Response of spatial structures to internal fluctuations and perturbations from external environment

by Igor SÎRODOEV

Abstract

Previous researches carried out by the author have *three common elements*: the concept, the method and final results. My thesis submitted to receiving BSc in geography was focused on the geographical study of tourism in the Republic of Moldova. In my MSc (in geography) thesis I applied the Mandelbrot's fractals to the study of urban forms in the same country. My PhD thesis is focused on the role of cities and settlement systems in facilitating regional development policies, having the Republic of Moldova as a case study. Since 2010 I have been involved in various research projects in Romania within post-doctoral scholarships and research grants financed by UEFISCDI. Currently, I am director of one such grant, team-leader in the other grant and a member in the third one. In the first two grants I coordinate teams of young researches. In 2015 I occupied, as a result of public competition, the position of associate professor at Ovidius University of Constanța.

Using the *theory of territorial systems and the concepts vulnerability and resilience* applied to studying such systems represent the element which bounds my research outputs. In my activity I tried to adapt to national context research approaches developed at the global level. Particularly, adaptation of the concepts of vulnerability and resilience to the needs of geographical research at the level of nations and regions is especially challenging. In view of these concepts, territorial systems can play both active and passive role, responding to the changes in their internal structure due to both internal logic of their dynamics and interventions from the outside. The most challenging issue consists in finding the best way to use the knowledge about systems' internal structure and dynamics for achieving the development policy goals. While my previous work was focused on studying system structure, my current research deals with linking our knowledge about the structure to the policy needs.

In my research I frequently use *advanced quantitative methods* of geographical analysis. These methods are applied to determine and analyze internal structure of territorial systems. Thus, in order to get and analyze remotely sensed data I have used analysis of mixed spectra, artificial neural networks, unsupervised and supervised classification. Geographical Information Systems were applied through using spatial modeling for optimal configuration of administrative-territorial units, logistic regression artificial neural networks for slope stability modeling. Various statistical methods were used for the analysis of the relations between systems' components: multivariate statistical analysis, concentration indexes, and cluster analysis. Relations between systems' characteristics were modeled through linear and polynomial regression and using the bootstrapping approach. Finally, some econometric methods (β-convergence and Gini index) were used for the analysis of concentration and dynamics of the systems' components. I have frequently used cartographic methods to present my results as parts of complex research projects or as independent products (atlases).

Scientific results of my research activity relevant to geographical science can be structured by scale level of the analysis. At the *national level* I had decisive contribution to spatial configuration of the optimal scheme of administrative-territorial organization of the Republic of Moldova, proposing two different spatial scenarios. I came with statistically significant arguments that foreign direct investment in Romania has had

weak effect (less than expected) on diminishing regional disparities and on bringing sustainable growth to regional economies. I grounded the need of diversification of regional development policies in what refers to different types of small towns with strong impact of rural activities: each of the four types of towns (*agricultural towns, modernized rural towns* and *non-modernized rural towns*, as well as *suburbs* regardless of their urban/rural status) require specific policy measures. "One-size-fits-all" approach will certainly fail in their case. I showed that the dynamics of main agricultural land-use patterns have quite a strong inertia with few changes in the post-socialist period. However, one sad trend could be identified, namely lands with highly added value potential have been diminishing since the beginning of post-socialist period. At the *regional scale* I studied the dynamics of agricultural systems in two major agricultural regions of Romania (Oltenia and Dobrogea): both regions are highly exposed to variations in climatic variables as an effect of abandonment of irrigational systems. At the *local scale* my research interest was focused on internal organization of cities and urban-rural relations. Thus, I showed how the intensity of land-use conflicts depends on legal measures and how they impact urban settlements. In a series of papers I proposed and analyzed the model of spatial development of Bucharest the EU's 6th biggest city, namely, I identified relative decay of inner urban core and explosive development of its semi-peripheries and peripheries. This model was completed by another one, which focuses on rural-urban fringe of Bucharest.

Vulnerability and resilience of territorial systems was studied in the context of global environmental change. I showed the negative impact of aridization on agricultural systems. I identified the impact of post-socialist changes on forest ecosystems in Romania. A series of works were focused on the analysis of climate change impact on surface water resources. Economic scenarios of water use in the Republic of Moldova, in relation to climate SRES scenarios, are of particular interest. I have also identified territories the most vulnerable to likely water shortages. Vulnerability of local communities to expected climate change was assessed in the Moldavian part of the Dniester River basin. I also proposed a model of creation of urban heat island starting from the density of buildings in Bucharest.

In addition, I have contributed to modeling of some *natural processes within territorial systems*. I have assessed some hilly systems in the Republic of Moldova from the viewpoint of landslide susceptibility and identified new territories potentially threating local development. I have also contributed to the internal zoning of some forest ecosystems in the Republic of Moldova from the viewpoint of fire protection.

I consider my short- and medium-termed *professional development* within the perspective of three directions. In the direction of theoretical approach I will follow the vulnerability and resilience concepts in trying to find the way how they can help achieving the development goals at local, regional, national and international scales. In my university career I will abide by five simple principles: (i) explication of complex issues through simple ones; (ii) seeking new teaching methods; (iii) using up-to-date technologies in teaching; (iv) supporting free and open-source solutions; (v) promoting inter- and trans-disciplinary approaches. In my research activity I have followed (and will keep following in the future) three principles: (i) combining complexity with simplicity; (ii) involving cutting-edge technologies and methods; (iii) carrying-out problem-oriented researches (and not science-oriented ones). I strongly believe that the grants I am currently involved in will certainly facilitate following these principles and achieving the goals of my teaching and research career.