

Metropolitan areas, key to balanced spatial sustainable development in Romania / Zonele metropolitane, cheia dezvoltării spațiale durabile echilibrate a României

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Abstract. Spatial policies are meant to ensure a balanced and sustainable development at different territorial levels. Although numerous studies were carried out, consensus was not achieved on the importance of different levels of policies (local, regional, national, European) on the development process, and whether regulated interventions can stimulate development better than the intrinsic mechanisms of territorial processes. This study aims to assess the development of Romania at the level of metropolitan areas, using GIS in conjunction with the statistical and mathematical modeling of territorial dynamics. The results strengthen the importance of the local level in monitoring the efficiency of spatial development policies.

Key words: spatial planning, regional development, ESPON, territorial development, growth poles, spatial policies, functional urban areas

1. Introduction

The concentration of human activities, political power and decision centers in the territory is a paradigm of the evolution of human settlements, as identified in the history of territories. This dynamic implies a hierarchy of human settlements sustained (among others) by the increase of *accessibility of the closest urban center through the development of main and secondary networks of communication. The communication routes sustain the provision of services and increase of functional efficiency of administrative and governance systems.* The diffusion of cities in the territory and evolution of two-way relations of human settlements in the rural territory is a phenomenon that increased its importance in the past 70 years, constituting one of the most persistent characteristics of the contemporary world. The magnitude and political importance of the phenomena defining this dynamic rewrite the priorities of studying territorial dynamics and affect the process of phrasing development policies¹.

The process of developing functional urban areas generated the growth of the development potential and in many cases increased the quality of life within the territories, but produced major problems affecting the territorial ecological balance (increased transport flows and energy flows, decrease of population services, soil sealing by anthropic structures, degradation of cultural and natural landscapes)². The importance of growth poles was restudied using a complex approach based on a territorial context, substantiating the major guidelines of EU and Romanian spatial planning. The approach consisted of elaborating economic approaches sustained by spatial analyses substantiating development policies for

¹ Adell 1999

² E.U. Territorial Cohesion and Urban Matters Workgroup 2010

all spatial scales (European, national, regional, and local). Urbanization (including first the concentration of population and social-economic activities), expressed spatially by urban sprawl, increasing the use density in the peri-urban territory of polarizing centers, is the expression of processes manifested mostly after WW2.

Due to the huge diversity and amount of data, and the change rate important due to the relations between different territorial phenomena, the statement "*planning is the art of possible*"³ surprises in the best way the need to identify and understand the most significant elements characterizing a territory. These lead (due to managing reasons) to the desire to simplify the analysis down to essential data. Regional planning is analyzed along with the national one, an important feature of changes in social systems⁴. An important viewpoint addresses the importance of growing innovation drivers on the transformation of existing social structures⁵, expressed by the increasing interactions between interconnected systems⁶. This assumes the evolution of urbanized regions around cities becoming centers of metropolitan development. The idea of developing a coherent network of European settlements was substantiated by thematic EU projects, such as ESPON 1.1.3⁷.

Despite the decrease of birth rates in Europe, the growth of urban population, especially in the regional centers, stimulated researches on integrated urban and regional planning and development⁸. This trend, evident after 1945 in Western Europe, is targeted to the identification of ad-hoc pools of region-city planning⁹, and resulted into multi-scale spatial approaches of development. The multi-directional development (top-down and down-up) became part of current regional and metropolitan development practice especially after the first ESPON studies (starting with ESPON 1.1.1 in 2004) became the scientific grounds of later studies aimed at substantiating the EU budget allocations. Metropolises are tightly related to regional identities, offering them opportunities for valorizing the economic, social, and cultural development potentials, stimulating their evolution¹⁰. From this perspective, the coverage of the national territory by a network of strong metropolises or urban centers, able to generate existing or emerging functional areas, mirror the evolution of actors (especially economic ones) and their relations in the geographic and economic spaces, and of the networks defining endogenous and exogenous flows (from the metropolitan area and development region). The core analysis of these dynamic structures and spatial relations of population are the start point of phrasing development policies¹¹. The profile of the urban process is an interpretative description of an urban region and its surrounding territory, depending on the development of data banks and identification of the limits of field studies¹². The desirable result is a graph useful and necessary for determining in-depth coordinates of development for the area. The main research areas are ecological resilience,

³ Faludi 1973:261

⁴ Friedmann 2007:2

⁵ Friedmann 2007:9

⁶ Friedmann 2007:11

⁷ The Royal Institute of Technology - Faculty of Civil and Geodetic Engineering et al. 2005

⁸ Hall 2000:99-100

⁹ Hall 2000:121

¹⁰ Scridon and Ilovan 2015 2016

¹¹ Hall and Pain 2006:91-92

¹² James 2015:137

economic welfare, and levels of political involvement of population and cultural vitality¹³. *The analysis of complex territorial structure* identifies the elements influencing territorial development, and a historic perspective can suggest the directions of evolutions. Along with the economic modeling of territorial phenomena, these approaches are the grounds of *national, regional, and local policies*, and of *transposing European objectives* into national ones.

Perroux¹⁴ developed in his works written after WW2 the economic idea of growth poles into a vision of an abstract economic space that must correspond to a geographic area, region or city, referring to the external economies, agglomerations and relations. Other authors (e.g., Albert Hirschman), give the term a negative meaning (impact of growth poles on surrounding regions), underlining the complexity of the issue. This theory develops the previous location theories (Alfred Weber - 1909; Walter Christaller - 1935; August Lösch - 1953). The latest amplifies older spatial analyses correlated to economic dynamics (Johann Heinrich von Thünen - 1826). Other regional development approaches¹⁵ continued regional development studies, underlining through the endogenous development theory the fact that the grounds of spatial organization are the core of regional planning and an alternative to the classical theories. The theories on the development of urban planning are decisively related to global and local environmental issues and directed toward action (relations between land cover and functional anthropic structures)¹⁶. Due to this, the practical knowledge of urban development objectives in urban planning becomes a priority¹⁷. The geometric methods of approximating functional urban areas using Thiessen polygons, or spatial influences of activities – limits of market attraction areas, Reilly-Converse law – 1929 and 1949¹⁸ aim to understand the spatial relations between different activities or activity clusters for substantiating political decisions. They are part of the GIS techniques and methods for the spatial analysis of large and diverse data. There is a strong relation between the spatial distributions of human settlements in the geographic space and the polycentric evolution of development processes¹⁹, affecting the analytical methodologies used for the complex planning of territories.

1.1. Metropolitan areas in Romania

Romanian metropolitan areas, seen as inter-communal cooperation structures, are the result of two complementary phenomena²⁰: urbanization as a result of regional and county-level development convergence, and growth of their peri-urban areas. The declared Romanian metropolitan areas, institutionally functional (Oradea 2001, Iași 2002, Constanța 2006) were followed by a longer series of similar initiatives. They imposed through accelerated development or aspirations of local authorities. The declared metropolitan areas of Cluj-Napoca, Timișoara, Brașov, Târgu-Mureș, Brăila-Galați, Ploiești etc. represent specific development opportunities and restrictions at different moments of their evolution. In the

¹³ James 2015:138

¹⁴ Perroux 1955

¹⁵ Friedmann 1967

¹⁶ Ianoș et al. 2011, Petrișor et al. 2010 2014

¹⁷ Kates 2012

¹⁸ Converse 1949

¹⁹ Duhr 2007

²⁰ Săgeată 2014:106

process of coagulating metropolitan cooperation areas, Bucharest is a special case due to the population size, economic and social power, and politico-administrative importance. The system of Romanian urban settlement is mostly based on centrality (coordination by subordination)²¹.

In Romania, the concentration of population and activities in cities was stimulated by political decisions reflected by Law no. 2 of 1968 on the administrative organization of the national territory. The creation of counties and administrative-territorial seats represented the means for distributing development resources over the national territory (in a centralized economic system) and stimulated the emergence of social and economic centers changing the urban-rural population balance to favor the first starting 1985²². Although no suburban communes administratively subordinated to the polarizing city were created (Decree-Law 38/1990, Art. 2), the strong economic and social ties developed up to the moment (especially by commuting within the labor force basin) led to the sprawl and development of peri-urban areas. The economic, social-demographic and cultural structuring process continued, and many Romanian county seats are part of the process of developing functional urban areas or incipient metropolization process. Through its rapid evolutionary nature, where anthropic pressure forces natural rhythms, spatial planning is a continuous process, evolving based on the influence of its contextual drivers. Thus, planning is a complex process²³, implying diverse professional and normative-institutional resources. The analysis of territorial coverage is not only part of the territorial process with its multiple coordinates, but also of planning. Specific territorial development policies rely on spatial theories of the regions. Operationally, Romania adopted this vision starting with Law no. 315 of 2003, updated). The approach was detailed by Law 350 of 2001 on urban planning and the National Spatial Plan – Law 351 of 2001 on the network of settlements.

The assessment of territorial administrative units at LAU 2 level in Romania is very necessary for estimating existing gaps between different regions and for correcting national, regional and local policies in territorial planning. The first, and probably the most important, step in the process of developing indicators is to clarify the basic concept which is to be represented by the analysis²⁴. Analytical structuring identifies those elements that influence the territorial development of short-, medium- and long-term territorial administrative units. To this end, European policies in the field and global development trends need to be taken into account. Also, the analytical structuring should take into account national, regional and local policies as well as the way to translate European objectives into national targets. The sustainable-growth policy approach will be characterized by strong emphasis on improving the resource efficiency in Europe by a proactive approach toward greener economic development strategies, and supporting measures of adaptation to climate change²⁵. It forecast that accessibility to the nearest urban centre, good secondary networks and levels of service provision (stronger focus on local accessibility than European scale) will be enhanced in this perspective, reinforcing the polycentric structure based on small and

²¹ Săgeată 2014:98

²² Voineagu 2007:44

²³ Faludi 1973:330

²⁴ Coombes and Wong 1994

²⁵ Servillo et al. 2011

medium-sized towns²⁶. At the same time attention will be paid to policies toward immigration and to accessibility to services of general interests in small towns for rural residents, and increase the accessibility to job opportunities and services²⁷. In the smart-growth policy approach, the role of large metropolitan areas is strengthened by focusing resources and efforts on investing in hi-tech technologies and by improving and improving European research networks and by investing in higher education institutions. Also, in the last decade large metropolitan areas have developed cultural industries, defending a new economic order that assigns culture and information a key role in regional and urban economies²⁸. The competitive advantage of the territories does not depend solely on their endowment of national resources (capital, labor and money); it depends fundamentally on their innovative dynamic²⁹. In this global system of urban and rural networks an important role is represented by the local government system. The EU is in the process of becoming a multi-level governance system and sub-national actors are given a role in policy-making³⁰. A well established and reliable governance system of a place can be a factor of localization, in particular concerning the "mobilization process" through which territorial assets are activated³¹. The future of these networks of localities will be influenced as much as possible on the quality of life and the attractiveness of the environment. There is a frequent confusion between attractiveness and competitiveness as many researches are made from economic perspectives³². The focus is often on production factors and space opportunities in order to attract firms, investors or qualified workforce³³. Studies on "creative cities" have shown the importance of space amenities and infrastructures in order to attract well-educated active people, the so-called "creative class"³⁴. Romania's Territorial Development Strategy (SDTR) is the long-term programmatic document establishing Romania's territorial development guidelines, based on a strategic concept, as well as the implementation directions for a period of more than 20 years, at regional, interregional, national scale, integrating relevant aspects across borders and transnational. Long-term territorial indicators will be periodically evaluated for the assessment of long-term territorial development policies.

1.3. Methodological issues

Land cover and use changes were assessed using several methods, such as the Integrated Spatial Decision Support Systems - which also embed economic models³⁵, old maps using in conjunction with soil mapping³⁶. However, they are hard to monitor without geospatial technology and data³⁷. Identifying the indicators for this study on the classification of territorial administrative units has taken into account national, European and local

²⁶ Tache and Petrișor 2017

²⁷ Russo et al. 2012

²⁸ Hall 1998, Simmie 2005

²⁹ Natário et al. 2012

³⁰ Warleigh 2002

³¹ Russo et al. 2012

³² Tache et al. 2017

³³ Kwiatek-Sołtys 2014

³⁴ Florida 2004

³⁵ van Delden and McDonald 2010

³⁶ Stângă and Niacșu 2016

³⁷ Xiao et al. 2006, Li et al. 2007, Osaci-Costache et al. 2015, Dulamă and Ilovan 2017

development trends of the localities network globally. The role of sustainable development agendas and the implementation of European Union policies are important in the construction of the criteria and indicators³⁸. Data availability is perhaps the most fundamental problem restricting the eventual set of indicators. The scientists have much to offer benchmarking studies in terms of the variables to include, best measures and data sources for variables chosen, and reasonable “formulas” or methods for combining the selected variables to best reflect the regional characteristic of interest (e.g., competitiveness, innovative capacity, entrepreneurial environment). The ranking studies vary in how the selected indicators are combined into the final index, rank, or grade³⁹. Various statistical techniques, including regression analysis, factor analysis, multi-criteria analysis, and cluster analysis, can be used to produce a combined multivariate index from the selected indicators⁴⁰. To determine the level of territorial development of administrative units, a great number of various and often incompatible criteria should be considered⁴¹. Therefore, statistical evaluation techniques should be designed to match the indicators for all areas studied and take into account both quantitative and qualitative aspects. The most important, step in the process of developing indicators is to clarify the basic concept which is to be represented by the analysis. For this reason, statistical techniques must be implemented according to the purpose of the study. Dario Cziraky⁴² proposed a multivariate statistical framework for regional development assessment based on structural equation modeling with latent variables and show how such methods can be combined with non-parametric classification methods such as cluster analysis to obtain development grouping of territorial units. These methods have several important advantages over the previously taken approaches in the literature in that they, the most important advantage take account of distributional issues in turn enabling application of more powerful inferential techniques⁴³. Assessing the major aspects of economic and social development of the Lithuanian regions, including the environmental problems, as well as multidimensional character of the criteria, the different directions of their changing and significances was the subject of a scientific study using multi-criteria assessment methods. The main advantage is that Multi-criteria evaluation methods allow to take into account multidimensional character and different directions of the criterion change as well as different significances (weights) of the criteria describing the development of the regions⁴⁴. To assess the regional disparities in Romania a new variant of the relative distances ranking method was adapted, so as to make it possible to measure simultaneously the intra and inter-regional disparities. Based on a multidimensional index of inequality, the Romanian counties plus Bucharest municipality have been ranked and included into four major development categories, according to their relative position in economic development. Gini coefficient, Herfindahl index and Theil index have been also employed, suggesting a relatively low amplitude of both inter-regional and intra regional disparities⁴⁵. Neural general regression network is a new approach used to solve complex non-linear modeling problems. Based on this method it was calculated an

³⁸ Musson 2010

³⁹ Barkley 2008

⁴⁰ Coombes and Wong 1994

⁴¹ Wang et al. 2008

⁴² Cziraky 2006

⁴³ Cziraki 2006

⁴⁴ Ginevičius et al. 2009

⁴⁵ Goschin et al. 2008

index system in 109 counties in Henan region for evaluating territorial functions including agricultural function, social function, economic function and ecological function. This model based on a General Regression Neural Network (GRNN) makes a comprehensive evaluation and analyses the chronological evolution process of territorial functions of 109 counties in 2000, 2005 and 2010⁴⁶. The EU Regional Competitiveness Index (RCI) is the first composite indicator which provides a synthetic picture of territorial competitiveness for each of the NUTS 2 regions of the 27 EU Member States. It builds on and modifies the approach of the Global Competitiveness Index of the World Economic Forum (WEF). It consists of eleven pillars grouped in three groups: basic, efficiency and innovation. A original study embedding mathematical methods (ELECTRE) and Delhi method in a GIS in order to produce hierarchies of the territorial indices at the NUTS levels III and V, displayed as charts and maps underlining the disparities between the socioeconomic, cultural and environmental aspects of the development was achieved during 2007-2009 in a Romanian research project⁴⁷. Implementation a set of indices for monitoring the effects of new regional development policies of the European Union, as well as other sectoral policies with territorial effects, resulted into the creation of new flexible systems, able to increase the administrative capacity to access structural and cohesion funds at regional level in Romania. Data Envelopment Analysis (DEA) is a linear programming technique that obtains flexible weights directly from the data⁴⁸. DEA tries to find for each case a set of specific weights such that a weighted sum of values is maximized with the restriction that none of the cases receives a score greater than unity (for a recent review of DEA methods see the authors below⁴⁹). New territorial development trends at European level take into account accessibility at macro and micro levels, polycentric development of localities, governance of metropolitan areas and smart specialization of cities and regions⁵⁰. The new approaches require new statistical indicators and methods of mathematical, statistical and IT evaluation.

1.4. Research goals

The study aims to identify the opportunities and limitations of territorial development capacities of territorial administrative units, in order to enable balanced and sustainable long-term national and regional development policies in accordance to the sustainability goals.

2. Data and methods

The study proposes a methodology for assessing the performance of metropolitan areas in the last 10 years based on evolving statistical indicators, an innovative mathematical-statistical method, and the analytical capacity of Geographical Information Systems. The statistical indicators quantifiable over time were selected based on their ability to express most adequately the socioeconomic performance of investigated metropolitan areas. These indicators relate to the mobility of people and evolving economic performance. The GIS

⁴⁶ Chao 2017

⁴⁷ Manole et al. 2011 2012

⁴⁸ Charnes et al. 1978, Banker et al. 1984

⁴⁹ Lovell and Pastor 1999, Liu et al. 2011 Yang et al. 2014 and Cook and Seiford 2009

⁵⁰ Tache et al. 2016, Manole 2017, Manole et al. 2018

database contains the following indicators for the administrative territorial units within the investigated metropolitan areas:

- Number of new dwellings (2012, 2013, 2014, 2015, 2016);
- Total number of dwellings (2016);
- Population of administrative territorial units (2008, 2011, 2014, 2016, 2017);
- Number of employees within the administrative territorial units (2008, 2011, 2014, 2016);
- Turnover of the administrative territorial units (2009, 2011, 2013, 2015, 2016).

Core statistical indicators were combined into indices pinpointing correctly the territorial dynamics of investigated metropolitan areas. The following joint indices were identified:

- Ratio of the number of new dwellings built within the last 5 years and total number of dwellings per administrative territorial unit in 2016;
- Ratio of the 2016 number of employees and 2016 population of administrative territorial units;
- Average slope of the increase of the number of employees;
- Average slope of the increase of turnover;
- Average slope of the decrease of population.

Similar to the evaluation of Romanian functional areas⁵¹, for each joint index values were grouped in 10 classes using the natural breaks (Jencks) classification, labeled from 1 to 10. Classes are defined by large gaps between the threshold values. If an index was in class 0, the score of the administrative territorial unit was 0 too. Thus, values of indices were transformed scores for their groups (1, 2, ..., 10, even 0), using the statistical tools of ArcGIS 10.4. For each index joint using iterative techniques (Delphi method) weights were assigned to build up a joint index for the performance of administrative territorial units within the investigated metropolitan areas.

3. Results and discussion

The map of investigated metropolitan areas, presented in Fig. 1, is based on data available on the websites of Romanian metropolitan areas and other sources, including online publications.

The assessment of the dynamic of the housing index (a joint index consisting of the ratio of the number of new dwellings built within the last 5 years and total number of dwellings per administrative territorial unit in 2016) is displayed in Fig. 2; bright colors suggest a positive trend, and dark colors indicate negative trends compared to the total number of dwellings in 2016.

The results indicate a significant increase of new dwellings around the large cities: Bucharest, Cluj-Napoca, Timișoara, and Constanța and partially around Iași, Craiova, Pitești, Oradea, Arad, Sibiu and Ploiești.

⁵¹ Tache et al. 2018b

The ratio of the 2016 number of employees and 2016 population of administrative territorial units has a positive trend within the development corridor Timișoara-Arad and in Ilfov County, and partially around the cities Brașov, Oradea, Ploiești, Sibiu, Baia Mare, and Târgu Mureș (Fig. 3).

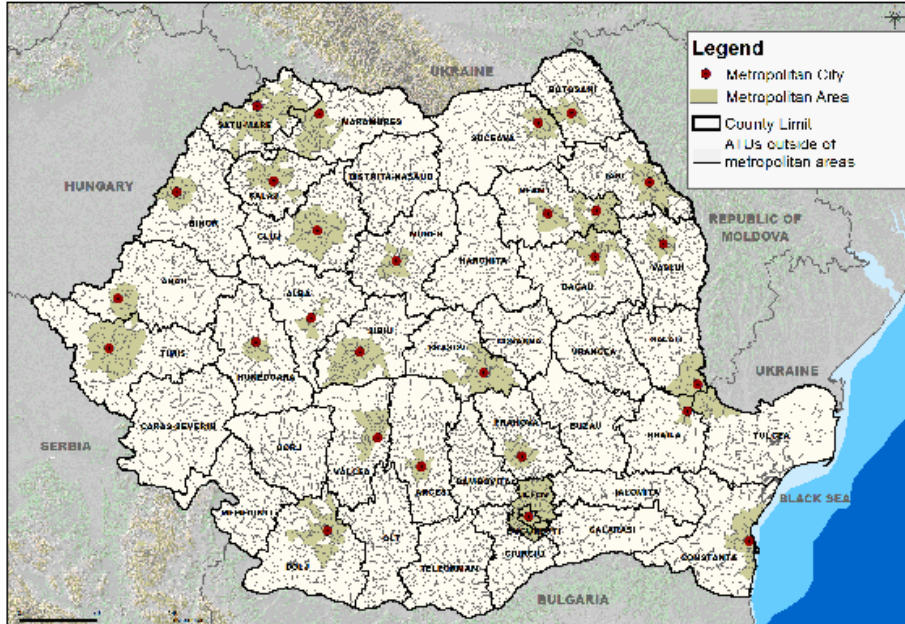


Fig. 1. Investigated metropolitan areas.

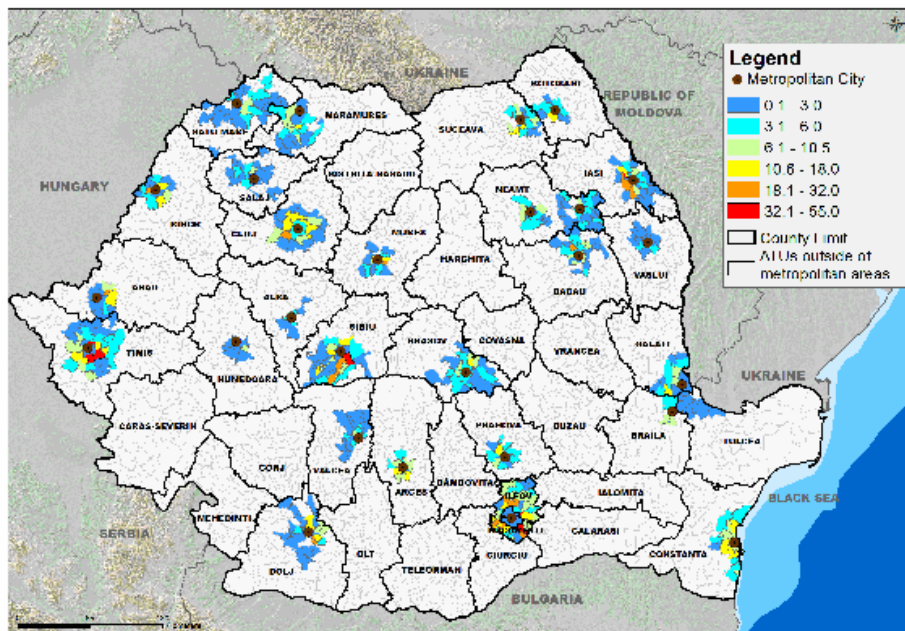


Fig. 2. Analysis of the dynamic of the ratio of the number of new dwellings built within the last 5 years and total number of dwellings per administrative territorial unit in 2016 within the investigated metropolitan areas.

The average slope of the increase of the number of employees (Fig. 4), assessed in 2008, 2011, 2014, and 2016, shows that the metropolitan areas with significant increases in the number of employees (even 3-7 times) are within the development corridor Timișoara-Arad,

around Bucharest, and partially within the corridor Baia Mare-Satu Mare and around the cities Iași and Vaslui.

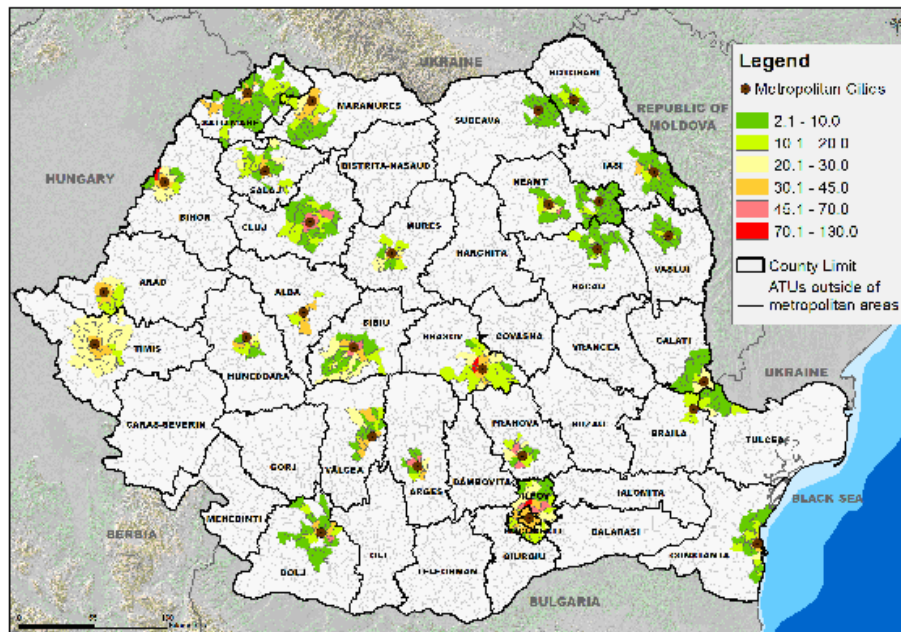


Fig. 3. Analysis of the dynamic of the ratio of the 2016 number of employees and 2016 population of administrative territorial units within the investigated metropolitan areas.

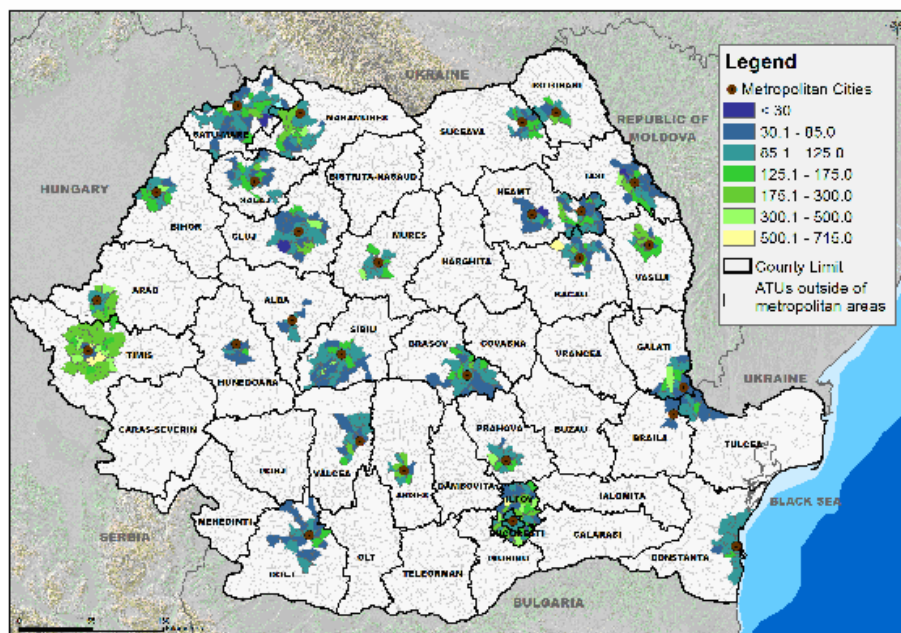


Fig. 4. Analysis of the average slope of the increase of the number of employees within the investigated metropolitan areas.

The analysis of the ratio of the number of employees in 2016 and 2014 (Fig. 5) reflects a similar trend within the development corridor Timiș-Arad and around Bucharest, but also important increases around the cities Cluj-Napoca, Târgu-Mureș, Iași, Brașov, Sibiu, Oradea, Bacău, Botoșani, Baia Mare, Suceava and Vaslui.

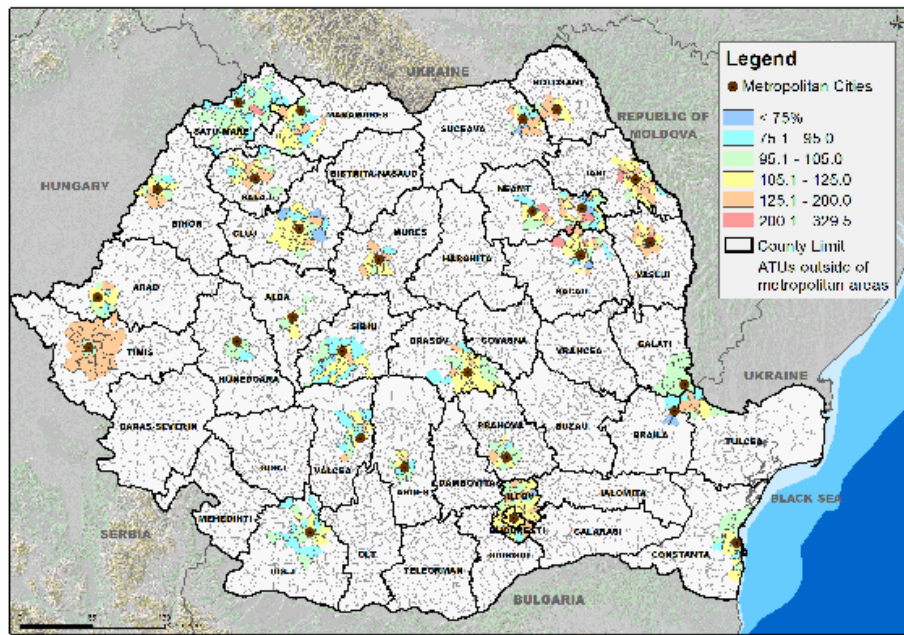


Fig. 5. Analysis of the ratio of the number of employees in 2016 and 2014 within the investigated metropolitan areas.

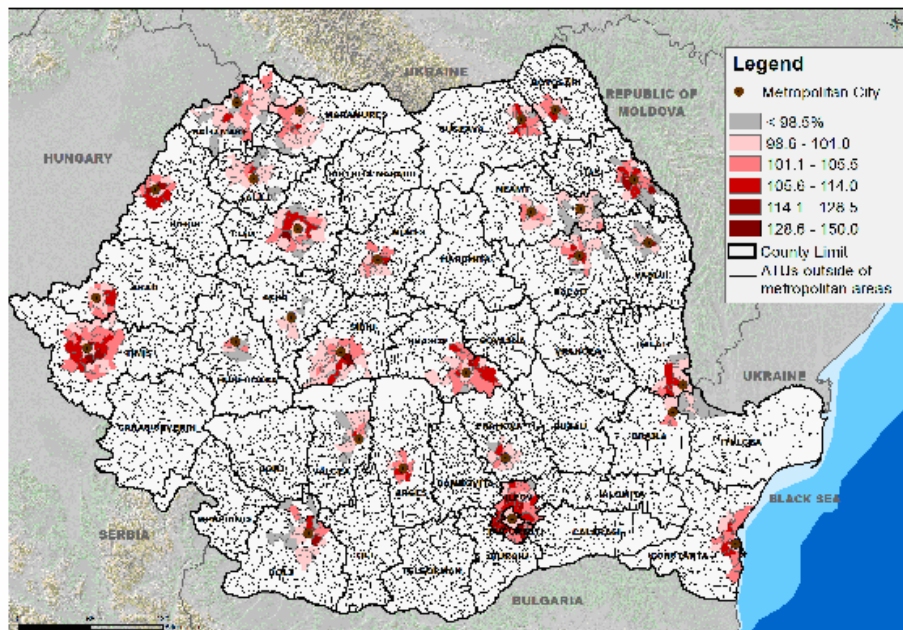


Fig. 6. Analysis of the average slope of the increase of population within the investigated metropolitan areas.

The analysis of the dynamic of population during 2009-2017 (Fig. 6) indicates the growth of population around the large Romanian cities: Bucharest, Timișoara, Cluj-Napoca, Iași, Sibiu, Târgu-Mureș, Oradea, Arad, Suceava, Constanța, Ploiești, and Pitești and partially around Satu-Mare, Baia-Mare, Botoșani, Craiova, Bacău, Brăila, and Zalău.

The analysis of the slope of turnover (Fig. 7) indicates important growth in the cities Cluj-Napoca (here the turnover increased twice during 2009-2016, situation the city in 2nd place

after Bucharest), Timișoara, Brașov, and Arad (2.5 times increase), Oradea and Târgu Mureș. Large values, but with a slower growth are found in: Constanța, Ploiești, Pitești, Sibiu, Iași, Galați, Craiova, and Bacău. Average values, but important growth is found in the cities Baia Mare, Satu Mare, Alba-Iulia, Suceava, and Brăila. The lowest values are found in cities with a low potential of becoming functional urban areas: Râmnicu Vâlcea, Deva, Piatra Neamț, and Vaslui.

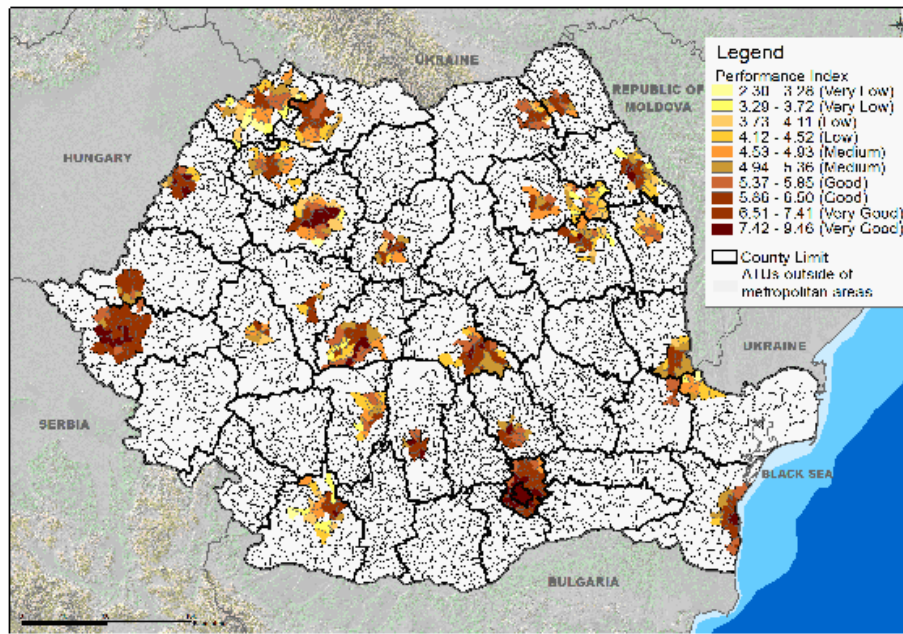


Fig. 7. Analysis of the slope of turnover within the investigated metropolitan areas.

The map of overall performance of the units composing Romanian metropolitan areas (Fig. 8) reflects the national dynamic. Analyses prove that development occurred at different speeds. There are some territories where economic development poles have ascending trends: Bucharest and surrounding Ilfov County, the development corridor Timiș-Arad, metropolitan areas of Cluj-Napoca, Oradea, Constanța, Brașov, Ploiești, and Pitești. However, there are cities with low turnovers compared to the larger ones, and an insignificant economic trend for creating functional urban areas and sustaining a polycentric development⁵².

Spatial planning has a crucial importance in delimiting functional areas for each city which is also the county seat. Moreover, drafting an average and long term integrated metropolitan strategy is essential for each functional metropolitan area in order to promote a vision based on strategic policies, programs, and projects. Integrated territorial investments are an excellent tool for stimulating the creation of new urban functional areas⁵³, but the 2014-2020 Regional Operational Program missed the opportunity for large Romanian municipalities. In this context, metropolitan governing means play a key role in territorial development by strengthening competitiveness and attracting new functional specializations⁵⁴. A smart approach to functional specialization requires focusing public

⁵² Tache and Tache 2016, Tache et al. 2016, Manole et al. 2019

⁵³ Ianoș et al. 2013

⁵⁴ Petrișor 2017

interventions on specializations chosen according to the principle "limited resources directed to limited sectors". This is a challenge assumed by the higher education institutions through the creation of new specializations.

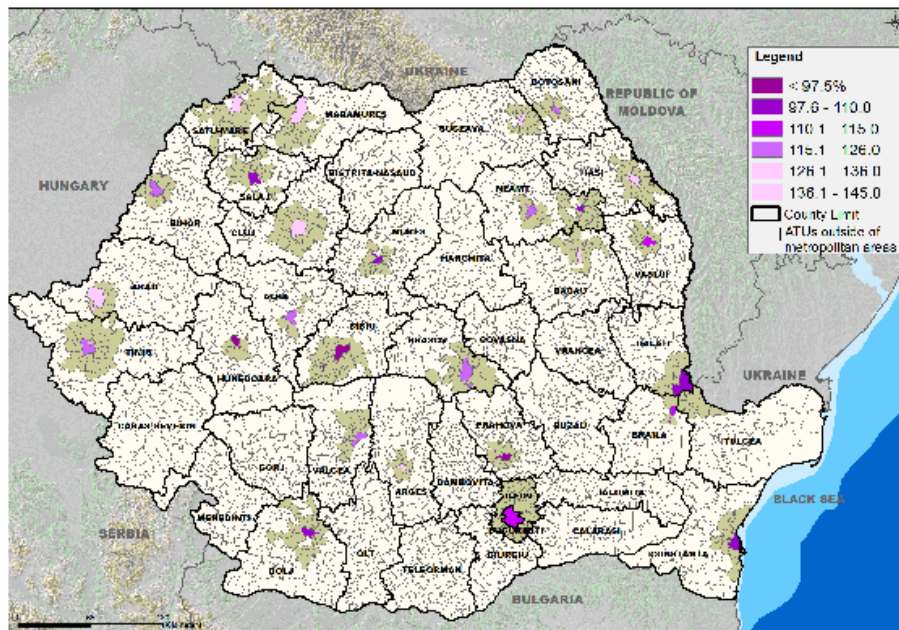


Fig. 8. Map of overall performance of the units composing Romanian metropolitan areas.

Metropolitan areas are the most dynamic spatial structures worldwide, with important dynamics of development, and are considered engines of socio-economic development⁵⁵. Their dynamic in Romania is similar to the European and worldwide ones. The assets of large Romanian cities (efficient spatial planning, functional specialization and smart functional specialization, good governance) attract investments able to generate welfare within the city and in its metropolitan area.

4. Conclusions

The continuous monitoring of local policies on the development of Romanian metropolitan areas is absolutely necessary to correct the development strategies and improve local governance. A polycentric development strategy and defining smart functional urban areas are requirements for creating the grounds of national priorities, objectives and needs for developing a functionally efficient polycentric network, related to the regional and local levels. Furthermore, good local governance is a premise for developing functional urban areas able to attract investments and increase the welfare within these areas.

The question of interpretability is the single most important part of the evaluation of possible indicators, because the objective in developing the indicators is to provide measures which adequately reflect the key issues of concern.

⁵⁵ Tache et al. 2018a

References

- Adell, G. (1999), *Theories and models of the peri-urban interface. A changing conceptual landscape, strategic environmental planning and management for the peri-urban interface – research project*, Development Planning Unit, University College, London, UK
- Banker, R. D., Charnes, A., Cooper, W. W. (1984). "Some models for estimating technical and scale inefficiencies in data envelopment analysis" *Management Science*, **30 (9)**, 1078-92.
- Barkley, D. L. (2008). "Evaluations of regional competitiveness: Making a case for case studies" *The Review of Regional Studies*, **38 (2)**, 121-43.
- Chao, F.U. (2017). "The Evaluation of Rural Territorial Functions: A Case Study of Henan, China" *Journal of Resources and Ecology*, **8 (3)**, 242-50.
- Charnes, A., Cooper, W. W., Rhodes, E. (1978). "Measuring the efficiency of decision making units" *European Journal of Operational Research*, **2 (6)**, 429-44.
- Converse, P. D. (1949). „New Laws of Retail Gravitation" *Journal of Marketing*, **14**, 379-84.
- Cook, W. D., Seiford, L. M. (2009). "Data envelopment analysis (DEA)—Thirty years on" *European Journal of Operational Research*, **192 (1)**, 1-17.
- Coombes, M., Wong, C. (1994). "Methodological steps in the development of multivariate indexes for urban and regional policy analysis" *Environment and Planning A*, **26 (8)**, 1297-316.
- Duhr, S. (2007). *The visual language of spatial planning – Exploring cartographic representations for spatial planning in Europe*. Routledge, New York, NY, USA.
- E.U. Territorial Cohesion and Urban Matters Workgroup (2010). *Thematic subgroup "Urban and development sprawl". Final report*. Publications Office of the EU, Luxembourg, Luxembourg.
- Faludi, A. (Ed.) (1973). *A reader in planning theory*. Pergamon Press, Oxford, UK.
- Florida, R. (2004). *The rise of the creative class. And how it's transforming work, leisure and everyday life*. Basic Books, New York, NY, USA.
- Friedmann, J. (1967). *A general theory of polarised development*. Ford Foundation, Urban and Regional Advisory Program in Chile, Santiago, Chile.
- Ginevičius, R., Podvezko, V. (2009). "Evaluating the changes in economic and social development of Lithuanian counties by multiple criteria methods" *Technological and Economic Development of Economy*, **15 (3)**, 418-36.
- Goschin, Z., Constantin, D. L., Roman, M., Ileanu, B. (2008). "The current state and dynamics of regional disparities in Romania" *Romanian Journal of Regional Science*, **2 (2)**, 80-105.
- Hall, P. (1988). *Cities of tomorrow*. Blackwell Publishers, New York, NY, USA.
- Hall, P. (2000). *Urban and Regional Planning. 4th edition*. Routledge, London, UK.
- Hall, P., Pain K. (Eds.) (2006). *The Polycentric Metropolis Learning from Mega-City Regions in Europe*. Earthscan London, UK.
- Ianoș, I., Petrișor, A.-I., Stoica, I. V., Sârbu, C. N., Zamfir, D., Cercleux, A. L. (2011). „The different consuming of primary eco-energies and their degradation in territorial systems" *Carpathian Journal of Earth and Environmental Sciences*, **6 (2)**, 251-60.
- Ianoș, I., Petrișor, 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.
- James, P. (2015). *Urban Sustainability in Theory and Practice: Circles of sustainability*. Routledge, London, UK.
- Kates, R. W. (2012). „From the Unity of Nature to Sustainability Science: Ideas and Practice" in: *Sustainability Science*, M. Weinstein, R. Turner, Eds., Springer, New York, NY, USA.
- Kwiątek-Sołtys, A., Mainet, H. (2014). "Quality of life and attractiveness of small towns: a comparison of France and Poland" *Quaestiones Geographicae*, **33 (2)**, 103-13.
- Liu, W. B., Zhang, D. Q., Meng, W., Li, X. X., Xu, F. (2011). "A study of DEA models without explicit inputs" *Omega*, **39 (5)**, 472-80.
- Lovell, C. K., Pastor, J. T. (1999). "Radial DEA models without inputs or without outputs" *European Journal of Operational Research*, **118 (1)**, 46-51.
- Manole, S. D. (2017). "Polycentricity issues of Romania's South-East Region" *Management Strategies*, **34 (1)**, 411-419.

- Manole, S. D., Petrișor, A.-I., Tache, A. V., Pârvu, E. (2011). "GIS assessment of development gaps among Romanian administrative units" *Theoretical and Empirical Researches in Urban Management*, **6 (4)**, 5-19.
- Manole, S. D., Tache, A. V., Meiță, V., Petrișor, A.-I. (2019). "Analysis of Romanian polycentricity based on functional urban areas identified by approximation with the Potential Urban Strategic Horizons" *Mitteilungen der Osterreichischen Geographischen Gesellschaft*, **161**, 160-188
- Manole, S. D., Tache, A. V., Petrișor, A.-I., Pârvu, E. (2012). "Geographical Information Systems Assessment of Development Disparities among Romanian Regions of Development" *Romanian Review of Regional Studies*, **8 (1)**, 3-16.
- Manole, S. D., Tache, A. V., Popescu, O. C. (2018). "Evaluating the Romanian polycentricity using the functional urban areas determined on the basis of statistical indicators" *Romanian Statistical Review*, **66 (S2)**, 159-77.
- Musson, A. (2010). "Revue de littérature sur les indicateurs d'attractivité et de développement durable: vers un indicateur d'attractivité durable (Survey of attractiveness and sustainable development indicators. Towards an indicator of sustainable attractiveness)" *Géographie, économie, société*, **12 (2)**, 181-223.
- Natário, M., Braga, A., Couto, J., Tiago, T. (2012). "Territorial standards for innovation: analysis for the regions of Portugal" *Revista de Estudios Regionales*, **95**, 15-38.
- Perroux, F. (1955). "Note sur la notion de pole de croissance?" *Economie Applique*, **8**, 307-20.
- Petrișor, A.-I. (2017). "A diversity-based approach to the spatial development of socio-ecological systems" *Urbanism Architecture Constructions*, **8 (2)**, 143-62.
- Petrișor, A.-I., Ianoș, I., Tălângă, C. (2010). "Land cover and use changes focused on the urbanization processes in Romania" *Environmental Engineering and Management Journal*, **9 (6)**, 765-71.
- Petrișor, A.-I., Grigorovschi, M., Meiță, V., Simion-Melinte, C. P. (2014). "Long-term environmental changes analysis using CORINE data" *Environmental Engineering and Management Journal*, **13 (4)**, 847-60.
- Planning - Ljubljana, Institute of Geography and Spatial Organization - Polish Academy of Sciences, Centre for Advanced Spatial Analysis, National Technical University of Athens, Spiekermann & Wegener - Urban and Regional Research, Austrian Institute for Regional Studies and Spatial Planning, Global Urban Development, Centre for Urban and Regional Development Studies, IRER - University of Neuchâtel, Karelian Institute - University of Joensuu, TNO Inro, Hungarian Public Nonprofit Company for Regional Development and Town Planning, Nordregio, Swedish Institute for Growth Policy Studies (2005). *ESPON project 1.1.3. Enlargement of the European Union and the wider European Perspective as regards its Polycentric Spatial Structure. Final Report*. ESPON Monitoring Committee, Luxembourg, Luxembourg.
- Russo, A., Smith, I., Atkinson, R., Servillo, L. A., Madsen, B., Van den Borg, J. (2012). *ESPON ATTREG, The Attractiveness of European regions and cities for residents and visitors. Scientific Report*. Nordregio, Sweden.
- Săgeată, D.-R. (2014). *The Urban Systems in the Age of Globalization. Geographical studies with focus on Romania*. Lamberg Academic Publishing, Saarbrücken, Germany.
- Scridon, I., Ilovan, O.-R. (2016). "The Zipsers' ethnic identity in Viseu de sus/Oberwischau, Romania, in the context of inter-ethnic relationships" *Mitteilungen der Osterreichischen Geographischen Gesellschaft*, **157**, 151-68.
- Scridon, I., Ilovan, O.-R. (2016). "Approaching the Other in the Zipser Community Identity Issues and Methodological Insights into Geographical Cross-Cultural Research" *Transylvanian Review*, **25 (1)**, 55-73.
- Servillo, L., Atkinson, R., Russo, P. (2012). "Territorial Attractiveness in EU Urban and Spatial Policy: A critical review and future research agenda" *European Urban and Regional Studies*, **19 (4)**, 349-65.
- Simmie J. (2005), Innovation and space: A critical review of the literature, *Regional Studies* 39(6): 789-804.
- Tache, A. V., Manole, S. D., Petrișor, A.-I. (2018). "Metropolization of large urban centers in Romania: Analyses and solutions" *Algerian Journal of Engineering, Architecture and Urbanism*, **2 (1)**, 8-17.
- Tache, A. V., Petrișor, A.-I. (2017). "GIS-based IT model for assessing territorial accessibility in Romania" *International Journal of Human Settlements*, **1 (2)**, 13-23.

- Tache, A. V., Popescu, O. C., Manole, S. D., Petrișor, A.-I. (2018b). "Methodology for assessing the Romanian functional urban areas using GIS and LAU 2 territorial indicators" *Territorial Identity and Development*, **3 (1)**, 24-37.
- Tache, A. V., Popescu, O. C., Tache, M. M. (2017). "GIS mathematic model analyzing the attractiveness of the Romanian settlements network, assessing the competitiveness factors at national level" *Romanian Statistical Review*, **65 (S9)**, 83-102.
- Tache, A. V., Tache, M. M. (2016). "A methodology for the evaluation of functional urban areas in Romania" *Romanian Journal of Geography*, **60 (1)**, 73-83.
- Tache, A., Manole, S. D., Tache, M. M., Petrișor, A.-I. (2016). "Analysis of the polycentricity of Romanian county residences" *Urbanism Architecture Constructions*, **7 (4)**, 301-20.
- Voineagu, V. (Ed.) (2007). *2007 Romanian Statistical Yearbook*. National Institute of Statistics, Bucharest, Romania.
- Wang, Y. M., Chin, K. S., Poon, G. K. K. (2008). "A data envelopment analysis method with assurance region for weight generation in the analytic hierarchy process" *Decision Support Systems*, **45 (4)**, 913-21.
- Warleigh, A. (2002). "The Committee of the Regions" in: *Understanding European Union Institutions*, Warleigh A., Ed., Routledge, London, pp. 177-90.
- Yang, G., Shen, W., Zhang, D., Liu, W. (2014). "Extended utility and DEA models without explicit input" *Journal of the Operational Research Society*, **65 (8)**, 1212-20.