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ANALYSIS OF TOURIST ATTRACTIVENESS OF COMMUNES SITUATED ON THE KRZNA RIVER

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Key words: tourist attractiveness, the Krzna river, statistical and econometric methods.

Abstract

The paper presents an analysis of conditions affecting the tourist attractiveness of communes situated along the banks of the Krzna river. The aim of the study was to present the characteristics of tourist traffic recorded in the area of the communes through which the Krzna River flows. The objective of the work was to carry out multi-trait comparisons of communes located on the Krzna river in terms of tourist attractiveness, to determine factors which are the major source of differences between the communities analysed, and to group the communes with similar tourist attractions. The evaluation of commune tourist attractiveness in terms of tourist traffic intensity was based on basic indicators of tourism function (Baretje-Defert index, Schneider index and other) as well as selected variables describing the natural environment status of communes (forests and woodlands, area covered by water). The analysed data is for the year 2015 and comes from the Central Statistical Office of Poland *Local Data Bank*. Principal component analysis (PCA) was used in order to determine multidimensional associations between the characteristics studied. The communes examined differed the most in terms of the characteristics which were the most strongly correlated with the first principal component (PC1). The communes were assigned to 3 groups with different tourist attractiveness properties based on cluster analysis. PCA made it possible to distinguish factors which were the strongest determinants of tourism conditions in the study area. Cluster analysis used to group communes is a useful tool to evaluate the potential of tourism development in communes.

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ANALIZA ATRAKCYJNOŚCI TURYSTYCZNEJ GMIN POŁOŻONYCH NAD RZEKĄ KRZNĄ

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Słowa kluczowe: atrakcyjność turystyczna, rzeka Krzna, metody statystyczne i ekonometryczne.

Abstrakt

W artykule przeanalizowano uwarunkowania atrakcyjności turystycznej obszaru gmin, przez które płynie rzeka Krzna. Celem pracy było wielocechowe porównanie gmin leżących nad rzeką Krzną pod względem atrakcyjności turystycznej oraz wskazanie czynników, które w największym stopniu różnicują analizowane gminy, a także pogrupowanie gmin o podobnych walorach turystycznych. Do oceny atrakcyjności turystycznej gmin ze względu na intensywność ruchu turystycznego wykorzystano podstawowe wskaźniki funkcji turystycznej (wskaźnik Baretje'a-Deferta, Schneidera i in.) oraz wybrane zmienne opisujące stan środowiska przyrodniczego gmin (tereny leśne i zalesione, tereny pokryte wodami). Dane do analizy zaczerpnięto z *Banku Danych Lokalnych* GUS za 2015 rok. W celu ustalenia wielowymiarowych zależności między badanymi cechami zastosowano analizę składowych głównych (PCA).

Badane gminy w największym stopniu różnicowane były przez cechy najsilniej skorelowane z pierwszą składową główną (PC1). Na podstawie analizy skupień pod względem atrakcyjności turystycznej gminy można podzielić na trzy grupy. Zastosowana metoda składowych głównych pozwoliła na wskazanie czynników, które w największym stopniu różnicują warunki turystyczne na badanym obszarze.

Analiza skupień, jako metoda klasyfikacji gmin, jest użytecznym narzędziem służącym do oceny potencjału rozwoju turystyki.

Introduction

Various definitions of tourist attractiveness are found in the literature of the subject. According to KUREK (2007), it may be universal when the area is attractive to the general public or relative when referring to certain forms of tourism (water tourism, cycling, etc.). ROGALEWSKI (1974) mentions tourist attractions – nature and culture and tourist development. There are different methods of assessing the attractiveness of a given area, depending on the outcome of the different classifications, categorization (e.g. class 0 monument, five-star hotel, etc.); as a result of the application of a specific research technique (e.g. attractiveness of the area determined by point boning method). The assessment of attractiveness in this case is called valorisation (POTOCKA 2009). The standardized assessment of tourist

attractiveness is difficult because apart from the objectively existing conditions of the natural, cultural and social environment, psychological factors play an important role in the perception and valuation of the object (WARSZYŃSKA 1970, WARSZYŃSKA and JACKOWSKI 1978)

Factors which determine the tourist attractiveness of a given area are dependent on various determinants, eg: natural environment effectiveness, leisure, cultural and tourist facilities visitors are interested in, the size and diversity of accommodation and gastronomic facilities and theirs prices, public transport service availability, entertainment, cultural and sports events. Attractiveness of the natural environment, including its quality, beauty of the surrounding landscape, access to a river or lake, are perceived as main assets of tourist facilities in rural areas (CHMIEL et al. 2012).

The source of the Krzna river, the largest left-hand tributary of the Bug river, is in the areas of mid-forest marshes located in the Jata Sanctuary, in the north-west of Łuków (51°58′56″N 22°45′59″E). The Krzna flows into the Bug in the proximity of the village Neple (52°07′56″N 23°31′19″E), in the enchanting sanctuary called Szwajcaria Podlaska located 7 km off Terespol. The Krzna river is 119.9 km long. Initially, there are two streams: the Northern Krzna and the Southern Krzna whose parallel riverbeds are about 1 km apart. The streams join after the distance of around 55 km before they reach Międzyrzec Podlaski. The Southern Krzna is thought to be the main branch as it is several kilometres longer (*Studium uwarunkowań...* 2010). Based on the regional division of Poland (KONDRACKI 2002), the Krzna flows along the boundaries of two macroregions: Southern Podlasie Lowland and Western Polesie. The Krzna is a typical lowland river with a slope of 0.35‰ (*Studium uwarunkowań...* 2010) whose flow has been regulated along most of its course. It is the final element of the Wieprz-Krzna Canal which is the longest water canal in Poland built in mid-20th century. Only the final part of the river has many meanders which make it very picturesque. In the valley of the Krzna river there can be found various nature conservation forms (sanctuaries, Natura 2000 areas) as well as localities associated with cultural heritage of the area (eg: Łuków, Międzyrzec Podlaski, Biała Podlaska, Neple).

The aim of the study was to present the characteristics of tourist traffic recorded in the area of the communes through which the Krzna River flows. The objective of the work was to carry out multi-trait comparisons of communes located on the Krzna river in terms of tourist attractiveness, to determine factors which are the major source of differences between the communities analysed, and to group the communes with similar tourist attractions.

Materials and Methods

Data for the year 2015 was used to compare the tourist attractiveness of communes located along the banks of the Krzna river. The data was obtained from the online *Local Data Bank* for the following communes: Łuków, the town of Łuków, Trzebieszów, Kąkolewnica, Międzyrzec Podlaski, the town of Międzyrzec Podlaski, Drelów, Biała Podlaska, the town of Biała Podlaska, Zalesie, Terespol, the town of Terespol (Figure 1).

Fig. 1. Location of analyzed communes upon the Krzna river

The analysis was based on the following variables: X_1 – Baretje-Defert index, which indicates the number of beds available for tourists per 100 inhabitants of a tourist-oriented locality, in literature also called the index of tourist function of a locality (CHUDY-HYSKI 2006), X_2 – Schneider index expressing the number of tourists using accommodation facilities per 100 permanent inhabitants of the area, X_3 – Charvart index which is the number of overnight stays per 100 inhabitants of the area, X_4 – index of accommodation capacity utilisation which is the number of overnight stays per one bed, X_5 – index of the development of accommodation facilities which is the number of tourists per one bed in the area, X_6 – index of tourist traffic density which denotes the number of tourists per 1 km^2, X_7 – index of accommodation density which denotes the number of beds available for tourists per 1 km^2 of the area (BĄK and WAWRZYNIAK 2008, 2009), X_8 – forests and woodlands in hectares, X_9 – area covered by water in hectares. Due to the fact that the variables describing natural conditions were expressed in different units, they were standardised according to the following formula (PANEK and ZWIERZCHOWSKI 2013):

$$z_{ij} = \frac{x_{ij} - \bar{x}_i}{s_i}$$

where:
z_{ij} – value of standardised variable,
x_{ij} – value of i-th variable and j-th commune,
$\bar{x}_i$ – arithmetic mean of i-th characteristic,
s_i – standard deviation of i-th characteristic.

In order to determine multidimensional relationships between the characteristics studied, principal component analysis (PCA) was used to reduce the number of diagnostic variables to obtain a limited number of formal variables called principal components. The number was chosen based on the Kaiser criterion according to which only the components whose eigenvalues are greater than one are subjected to analysis. The principal objective of cluster analysis is to establish groups of objects which are similar in terms of many characteristics (variables). The analysis was based on the Euclidean distance, which is a measure of the distance between objects, and Ward's method as an agglomeration method. The stopping rule applied was Mojena's rule (STANISZ 2009). Calculations were performed using Statistica 12.0 software.

Results and Discussion

The possibilities of tourism development in a given area are determined by a number of factors which differ in character. Of these, tourist resources and assets in the study area are of primary importance (MEYER 2010). Tourist attractiveness of a given area is to a great extent dependent on the quality of natural environment, recreational interests of visitors as well as the size and diversity of accommodation (CHMIEL et al. 2012). Principal component analysis demonstrated that the tourist attractiveness of communes located on the Krzna river was affected by characteristics associated with the first two principal components: PC1 and PC2 which accounted for over 77% of the total variance being the overall multidimensional variation of characteristics (Table 1).

The first principal component, accounting for 47.16% of the total variation, correlated the most strongly with the index of accommodation facilities (-0.970), Charvat index (-0.963), Schneider index (-0.948) and index of accommodation capacity utilisation (-0.947). In terms of these indicators, the communes analysed differed the most as far as tourism function was concerned. The use of these indicators makes possible to compare the

use of accommodation facilities in the communes of the region and applies to tourists in the strict sense of the term, excluding hikers who visit the area and whose number is not included in the resulting value (SZROMEK 2012).

Table 1
Eigenvalues, percent of variance and cumulative percent of variance of the components obtained

Principal components	Eigenvalues	Part of the multi-trait variation being explained	Cumulative part of the multi-trait variation
PC1	4.244	47.160	47.16
PC2	2.695	29.947	77.11
PC3	0.952	10.581	87.69
PC4	0.703	7.813	95.50
PC5	0.355	3.946	99.45
PC6	0.037	0.413	99.86
PC7	0.011	0.127	99.99
PC8	0.001	0.012	100.00
PC9	0.000	0.002	100.00

Source: authors' calculations based on data from the *Local Data Bank* (2015)

Communes which made the most use of their accommodation facilities had the highest Schneider index and Charvat index. These relationships agree with findings reported by SZROMEK (2012) who has demonstrated an existence of associations between Baretje-Defert index, Schneider index, Charvat index and accommodation density.

The second principal component was strongly associated with the index of accommodation density (-0.893), forested area and woodlands (0.839), index of tourist traffic density (-0.701) and area covered by water (0.611); it accounted for almost 30% of the total variation. This component is related both to natural values and to tourist development, which is the basic element determining the attractiveness of tourism (ROGALEWSKI 1974). In communes with larger forested and woodland areas as well as areas covered by water, the index of accommodation density was lower (Table 1 and Table 2, Figure 2). A similar correlation of forested and woodland area with the first principal component (0.931) was reported by RYMUZA et al. (2015). All the communes with a high Chavart index also had the highest index of accommodation capacity utilisation as well as index of accommodation development. Moreover, it is evident from Figure 2 that communes with high values of Baretje-Defert index, tourist traffic density and accommodation density had the smallest forested and woodland areas as well as areas covered by water.

Table 2

Factor load values of the first three principal components as well as diagnostic characteristics, eigenvalues and cumulative eigenvalues of components

Characteristics	PC1	PC2
Baretje-Defert index	-0.589	-0.348
Schneider index	-0.948	0.293
Charvat index	-0.963	0.253
Index of accommodation capacity utilisation	-0.947	0.147
Index of accommodation development	-0.970	0.190
Index of tourist traffic density	-0.370	-0.701
Index of accommodation density	-0.164	-0.893
Forests and woodlands [ha]	0.099	0.839
Areas covered by water [ha]	0.247	0.611

Source: authors' calculations based on data from the *Local Data Bank* (2015)

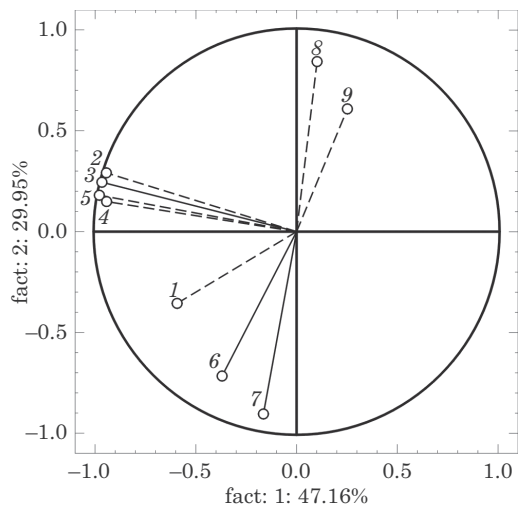

Fig. 2. Location of diagnostic characteristics in the system of the first two principal components: *1* – Baretje-Defert index; *2* – Schneider index; *3* – Charvat index; *4* – index of accommodation capacity utilisation; *5* – index of accommodation facility development; *6* – index of tourist traffic density; *7* – index of accommodation density; *8* – forests and woodlands [ha]; *9* – areas covered by water [ha]

Source: authors' calculations based on data from the *Local Data Bank* (2015)

Cluster analysis performed based on principal components yielded 3 groups of communes with different tourist attractiveness (Figure 3). The first group was composed of the following rural communes: Łuków, Międzyrzec Podlaski, Terespol, Biała Podlaska, Drelów, Kąkolewnica and Trzebieszów. The first group of communes had the lowest values of Baretje-

-Defert index, Schneider index, Charvat index, index of accommodation capacity utilisation, index of tourist traffic density and index of accommodation density. Also, the communes had the largest forested areas and areas covered by water (Table 3).

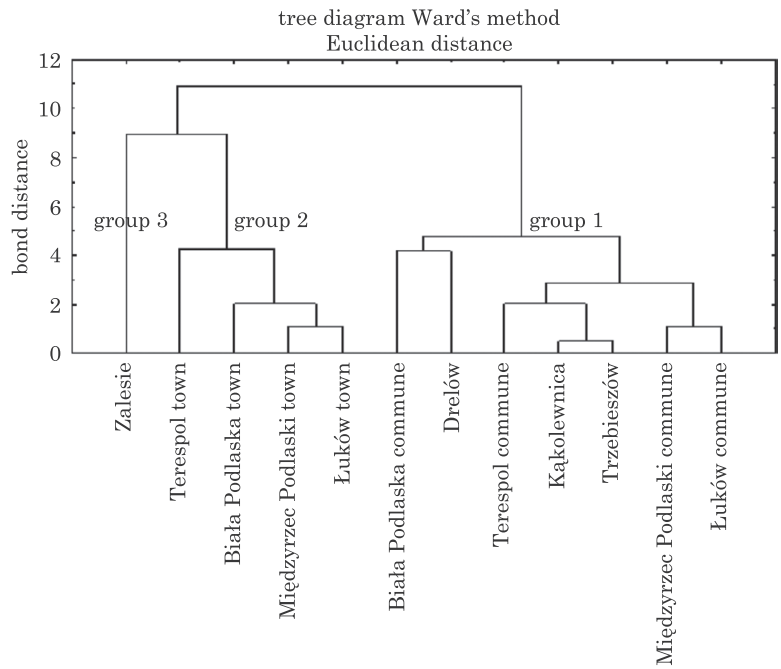

Fig. 3. Dendrogram demonstrating groups of communes with similar natural conditions
Source: authors' calculations based on data from the *Local Data Bank* (2015)

Table 3

Mean values of diagnostic variables in individual groups

Variable	Group 1	Group 2	Group 3
Baretje-Defert index	0.59	1.21	1.63
Schneider index	19.93	38.85	395.26
Charvat index	23.31	53.86	396.70
Index of accommodation capacity utilisation	25.68	63.16	243.92
Index of accommodation development	16.29	46.54	243.03
Index of tourist traffic density	8.50	347.59	119.03
Index of accommodation density	0.28	8.98	0.49
Forests and woodlands (ha)	6401.57	382.75	5609.00
Areas covered by water (ha)	126.57	23.00	79.00

Source: authors' calculations based on data from the *Local Data Bank* (2015)

The course of agglomeration (clustering) indicates that, in this group, Trzebieszów and Kąkolewnica, which formed a cluster at the first step, were the most similar in terms of tourist conditions (Table 4). Group 2 included the following urban communes: Łuków, Międzyrzec Podlaski, Biała Podlaska and Terespol. Within this group, Łuków and Międzyrzec Podlaski were the most similar communes as they were the first ones to form a cluster (step 2). As shown in Table 3, the communes had the highest mean index of tourist traffic density, the highest index of accommodation density but the lowest forested area and area covered by water. A separate group was formed by Zalesie which had the highest values of Baretje-Defert index, Schneider index, Charvat index, index of accommodation capacity utilisation and index of accommodation development. These values indicate that this commune is well developed in terms of tourism (SZROMEK 2012). A similar division of the communes into groups was obtained by means of principal components analysis (PCA). Figure 4 shows spatial variation of the communes in the system of the first two principal components which accounted for over 77% of the total variation. Distribution of communes in the system of the first two principal components indicates that Kąkolewnica and Trzebieszów had the highest mean values of variables associated with the first principal component, that is index of accommodation density, forested and woodland areas as well as area covered by water.

Table 4

Course of agglomeration of communes into clusters

Step	Communes										
1	T	K	–	–	–	–	–	–	–	–	–
2	ŁGW	MPGW	–	–	–	–	–	–	–	–	–
3	ŁGM	MPGM	–	–	–	–	–	–	–	–	–
4	ŁGM	MPGM	BPGW	–	–	–	–	–	–	–	–
5	T	K	TGW	–	–	–	–	–	–	–	–
6	ŁGW	MPGW	T	K	TGW	–	–	–	–	–	–
7	D	BPGW	–	–	–	–	–	–	–	–	–
8	ŁGM	MPGM	BPGM	TGM	–	–	–	–	–	–	–
9	ŁGW	MPGW	T	K	TGW	D	BPGW	–	–	–	–
10	ŁGM	MPGW	BPGM	TGM	Z	–	–	–	–	–	–
11	ŁGW	MPGW	T	K	TGW	BPGM	ŁGM	MPGM	BPGM	TGM	Z

T – Trzebieszów, ŁGW – Łuków rural commune, ŁGM – Łuków urban commune, D – Drelów, K – Kąkolewnica, MPGW– Międzyrzec rural commune, MPGM – Międzyrzec urban commune, BPGW – Biała Podlaska rural commune,TGW – Terespol rural commune, TGM– Terespol urban commune, Z – Zalesie

Source: authors' calculations based on data from the *Local Data Bank* (2015)

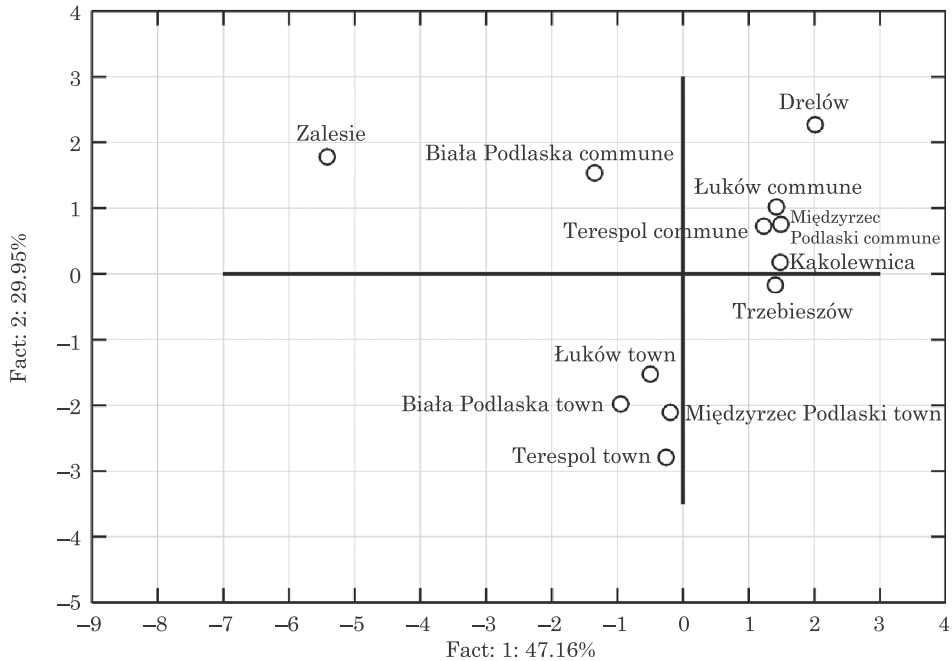

Fig. 4. Distribution of communes in the system of the first two principal components
Source: authors' calculations based on data from the *Local Data Bank* (2015)

It can be inferred from the location of Drelów in the system of principal components that the commune had a low index of accommodation density, index of accommodation capacity utilisation, Schneider index and Charvat index but large forested and woodland areas and an area covered by waters. The following communes: Terespol, Międzyrzec Podlaski, Biała Podlaska and Łuków had average values of the index of accommodation capacity, Schneider index as well as Charvat index. In these communes, the forested area and area covered by water were below the average level. It is worth stressing that the commune Zalesie had high values of variables associated with both the first and second component.

The present study revealed that the tourist attractiveness of areas located along the banks of the Krzna river depends on many factors, the main ones being the development and accessibility of tourist facilities as well as attractiveness of the environment. Similar findings were obtained based on research into the tourism competitiveness and attractiveness of communes located on the Liwiec river (STARCZEWSKI et al. 2014).

Conclusions

1. In terms of tourist attractiveness, communes located on the Krzna river were the most affected by the characteristics which were the most strongly correlated with the first principal component PC1 (that is the index of accommodation development, index of accommodation capacity utilisation, Schneider index and Charvat index).

2. Based on cluster analysis, the communes were divided into 3 groups in terms of tourist attractiveness. Urban and rural communes formed two separate clusters which mainly differed as to the values of their indicators, forested areas and areas covered by water. Moreover, a separate cluster was formed by Zalesie, a commune which had the highest values of Baretje-Defert index, Schneider index, Charvat index, index of accommodation capacity utilisation and index of accommodation development.

3. Principal component analysis made it possible to indicate the factors which had the greatest effect on the tourism conditions of communes located on the Krzna river. Cluster analysis, a method of grouping communes based on variables describing tourism conditions, is a useful tool to evaluate the potential of tourism development in communes. The methods may be used in the process of management and undertaking necessary steps while creating and carrying out the strategy of commune development.

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