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## A comparative analysis of Lubelskie and Kujawsko-Pomorskie voivodships in the context of environmental competitiveness of regions

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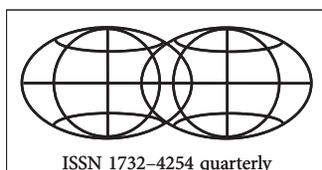
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## A comparative analysis of Lubelskie and Kujawsko-Pomorskie voivodships in the context of environmental competitiveness of regions

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**Abstract.** The aim of the study is an analysis of the environmental competitiveness of Lubelskie and Kujawsko-Pomorskie voivodships. There was performed an analysis of indices of the condition and protection of the environment, and also of the pressures placed on the environment in particular regions in order to assess the environmental competitiveness of Polish voivodships using a rating method (point one).

The comparison of Lubelskie and Kujawsko-Pomorskie voivodships leads to the conclusion that these regions are characterised by a relatively good environmental potential, creating chances for specialisation in a range of those forms of economic activity which are based on the use of environmental resources and values.

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## 1. Introduction

The competitive advantage of a region is based on distinctive, unique features, factors and conditions available for the region, which other regions do not possess or possess to a lesser extent. This is consistent with the concept of endogenous regional development, which is characterised by economic growth based on the creation and exploitation of internal resources. It should be emphasised that regions and cities characterized by high concentrations of production are particularly capable of creating conditions for innovation and knowledge flow between enterprises. Such a diffusion of knowledge and innovative ideas occurring within a region becomes a kind of protective umbrella for the activities of local industry, or even more broadly, for the entire region's economy towards external competition (Szajnowska-Wysocka, 2009).

Thus far, despite some recent exceptions (Kasztelan, 2010a, 2010b, 2011, 2013a, 2013b; Kruk, 2010), discussions of the problems of regional development, including the widely understood regional competitiveness, have focused less on the significance of environmental factors in Poland. Natural capital is a source of significant functions for both the economic system and human life, and its loss may considerably decrease future development opportunities. According to current research, the resources and values of the environment have become a key resource in developmental processes. This way of interpreting natural capital has also gained increasing acceptance in the field of economics (Kudłacz, 2001; Ekins et al., 2003; Malovics, 2007; Malik, 2009; Kruk, 2010;).

## 2. Theoretical basis of regional competitiveness

In the literature, there is no single universally accepted definition of regional competitiveness. It depends whether we are dealing with an interpretation from the viewpoint of public authorities, or from that of enterprises located in the region (Chądzyński et al., 2007).

Among the most frequently cited definitions of regional competitiveness, one can distinguish the definition developed by the Commission of the European Communities which specifies that it is the ability to produce goods and services that meet the requirements of international markets, maintaining a high and sustainable level of income or, more generally, the ability of regions to generate a relatively high income and employment rate under conditions of outside competition (Sixth Periodic Report..., 1999).

On the other hand, Klasik and Markowski (2002: 99-100) define competitiveness of regions as an *'...advantage over other regions, which is an outcome of attractive service offerings targeted at current and potential users of the region, such as residents, businesses, investors, visitors; its source is modern material, institutional and intellectual infrastructure'*.

Additionally, Winiarski (1999b) distinguishes direct and indirect competition. According to this concept, regional competitiveness is the ability to adapt to changing conditions in terms of maintaining or improving a region's relative position in the ongoing direct and indirect competition between them. Direct competition manifests itself as competition for access to all sorts of benefits from outside, e.g. in attracting investors. Indirect competition is expressed in the actions of regional authorities to improve the environment for businesses operating in regions, and thus influencing economic performance achieved in regions.

From this study's point of view, an important definition is the one proposed by Hryniewicki and Sadowski (2006), highlighting the essence of natural capital in achieving competitive advantage. According to this concept, regional competitiveness is an effect of the combination of natural and human-made resources which, once processed, result in satisfactory effects, thanks to which a region will attain a better position in the country as well as in the international arena (Hryniewicki, Sadowski, 2006).

Taking into account the fact that the concept of regional competitiveness is very complex and can be considered from many viewpoints, it is difficult to identify factors influencing this phenomenon. In the literature, one can encounter many studies of the factors of regional competitiveness, which make it possible to identify the following factors:

1. Condition of infrastructure (e.g. Winiarski, 1999a; Martin, 2003; Rucinska, 2009):
  - a) basic infrastructure: roads, railways, aviation, municipal;
  - b) economic infrastructure: real estate suitable for the location of investments, institutions and banking units, insurance and consulting companies, local development agencies, business incubators, etc.;
  - c) social infrastructure: educational institutions, health care system and social services, recreation facilities;
  - d) technological infrastructure: information and communication technologies, telecommunication, the Internet;
2. Developed and diversified economic structure (Pietrzyk, 2000; Gardiner, 2003; Piotrowska-Trybull, 2004);
3. Innovation: the scale of realisable innovative projects, including eco-innovation, the number of patents, the level of R&D, research institutes and universities, connections between companies and science (Makkonen, 2011; Kijek, 2013, Kijek, Kasztelan, 2013);
4. Investment: domestic and foreign, public and private (Piotrowska-Trybull, 2004; Rucinska, 2009);
5. The condition, quality and distribution of natural resources (Winiarski, 1999a; Martin, 2003; Piotrowska-Trybull, 2004; Kosiedowski, 2009);
6. Housing (Winiarski, 1999a; Gardiner, 2003; Kitson et al., 2004);
7. Human resources: demographic trends (migration of skilled workers, diversity), highly skilled workforce (skill-based knowledge) (Gardiner, 2003; Martin, 2003; Kitson et al., 2004; Kosiedowski, 2009);
8. The method of governance and level of management of regional development: the effectiveness of territorial marketing, the ability to absorb financial assets, including those from the EU (Winiarski, 1999a; Martin, 2003; Kosiedowski, 2009);
9. Location in the political and economic space: surrounding regions and countries, distance from metropolis, industrial centres (Kosiedowski, 2009; Rucinska, 2009);
10. The degree of internationalisation: the proportion of exports in the total sales of the region,

foreign investments and their character (Winiarski, 1999a; Martin, 2003).

In addition to the above mentioned factors, the literature indicates the importance of the following determinants influencing a region's competitive advantages: cultural facilities, security, entrepreneurship, access to capital, extent of regional specialisation (Winiarski, 1999a; Gardiner, 2003; Martin, 2003; Kitson et al., 2004; Rucinska, 2009).

### 3. Significance and determinants of environmental competitiveness of regions

Regional variations are a common phenomenon in all countries across the world. Environmental conditions variability is the most stable, but simultaneously the conditions are only slightly dependent on human activity. In this regard, there can be distinguished two kinds of changes: on the one hand, changes in components of the natural environment as a consequence of their development, and to a lesser extent, as a consequence of natural environmental processes (e.g. soil erosion, climate change); and on the other hand, changes resulting from the evolution of the utility of specific environmental features for economic and local development (Kudłacz, 2001).

The state of the environment and the steps undertaken to protect it are increasingly treated as a competitiveness factor, resulting from increasing public awareness with respect to the necessity to protect the natural environment, which is gradually losing its ability to self-regulate.

Natural capital is a source of functions or services essential for both the economic system and human life. Many of these functions cannot be replaced (or at least, not at an affordable price) by human-made capital (modern technologies). Therefore, it can be stated that processes occurring in ecosystems are becoming, either directly or indirectly, the source of general welfare.

Therefore, it can be concluded that one of the main determinants influencing regional competitiveness are widely understood environmental factors, including not only the resources and values of the natural environment, but also elements related

to its quality, the scale of human impact on the environment or the methods to protect it.

Achieving a competitive advantage over other regions based on existing environmental potential, the ability to use it in social-economic growth and development processes, and a low level of anthropopression may be defined as environmental competitiveness of a region (Kasztelan, 2010a).

This competitiveness should be considered two-directionally. Firstly, it may be related to the environmental conditions in a given region, while on the other hand it may concern their skillful use in social-economic processes which will influence any increase in the region's competitiveness.

At this point, it seems justified to demonstrate the factors determining the environmental competitiveness of regions. These factors may be enumerated as follows:

1. Natural conditions – landscape differentiation (land relief, lakes, rivers), air temperature, precipitation and other aspects connected to microclimate, presence of energetic resources and fossil fuels;
2. Geodetic-soil conditions of the region – structure of land management, e.g. contribution of agricultural/forest areas in the general area of the region;
3. State of water resources and extent of their pollution – amount and quality of underground and ground water resources, amount of generated industrial and municipal wastes discharged into water and soil;
4. Quality of air – amount and structure of pollution emitted into the atmosphere, intensity of UV-B radiation, frequency of the so-called acid rain occurrence; number of plants, especially burdensome for the environment, level of pollution neutralized and retained by reducing devices;
5. Amount of waste produced, as well as its structure;
6. Naturally valuable areas, forestation rate and land afforestation;
7. Intensity of road and industrial noise;
8. System of environmental protection and water management – number of wastewater treatment plants in urban and rural areas; sewage networks; devices reducing levels of pollution emitted into the atmosphere (Kasztelan, 2013b).

Taking into account the above factors, different research and analytical methods may be applied to assess the environmental competitiveness of particular regions. This will allow to identify those regions which are characterized by relatively high environmental potential, and thus may direct their development strategies towards processes making use of environmental resources and values. Conducting this kind of analysis should also create the basis for processes of regional specialisation taking into account environmental factors. A more thorough theoretical justification of the concept, or generally the relation between the quality of the natural environment and regional development or/and competitiveness has been presented in Kasztelan (2010a, 2010b, 2011, 2013b).

#### 4. Characteristics of the research method

Lubelskie and Kujawsko-Pomorskie voivodships are regions characterised by similar socio-economic potential. Their contribution to national GDP in 2010 was 3.8% (10<sup>th</sup> position) and 4.7% (8<sup>th</sup> position), respectively. In terms of the average GDP growth per capita in the voivodships for the years 2007-2010 and the relationship of their per capita GDP to the national average, these regions are classified within the group of the so-called outstanding voivodships (Raport Polska 2011). They face a key challenge, which is the necessity of breaking the syndrome of relatively low levels of socio-economic development. It seems that the widely-accepted concept of natural capital could be adopted as one of the key pro-growth factors in the case of the examined regions.

The analysis of the indices of the condition and protection of the environment and of the pressures placed on the environment in particular regions was performed in order to assess the environmental competitiveness of Polish voivodships using a rating method.

Studies conducted on the basis of this method should be treated as the first stage in the assessment of the environmental competitiveness of regions. In further investigations, more advanced methods are to be employed, including those using weightings of importance, e.g. Hellwig's methods. However, at this stage of the study, the point method will al-

low for a preliminary assessment of the phenomenon under study.

According to this method, points from 1 to 16 were attributed to the voivodships within particular indices (the division into 16 NUTS 2 regions is applicable in Poland), depending on the position occupied on the national level with respect to a given factor. Then, the points attributed within particular indices were totalled, producing a total result for each voivodship.

The following indices of environmental conditions, pressures and protection published in CSO statistical yearbooks (Environmental Protection 2012) were used:

1. The proportion of organic land within the overall area of the voivodship (as %);
2. The proportion of forested land within the overall area of the voivodship (as %) (forestation rate);
3. The proportion of lands under surface waters within the overall area of the voivodship (as %);
4. The proportion of devastated and degraded lands requiring reclamation and management within the overall area of the voivodship (as %);
5. The proportion of agricultural lands threatened by wind erosion within the overall area of the voivodship (as %);
6. The proportion of agricultural and forested lands threatened by water erosion within the overall area of the voivodship (as %);
7. The proportion of agricultural and forested lands threatened by gully erosion within the overall area of the voivodship (as %);
8. Consumption of artificial fertilizers in the economic year 2010/2011 (in kg/1 ha of agricultural land);
9. Exploitable underground water resources in Poland (in cubic hectometers per year);
10. Water withdrawal for the needs of national economy and population (in dam<sup>3</sup>/1 km<sup>2</sup>);
11. Consumption of water for production purposes in closed cycles (as % of total consumption);
12. Water consumption in households (in m<sup>3</sup> per capita in cities);
13. Amount of industrial and municipal wastewater discharged into waters or into the ground (in m<sup>3</sup> per 1 km<sup>2</sup> of voivodship area);
14. The proportion of treated wastewater requiring treatment (%);
15. Population in cities connected to wastewater treatment plants (as % of total population of cities);
16. Population in villages connected to wastewater treatment plants (as % of total population of villages);
17. Degree of reduction in generated particulate pollutants especially in noxious plants (as %);
18. Degree of reduction in generated gaseous pollutants especially in noxious plants (as %);
19. Area of special natural value protected by law (as % of voivodship area);
20. Area of parks, lawns and estate green belts (in m<sup>2</sup> per capita);
21. Industrial waste generated during a year (in t/1km<sup>2</sup>);
22. Recovered waste (as % of generated wastes);
23. Waste accumulated so far on own landfill areas (in t/1 km<sup>2</sup>);
24. Proportion of municipal waste collected selectively in relation to the total amount of collected municipal waste (as %);
25. Levels of recycling packaging waste (as %);
26. Proportion of plants exceeding permissible noise levels in relation to the overall number of controlled entities (all %).

For indices from 1 to 3, 9, 11, from 14 to 20, 22 as well as 24 and 25 the maximum number of points was attributed to voivodships with the highest levels of the examined index, while for indices from 4 to 8, 10, 12, 13, 21, 22, 23 and 26 the maximum number of points was attributed to voivodships with the lowest levels of the examined index (Kasztelan 2013a). Table 1 contains a cumulative presentation of the results obtained by particular voivodships in 2011.

## 5. Analysis and discussion of the results

The analysis shows that in 2011, the Warmińsko-Mazurskie voivodship was characterised by the highest level of environmental competitiveness, which received a total of 277 points (Table 1). In comparison to the previous year, this region improved its score by 6 points. On the other hand, for the second consecutive year the Świętokrzyskie voivodship obtained the worst score in the assessment, gaining 144 points in 2011, with 173 points in 2010.



neighbourhood of Inowrocław), very good and good soils predominate: Class I, II and III, in almost 60% of agricultural lands (Szymańska, Biegańska, 2008).

Also, the lowest number of industrial plants in Poland exceeding acceptable levels of noise (29.4% – 45.9% national average) should be noted. Additionally, the Kujawsko-Pomorskie voivodship is characterised by one of the highest percentages of companies in Poland equipped with instruments designed for the reduction of gaseous (16.7% – 14.1% national average) and dust (94% – 88.6% national average) pollutants.

A relatively high proportion of lands under surface water – almost 2.7% of the total area of the voivodship (the national average is nearly 1.8%), undoubtedly predisposes the Kujawsko-Pomorskie voivodship to develop different forms of tourism, recreation and relaxation.

In Europe, the level of surface water and groundwater resources varies depending on the area. In the European classification, Poland is called the 'Egypt of the Europe' because it is characterised by one of the lowest levels of surface water and groundwater in Europe (Poland – 63 km<sup>3</sup> of water, and Norway – 391 km<sup>3</sup>) (Syposz-Łuczak, 2010). On a national scale, the Kujawsko-Pomorskie voivodship is characterised by a relatively high rate of groundwater (1,448.4 hm<sup>3</sup>/year – 1,079.8 hm<sup>3</sup>/year national average). Furthermore, Kujawsko-Pomorskie belongs to a group of voivodships characterised by relatively low levels of water consumption for national economy and population use (14 dam<sup>3</sup>/1 km<sup>2</sup> whereas national average – 33.6 dam<sup>3</sup>/1 km<sup>2</sup>).

Another advantage of the region is the relatively well developed municipal infrastructure, as evidenced by indicators of urban populations (94.4% – 91.1% national average) and rural areas (33.4% – 31.6% national average) exploiting wastewater treatment plants. In addition, this region is one of the inner circle of voivodships with the lowest indication of wastewater emission (3<sup>rd</sup> place, 2,651.7 m<sup>3</sup>/km<sup>2</sup> – national average 2,8456.2 m<sup>3</sup>/km<sup>2</sup>).

In comparison, the Lubelskie voivodship secured above-average scores for only 12 of the 26 indicators taken into account (just over 46%). The environmental potential for the development of the region can therefore be assessed as average. However, one may identify some characteristics of the Lubelskie voivodship, which give an opportunity for pro-environmental directions for further development.

Firstly, rational wastewater management. The Lubelskie voivodship ranks third in the country in terms of the low rate of water consumption in households (31.3 m<sup>3</sup>/1 city inhabitant – 34 m<sup>3</sup>/1 city inhabitant), and also ranks third regarding the highest percentage of treated wastewater requiring treatment (99.7% – 94.2% national average). In addition, it also belongs to a group of voivodships with the least amount of wastewater emitted to water or the ground (4<sup>th</sup> place, 6,197.6 m<sup>3</sup>/km<sup>2</sup> – 28,456.2 m<sup>3</sup>/km<sup>2</sup>).

The second characteristic is the quality of flowing water. In the regions under study, the biological, physicochemical and chemical quality of water was assessed and analysed. With regard to biological criteria, in the Lubelskie voivodship 49% of measurement and control points showed above good conditions, and 51% good conditions. In the Kujawsko-Pomorskie, 37% showed good and above good conditions, 60% moderate conditions, and 3% poor conditions. According to physicochemical criteria, in the Lubelskie voivodship 5.3% of measurement and control points showed very good conditions, 68.4% good conditions, and 26.3% below good conditions. However, in the Kujawsko-Pomorskie voivodship 9.5% showed very good conditions, 30.2% good conditions, and 60.3% below good conditions. Finally, in terms of chemical criteria, in the Lubelskie voivodship all measurement and control points were found to be in good condition without any infringement, while in Kujawsko-Pomorskie, for 9 points evaluated, 67% were found to be in good condition. The analysis allows therefore to conclude that the Lublin region is characterized by relatively better parameters of flowing water.

Taking into account the presence of areas of outstanding natural beauty, such as Polesie, Roztocze (the valley of the Vistula and the Bug) in the voivodship, the large biodiversity and varied landscape, it appears advisable to promote the Lubelskie region as attractive for tourists and recreational activity.

Furthermore, the Lubelskie voivodship is characterised by a relatively high percentage of ecological use in the total area of the voivodship (nearly 0.18%), with a national average rate of 0.11%. Taking into account one of the lowest indicators of artificial fertiliser use (115.4 kg/ha of agricultural land – 125.4 kg/ha national average), and the relative-

ly low proportion of devastated and degraded areas requiring recultivation, one can conclude that in the Lubelskie voivodship there are conditions for further development of ecological food production.

In addition to the above analysis, one should also pay attention to the presence of mineral deposits in both regions. Analysed nationally, the Lubelskie voivodship is abundant in coal deposits (Lublin Coal Basin), siliceous earths (Rejowiec), deposits of phosphorite (Annopol), deposits of limestone and marl (Chełm and Rejowiec), deposits of

road and building stones, quartz sand, and clay materials (Plan zagospodarowania przestrzennego..., 2002). Apart from the above mentioned deposits of local character, there are other mineral deposits of supra-regional significance. These are, among others: crude oil, natural gas, brown coal, glass sand, peat, and chalk lake. In comparison, the Kujawsko-Pomorskie voivodship has significant resources of brown coal and rock salt, as well as limestone, marl, peat, sand and gravel, clay materials and chalk (Program ochrony środowiska..., 2011).

**Table 1.** Assessment of environmental conditions for regions' development (NUTS 2) by scoring method, 2011

Voivodships	Indices																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Dolnośląskie	13	9	4	1	10	9	4	4	6	7	16	7	8	5	12	11	10	12	1	14	2	6	2	2
Kujawsko-pomorskie	16	4	13	6	6	10	10	3	13	11	12	11	11	6	11	10	12	11	9	11	10	8	10	10
Lubelskie	12	3	3	11	4	7	8	11	10	10	8	14	13	14	7	3	2	5	5	6	7	4	11	6
Lubuskie	15	16	12	15	16	12	11	10	7	14	9	12	15	8	6	7	1	3	12	15	14	15	13	5
Łódzkie	7	1	1	7	1	13	14	6	12	8	13	4	12	13	13	1	15	6	2	9	4	1	5	12
Małopolskie	2	8	8	12	11	1	1	15	4	6	7	2	5	9	5	6	14	14	15	4	3	13	3	16
Mazowieckie	5	2	5	14	7	15	16	12	16	2	4	1	2	2	1	5	4	13	7	7	6	3	8	13
Opolskie	4	6	7	3	8	16	12	1	1	13	15	10	9	4	15	13	3	2	6	11	13	7	6	9
Podkarpackie	9	15	6	16	15	5	5	16	2	9	5	15	7	7	8	14	16	16	13	1	12	14	16	15
Podlaskie	8	10	9	10	2	11	15	13	5	16	11	16	16	16	9	2	7	8	10	3	16	12	14	1
Pomorskie	10	14	15	9	14	3	3	5	11	12	6	5	10	12	14	16	5	15	11	8	11	11	12	7
Śląskie	3	12	11	2	5	4	9	9	8	5	14	13	6	3	2	8	13	10	4	16	1	10	1	11
Świętokrzyskie	1	7	2	5	3	2	6	14	3	1	2	7	1	1	3	4	8	1	16	2	9	16	9	4
Warmińsko-mazurskie	11	11	16	8	13	8	2	8	9	15	10	9	14	11	16	12	9	7	14	5	15	9	15	8
Wielkopolskie	6	5	10	4	10	14	13	2	15	4	3	3	4	15	4	9	6	10	9	13	8	5	7	14
Zachodniopomorskie	14	13	14	13	12	6	7	7	14	3	1	6	3	10	10	15	11	4	3	12	5	2	4	3

Source: Own calculations based on Environmental Protection 2012

**Table 1.** Continue

Regions	Indices		Total points	Position
	25	26		
Dolnośląskie	4	5	184	14
Kujawsko-pomorskie	12	16	262	5
Lubelskie	11	14	209	8
Lubuskie	10	2	275	2
Łódzkie	8	6	194	13
Małopolskie	7	10	201	11
Mazowieckie	2	11	183	15
Opolskie	16	15	225	7
Podkarpackie	3	12	272	3
Podlaskie	15	8	263	4
Pomorskie	5	1	245	6
Śląskie	14	9	203	9
Świętokrzyskie	13	4	144	16
Warmińsko-mazurskie	9	13	277	1
Wielkopolskie	6	3	202	10
Zachodniopomorskie	1	7	200	12

## 6. Conclusions

A relatively clean natural environment constitutes a significant growth factor, and this is usually observed in more poorly developed regions. Properly used, this attribute may be a lever to enable regional development assuring prosperity for the inhabitants and also a competitive advantage over other regions. If a region is considered to be a space accommodating human activity, it may be safely concluded that its quality (cleanness) determines its social and economic attractiveness. Enacting pro-active measures to foster environment protection favors the development of the so-called 'green' specialization of the regions, and thus increases their competitiveness on the national or even international level.

The environmental competitiveness of regions can be studied with both simple and more complex statistical methods. This allows for the selection of those regions, which are characterized by a relatively high environmental potential. Thus, local/regional governments can focus their development strategies on processes that utilise resources and environmental quality. Conducting this type of analysis should provide the basis for the development of the processes of regional specialisation, including environmental factors.

Of all Polish regions, the highest level of environmental competitiveness is presented by Warmińsko-Mazurskie, Lubuskie, and Podkarpackie, while Świętokrzyskie, Mazowieckie and Dolnośląskie voivodships are classified lower in this regard.

The comparison of the Lubelskie and Kujawsko-Pomorskie voivodships leads to the conclusion that these are regions characterized by respectively average and above-average levels of environmental competitiveness. In 2011, they were in the 8<sup>th</sup> and 5<sup>th</sup> position, respectively, in a ranking of Polish voivodships. It may be concluded that the Lubelskie and Kujawsko-Pomorskie voivodships are characterised by a relatively good environmental potential, creating chances for specialisation in those forms of economic activities which are based on the use of environmental resources and values.

The analyses presented in this paper are based on one of the simplest statistical methods, known as the point method. Therefore, it is necessary to continue further studies using a more advanced statisti-

cal approach, especially taking into account relative weighting of each indicator in the achievement of regional advantage in terms of environmental competitiveness.

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