Carpathian Journal of Earth and Environmental Sciences, August 2015, Vol. 10, No 3, p. 167 - 176

INCREASING THE RURAL COMMUNITIES' RESILIENCE THROUGH UNCERTAIN TERRITORIAL SYSTEMS

Paul-Răzvan ȘERBAN[1], Cristian TĂLÂNGĂ[2], Radu SĂGEATĂ[3] & Dragoș BAROIU[3]

[1]*University of Bucharest, Faculty of Geography, Bucharest & Vasile Goldis Western University of Arad, Faculty of Natural Sciences, Engineering and Computer Science, paulrazvanserban@yahoo.co.uk*
[2]*University of Bucharest, Faculty of Geography, Interdisciplinary Center for Advanced Research on Territorial Dynamics (CICADIT), Bucharest, Romania, cristian.talanga@geo.unibuc.ro*
[3]*Institute of Geography, the Romanian Academy, Bucharest, radu_sageata@yahoo.com, baroiud@yahoo.com*

Abstract: How the decision makers act on the territorial system seems at first glance coherent and self-evident, the communal component desiring a high standard of living while entrepreneurial component trying to maximize their profits. In addition, the political component should be considered by governmental and local policies but also by the non-governmental component (governance) that provides the link between local (the problems faced) and national level (hence local problems are managed through budgetary allocation). Thus, the territorial system is complex, involving the underlying relationships between components whose evolution is difficult to determine. To reveal the links between the community and the entrepreneurial component, so the resilience of human communities, we used the Principal Component Analysis and Hierarchical Ascendant Classification. Within Hierarchical Ascending Classification we started from the spatial component, from the similarities in regions profile seen *apriori* as a group of components while within the Principal Component Analysis we considered the distribution of each component, comparing it with the others, and based on similarities of distribution, we grouped them around some principal components. Local profiling of the community component (movement of people looking for a job) and of the entrepreneurial component (employers' decisions to increase or reduce the number of jobs) was the first step in the study of resilience of human communities. The next step was to analyze the causes of the deficit of resilience (no correlation between the evolution of the community and the entrepreneurial component) and the role of self-organization to increase resilience to a level that would ensure sustainable development. To this end our case studies were two local resilience deficient communities, each with its distinct profile. In the first case, low resilience was due to the inflexibility of commuting workers laid off from jobs in the neighbouring town; in the second case, low resilience was due to the difficulty of high school and vocational school graduates to accede to the labor market in their native community. In none of these cases, the local authorities could not do anything to solve the problem, because the magnitude of the phenomenon was beyond them. In times of economic growth, the presence of commutation and of schools represented strengths for the communities, while in times of economic and financial crisis they became vulnerabilities.

Keywords: Resilience, rural space, uncertainty, territorial system

1. INTRODUCTION

Self-organizing provides a favorable environment for human communities' adaptation to change in the system's components (Ianoș et al., 2011). In respect of the territorial system, we have chosen to refer to the community and the entrepreneurial changes produced by the recent economic-financial crisis which occurred when the system was recovering after the downfall of the communist system.

Adaptation of human communities to crisis-induced economic changes is called communities' resilience and it means to tackle the crisis, so that the population suffers less from it (unemployment rates showing no significant changes). Among the

population ways of reaction to the entrepreneurial environment changes we mention job searching within the same territorial unit or elsewhere, in the same domain or in another field of activity.

As time-horizons, we shall take into consideration the years when entrepreneurial events with repercussions on various social phenomena, particularly unemployment, occurred. The economic crisis that began in 2009, when reached the highest level, and continued until 2011, is the best example of an entrepreneurial event with negative social effects. In our opinion, the unemployment rate is the most sensitive interface between the community and entrepreneurial components of the system, reacting almost instantly. For that unemployment rate was used as benchmark. In contrast, the response-time of other community components is much longer, resulting in an attenuation of the impact of sudden changes in the entrepreneurial components.

Based on the meanings that the concept of resilience was incorporated by referring to various scientific domains, we aim to emphasize its essence, but also its changes in the process of adaptation to the needs of different research fields. Thus, extracted from physics (the term was used for the first time by Charpy, 1901), resilience has been personified and gained metaphoric meanings to be used in the social and natural sciences. Among social sciences we note the psychological studies of Werner & Smith who, between 1939 and 1945, achieved major mental recovery, namely ego resilience, in a group of children with disabilities (later published in Werner & Smith, 1982). Also, Bowlby (1940) used resilience in his research of emotional attachment. Ego resilience is the ability to recover psychological functions from a powerful stress of different causes: disaster, war, marital trauma, difficult living conditions, job loss, extended unemployment and other similar situations (Wagnild & Young, 1993).

The use of resilience in ecology enriched it with new meanings:

1. "Technical Resilience" focuses on the stability of a system near a state of equilibrium, where resistance to disturbance and speed of return to a pre-existing equilibrium state is used to define the resilience (Holling, 1973).
2. "Ecological resilience" refers to the shock magnitude of disturbance that can be absorbed before the systems' change their structure and function and they are shaped by a different set of processes (Holling, 1973).

Holling (1986) indicated that resilience is persistence confirmed by change and renewal adaptive cycles. Berkes & Seixas (2005) agreed with Gunderson (2002) when included among resilience-related factors: "learning to live with change and uncertainty, nurturing diversity for reorganization and renewal, combining different kinds of knowledge, and creating opportunity for self-organization".

Firstly, the systems evolution is not at all linear, assuming times when predictability of future states is difficult to make (Smit & Wandel, 2006). At such times, called thresholds or interruptions in the system's [community] evolution, Berkes & Seixas (2005) appreciated that the system moves from one state to another. Thus, when we analyze the evolution of a system, and wish to intervene on it, we should not have in mind to maintain its balance, but rather the persistence developed through adaptive renewal cycles stimulated by change (Gunderson, 2002). Secondly, community resilience requires self-organization, learning, and experiment (Gunderson, 2002). Thirdly, high resilience increases the community's capacity to develop in dynamic environments that are characterized by unpredictability and surprise (Walker et al., 2004). And fourthly, community resilience is dynamic (Harris et al., 2000; Magis, 2010).

Big dynamic interactive systems can "self-organize" into a critical state (Bak et al., 1988). This means that the critical state may be, in fact, an attractor for the dynamic system, to which the system evolves naturally, returning after being disturbed by some big external shocks.

In the case of human communities, self-organization can be achieved at different spatial scales, depending on the administrative system (Ianoş et al., 2011):

a) at national level, in a centralized political system;
b) at regional level, in a decentralized political system in which human communities have enough action space for self-administration.

Self-organization at national level, called government, and decentralized system of territorial administration, called governance, behave differently when important changes occur in the territorial system by favoring more or less the manifestation of communities' resilience (Ianoş et al., 2011).

Next we shall make a brief historical overview of the evolution of the political system in Romania with important consequences for the resilience of human communities.

In the late 1980s, the authoritarian political systems were brutally removed, causing chaos and entrepreneurial decline, unemployment, degradation of the population's living standards and, consequently, numerous social tensions and protests set in. Deindustrialization, begun in 1990, and had

totally changed this administrative system (Săgeată, 2006). Dismantling inter-industrial relations, established in the context of the centralized economy, based on decisions made at central level and firm contracts within CMEA member-states has entailed vast social and territorial disruptions (Groza, 2003).

First, there were created new spatial supply dependencies (both of raw materials and labor) and product sales; where these have not worked, proving to be inefficient; productive units were closed down and in many cases demolished, leading to mutations in functional urban zoning, particularly by replacing former industrial sites with retail and services areas (Săgeată, 2014). Urban functions (residential, industrial or services) were assumed by the surrounding rural areas, which from polarized areas became integrated areas, the administrative boundaries becoming purely formal. At the same time, peripheral rural areas, weakly polarized by urban nuclei, continued to devolve through aging and depopulation, due to lack of viable alternatives for occupational diversification (Săgeată, 2012). Thus, additional areas with specific problems emerged, often transcending administrative boundaries and requiring a unified, participative approach, through cooperation between the local actors involved.

On the other hand, unemployment increased social cleavages, leading to tensions and massive depopulation, manifest by unprecedented increase of emigration (Mocanu, 2008), raising serious problems, including the aspect of national security (Dolghin et al., 2004).

Consequently, after the fall of the communist regime, which had directed the dynamics of the Romanian territorial system, the system was dismantled and its components began to float into an uncertain environment (Ianos, 1997). The relations between the system' components were weakening, some components have evolved in an opposite direction, or directions, and did not require integration into a whole (Ianoș, 2000). For example, industrial restructuring in the post-revolutionary period was not scheduled to occur in an organized manner, so that the labour force was drawn to other activity sectors (Ianos, 1998). Once the industry restructured, changes in the daily mobility of population from the rural to the urban can be observed. Commuting from the rural to nearby industrial centres considerably diminished (Roznovieţchi, 2000). Furthermore, this component of the territorial system entailed changes in the natural movement, depleting birth rates due to difficult integration into the labour market and the impossibility of securing a decent living standard for children. On the other hand, the population's return to the countryside and their practice of a mostly subsistence agriculture is not a solution for solving a critical situation (Ianos, 1998). The land reform in the early 1990s must be seen only as an intermediate step in the modernization of agriculture. To date, the beneficiaries of agricultural land restitution practice mostly a kind of agriculture that is of subsistence, and food aid from the European Union funds is directed especially to this category of population (Săgeată, 2012). Consequently, in most cases, redundant population coming from industry, and engaged in farming, cannot be considered resilient, either. All these have directed the territorial system's dynamics to an unknown direction, where the development of the systems' components cannot be precisely predicted, creating an uncertain environment for a particular component that should be analyzed separately (Ianoș, 2000).

This lack of predictability, which local communities are trying to cope with, created anxiety among the population, especially because it was not helped by coherent central administration policies to reduce the negative effects of economic transition.

The problem of the uncertain environment in which the system's components evolve is widely debated today. The precautionary principle states that the probability distribution of future outcomes cannot be known with confidence. This is where the decision theory splits from the study of probability, because the effects of certain human actions on the environment (especially entrepreneurial actions) are unknown and unknowable in advance. In the classical works of Knight (1921) and Keynes (1921) which make a distinction between the two types of uncertainty (weak variety called risk and strong variety called uncertainty) the roots of this research line can be seen. In particular, "risk refers to probability distributions based on a reliable classification of possible events and uncertainty refers to events whose probability distribution does not exist or is not fully definable for lack of reliable classification criteria" (Vercelli, 1991).

Given the effects of previous decisions, which the current decisions are based on, the decisional problem is a complex one, decision-makers' options changing endogenously at any time. In addition, multidimensional interactions between system and environment should be considered. Thus, O'Connor et al., (1996) considered difficult to forecast environmental changes that may be caused by anthropic activities and the significance of possible welfare that may be caused by the effects of these activities.

Indeterminacy is rather a feature of social life than an "imperfection" of human knowledge, as indicated by the Laplacian view of science which

was based on substantive rationality (Faucheux & Froger, 1995). "Incompleteness" of human knowledge is not due to lack of information, but it is inherent to indeterminacies in the social-ecological processes (Faucheux & Froger, 1995).

The issues facing contemporary science are global in scale and long-term in impact. Data on "undisturbed" systems (components without interactions) are completely inadequate, as explained by Funtowicz & Ravetz (1991).

Thus, we can characterize changes in the Romanian territorial system as being triggered by change in the political regime - the bifurcation threshold in the territorial system dynamics. The next step in the system's evolution envisages increasing entropy in an uncertain environment followed by self-organizing, a process that establishes new relationships between the system's components and the dynamics of the system, becoming robust by "finding" the path of evolution (Ianoş, 2000). Whether this is the way found until the economic and financial crisis was triggered in 2009, remains to be seen.

To ensure the sustainable development of human communities it is necessary to preserve favorable environmental conditions or, as Ianoş (2000) and then Braghină et al., (2010) pointed out, the conservation of primary eco-energy. In most cases, the development of anthropic activities has significantly reduced primary eco-energies, whether we refer to activities based on the exploitation of natural resources (mining, wood processing, etc.), or to the conversion of natural areas by the construction of housing, infrastructure, industrial plants, etc. (Ianoş, 2000). Reducing the eco-energies of big cities makes the population seek them in the countryside, thus an eco-energy transfer is taking place from rural to urban areas (Ianoş et al., 2011). The regularity of the urban population movement to rural areas determines the "transfer of development" and thus the transformation of rural areas of destination (Ianoş et al., 2011). This transformation is sometimes so radical that certain environmental components presenting attractiveness *per se* diminishes this quality. Eco-energy consumption increases spatial complexity and diversification of anthropogenic subsystems (Ianoş et al., 2011), in this case of the anthropogenic systems of rural areas. An efficient territorial management, on long and ultra-long term, where the respect for environment dominates all the categories of territorial actors needs qualitative assessments of the relationship between the anthropic process and the conservation of primary eco-energies, especially in the conditions of the global climatic changes (Ianoş et al., 2010).

Thus, geography, as part of the social sciences, calls for resilience to explain the mechanisms of adaptation to changing components from inside the territorial system, but also from the outside of it.

Resilience shifts the perspective from attempts to control change in systems assumed to be stable, to manage the capacity of social-ecologic systems to cope with, adapt to and configure the change (Smit & Wandel, 2006).

The shift, or critical point, in the evolution of a system is due to a number of factors including the positioning of the system dynamics in far-from-equilibrium conditions and the nonlinear behavior of the components (Morçöl, 2005). The critical points are rather exceptions in the evolution of systems and, the frequency of events is negatively correlated with their magnitude, concludes Bak (1996). At critical points, decisions are not two-dimensional, decision makers do not choose between adopting a way forward, or not, but depending on the number of components of the system that is being analyzed, their decision is the result of fuzzy combinations in the evolution of those components (Șerban, 2012).

The aim of this study is to bring some clarifications on how territorial system components relate and evolve in order to strengthen against the fluctuations and disturbances they are subject to. In this view, we decided to separate the two components, namely the community (movement of people looking for a job) and entrepreneurial (employers' decisions to increase or reduce the number of jobs) components, and to analyze their interaction. Apparent consistency is betrayed by the operation mechanisms of the two components and by the difficulty with which one responds to changes in the other.

2. MATERIALS AND METHODS

This paper illustrates the entrepreneurial and community consequences of change in the territorial management reflected in planning policies, particularly in rural planning. To make this scientific approach, we considered combining historical analysis and territorial analysis (highlighting the genesis and configuration of territorial cleavages), socio-economic analysis (by interviews applied to a human community considered representative) and comparative analysis (by comparing with concrete situations in other rural space).

Thus, we chose to analyze communities' resilience in terms of the relevant indicators: resident population, active population, departures and settling of residence, employees plus unemployment rate.

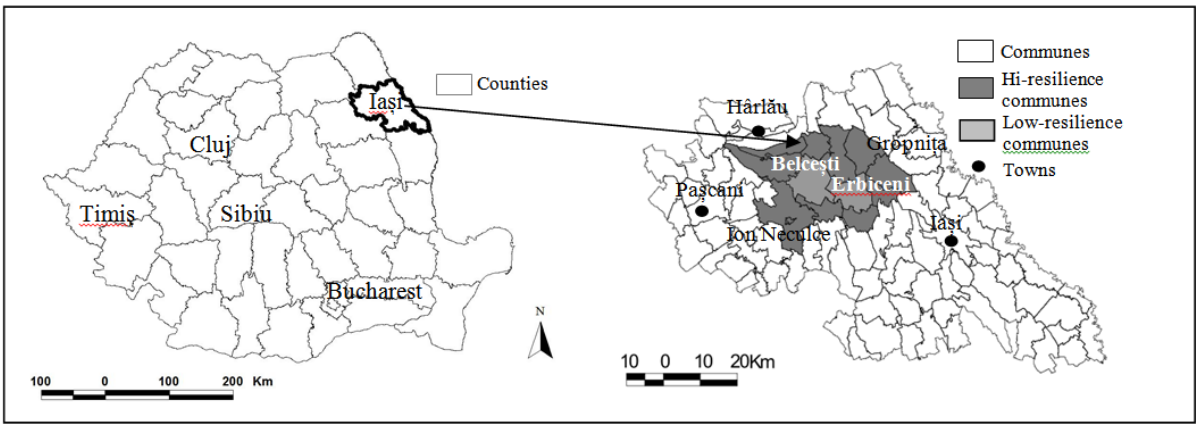

Figure 1. Study area positioning

These indicators provided information on the attractiveness of the place of residence (resident population evolution), the degree of influence of the active population, the intensity of migration flows, the share of employees in the migrant population, unemployment as a benchmark of successful adaptation, or measure of the degree of communities' resilience (how people coped with entrepreneurial environment changes). We used the values of the above-mentioned indicators by calculating the difference between the indicators' value in 2011 and 2009 (eg. to calculate the evolution of the resident population we made the difference between 2011 and 2009 values), excepting the data on population migration, when we calculated the amount of people involved (for people who settled in a commune we put together 2009, 2010 and 2011 values in order to record all persons who had settled over 2009-2011). Therefore, the data used are at NUTS V territorial level and only for rural areas (commune). Data source includes the National Institute of Statistics and interviews.

As mentioned by Kaiser et al., (1985), the novelty (in the system) is not reducible to a known parameter of the system, and therefore we need to introduce a new parameter at the time of novelty emergence (to analyze it). In a mathematical interpretation, the new parameter cannot be a linear combination of the old parameters but must be an orthogonal one, including the vectors from the phase space, according to Kaiser et al., (1985). Based on the above, we extracted the principal components of social and economic variables, a method based on the orthogonal projection of variables. To produce novelty, the system needs different degrees of freedom, degrees offered by the components. But not all components influence the evolution of the system and their importance is different.

The Principal Component Analysis (PCA) helps selecting the variables which influence the evolution of the system by their degrees of freedom.

Consequently, the first step in our approach was to eliminate redundant information from our data by using data on the evolution of the six indicators at commune level, in 2009-2011 to run PCA. Analyzing Plot Screen we decided to keep the five principal components (which preserved most of the original information – 99.5%, information useful in the next step) by removing the indicator of the active population, which exists in the same principal component of the resident population, following a similar evolution.

The second step involved the achievement of a typology of the Romanian rural space. By running the Hierarchical Ascending Classification (HAC) we determined how the evolutions of the five indicators selected in rural space combined. To preserve more information contained in the data (61% of the initial variance), we selected 12 classes representing as many rural area typologies. Then, we chose an area of communes with both low resilience and high resilience (Fig. 1).We considered low resilience in communities with high unemployment rate, without peoples' response to the migratory movement (resident departures were close to the rural areas mean). The two low-resilience communes were Belceşti and Erbiceni, which had a significant increase of unemployment rate, the evolution of the other indicators being close to the rural mean. These communes were surrounded by high-resilience communes: Bălţaţi, Cepleniţa, Coarnele Caprei, Cotnari, Ion Neculce, Focuri, Gropniţa, Movileni, and Romăneşti, with unemployment rate around the rural areas mean and slightly lower resident departures or slightly higher, the evolutions of the other indicators being close to the rural mean.

In the selected area we introduced the same data as above. In this way, we obtained a more detailed map on the types of communes, by reference to the respective area mean and not to the entire Romanian rural area mean (Fig. 2).

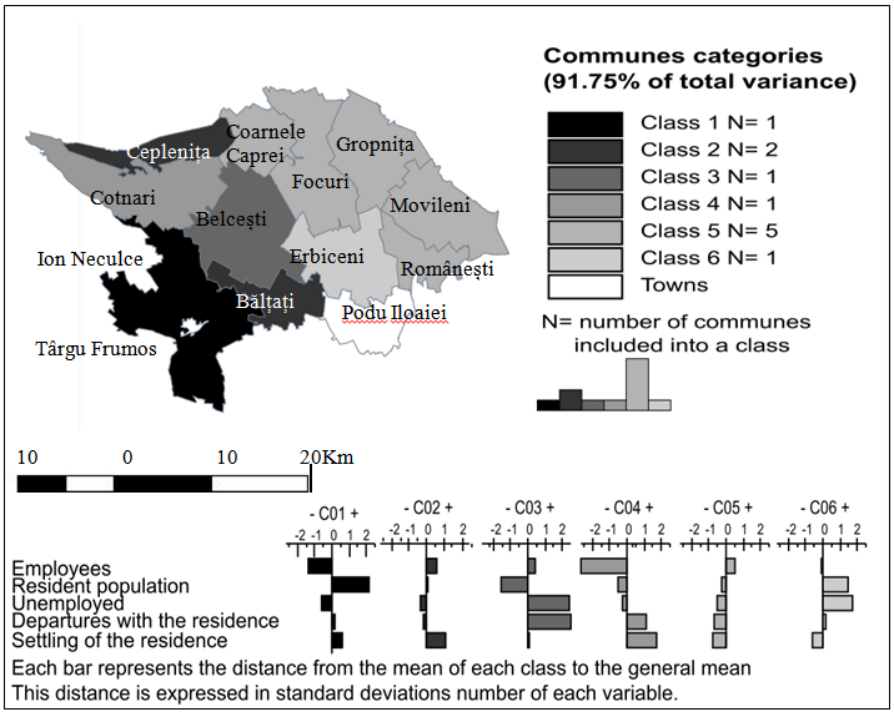

Figure 2. The typology of communes by using selected variables, and the average profiles of classes
Made with Philcarto (http://philcarto.free.fr)

Class 1. Communes with extending population (increasing resident population and poor employment); Class 2. Attractive communes for employment (increasing settling of residence); Class 3. Repulsive communes for employment (increasing departures with residence and increasing unemployment rate); Class 4. Communes with changing employment (very poor employment and intensive population movement); Class 5. Communes with stable working population (reduced population movement and balanced employment); Class 6. Communes with stable working population but with community problems (increasing resident population and increasing unemployment rate).

Thus, differences in the numerical evolution of residents emerged between the two low-resilience communes. While Belcești had more unemployed people and even the population decreased and resident departures were above the zonal mean, Erbiceni showed a growing resident population, more unemployed people and the population movements maintained at the zonal mean.

Noteworthy, the growing number of the unemployed in both communes did not correlate negatively with the numerical evolution of employees, the latter keeping constantly within the same values. This situation is explained in the next step, by analyzing additional data.

The third step involved interviewing of local authorities (mayors), in June 2014, in the selected area in order to analyze the problems faced by the population and how the local administration had acted to help people who lost their job; the interviews referred to two years: 2009 (beginning of the crisis), and 2011 (end of the crisis – a period long enough to figure out whether the population adapted or not to the related economic crisis changes). The interviews requested respondents to answer the following: 1) job localization (in or outside the commune); 2) field of activity in which the population was employed (some areas being more vulnerable to the financial crisis than others); 3) programs implemented by the central or local government to insert people in the labour market; and 4) programs for rural development implemented by the local government. To achieve a typology of the communes in matters of labour market, migration, and local administration action in the study area, interviews data have been integrated into a HAC (Fig. 3).

3. RESULTS AND DISCUSSION

Depending on how the decision of the two types of components (community and entrepreneurial) is correlated, conclusions were drawn on how human communities coped with the financial crisis through communities' resilience. If the above analysis displayed the number of employees in a commune, the interviews provided more accurate information on the commuter population. This helped us explain following situation of Erbiceni commune: higher numbers of unemployed people correlated with even fewer commuters.

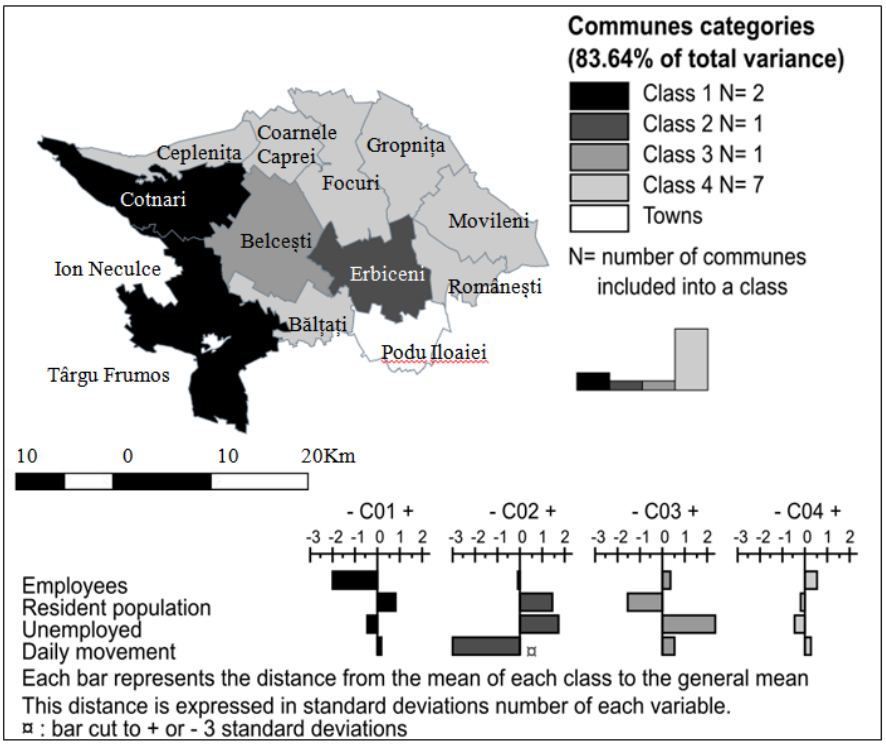

Figure 3. The typology of communes by using interviews data, and the average profiles of classes

Made with Philcarto (http://philcarto.free.fr)

Class 1. Communes with extending population (increasing resident population and poor employment); Class 2. Communes with unemployed former commuters (increasing resident population, increasing unemployment rate and very poor daily movement); Class 3. Repulsive communes for employment (decreasing resident population and increasing unemployment rate); Class 4. Communes with stable working population (reduced population movement and balanced employment).

Even if some people used to commute from other communes to Podul Iloaiei Town, in Erbiceni, there were significantly more commuters because of the proximity to town. This explains the numerical increase of the unemployed at a time when the number of employees inside the commune showed no significant decrease, the evolution being close to the area's mean. Speaking about Belcești commune, we would recall the decline of its population over 2009-2011 due to a rise in resident departures, while the number of employees inside the commune remained constant, the number of commuters was slightly decreasing and the number of the unemployed population was rising. Thus, Belcești was in a different situation than Erbiceni, because the rising unemployment rate could not be explained by the decrease in commuters.

This situation seems somehow abnormal and cannot be accounted for either by the net population migration, which showed a negative balance, or by the reduced number of jobs, both inside or outside the commune. What explains the higher number of unemployed is the existence in the commune of a high school and a vocational school, while the graduates unable to find a job became unemployed. This is understandable having in view the steadily fewer number of jobs inside the commune and the ever fewer in the nearby towns: Podu Iloaiei and Târgu Frumos. If we compare the situation in Belcești with that of other communes in our study area, which also host a pre-university educational institution, we see that the number of graduates from Belcești is much higher, about 350 graduates per year compared to 50-60 in Coarnele Caprei, Cotnari, Dumești, Focuri or Gropnița.

Analyzing the adaptation of the communities to the entrepreneurial environment changes induced by the recent economic crisis, we found that there is no (negative) correlation between the evolution of the employed and the unemployed people, meaning that another variable, unknown, is interposed between the two variables, explaining the events on the labour market. Not even the number of employees by activity explains the situation. The cause of this mismatch evolution between the employed and the unemployed population was not the cutting of commuters' jobs (the unemployed people are registered in the commune of residence and jobs are reduced in the commune where they are supposed to work), because the dynamics of these three indicators was not correlating in all the communes. The presence of a high school and a vocational school, whose graduates could not find a job, becoming unemployed, explains the situation.

The local government intervention was not significant and Local Action Groups were established later, hence we conclude that self-organization at local level didn't emerge at that time.

4. CONCLUSIONS

The period of analysis was characterized by significant entrepreneurial environment changes that have resulted in changes of the community component. Communities that have learned to live with uncertainty (Berkes & Seixas, 2005) and to tackle the challenges of the entrepreneurial environment, consisting of job cuts, showed communities' resilience.

Resilience is close in meaning to the term sustainability in that it refers to persistence. Community and entrepreneurial sustainable development is based on adaptive renewal cycles (Holling, 1886) stimulated by change, namely the emergence of communities' resilience. Communities' resilience means, at the same time, the self-organization of communities in times of entrepreneurial environment changes. However, these changes should not cover environmental conditions or eco-energies, these components of the Earth system needing a long period of time to recover.

Human communities in the analyzed rural area adapted to the crisis in a different way, depending on the features of each. Some components of the territorial system, which in the growth period proved advantageous for the community, became true obstacles during the crisis for the communities' resilience. Thus, the presence of commuters or of a high school and vocational school represented vulnerabilities in the adaptation to the adverse entrepreneurial environment. In a time when the labour market is shrinking, such as during the financial and economic crisis, it is very difficult to find a job for the new graduates. If we add that these graduates do not have a higher education, but only a secondary education, just trying to integrate themselves in an increasingly competitive labour market, we understand the difficult situation in which these graduates are. Another problem emerging in the crisis period was based on the commuters. The workers, who daily moved to work in the neighbouring town, were much more affected by the cutting jobs. The reason for this was: in the rural area, the salaried were mainly employed in the public service system (showing no significant changes), while commuters were employed in the private sector in the nearby town (where there have been major job cuts).

Diversity, or a certain kind of variety, which could be crucial for communities' resilience, had opposite effects. The necessary variety principle states that systems should encourage domestic variety in order to survive. This is true only insofar as it refers to the diversity of activities in rural areas compared to urban areas, where specialization in certain industrial branches creates problems of adaptation to the entrepreneurial changes during the crisis. In fact, the more diverse and complex a system is, the better prepared it is to cope with external disturbances (Morgan, 1997), uncertainty and surprise (Perrings et al., 1995), which is due to the balanced development of all activity sectors. Therefore, the development of different networks and weak ties between networks is essential for achieving community resilience.

AKNOWLEDGMENTS

This work was supported by the project: POSDRU/159/1.5/S/133391 "Doctoral and postdoctoral programs supporting research", project co-financed through Sectoral Operational Program for the Development of Human Resources 2007-2013 from European Social Fund.

REFERENCES

Bak, P., 1996. *How Nature Works: The Science of Self-Organized Criticality*. Copernicus, New York, 212 p.

Bak, P., Tang, C. & Wiesenfeld, K., 1988. *Self-Organized Criticality*. Physical Review A, 38, 1, 364-374.

Berkes, F. & Seixas, C.S., 2005. *Building resilience in lagoon social–ecological systems: a local-level perspective*. Ecosystems, 8, 8, 967-974.

Bowlby, J., 1940. *The problem of the young child*. Children in War-time, 21, 3, 19-30.

Braghină, C., Peptenatu, D., Constantinescu, S., Pintilii, R.D. & Drăghici, C., 2010. *The pressure exerted on the natural environment in the open pit exploitation areas in Oltenia.* Carpathian Journal of Earth and Environmental Sciences, 5, 1, 33-40.

Charpy, G., 1901. *Note sur L'essai des métaux á la flexion par choc de barreaux entaillés*. Soc. Ing. Civ. de Francis, 848-877.

Dolghin, N., Sarcinschi, A. & Dinu, M.-Ş., 2004. *Risks and threats to the security of Romania. Present and perspective* (In Romanian). UNAP Publishing House, Bucharest, 48 p.

Faucheux, S. & Froger, G., 1995. *Decision-making under environmental uncertainty*. Ecological Economics, 15, 1, 29-42.

Funtowicz, S.O. & Ravetz, J.R., 1991. *A new scientific methodology for global environmental issues.* In: Costanza, R. (ed.), Ecological Economics: The Science and Management of Sustainability,

Columbia University Press, New York, pp. 137-152.

Groza, O., 2003. *Les territoires de l'industrie*. Didactic and pedagogic Publishing House, Bucharest, 418 p.

Gunderson, L.H., 2002. *Adaptive dancing: interactions between social resilience and ecological crises*. In: Berkes, F., Colding, J. & Folke, C. (eds.), Navigating social-ecological systems: building resilience for complexity and change, Cambridge University Press, Cambridge, pp. 33-52.

Harris, C.C., McLaughlin, W., Brown, G. & Becker, D.R., 2000. *Rural communities in the inland Northwest: An assessment of small communities in the interior and upper Columbia River basins*. USDA Forest Service - General Technical Report PNW, PNW-GTR-477, 1-120.

Holling, C.S., 1973. *Resilience and stability of ecological systems*. Annual Review of Ecology and Systematics, 4, 1-23.

Holling, C.S., 1986. *The resilience of terrestrial ecosystems: local surprise and global change*. In: Clark, W.C. & Munn, R.E. (eds.), Sustainable development of the biosphere, Cambridge University Press, Cambridge, pp. 292-317.

Ianos, I., 1997. *Hierarchical distortions within the Romanian urban system*. Geographia Polonica, 69, 55-65.

Ianos, I., 1998. *The influence of economic and regional policies on migration in Romania*. Südosteuropa-Studien, 62, 55-76.

Ianoş, I., 2000. *Territorial systems. A geographical approach* (In Romanian). Technical Publishing House, Bucharest, 197 p.

Ianoș, I., Humeau, J.B., Tălângă, C., Braghină, C., Ancuța, C. & Bogdan, L., 2010. *Ethics of space and the treatment of most disadvantaged areas*. Carpathian Journal of Earth and Environmental Sciences, 5, 2, 211-217.

Ianoş, I, Petrişor, 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, 251-260.

Kaiser, H., Mlitz, R. & Zeilinger, G., 1985. *Algebra für Informatiker. Second, revised edition*. Springer-Verlag, Wien/New York, 254 p.

Keynes, J.M., 1921. *A Treatise on Probability*. Macmillan and Co., London, 489 p.

Knight, F.H., 1921. *Risk, Uncertainty and Profit*. Houghton Mifflin Co., Boston, 381 p.

Magis, K., 2010. *Community resilience. An indicator of social sustainability*. Society and natural resources, 23, 401-416.

Mocanu, I., 2008. *Unemployment in Romania. Dynamics and geographical differences* (In Romanian). Universitary Publishing House, Bucharest, 250 p.

Morçöl, G., 2005. *Postpositivist Perspectives in Policy Analysis.* In: Rabin, J. (ed.), Encyclopedia of Public Administration and Public Policy, Taylor & Francis, New York, pp. 217-220.

Morgan, G., 1997. *Images of Organizations*. Sage, Newbury Park, 485 p.

O'Connor, M., Faucheux, S., Froger, G., Funtowicz, S.O. & Munda, G., 1996. *Emergent complexity and procedural rationality: post-normal science for sustainability*. In: Costanza, R., Segura, O. & Martinez-Alier, J. (eds.), Getting Down to Earth: Practical Applications of Ecological Economics, Island Press, Washington, DC, pp. 223-248.

Perrings, C.A., Mäler, K.-G., Folke, C., Holling, C.S. & Jansson, B.-O., 1995. *Biodiversity conservation and economic development: the policy problem*. In: Perrings, C.A., Mäler, K.-G., Folke, C., Holling, C.S. & Jansson, B.-O. (eds.), Biodiversity Conservation: Problems and Policies, Springer, Dordrecht, pp. 3-21.

Roznovieţchi, I., 2000. *Current aspects of local commuting* (In Romanian). Revista Geografică, 7, 48-52.

Săgeată, R., 2006. *The political-administrative decisions and territorial planning* (In Romanian). Top Forum Publishing House, Bucharest, 395 p.

Săgeată, R., 2012. *Inter-communal cooperation and regional development: The case of Romania.* Quaestiones Geographicae, 31, 2, 95-106.

Săgeată, R., 2014. *Globalisation and Urban Spatial Reconversion. Case-Study: Commercial Services in Romania*. Forum geografic, 13, 1, 91-100.

Smit, B. & Wandel, J., 2006. *Adaptation, adaptive capacity and vulnerability*. Global Environmental Change, 16, 3, 282-292.

Șerban, P.-R., 2012. *What means "balance" in the center-periphery model*. Annals of the University of Bucharest – Geography Series, 107-115.

Vercelli, A., 1991. *Methodological Foundations of Macroeconomics: Keynes and Lucas*. Cambridge University Press, Cambridge, 288 p.

Wagnild, G.M. & Young, H.M., 1993. *Development and psychometric evaluation of the Resilience Scale*. Journal of Nursing Measurement, 1, 2, 165-178.

Walker, B., Holling, C.S., Carpenter, S.R. & Kinzig, A., 2004. *Resilience, adaptability and transformability in social–ecological systems*. Ecology and Society, 9, 2, 5.

Werner, E. & Smith, R., 1982. *Vulnerable but invincible: A study of resilient children*. McGraw-Hill, New York, 228p.

Received at: 19.12.2014

Revised at: 03.03.2015
Accepted for publication at: 10. 07. 2015
Published online at: 15. 07. 2015