8,5
Obalno-kraška	7	3	8	12	30	8,5
Koroška	9	9	2	8	28	7
Jugovzhodna Slovenija	6	4	5	11	26	5
Notranjsko-kraška	4	2	10	10	26	5
Savinjska	5	8	4	9	26	5
Podravska	8	5	7	1	21	3
Gorenjska	2	7	3	6	18	2
Osrednjeslovenska	1	1	1	4	7	1

Source: Kušar 2015.

Notes:
1 - globalization
2 - demographic change
3 - climate change
4 - energy challenge

Koroška region, falling in the final rank 7, is mostly ranked in the third quarter of regions in Slovenia. Much better is ranked on climate change (rank 2), mainly due to the high value intended for the protection of air and climate and low exposure to expected climate changes.

The next three regions have the same sum of ranks and with the final rank of 5. These are Jugovzhodna Slovenija, Notranjsko-kraška and Savinjska regions. All three regions have relatively low vulnerability in the context of globalization and demographic change. But they are experiencing some challenges in the field of energy challenge, where they are ranked in the range 11 (Jugovzhodna Slovenija), 10 (Notranjsko-kraška region) and 9 (Savinjska region). Notranjsko-kraška region is also vulnerable to climate change, while Savinjska region is more vulnerable to demographic change (rank 8).

Podravska and Gorenjska regions have relatively low sum of ranks. Podravska region has final rank 3 mainly because of its low vulnerability to the energy challenge (rank 1), while Gorenjska region has low vulnerability to globalization (rank 2).

The final sum of ranks has Osrednjeslovenska region (sum of ranks 7; final rank 1). In the last rank was put at globalization, demographic change and climate change. Only at the challenges associated with the provision of energy Osrednjeslovenska region is not placed in the lowest rank (rank 4). This means that Osrednjeslovenska region is the best prepared development region in Slovenia to the global challenges and, consequently, least vulnerable region in Slovenia.

5. Discussion and conclusions

The European Commission has for the appropriate creation of development policies analyzed the vulnerability of European regions to the four global development challenges: globalization, demographic change, climate change and energy challenge. In this paper we proposed a system of factors and indicators that can be used to analyze the vulnerability of regions in all four global challenges European regions are supposed to face with. Globalization and demographic change are described each through five socio-economic factors.

Climate change and energy challenge are defined each through four indicators that show the economic structure of regions, how socio-economic system responses to future challenges and scenarios envisaged future state in both areas. The system of indicators was tested in the case of 12 development regions in Slovenia.

At least nine development regions in Slovenia is faced with at least one major challenges in the field of globalization, demographic and climate change and challenges associated with energy use. Pomurska region is facing three challenges. Almost half of Slovene development regions (5 regions) are facing two major challenges, mostly in the fields of globalization and demographic change. One notable development challenge was found in Obalno-kraška region, Jugovzhodna Slovenija and Savinjska region. All three regions have important challenges in ensuring the appropriate energy supply.

Although Podravska, Gorenjska and Osrednjeslovenska regions do not meet major global challenges, they are still faced with inadequate preparation to them in specific areas. In Osrednjeslovenska region appears somewhat greater vulnerability in the areas of participation in tertiary education, aging of the population and low investments in energy efficiency and protection of air and climate. In Gorenjska region main challenges are related to the relatively high proportion of "problematic" activities, ie economic activities, for which we estimate high vulnerability to future climate change. Podravska region is not one of the most economically developed regions in Slovenia; by gross domestic product per capita it is ranked at the beginning of the last third. Anyway, it is not faced with major global challenges. Slightly more vulnerable is just in areas of participation in tertiary education, the employment rate, aging of population and threat of natural disasters, while it has favorable position in the field of energy challenge.

Comparison of the final ranking, which defines the vulnerability of development regions in Slovenia to global challenges, with the rank of regional gross domestic product per capita shows that there isn't any statistically significant connections between the rank of regional GDP per capita and the final rank of the development challenges of development regions ($r = 0.403$; $p = 0.194$). Only three regions have the same ranking in both ranges: Pomurska, Savinjska and Osrednjeslovenska regions. Significant differences between the ranks of the gross domestic product per capita and the assessment of vulnerability of regions to global challenges occured in case of Goriška, Obalno-kraška, Notranjsko-kraška, Podravska and Gorenjska regions. This means that the regional development measurement of gross domestic product per capita is not suitable for assessing the (vulnerability to) future development challenges of regions.

Analysis of regional development programs prepared for every development region in Slovenia shows that more vulnerable regions are aware of their weaknesses, but also opportunities, especially in the field of renewable energy sources and energy efficiency. In regional development programs are to a lesser extent presented measures in the field of climate change and, above all, which is surprising, almost no planned activities was noticed on the issue of demographic change. Therefore, we propose that regional development agencies are more courageous in solving particular the latter two issues.

Global challenges will have a significant impact on the development of the already less-developed regions. Because of their limited (financial, organizational) capacity to adapt new circumstances we expect that regional disparities between regions will increase. We hope that this article presents an approach that might help to identify which areas of the region needs the most attention that they will be prepared on future development challenges.

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