

ANALYSIS OF THE POLYCENTRICITY OF ROMANIAN COUNTY RESIDENCES

Antonio TACHE

Main researcher III, National Institute for Research and Development in
Constructions, Urbanism and Sustainable Spatial Development URBAN-
INCERC, e-mail: tonytache@yahoo.ro

Sorin Daniel MANOLE

PhD. Associate Professor, "Constantin Brancoveanu" University of
Pitesti, e-mail: danielsorinmanole@yahoo.com

Monica TACHE

Main researcher, National Institute for Research and Development in
Constructions, Urbanism and Sustainable Spatial Development URBAN-
INCERC, e-mail: nitumaria12@yahoo.ro

Alexandru-Ionuț PETRIȘOR

PhD (Ecology), PhD (Geography), Habil. (Urban planning), Associate
Professor and Director, Doctoral School of Urban Planning, "Ion Mincu" Uni-
versity of Architecture and Urban Planning & Senior Researcher I and Scientific
Director, National Institute for Research and Development in Constructions,
Urban Planning and Sustainable Spatial Development URBAN-INCERC, Bu-
charest, Romania, e-mail: alexandru_petrisor@yahoo.com

Abstract: In order to achieve a balanced and sustainable spatial development within the European Union, two of the basic spatial principles are: developing a balanced and polycentric urban system and promoting integrated transport and communication schemes, likely to favor the polycentric development of the EU territory. Therefore, the development of a methodology for estimating the polycentricity degree of cities becomes a topic of interest. This paper includes the presentation of such a methodology that is based on ESPON 1.1.1 program criteria, but it is original. The submitted methodology is also applied to county residences and to the Municipality of Bucharest. The methodology involves the following steps: identifying some domains characteristic to polycentricity and of some relevant indicators within such domains, the transformation of indicators' values into scores, calculating some composite indices corresponding to the domains and the potential, which is obtained by summing these indices. The analysis of results obtained leads to certain conclusions on the formulation of some regional and national development policies.

Keywords: polycentricity, county residence, domain, indicator, index

1. Introduction

Although the term polycentric development is widely spread both in scientific research and normative agenda, the concept of polycentricity still does not have a shared definition, or a shared measurement method (Veneri and Burgalassi, 2012; Petrișor and Petrișor, 2014). The concept of polycentricity can have different meanings in different countries, depending on national territorial and urban structure, which makes national policies aimed at polycentric development follow different approaches (Meijers *et al.*, 2005). The polycentricity is a multi-layered phenomenon, with each layer displaying a distinctive spatial model, which is why the investigation of the underlying processes requires a variety of methods (Hoyler *et al.*, 2008).

Through a series of studies and reports of the Commission of the European Communities in the 1990s the concept of polycentric urban system was outlined, which was at the core of spatial strategy (Richardson and Jensen, 2000). A successful urban strategy is characterized by the following features: the ability to adapt the economic base to a new demand of specialized production, infrastructure and communication links, efficient transportation, a well educated workforce, good 'quality of life', local institutional capacity and an open attitude towards urban networking with other cities and regions (CEC, 1991, p. 148; Lapushniak *et al.*, 2015; Schvab *et al.*, 2015). To create a more equal economic and social development within the EU's cities, it is necessary to establish joint actions between major urban centers and integrated systems of agglomerations (CEC, 1994).

„Polycentric systems have considerable advantages given their mechanisms for mutual monitoring, learning, and adapta-

tion of better strategies over time” (Ostrom, 2010). A system of urban centers is characterized as being polycentric if it provides, with a minimum of spatial interaction effort, the agglomeration effects needed for economic growth and the equitable distribution of services of general interest (Wegener, 2013). „Due to the complexity of broader field settings, one needs to develop more configural approaches to the study of factors that enhance or detract from the emergence and robustness of self-organized efforts within multilevel, polycentric systems” (Ostrom, 2010). In relational terms, polycentric development means getting new connections by overcoming historical barriers such as those caused by national borders, local rivalries, distance and poor communications (Hague and Kirk, 2003).

In ESPON 1.1.1 European urban systems were analyzed at three spatial levels: at the European level, at the national level and at the regional and local level. This article aims to calculate some general indices expressing potential for the Municipality of Bucharest and county residences. Regardless of the scale according to which polycentricity is analyzed (national, regional or local), these settlements constitute important parts of the urban network, so the study here is the first step in such an analysis.

The polycentricity has two dimensions which are closely related to each other: the morphological dimension and the functional dimension. Morphological dimension regards size and distribution of urban centers across space and is associated with the extent to which the area is characterized by a balanced development (Brezzi and Veneri, 2015). The functional dimension focuses on the way these centers organize the rest of the territory by supplying the functions that shape the

territorial hierarchies (Green, 2007; Petrișor *et al.*, 2012).

In Europe, most monocentric countries have polycentric development policies designed to adjust the dominance of the largest city in the region (which is the capital Region), and relatively monocentric countries tend to have polycentric development policies (Meijers *et al.*, 2007). In general, it is mentioned that polycentric development reduces regional disparities (CEC, 1999 and 2001; Faludi, 2005; Ianoș *et al.*, 2013; Stan, 2014). However, Sandberg and Meijers (2006) found that between most measures of polycentricity and measures of regional disparities there is no significant relationship.

Study of polycentricity at regional level is the subject of numerous articles from the planning and economic geography specialty literature. Among the most representative articles we mention the one analyzing: Italian NUTS 2 Regions (Veneri and Burgalassi, 2012), Dutch Randstad Region (Meijers, 2005; Kloosterman and Lambregts, 2001; Meijers and Romein, 2003), Central Region of Scotland (Bailey and Turok, 2001; Meijers and Romein, 2003), Ruhr area in Germany and Basque Country (van Houtum and Lagendijk, 2001), Rhein-Ruhr Region and Flemish Diamond Region (Meijers and Romein, 2003).

More papers are intended to the study of specific aspects of metropolitan areas polycentricity. We can illustrate with studies aimed at metropolitan areas: Los Angeles (Gordon *et al.*, 1986; Heikkila *et al.*, 1989; Redfearn, 2007), Cleveland, Indianapolis, Portland and St. Louis (Anderson and Borgia, 2001), Chicago (McDonald and McMillen, 1990; McMillen and McDonald,

1997), Paris, Lyon and Marseille (Aguilera, 2005), Munich (Goebel *et al.*, 2007), metropolitan areas in Central Europe (ESPON, 2012), metropolitan areas in Western Europe (Taylor and Pain, 2007), Shanghai (Wang *et al.*, 2012), Hangzhou (Yue *et al.*, 2010; Liu *et al.*, 2011).

In the Romanian literature in the field, there are few papers dedicated to polycentricity or to some aspects related to polycentricity, most of them being theoretical studies, without numerical assessments (Braghina *et al.*, 2008; Ceausescu, 2009; Peptenatu *et al.*, 2009; Talanga *et al.*, 2010; Peptenatu *et al.*, 2012; Tache and Popescu, 2015).

Some of the outstanding theoretical contributions related to polycentricity are: developing a theoretical framework for describing evolution polycentric structure as a result of centripetal and centrifugal forces of economic relations between companies (Krugman, 1996; Fujita *et al.*, 1999; Csomós and Derudder, 2014), construction of a general equilibrium model where congestion and employment location are endogenous (Anas and Kim, 1996) and construction of a stochastic model, which does not accept the assumption of equilibrium (out-of-equilibrium) and which explains the emergence of sub-centers as a result of traffic congestion (Louf and Barthelemy, 2013).

2. Methodology

2.1. Methodology of assessing the polycentric urban system of county residences in Romania

In this study we have used the statistical data available in the county residences and in particular from the National Institute of Statistics but also from other sources, especially Eurostat. As we have seen, the two dimensions that express the concept of polycentricity are morphological polycentricity

tricity, which refers to the size and location of centers and functional polycentricity, which envisages the connectivity between centers. Due to lack of data on connectivity (the volume of traffic or the number of commuters (in- and outgoing commuters) to and from the county residences), the study does not examine the functional polycentricity.

First, we intend to include the county residences of Romania and the Municipality of Bucharest in the categories described in ESPON 1.1.1 program. Therefore, we further detail the categories of towns and criteria for the classification of cities in the European Union, according to the ESPON 1.1.1 Programme (Table 1). For the spatial database we considered several domains, and for each domain relevant statistical indicators were selected, based on the criteria of ESPON 1.1.1. Programme, on the national specific features and existing data. Using its own methodology, the indices of these domains, as well as a general polycentricity index were calculated. The structure of the database for county residences and the Municipality of Bucharest includes the following domains and indicators:

Economy:

- The headquarters of top 100 companies (in terms of turnover);
- Gross domestic product per capita at current prices (in euro) in 2008;
- Gross domestic product per capita at current prices (in euro) forecasted for 2013;
- Dynamic index of gross domestic product per capita at current prices $I_{2013/2008}$;
- Industry gross value added in 2008 as a percentage of GDP;

Population:

- Population in 2011;

Tourism:

- Number of overnight stays in tourist units in 2012;

- Number of tourists in 2012;

Transport:

- Number of passengers transited through the airports in 2012;
- The volume of goods in transit through the ports in 2012;

Education:

- Number of public universities in 2012;
- Number of private universities in 2012;
- Number of students in 2012.

For every indicator there has been achieved a grouping of values registered at the level of cities on 10 equal intervals, thus obtaining 10 groups, which were awarded in ascending order of values, scores from 1 to 10. When an indicator registered a value of 0 at a city, the score given to the city at this indicator was also 0. Therefore, the values of selected indicators were transformed into scores of groups to which they belong (1, 2, ..., 10, even 0) with the statistic support of the program ArcGIS 9.3. For each domain, the scores corresponding to a city recorded for all indicators within that domain were cumulated. Further, we proceed in the same manner as before to transform these values into scores (1, 2, ..., 10, even 0), which are even domain indices. The general polycentricity index that will be called the potential index (or the potential), is calculated by summing indices corresponding to the domains.

3. Results and analyses

3.1. Typology of studied cities

The first problem caused by the analysis is the framing of county residences and of the Municipality of Bucharest into the five categories of cities (Global (G), European (E), National (N), Regional (R), Local (L)) at the domains Population, Industry, Transport, Tourism and Knowledge Activities (Table 2), on the basis of criteria in Table 1. Analyzing the above table, we can see that the Municipality of Bucharest

fulfills the European criteria at the 5 domains, the Municipality Cluj-Napoca fulfills the European criteria at 2 domains and the national criteria at the other 3 domains and the Municipalities Timisoara, Constanta and Iasi fulfill the European criteria at only one of the domains. Moreover, we can notice that the only cities which fulfill the criteria at national or European level at the 5 domains are: Bucharest, Cluj-Napoca, Timisoara, Constanta and Brasov.

We can also notice that there are county residences without framing to certain domains. At the Transport, this thing is caused by the fact that only the following indicators were taken into consideration: number of passengers transited through the airports and volume of goods in transit through the ports, and at the Knowledge Activities the cause is the registration manner of students in the Romanian statistics – according to the university center where they study, and not according to their address.

Table 1. The categories of cities Performed by authors based on information from the ESPON 1.1.1 Programme

| Category | Description | Criteria | | | | | | |
|--------------|--|---------------------------------|----------------------------|----------------------------|----------------------------|--|-----------------------------|---|
| | | Population | Industry | Tourism | Transport | Knowledge Activities | Decision-making centre | Administrative activities |
| Global (G) | Cities with global activities/importance | more than 1%E ¹ | more than 2%E ¹ | more than 2%E ¹ | more than 2%E ¹ | top universities ² | more than 10%E ¹ | EU activities |
| European (E) | Cities with European/Transnational activities/importance | more than 1 million inhabitants | more than 1%E ¹ | more than 1%E ¹ | more than 1%E ¹ | universities with over 50,000 students enrolled | more than 10%E ¹ | Activities with national capital |
| National (N) | Cities with national/regional activities/importance | more than 250,000 inhabitants | more than 5%N ³ | more than 5%N ³ | more than 5%N ³ | universities with over 50,000 students enrolled | more than 10%N ³ | Activities with less capital than the national capital (NUTS 2 or NUTS 3, in compliance with the national definition) |
| Regional (R) | Cities with regional activities/importance | more than 50,000 inhabitants | more than 2%N ³ | more than 2%N ³ | more than 2%N ³ | universities with less than 50,000 students enrolled | more than 5%N ³ | Local administrative activities (compliance with the national definition) |
| Local (L) | Cities first having local activities/importance | more than 20,000 inhabitants | more than 1%N ³ | more than 1%N ³ | more than 1%N ³ | no university | less than 5% N ³ | It is not relevant |

¹ European value, i.e. the values of the 29 ESPON countries; ² not yet defined criteria for a top university; ³ national value

Table 2. Typology of county residences of Romania and Bucharest. Produced by the authors based on the data provided by the National Institute of Statistics and Eurostat and our own calculations.

| The name of the city | Population | Industry | Transport | Tourism | Knowledge Activities |
|-----------------------|------------|----------|-----------|---------|----------------------|
| Vaslui | R | L | - | - | - |
| Focsani | R | L | - | - | - |
| Ramnicu-Valcea | R | R | - | L | - |
| Alexandria | L | L | - | - | - |
| Timisoara | N | N | E | N | N |
| Tulcea | R | L | L | R | - |
| Suceava | R | L | L | R | R |
| Satu Mare | R | L | L | R | L |
| Zalau | R | R | - | - | - |
| Sibiu | R | N | R | N | R |
| Ploiesti | R | N | - | R | R |
| Slatina | R | L | - | L | - |
| Piatra Neamt | R | L | - | L | L |
| Targu Mures | R | R | N | R | R |
| Baia Mare | R | L | L | R | L |
| Drobeta-Turnu Severin | R | L | - | L | - |
| Iasi | N | R | R | N | E |
| Slobozia | L | L | - | - | - |
| Bufta | L | N | - | - | - |
| Bucharest | E | E | E | E | E |
| Miercurea Ciuc | L | R | - | L | - |
| Deva | R | R | - | R | - |
| Giurgiu | R | L | L | L | - |
| Galati | R | L | R | R | R |
| Targu Jiu | R | R | - | R | L |
| Craiova | N | R | L | R | N |
| Targovise | R | L | - | L | R |
| Sfantu Gheorghe | R | R | - | L | - |
| Constanta | N | N | E | N | N |
| Resita | R | R | - | L | L |
| Calarasi | R | L | L | - | - |
| Cluj-Napoca | N | N | E | N | E |
| Buzau | R | L | - | - | - |
| Brasov | N | N | - | N | N |
| Botosani | R | L | - | L | - |
| Braila | R | R | R | R | - |
| Bistrita | R | R | - | L | - |
| Oradea | R | R | L | N | R |
| Bacau | R | L | N | L | R |
| Arad | R | N | L | R | R |
| Pitesti | R | N | - | R | R |
| Alba Iulia | R | R | - | R | L |

Table 3. The indices corresponding to domains and the potential index of county residences of Romania and Bucharest. The data in the table were determined by the authors based on the information from the National Institute of Statistics by own calculations and by using the statistic support of the program ArcGIS 9.3.

| The name of the city | Population | Economy | Transport | Tourism | Education | Potential |
|-----------------------|------------|---------|-----------|---------|-----------|-----------|
| Vaslui | 2 | 1 | 0 | 1 | 0 | 4 |
| Focsani | 3 | 3 | 0 | 1 | 1 | 8 |
| Ramnicu-Valcea | 3 | 3 | 0 | 3 | 2 | 11 |
| Alexandria | 1 | 2 | 0 | 1 | 1 | 5 |
| Timisoara | 7 | 9 | 8 | 8 | 7 | 39 |
| Tulcea | 2 | 1 | 2 | 4 | 0 | 9 |
| Suceava | 3 | 4 | 2 | 3 | 4 | 16 |
| Satu Mare | 4 | 3 | 1 | 3 | 2 | 13 |
| Zalau | 2 | 1 | 0 | 1 | 1 | 5 |
| Sibiu | 4 | 5 | 4 | 8 | 5 | 26 |
| Ploiesti | 5 | 7 | 0 | 3 | 4 | 19 |
| Slatina | 2 | 3 | 0 | 3 | 1 | 9 |
| Piatra Neamt | 3 | 3 | 0 | 3 | 1 | 10 |
| Targu Mures | 4 | 5 | 5 | 6 | 4 | 24 |
| Baia Mare | 4 | 4 | 1 | 4 | 2 | 15 |
| Drobeta-Turnu Severin | 3 | 1 | 0 | 3 | 2 | 9 |
| Iasi | 6 | 7 | 4 | 7 | 8 | 32 |
| Slobozia | 1 | 1 | 0 | 1 | 1 | 4 |
| Buftea | 1 | 5 | 0 | 0 | 0 | 6 |
| Bucharest | 10 | 10 | 10 | 10 | 10 | 50 |
| Miercurea Ciuc | 1 | 3 | 0 | 3 | 1 | 8 |
| Deva | 2 | 4 | 0 | 1 | 1 | 8 |
| Giurgiu | 2 | 2 | 0 | 3 | 0 | 7 |
| Galati | 6 | 5 | 2 | 4 | 4 | 21 |
| Targu Jiu | 3 | 4 | 0 | 4 | 3 | 14 |
| Craiova | 6 | 5 | 2 | 4 | 6 | 23 |
| Targovise | 3 | 4 | 0 | 3 | 3 | 13 |
| Sfantu Gheorghe | 2 | 1 | 0 | 1 | 1 | 5 |
| Constanta | 6 | 8 | 9 | 9 | 6 | 38 |
| Resita | 2 | 3 | 0 | 1 | 2 | 8 |
| Calarasi | 2 | 2 | 1 | 1 | 1 | 7 |
| Cluj-Napoca | 7 | 8 | 8 | 8 | 8 | 39 |
| Buzau | 4 | 4 | 0 | 1 | 1 | 10 |
| Brasov | 6 | 7 | 0 | 9 | 6 | 28 |
| Botosani | 4 | 2 | 0 | 3 | 1 | 10 |
| Braila | 5 | 3 | 2 | 5 | 2 | 17 |
| Bistrita | 3 | 2 | 0 | 3 | 2 | 10 |
| Oradea | 5 | 5 | 2 | 5 | 5 | 22 |
| Bacau | 4 | 5 | 5 | 3 | 3 | 20 |
| Arad | 5 | 5 | 1 | 6 | 5 | 22 |
| Pitesti | 5 | 7 | 0 | 3 | 4 | 19 |
| Alba Iulia | 2 | 4 | 0 | 4 | 3 | 13 |

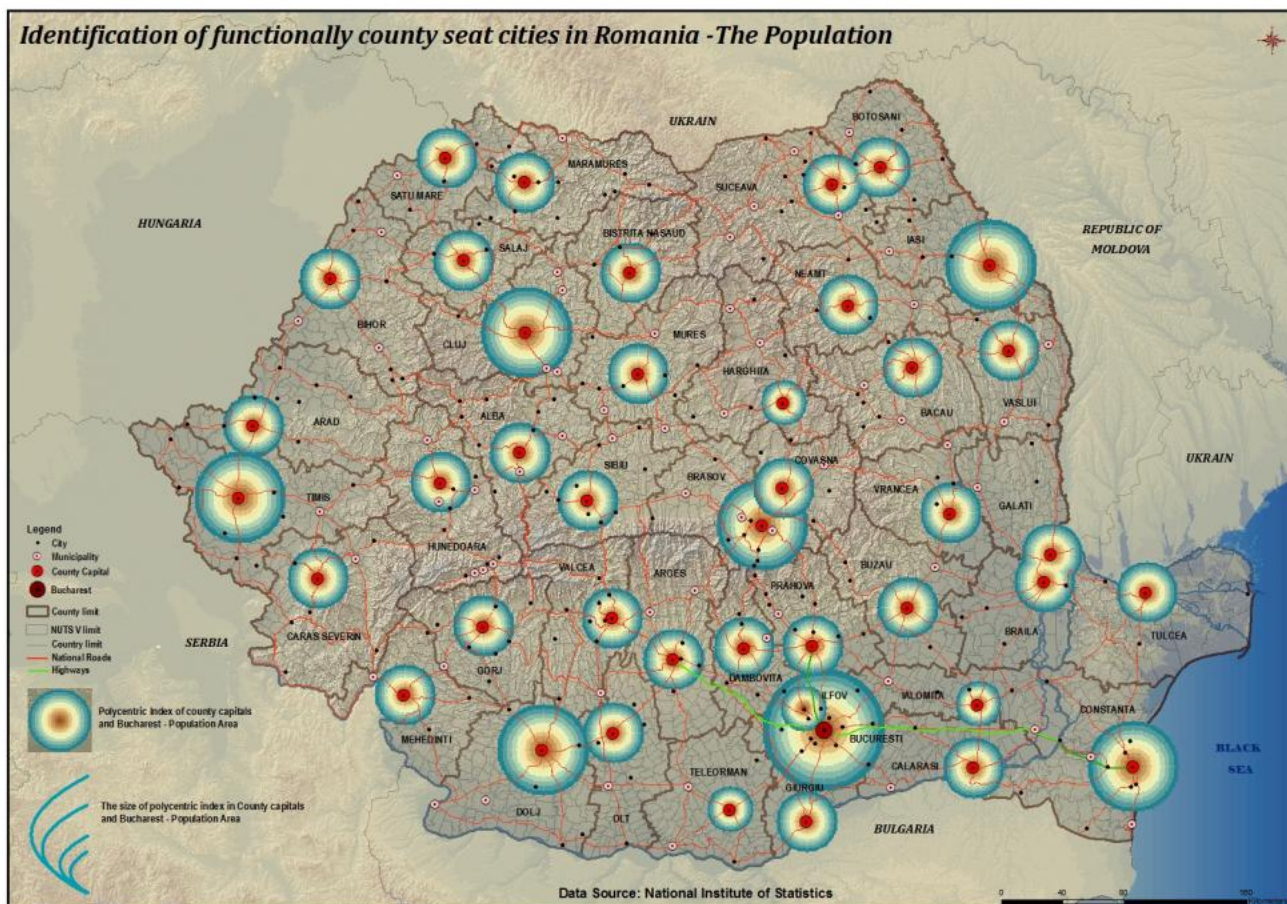


Fig. 1. The population index at the level of county residences of Romania and Bucharest. Produced by the authors based on the data from Table 3 by using ArcGIS 9.3.

At the Tourism, the line represents the very low tourism potential, resulting after having processed the related indicators. At the same time, we can highlight the typology of county residences at every domain. At the Population, the Municipality Bucharest is of the European type and the Municipalities Timisoara, Iasi, Craiova, Constanta, Cluj-Napoca and Brasov are of a national type, according to ESPON 1.1.1 standards.

At the Industry (Competitiveness), domain which involves a high percent of gross value added, we can notice the cities: Bucharest (at European level), Timisoara, Sibiu, Ploiesti, Constanta, Cluj-Napoca, Brasov, Arad, Pitesti and Buftea (all at national level). The Transports domain emphasizes the Municipalities Bu-

charest, Timisoara, Constanta, Cluj-Napoca (at European level), Targu-Mures and Bacau (at national level). The Municipalities of Bucharest is the only one assessed at European level, while Constanta, Timisoara, Sibiu, Iasi, Cluj-Napoca, Brasov and Oradea are assessed at national level at the Tourism domain. At the Knowledge activities domain, Bucharest, Cluj-Napoca and Iasi fulfill the European standards and Timisoara, Craiova, Constanta and Brasov meet the national standards.

In contrast, we can notice county residences that meet only two criteria of classification of the 5, one at local level and the other at the regional or even local level: Vaslui, Focsani, Buzau (with one criterion at local level and other at regional level), Alexandria, Slobozia (with the 2 criteria locally).

3.2. *The indices corresponding to domains and the potential index*

Using the above-mentioned methodology, the indices corresponding to domains and the potential index were calculated (Table 3).

The analysis of the above table reveals discrepancies between county residences: there are county residences (generally, the major cities in Romania) which have high values at all 5 domains and county residences that have low values at all 5 domains. The cause of these disparities is the unbalanced development of the national territory, which is why there is a need of a coherent strategy of territorial development in Romania, which is based on the strengths of less favoured areas, highlighted by priority national projects.

3.3. *Population*

For the population index we performed a cartogram with the assistance of the program ArcGIS 9.3 (Fig. 1). The cartogram was performed on 4 categories of size, according to the typology of the studied cities. The Municipality of Bucharest, by the volume of population, fulfills the European criterion, according to the typology of ESPON 1.1.1. The great cities in Romania with populations over 250,000 inhabitants, out of which we can mention Cluj-Napoca (324,576), Timisoara (319,279), Iasi, Constanta, Craiova, Brasov and Galati, fulfill the national criterion.

There follows a massive group of county residences with populations between 50,000 and 250,000 inhabitants: Ploiesti, Oradea, Braila, Arad, Pitesti, Sibiu, Bacau, Targu Mures, Baia Mare, Buzau, Botosani, Satu Mare, Ramnicu-Valcea, Drobeta-Turnu Severin, Suceava, Piatra-Neamt, Targu Jiu, Targoviste, Focsani,

Bistrita, Tulcea, Resita, Slatina, Calarasi, Alba-Iulia, Giurgiu, Deva, Zalau, Sfantu-Gheorghe and Vaslui, which are of a regional type. Finally, we have county residences which fulfill the local criterion, i.e., with population between 20,000 and 50,000 inhabitants: Slobozia, Alexandria, Miercurea-Ciuc and Buftea, similar to Konecka-Szydłowska and Maćkowiak (2014).

3.4. *Economy*

After having analyzed the cartogram (Fig. 2) and some results obtained by the use of methodology, several ideas can be drawn on the level of the economic development of the analyzed cities.

The only Romanian city belonging to the "European" category is the Municipality of Bucharest, with a GDP per capita at the level of UE 27 average, with many top companies, but with a relatively small decrease of the GDP per capita forecasted for 2013 in comparison with the year 2008.

There are also only 9 cities of national type. The first among them is the Municipality of Timisoara with a high GDP per capita, with an increase in GDP per capita by 11 % in 2013 compared to 2008 and with an upward trend in terms of investments and the presence of 100 top companies. There follows Cluj-Napoca, another municipality in full development, with an increase in GDP per capita by 3% in 2013 compared to 2008 and with very many investments implemented lately. The Municipality of Brasov has an increase in GDP per capita by almost 19 percent in 2013 compared to 2008 and an upward trend in life quality in the city (such projects as The green town, Smart Cities etc.). The Municipality of Pitesti, which follows, had the greatest increase in GDP per cap-

ita during 2008-2013 (25.1%), first of all due to Dacia plant, which is now undergoing a favorable period. For the Municipality of Constanta a revival of the economic development is expected, having an increase in GDP per capita by 7% in 2013 compared to 2008 and a transit of goods through the port of Constanta in full rise. There are three more municipalities in full rise: Ploiesti - an old industrial center re-connected to new technologies by developing technological and industrial parks, Arad and Sibiu - two municipalities which have had an upward evolution during the last 10 years, with an increase in GDP per capita (by 11.3% for Arad and by 10.9% for Sibiu, during the above-mentioned period) and an increase in life quality, which actually has attracted numberless investors. A similar economic de-

velopment is experienced by Buftea, but with a slower increase in GDP per capita during 2008-2013 (only 2.3%) during the period 2000-2008.

In regional cities category we also find the old industrial centers with a great tradition in Romania, but underperformed lately (Popescu, 2014). We refer, first, to the Municipality of Craiova, with an economic recovery materialized in an increase in GDP per capita during 2008-2013 by 6.7%, to the Municipality of Galati, with a decrease in GDP per capita during the same period by 1.7% and to the Municipality of Resita, an old steel mill center with big problems in adjusting to a market economy after 1990, but with a high increase in the same indicator (by 23.6 %).

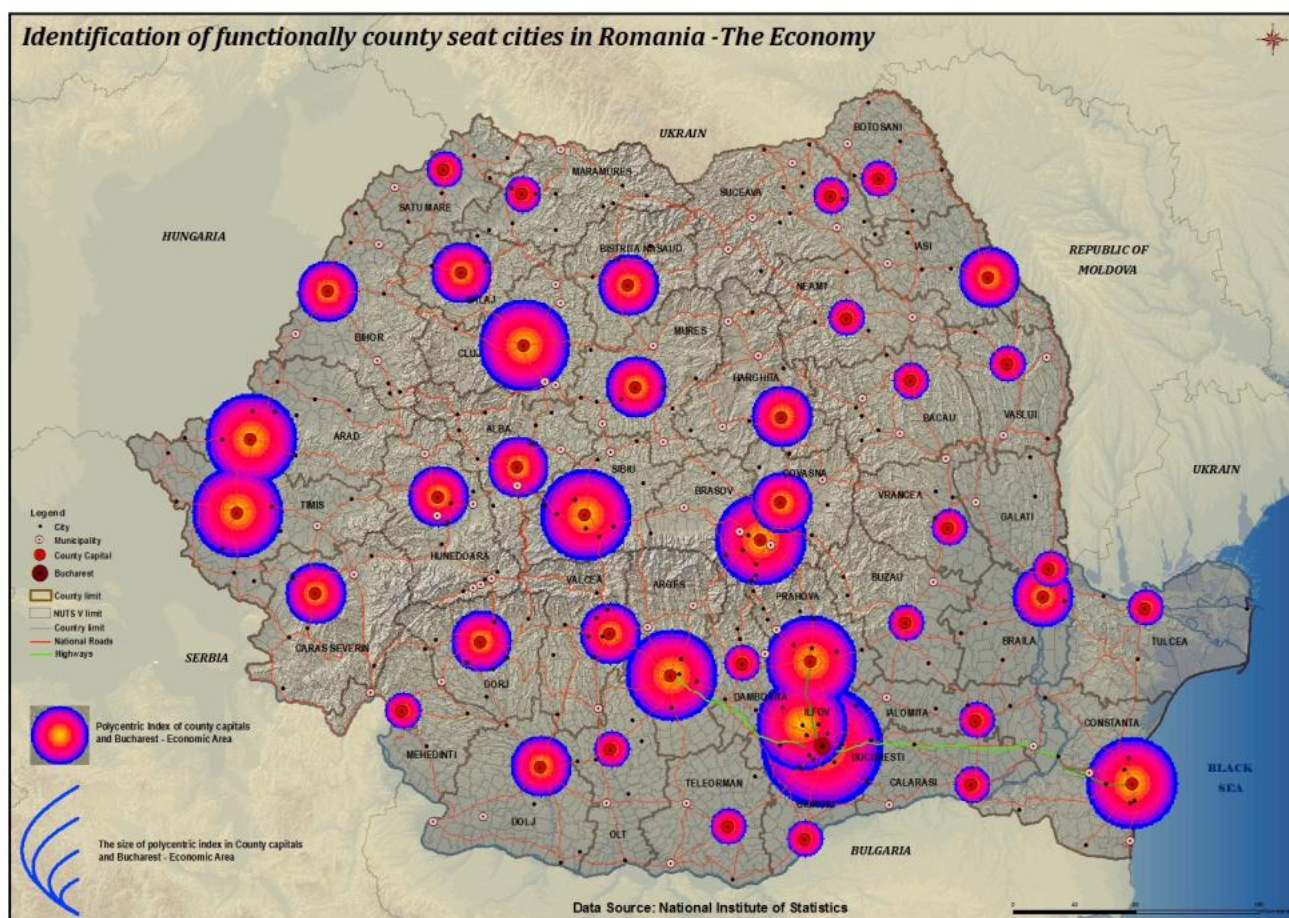


Fig. 2. The economy index at the level of county residences of Romania and Bucharest . Produced by the authors based on the data from Table 3 by using ArcGIS 9.3.

Another Municipality with industrial tradition – Targu-Mures has undergone a series of transformations, with the emergence of new companies and investors, which actually has determined an increase in GDP per capita in 2013 compared to 2008 by 12.9%.

Also on this trend, related to new investments, the emergence of new technologies and thus an increase in the GDP per capita, we can find the Municipalities of Oradea, Iasi, Bistrita. Targu Jiu, mainly due to extractive industry and to electricity production, enjoyed a significant increase in GDP per capita during 2008-2013, by 19.1%. A revival in the economic field is also encountered in the Municipalities of Alba-Iulia, Deva, Zalau, Sfantu-Gheorghe, Miercurea-Ciuc and Braila.

In the category of local cities we meet centers which enjoyed industrial development during the communist period or during the period 1990-2000. Among the municipalities in this category, which generally show an increase in GDP per capita during the period 2008-2013, we can mention: Tulcea (11.4%), Buzau (13.2%), Slobozia (11.1%), Giurgiu (13.8%) and Slatina, Baia Mare, Botosani (all by almost 10%). Small increases in GDP per capita during 2008-2013 are shown in the Municipalities of Bacau, Drobeta-Turnu Severin and Focsani. The Municipality of Calarasi makes an exception, with a relatively high decrease, by 8.4% in GDP per capita during 2008-2013.

3.5. Tourism

Analyzing the tourism cartogram (Fig. 3) and the results provided by applying the methodology we can formulate the follow-

ing ideas. As in the economic field, county residences municipalities fall in 4 of the 5 categories.

The category of European cities is represented by the city of Bucharest, which has had in the last 10 years an upward trend in the number of overnight stays in the tourism facilities and a growing number of Romanian and foreign tourists. We also note the presence of large cities in the "national" category (similar to Hołuj and Hołuj, 2015). The Municipality of Constanta, which also comprises the tourist towns around it, has had a sinuous evolution in the number of overnight stays and tourists, but in the last 5 years it has shown an increase in both indicators. The Municipality of Brasov (with the surroundings) has witnessed an upward trend at both indicators and has prospects for further growth. The Municipalities of Cluj-Napoca and Timisoara, first, and then Sibiu and Iasi have experienced a spectacular evolution in the development of tourism. We can also notice Oradea with a positive dynamic.

In the category of regional cities we find some municipalities with high tourism potential, but still unexploited: Tulcea, Baia Mare, Arad, Alba Iulia, Deva and Targu Mures. Some cities with cultural potential also belong to this category: Craiova, Braila, Ploiesti, Satu Mare, Suceava, Pitesti, Targu Jiu and Galati.

In the category of local towns there are included municipalities with average tourist resources or accessibility problems (not on European transport corridors) (Petrișor, 2010; Popescu and Petrișor, 2010; Sokhna *et al.*, 2015).

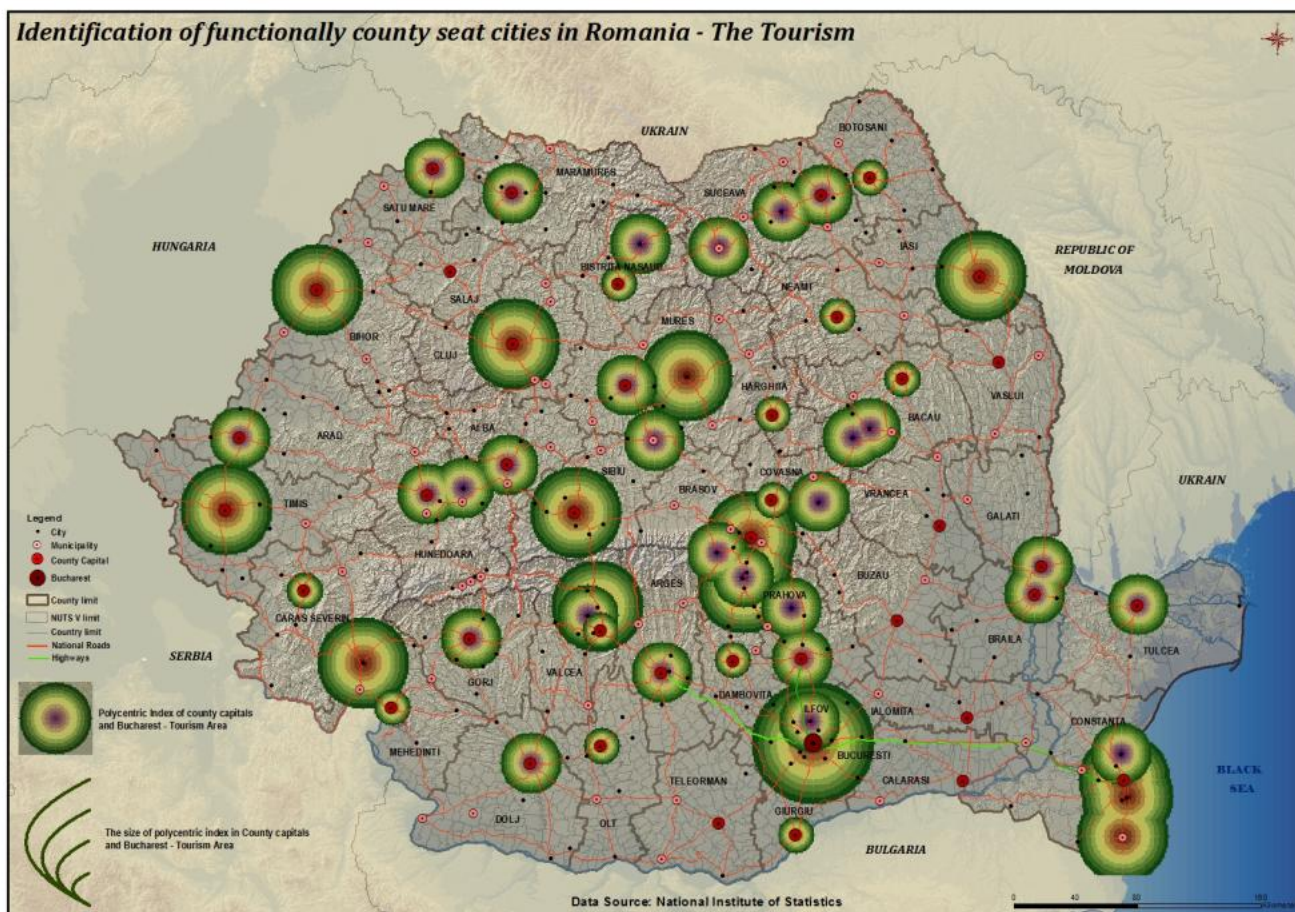


Fig. 3. The tourism index at the level of county residences of Romania and Bucharest. Produced by the authors based on the data from Table 3 by using ArcGIS 9.3.

Among them we can mention: Piatra Neamt, Sfântu Gheorghe, Resita, Miercurea Ciuc, Bistrita. We can also find historic medium sized cities without many cultural elements of attraction, such as: Bacau, Slatina, Targoviste, Giurgiu and Ramnicu-Valcea. There are also unclassified municipalities that have low tourism potential and have achieved a very small overall score according to the methodology, compared with the rest of the county residences. These include Alexandria, Slobozia, Calarasi, Vaslui, Focsani, Buzau and Zalau.

3.6. Transport

The analysis of transport cartogram (Fig. 4) and of evolution of some indicators highlights several elements. The cities studied, this time fall into 4 categories. It should be

noted that road, rail or combined transport were not taken into consideration, because we took into account the criteria in ESPON 1.1.1. The European criterion for the transport domain, according to ESPON 1.1.1, is fulfilled by 4 cities, the first among these is the Municipality of Bucharest, with a traffic through airports of 7,500,000 passengers per year and an upward trend during the last 5 years.

The other ones are Timisoara and Cluj-Napoca, with a traffic through airports of about 1,000,000 passengers for the year 2012 and Constanta, with a transit of goods through port of about 50,585 thousand tons. Still, the Municipality of Constanta and implicitly the county of Constanta, faces a big disillusionment related to Mihail Kogalniceanu Airport, kept al-

most constant for several years at a very low level (about 95,000 passengers in 2012). The category of national cities includes the municipalities of Bacau and Targu Mures, due to high passenger traffic through airports, which in addition has had an upward trend in recent years. The airport in Targu Mures has had a traffic of around 300,000 passengers and the airport in Bacau, around 400,000 passengers.

The category of regional cities includes the municipalities of Iasi, Sibiu, Braila and Galati, the first two because of the number of passengers transiting through airports (around 175,000 passengers), and the last two due to the amount of goods transited through ports.

The category of local cities includes Arad, Oradea, Satu Mare, Baia Mare, Suceava, Craiova (for the number of passengers transiting the airports) and Tulcea, Calarasi, Giurgiu (for the amount of goods transiting ports). We should also mention that the airport from Arad has been renovated, which caused a much lower traffic than in normal operating conditions.

The Municipality of Tulcea was taken into consideration only in terms of transited goods through the ports as the number of passengers transiting the airport in the year 2012 was around 800, entirely insignificant compared to the other airports in the country.

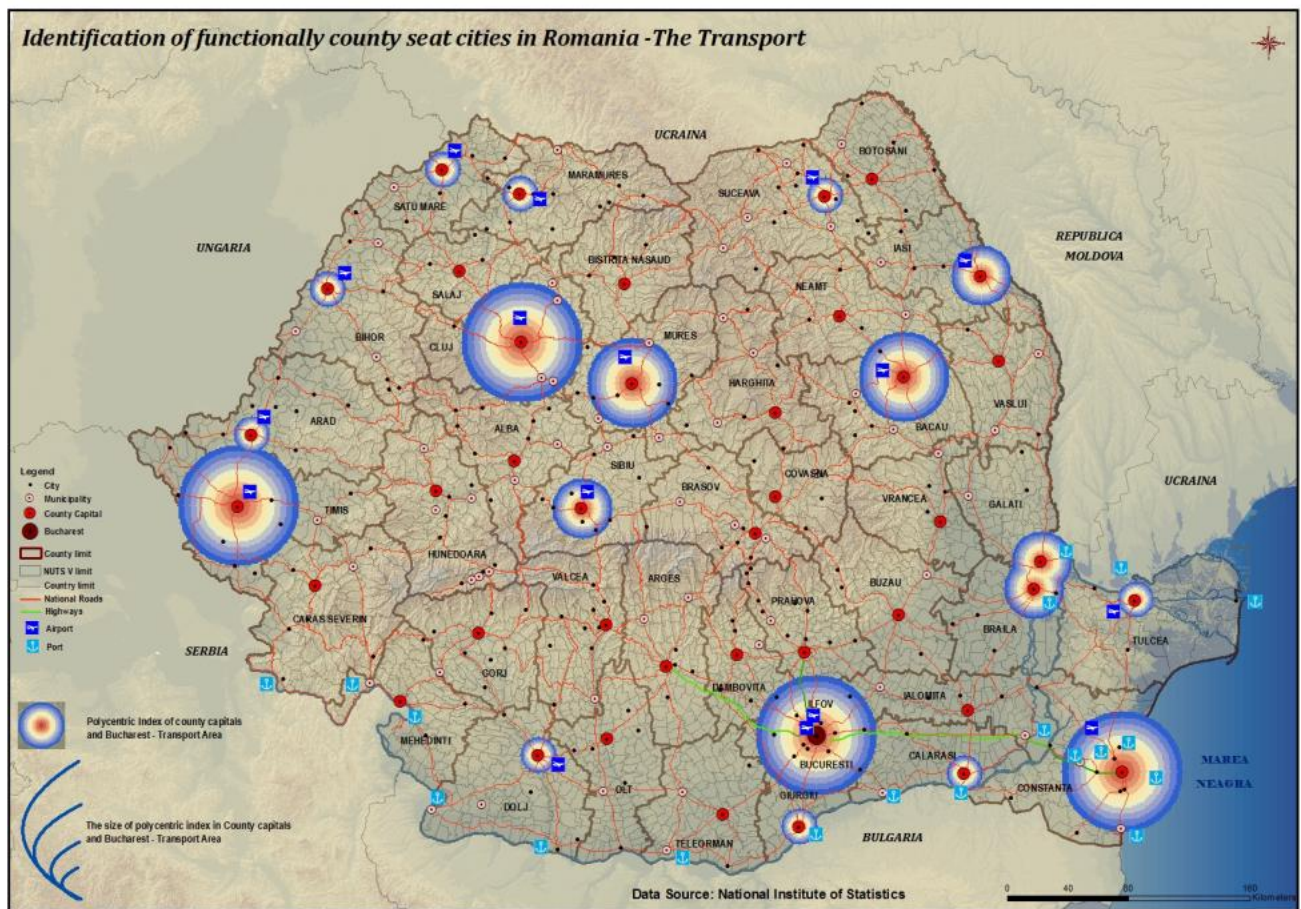


Fig. 4. The transport index at the level of county residences of Romania and Bucharest. Produced by the authors based on the data from Table 3 by using ArcGIS 9.3.

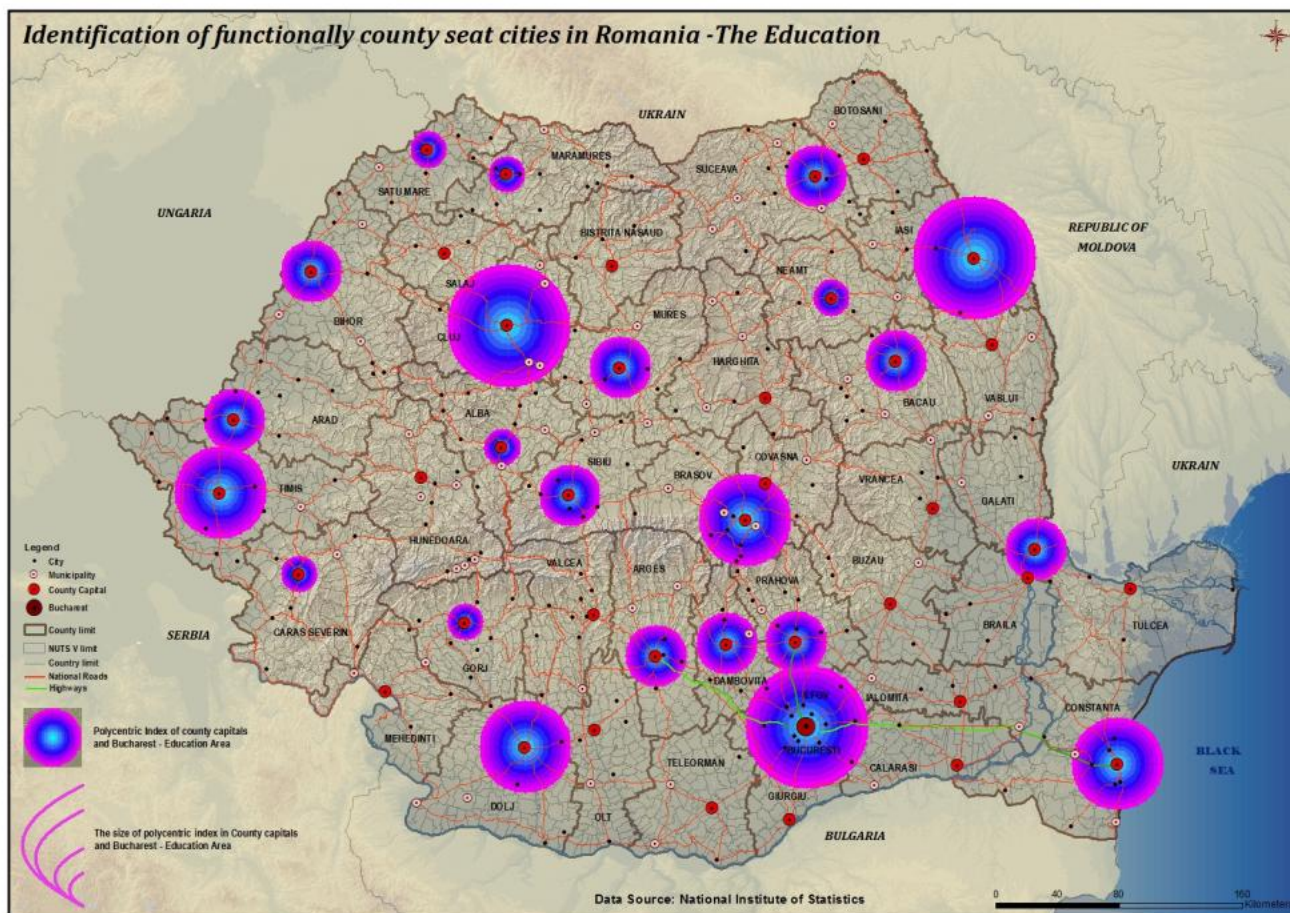


Fig. 5. The education index at the level of county residences of Romania and Bucharest Produced by the authors based on the data from Table 3 by using ArcGIS 9.3.

Table 4. The correlation between indices. Produced by authors by processing data from Table 3 using SPSS.

| | Population | Economy | Transport | Tourism | Education | Potential |
|------------|------------|---------|-----------|---------|-----------|-----------|
| Population | - | 0.819** | 0.795** | 0.730** | 0.877** | 0.916** |
| Economy | 0.819** | - | 0.748** | 0.713** | 0.869** | 0.904** |
| Transport | 0.795** | 0.748** | - | 0.761** | 0.852** | 0.914** |
| Tourism | 0.730** | 0.713** | 0.761** | - | 0.754** | 0.877** |
| Education | 0.877** | 0.869** | 0.852** | 0.754** | - | 0.951** |
| Potential | 0.916** | 0.904** | 0.914** | 0.877** | 0.951** | - |

** Correlation is significant at the 0.01 level (2-tailed)

3.7. Education

For the education index cartogram below was obtained (Fig. 5). At the education domain, as well as for the other domains, we find 4 categories of municipalities. The cities with an extremely low number of students were not taken into consideration. Thus, Bucharest, Cluj-Napoca and Iasi fulfill the European criteria in terms of ESPON 1.1.1. methodology. We should notice that the number of students has been continually decreasing since 2008 in

all the three university centers, but more intensively in the Municipality of Bucharest. The category of national cities includes university centers with tradition, such as: Timisoara, Craiova, Brasov and Constanta.

Similarly to the case of university centers within the first category, there has been a gradual decrease in the number of students since 2008 up to the reference year - 2012.

In the category of regional cities there belong traditional academic centers, but also university centers that have developed during the communist period (similar to Grabkowska and Frankowski, 2016). Specifically, it is about cities such as: Ploiesti, Targu Mures, Galati, Sibiu, Arad, Oradea, Suceava, Bacau, Pitesti and Targoviste. The category of local cities also includes traditional university centers such as Resita or Baia Mare, but also new university centers, with prospects, such as: Alba Iulia, Targu Jiu, Satu Mare or Piatra Neamt. The other municipalities have a number of students below 2,000 (for example Drobeta-Turnu Severin and Ramnicu-Valcea) or they do not have students (Tulcea, Giurgiu and Vaslui).

3.8. Potential index

As stated previously, the potential index is determined by summing the 5 indices corresponding to the domains. In this way, we obtained a score between 4 points (the Municipality of Vaslui) and 50 points (the Municipality of Bucharest).

Based on the Potential Index obtained for each county residences and for the Municipality of Bucharest, we have achieved the cartogram below (Fig. 6). We can notice that the cities which have been studied can be divided into 7 groups according to the potential index. Thus, the first group is represented by the Municipality of Bucharest, which has very good scores at all the 5 domains. In the second group we find Timisoara, Cluj-Napoca and Constanta, considered to be cities with great potential for future development.

The third group includes the Municipalities of Iasi, Brasov and Sibiu, which are also cities with great potential, with the mention that the Municipality of Brasov, due to the fact that it does not have one

airport, failed to be given points in the transport domain.

The fourth group of the potential index includes the Municipalities of Craiova, Arad, Oradea, Targu Mures, Galati, Pitesti, Ploiesti, Bacau, some with a fast development pace while the others facing regress. The fifth group includes the Municipalities of Braila, Suceava, Baia Mare, Targu Jiu, Targoviste, Alba Iulia, Satu Mare, Ramnicu-Valcea, Botosani, Buzau, Piatra Neamt, Bistrita. The sixth group includes the Municipalities of Drobeta-Turnu Severin, Slatina, Tulcea, Focsani, Resita, Miercurea Ciuc, Deva. And the last group includes: Giurgiu, Calarasi, Alexandria, Zalau, Sfantu Gheorghe, Vaslui and Slobozia.

Finally, we study the linear correlation between the domains and between them and the potential (Table 4). As shown in the table above, all correlations are significant (significantly different from zero). Furthermore all are strong and positive correlations (all correlation coefficients are positive and have values greater than 0.7). Consequently, the development of a domain influences both the development of other domains and the increase of potential.

4. Conclusions

Changing the law on spatial planning at national level in the last 10 years, not updating the documentation related to spatial planning and the lack of correlation between landscaping / urbanism documentation and the documentations related to strategic planning are three of the reasons why it is necessary to assess polycentricity and, implicitly, the functional specializations of cities in Romania. The assessment of functional specializations and of intelligent functional specializations enables focusing of public intervention on these areas of specialization.

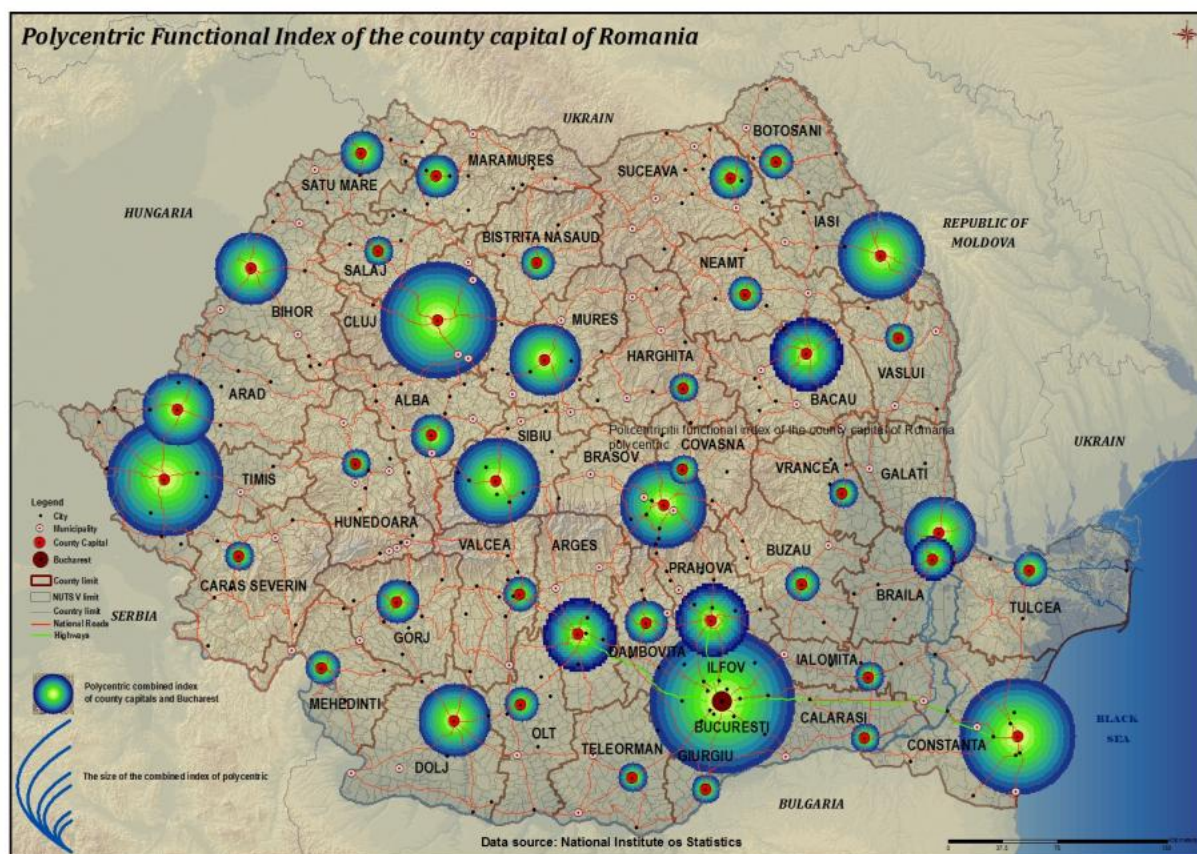


Fig. 6. The potential index at the level of county residences of Romania and Bucharest. Produced by the authors based on the data from Table 3 by using ArcGIS 9.3.

In recent years, considering the economic crisis, many small and medium towns, which have a low economic strength, have lost jobs and labor for countries of the EU or the large cities, and the economic, technological and social development are largely against them. This trend of economic development of small and medium towns in Romania is at odds with the EU policy of territorial cohesion (Alpopi, 2007). In the absence of a dynamic policy, of a development strategy scientifically designed and of consistent plan for urban management, it is possible for a large number of small and medium towns to face a crisis of survival with negative consequences on the territorial balance. The most vulnerable are the cities positioned geographically in places less favorable, in areas located far from a large city and small towns unable to offer

enough range of services and collective equipment and which do not have a geographic location that will enable them to easily integrated into a network of settlements.

Another conclusion that emerges from the results is that in Romania there are few cities that can generate a polycentric development that is a balanced development within their areas of action, which actually means that there will be large areas of territory which are less influenced by the economic expansion of these large cities. From the analysis of the cartogram performed for the transport domain there results the need for construction of new airports, especially in Brasov area, because it would lead to a more rapid development of the area and of Galati-Braila area because there is

a large volume of population concentrated.

In this paper is studied only morphological polycentricity, no functional polycentricity. For evaluate the functional polycentricity can be used special functional polycentricity to commuting networks (Green, 2004 and 2005). However, indices corresponding to the domains and potential index could be estimated to a better accuracy if the results for indicators should be transformed into utilities through linear functions (Manole *et al.*, 2011). All these are elements that form the basis of future papers.

REFERENCES

- Aguilera A. (2005), *Growth in commuting distances in French polycentric metropolitan areas: Paris, Lyon and Marseille*, Urban studies **42(9)**: 1537-1547.
- Alpöpi C. (2007), *Prerequisites for a sustainable model of cities development premise*, Theoretical and Empirical Researches in Urban Management **4(2)**: 1-8.
- Anas A., Kim I. (1996), *General equilibrium models of polycentric urban land use with endogenous congestion and job agglomeration*, Journal of Urban Economics **40(2)**: 232-256.
- Anderson N. B., Bogart W. T. (2001), *The structure of sprawl: Identifying and characterizing employment centers in polycentric metropolitan areas*, American Journal of Economics and Sociology **60(1)**: 147-169.
- Bailey N., Turok I. (2001), *Central Scotland as a polycentric urban region: useful planning concept or chimera?*, Urban Studies **38(4)**: 697-715.
- Braghină C., Peptenatu D., Drăghici C. (2008), *The function of polycentric development in the refinement of weakly polarized areas*, Geographica Timisensis **17(1-2)**: 45-53.
- Brezzi M., Veneri P. (2015), *Assessing polycentric urban systems in the OECD: Country, regional and metropolitan perspectives*, European Planning Studies **23(6)**: 1128-1145.
- Ceașescu A. I. (2009), *Polycentricity and Regional Development*, Annals of the University of Petrosani, Economics **9(3)**: 121-124.
- CEC (Commission of the European Communities) (1991), *Europe 2000: Outlook for the Development of the Community's Territory*, Office for Official Publications of the European Communities, Luxembourg.
- CEC (Commission of the European Communities) (1994), *Europe 2000+: Co-operation for European territorial development*, Office for Official Publications of the European Communities, Luxembourg.
- CEC (Commission of the European Communities) (1999), *European Spatial Development Perspective: Towards Balanced and Sustainable Development of the Territory of the EU*, Office for Official Publications of the European Communities, Luxembourg.
- CEC (Commission of the European Communities) (2001), *Unity, Solidarity, Diversity for Europe, Its People and Territory. Second Report on Economic and Social Cohesion*, Office for Official Publications of the European Communities, Luxembourg.
- Csomós G., Derudder B. (2014), *Ranking Asia-Pacific cities: Economic performance of multinational corporations and the regional urban hierarchy*, Bulletin of Geography. Socio-economic Series **25**: 69-80.
- ESPON (2004), *ESPON 1.1.1. Potentials for polycentric development in Europe*. Luxembourg. ESPON Monitoring Committee, http://www.espon.eu/mmp/online/website/content/projects/259/648/file_1174/fr-1.1.1_revised-full.pdf
- ESPON (2012), *POLYCE. Metropolisation and Polycentric Development in Central Europe. Final Report*, http://www.espon.eu/export/sites/default/Documents/Projects/TargetedAnalyses/_POLYCE/FR/POLYCE_FINAL_SCIENTIFICREPORT.pdf
- Faludi A. (2005), *Polycentric territorial cohesion policy*, Town Planning Review **76(1)**: 107-118.
- Fujita M., Krugman P. R., Venables A. J. (1999), *The Spatial Economy: Cities, Regions, and International Trade*, MIT Press, Cambridge.
- Goebel V., Thierstein A., Lüthi S. (2007), *Functional polycentricity in the mega-city region of Munich*. Conference Paper Annual Meeting of the Association of Eu-

- ropean Planning (AESOP), Naples, Italy.
- Gordon P., Richardson H. W., Wong H. L. (1986), *The distribution of population and employment in a polycentric city: the case of Los Angeles*, *Environment and Planning A* **18(2)**: 161-173.
- Grabkowska M., Frankowski J. (2016), 'Close to the city centre, close to the university'. *Are there symptoms of studentification in Gdańsk, Poland?*, *Bulletin of Geography. Socio-economic Series* **32**: 73-83.
- Green N. (2004), *General functional polycentricity: a definition. Manuscript*. Polynet Working Paper, London: Institute of Community Studies/ The Young Foundation & Polynet Partners.
- Green N. (2005), *Towards a definition of polycentricity in terms of network theory, and the visualisation of polycentricity using a GIS*, available at <http://128.40.111.250/cupum/searchpapers/papers/paper134.pdf>
- Green N. (2007), *Functional polycentricity: A formal definition in terms of social network analysis*, *Urban Studies* **44(11)**: 2077-2103.
- Hague C., Kirk K. (2003), *Polycentricity scoping study*. London: Office of the Deputy Prime Minister, available at <http://archive.northsearegion.eu/files/user/File/Events/Thematic%20Events/Polycentric%20Seminar/ScopingPoly.pdf>
- Heikkilä E., Gordon P., Kim J. I., Peiser R. B., Richardson H. W., Dale-Johnson D. (1989), *What happened to the CBD-distance gradient? Land values in a polycentric city*, *Environment and Planning A* **21(2)**: 221-232.
- Hoyler M., Kloosterman R. C., Sokol M. (2008), *Polycentric puzzles—emerging mega-city regions seen through the lens of advanced producer services*, *Regional Studies* **42(8)**: 1055-1064.
- Hołuj D., Hołuj A. (2015), *Mechanisms of densification of the city in the neoliberal economy - a case study: the surroundings of the eastern part of the former airport runway Rakowice-Czyżyny in Cracow*, *Bulletin of Geography. Socio-economic Series* **27**: 81-93.
- Ianoș I., Petrisor A. I., Zamfir D., Cercleux A. L., Stoica I. V., Tălângă C. (2013), *In search of a relevant index measuring territorial disparities in a transition country. Romania as a case study*. *Die Erde—Journal of the Geographical Society of Berlin* **144(1)**: 69-81.
- Kloosterman R. C., Lambregts B. (2001), *Clustering of economic activities in polycentric urban regions: the case of the Randstad*, *Urban Studies* **38(4)**: 717-732.
- Konecka-Szydłowska B., Maćkowiak H. (2014), *Spatial differences in the level of population and settlement development in Wielkopolskie voivodship*, *Bulletin of Geography. Socio-economic Series* **24**: 93-104.
- Krugman P. (1996), *The Self-organizing Economy*, Blackwell, Oxford, U.K.
- Lapushniak M., Hrytsku V., Hrytsku-Andriesh I., Danilova O. (2015), *Social-geographic analysis and assessment of population's quality of living (the case of Chernivtsi region)*, *Present Environment and Sustainable Development* **9(1)**: 243-248.
- Liu Y., Yue W., Fan P. (2011), *Spatial determinants of urban land conversion in large Chinese cities: a case of Hangzhou*, *Environment and Planning B* **38(4)**: 706-725.
- Louf R., Barthelemy M. (2013), *Modeling the polycentric transition of cities*, *Physical review letters* **111(19)**: 198702(1-5).
- Manole S. D., Petrișor A.-I., Tache A., Pârnu E. (2011), *GIS Assessment of Development Gaps Among Romanian Administrative Units*, *Theoretical and Empirical Researches in Urban Management* **6(4)**: 5-19.
- McDonald J. F., McMillen D. P. (1990), *Employment subcenters and land values in a polycentric urban area: the case of Chicago*, *Environment and Planning A* **22(12)**: 1561-1574.
- McMillen D. P., McDonald J. F. (1997), *A nonparametric analysis of employment density in a polycentric city*, *Journal of Regional Science* **37(4)**: 591-612.
- Meijers E. (2005), *Polycentric urban regions and the quest for synergy: is a network of cities more than the sum of the parts?*, *Urban studies* **42(4)**: 765-781.
- Meijers E. J., Romein A. (2003), *Realizing potential: building regional organizing capacity in polycentric urban regions*, *European Urban and Regional Studies* **10(2)**: 173-186.
- Meijers E., Waterhout B., Zonneveld W. (2005), *Polycentric development policies in European countries: An introduction*, *Built Environment* **31(2)**: 97-102.
- Meijers E. J., Waterhout B., Zonneveld W. A. M. (2007), *Closing the gap: Territorial*

- cohesion through polycentric development*, *European Journal of Spatial Development* **24**: 1-24.
- Ostrom E. (2010), *Beyond markets and states: polycentric governance of complex economic systems*, *American economic review* **100**(3): 641-672.
- Ostrom E. (2010), *Polycentric systems for coping with collective action and global environmental change*, *Global Environmental Change* **20**(4): 550-557.
- Peptenatu D., Pintilii R., Cepoiu L., Draghici C. (2009), *Polycentric development strategy – an efficient instrument in administrative decentralization*, *Romanian Review on Political Geography* **2**(2): 99-111.
- Peptenatu D., Pintilii R., Draghici C., Peptenatu A. (2012), *The efficiency of polycentric development strategies in the context of economic crisis. Case study - the development of Southwest Oltenia region - Romania*, *Bulletin of Geography. Socio-economic Series* **17**(17): 117-125.
- Petrișor A.-I. (2010), *Orientation of communication routes and balanced regional development*, *Theoretical and Empirical Researches in Urban Management* **7**(16): 32-45.
- Petrișor A.-I., Ianoș I., Iurea D., Văidianu M. N. (2012), *Applications of Principal Component Analysis integrated with GIS*, *Procedia Environmental Sciences* **14**: 247-256.
- Petrișor A.-I., Petrișor L. E. (2014), *25 years of sustainability. A critical analysis*, *Present Environment and Sustainable Development* **8**(1): 175-190.
- Popescu O. C., Petrișor A.-I. (2010), *GIS analysis of an area representative for the Romanian hardly accessible mountain regions with a complex and high-valued touristic potential*, *Carpathian Journal of Earth and Environmental Sciences* **5**(2): 203-210.
- Popescu C. (2014), *Deindustrialization and Urban Shrinkage in Romania. What Lessons for the Spatial Policy?*, *Transylvanian Review of Administrative Sciences* **42E**: 181-202.
- Redfearn C. L. (2007), *The topography of metropolitan employment: Identifying centers of employment in a polycentric urban area*, *Journal of Urban Economics* **61**(3): 519-541.
- Richardson T., Jensen O. B. (2000), *Discourses of mobility and polycentric development: a contested view of European spatial planning*, *European Planning Studies* **8**(4): 503-520.
- Sandberg K., Meijers E. (2006), *Polycentric development: panacea for regional disparities in European countries?*, Response paper presented at the 10th UNECE conference on Urban and Regional Research, Bratislava.
- Schvab A., Pintilii R., Peptenatu D., Stoian D. (2015), *Spatial Profile of Poverty. Case Study: The North-Eastern Development Region in Romania*, *Transylvanian Review of Administrative Sciences* **45E**: 201-216.
- Sokhna T., Roșu L., Faye O., Niang A. D., Muntele I. (2015), *Accessibility to basic urban services in Mbour City (Senegal): An approach based on geographical information system*, *Present Environment and Sustainable Development* **9**(1): 47-62.
- Stan M. -I. (2014), *The Opportunity of Romania regionalization*, *Curentul Juridic* **57**(2): 40-45.
- Tache A., Popescu O. (2015), *GIS model to evaluate the accessibility to major transport ways*, *Urbanism Architecture Constructions* **6**(1): 29-36.
- Taylor P. J., Pain, K. (2007), *Polycentric megacity regions: Exploratory research from Western Europe*, *The Healdsburg Research Seminar on Megaregions: Discussion Papers and Summary*, Lincoln Institute of Land Policy, Cambridge, MA, USA, pp. 59-66.
- Tălângă C., Zamfir D., Stoica I. V. (2010), *Urban-rural interface, polycentric development and transportation systems. Case study: Bucharest metropolitan area*, *Human Geographies - Journal of Studies and Research in Human Geography* **4**(2): 47-52.
- Van Houtum H., Legendijk A. (2001), *Contextualising regional identity and imagination in the construction of polycentric urban regions: the cases of the Ruhr area and the Basque country*, *Urban studies* **38**(4): 747-767.
- Veneri P., Burgalassi D. (2012), *Questioning polycentric development and its effects. Issues of definition and measurement for the Italian NUTS-2 regions*, *European Planning Studies* **20**(6): 1017-1037.
- Wang Y., Sun B., Qiao S., Zhou H. (2012), *Polycentric spatial strategy of mega-cities*

in China: The case of Shanghai, Urban Planning Forum 2: 17-23.

Wegener M. (2013), *Polycentric Europe: More efficient, more equitable and more sustainable?*, International Seminar on Welfare and competitiveness in the

European polycentric urban structure, Florence, Italy, vol. 7, pp. 62-64.

Yue W., Liu Y., Fan P. (2010), *Polycentric urban development: the case of Hangzhou*, Environment and planning A 42(3): 563-577.

Received: 9 May 2016 • **Revised:** 21 May 2016 • **Accepted:** 23 May 2016

Article distributed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND)

