

GEOGRAPHICAL INFORMATION SYSTEMS ASSESSMENT OF DEVELOPMENT DISPARITIES AMONG ROMANIAN REGIONS OF DEVELOPMENT

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ABSTRACT - New strategies of the European Union, focused directly on regional development or originated from different areas, but leading to changes in this field, had resulted into a set of indices used to monitor the effects of their implementation. Previous studies suggest that flexible systems perform better and could strengthen the administrative capacity of accessing structural and cohesion funds. Our study used the Geographical Information Systems (GIS) to produce hierarchies of the territorial indices at NUTS level II, displayed as charts and maps underlining the disparities between the socioeconomic, cultural and environmental aspects of the development. The results suggest that the regions with a low potential of development are situated in the south of Romania, but, most important, underline the potential of the method to be used as a planning tool in regional development, as its flexibility allows for an input with particular focus from different stakeholders, resulting into the selection of different indices and weights.

Keywords: regional development, GIS, EUROSTAT indices, ESPON, Lisbon Strategy

INTRODUCTION

Regional disparities or imbalances are situations where the values of different indicators exhibit uneven spatial distributions with respect to the values over a given region (Krimi *et al.*, 2010). Regional disparities have been and still are a global and almost universal phenomenon, with local variations (Krimi *et al.*, 2010). Regional disparities are at the order of the day due to the adverse implications over achieving a balanced territorial and economic development (Ardinat, 2011; Krimi *et al.*, 2010; Kuhar and Juvančič, 2007), but also in the functioning of the area and ethics (Ancuța, 2010; Siddiqui and Hussain, 2010) preventing an equitable distribution of income and wealth (Kuhar and Juvancic, 2007). For this reason, most developmental programs have aimed to progressively reduce territorial imbalances (Borbély, 2011; Siddiqui and Hussain, 2010); the same goal is achieved by globalization in general or accession to the European Union in particular (Gaubert and Yann, 2010; Juvančič, 2007; Kuyucu Helvacioğlu and Tektas, 2008). Disparities resisting all policies attempting to reduce or eliminate them were attributed to random shocks and structural differences between economies (Coulombe and Day, 1999).

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Traditionally, the study of heterogeneous space aimed to pinpoint homogenous areas (Ancuța, 2010). Most current studies of disparities rely on indicators reflecting economic, social, cultural, and environmental issues (Ákos, 2011; Alavi and Al-Alim Ramadan, 2008; Bunnell and Coe, 2005; Démurger, 2001; Soenandar, 2005). The studies analyzing the underlying causes seem to point toward unmonitored and uncontrolled growth (Siddiqui and Hussain, 2010), but also ethnic differences (Abeyratne, 2008). The study focused on the effects revealed two opposite conclusions, some authors arguing that inequalities stimulate economic performance, while other suggest that disparities call for interventions to level off economic development, suggesting that overall disparities can be seen as a threshold (Khalifa and El Hag, 2010). In summary, several theories attempted to explain territorial disparities: Smith's classical theory of growth, Keynesian growth theory, Neo-Classical theory of growth, and endogenous growth (Ianoș and Heller, 2006; Nedomlelová, 2007).

Due to the political changes occurred in the last 17 years and the accession of new members to the European Union (EU), new targets of socioeconomic cohesion have been established. Lisbon Strategy (Lisbon European Council, 2000) has set EU goals up to 2015, in order to have the most competitive and dynamic knowledge-based economy, with more and better employment opportunities and a strong social cohesion. Gothenburg Strategy (Göteborg European Council, 2001) has added environmental objectives. In order to achieve all these objectives, EU funds can be accessed based on projects that through implementation lead to increased welfare and are monitored based on a complex set of territorial indices. A system for assessing and monitoring regional policies in the EU represents the main vector of European economic development and consists of indicators provided by the Statistical Office of the European Communities (EUROSTAT) and the European Spatial Planning Observation Network (ESPON). Within the framework of INTERREG Programs, the European Space and Territorial Integration Alternatives (ESTIA) project aimed to establish a Spatial Planning Observation Network in the southeast of Europe based on an integrated system of territorial indices compatible with ESPON and the European Spatial Development Perspective (ESDP).

Romania has participated in these projects with a study aiming to identify a minimal set of indices (82) to be quantified at the level of administrative-territorial units (Institutul Național de Statistică, 2007), projects aiming to elaborate regional strategies based on spatial data (INCD Urbanproiect, 2006a) or develop a balanced and polycentric urban system (INCD Urbanproiect, 2006b), propose a spatial development concept of interregional cooperation in the Danube space (Ministry of Construction and Regional Development of the Slovak Republic, 2008), and promote a new type of rural-urban partnership (INCD Urbanproiect, 2006c), produce an average and long term model of economic development, statistics and forecasts used in developing governmental programs of development (Popescu, 2004). In 1998, the Romanian Ministry of Agriculture and Food implemented a PHARE program resulting into a green book of rural development (Ministerul Agriculturii și Alimentației, 1998). The elaboration of the National Plan of Development for 2007-2013 involves a precise assessment and monitoring of development within the country, which should comply with the principles of spatial planning and of the Nomenclature of Territorial Units for Statistics (NUTS): II, regions of development; III, county; and V, administrative territorial units). The European experience indicated that the evaluation of regional development policies cannot be done by a single complex monitoring unit, namely EUROSTAT. The dynamics of implemented projects funded by the EU has led to flexible monitoring systems, such as ESPON. Therefore, the accession of Romania to the EU implies a complex process of implementing projects funded by the EU as well as advanced flexible systems of spatial planning at national, urban and rural levels in order to strengthen the administrative capacity of accessing structural and cohesion funds. Geographical Information Systems (GIS) represent decision support systems involving the integration of spatially referenced data in a problem solving environment (Cowen, 1988) and has also been extensively used in spatial and urban planning (Petrescu, 2007; Petrișor, 2007, p. 57).

The novelty of this study consists of using GIS in conjunction with 424 indices grouped in 15 chapters. The results produced using this model were hierarchies of the territorial indices at the NUTS level II (region of development), displayed as charts and maps underlining the disparities between the socioeconomic, cultural and environmental aspects of the development, as well as disparities between

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the Romanian and European situation, based on Eurostat data, grouped using the “natural breaks” feature available with GIS.

Table 1. *Chapters and sub-chapters of regional development analyses at the level of the Romanian national territory*

Chapter	Sub-chapters
Population	(1) Number of people and structure of population, (2) evolution of population, (3) natural growth and migration, (4) demographic forecast
Health and security	(1) Medical assistance, (2) security, (3) social assistance
Education and training	(1) Education, (2) culture
Workforce market	(1) Occupied population, (2) unemployment
Housing and life conditions	(1) Housing, (2) town infrastructure, (3) incomes and expenditures of population, (4) possession of personal cars, (5) households with internet access
Economy	(1) National accounts, (2) competitiveness, (3) direct foreign investments, (4) medium and small enterprises, (5) business support infrastructure, (6) prices and salaries
Research-development	(none)
Industry	(none)
Transportation	(none)
Energy	(none)
Agriculture	(none)
Silviculture	(none)
Tourism	(none)
Environment	(1) Natural protected areas, (2) air pollution, (3) water pollution, (4) soil pollution, (5) waste, (6) environmental protection expenses
Spatial structure	(1) Spatial structure according to CORINE classification, (2) administrative-territorial structure of the regions of development, (3) size classes of administrative-territorial units, (4) evolution of population from municipalities and cities, by class size, (5) concentration of population in municipalities – residence of regions, (6) density of urban areas, (7) degree of urbanization, (8) urban poles, (9) structure of parcels by main land use classes

METHODS

Romania is organized in 41 counties, 103 municipalities (including Bucharest), 227 cities, and 2841 communes with 12951 villages. In addition, Law no. 315 of 2004 defined eight regions of development without judicial personality. These regions are areas including territories of counties, and also of Bucharest, created based on conventions between the county councils and Bucharest General Municipal Council. The number of counties within regions varies from 4 (West) to 7 (South). The region Bucharest-Ilfov consists of the capital Bucharest and Ilfov County (Figure 1). Analyses were carried out in this study at the level of the regions of development.

This study has used 424 indices grouped in 15 chapters presented in Table 1 and discussed below. (1) population: demographic elements represent one of the basic compartments of regional development through the importance of indices describing the size, evolution and structure of the human resources; (2) health and security: the general health of population and quality of medical services are crucial to the analysis of socioeconomic development, due to their connection with the economic development; (3) education and training: in addition to health, education represents another premise for a sustainable development of the country; (4) workforce market suffered significant

changes during the transition, due to the migration, resulting into lesser active and occupied population, constant unemployment rate, and changes in the structure by domains, regions, ownership, age, and professional status; (5) housing and life conditions: looks at the occupation and comfort of dwellings and the dynamics of building; life conditions are harder to assess due to the lack of information on some indices; (6) economy analyses are based on the national accounts, competitiveness, direct foreign investments, small and medium enterprises, support infrastructure, prices, and salaries; (7) research-development: the weight of expenses for research and development in

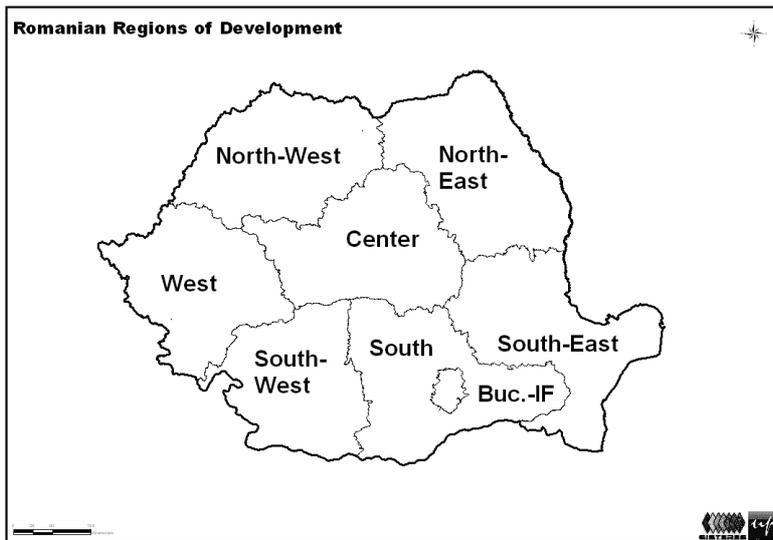


Figure 1. *Regions of development in Romania*

the GDP is the only index that could provide for compatibility with the European Union; (8) industry analyses looked at the earnings of companies, number of personnel per 1000 people and direct gross foreign investments; (9) transportation analyses were limited to railroad and highway transport; (10) energy has a fundamental influence on development. Energy policies must be able to support sustainable growth, based on conditions related to economic efficiency, but also on social and environmental criteria; (11) agriculture: Romania benefits by very favourable natural conditions (different types of soil, with a high percentage of high quality types, used for cereals and husbandry) and a temperate climate allowing for developing ecological agriculture or high quality foods, required more and more by the European market; (12) silviculture analyses looked at the forested surface, reforestations, and wood production, but also at the structure of wood by type; (13) tourism: Romania benefits by a varied potential constituted from natural, cultural, and historical heritage values; (14) environment: Romania benefits by a valuable natural heritage, but environmental issues could threaten it; (15) spatial structure: assessment of the situation at the level of the regions of development, with particular references to the base administrative territorial units (counties, cities, communes, and villages).

Regional databases have been designed based on the Lisbon Strategy (Lisbon European Council, 2000), Eurostat indices and the system of indices proposed by the ESPON project 4.1.3 - *Feasibility study on monitoring territorial development based on ESPON key indicators* (ESPON Monitoring Committee, 2007). In addition, the particularities due to the context specific to Romania have resulted into additional statistical indices referring to town infrastructure, which are no longer used currently in other European countries.

The application of the GIS model for the regions of development involved the following steps: (1) identify groups of qualitative and quantitative indices by chapter; (2) three experts assigned weights to indices within each chapter, summing up to 100; (3) apply the program for each chapter and establish decreasing rankings of regions; (4) exchange the format of data in order to provide compatibility with the GIS; (5) import data from a database produced in VisualFoxPro into GIS to produce shape (.shp) files; (6) analyze data with GIS grouping regions based on the natural limits and natural breaks, using the values of each index; (7) export data into a Personal Database (.mdb) format for use into an OpenGIS system corresponding to the new trends. The hierarchies established using the individual region values of indices by chapters resulted into relatively homogeneous areas of different sizes. Therefore, spatial clusters must be analyzed taking into account the importance and weight of each index accounted for.

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RESULTS AND DISCUSSION

The results are displayed in Figures 2 through 10 below, and discussed below for each of the chapters presented in the first column of Table 1:

1. Population - the key problems resulted from the analysis of aforementioned indices are: (a) the demographic decline present nationwide, as well as in all regions of development, decreasing significantly in the west, the Northwest, and the Center (Figure 2); (b) continued deterioration of the age structure in all regions, indicating ageing and increased demographic dependence rate; (c) low fertility and natality and high mortality in general, leading during the last decade to a negative balance of the natural increase (excepting for Northwest) with alarming values in the Southwest, the South, and the west; (d) a very high rate of infant mortality, reaching 19-21‰ between 2001 and 2006 in the Northeast, Southeast, South, and the Southwest; (e) a negative balance of international migration, nationwide and regionally, with higher values in the last years in the West and the Southwest; and (f) premises for a continuation of the demographic decline by 2025 due to an increased trend of the possibility to replace previous generations (Figure 3).

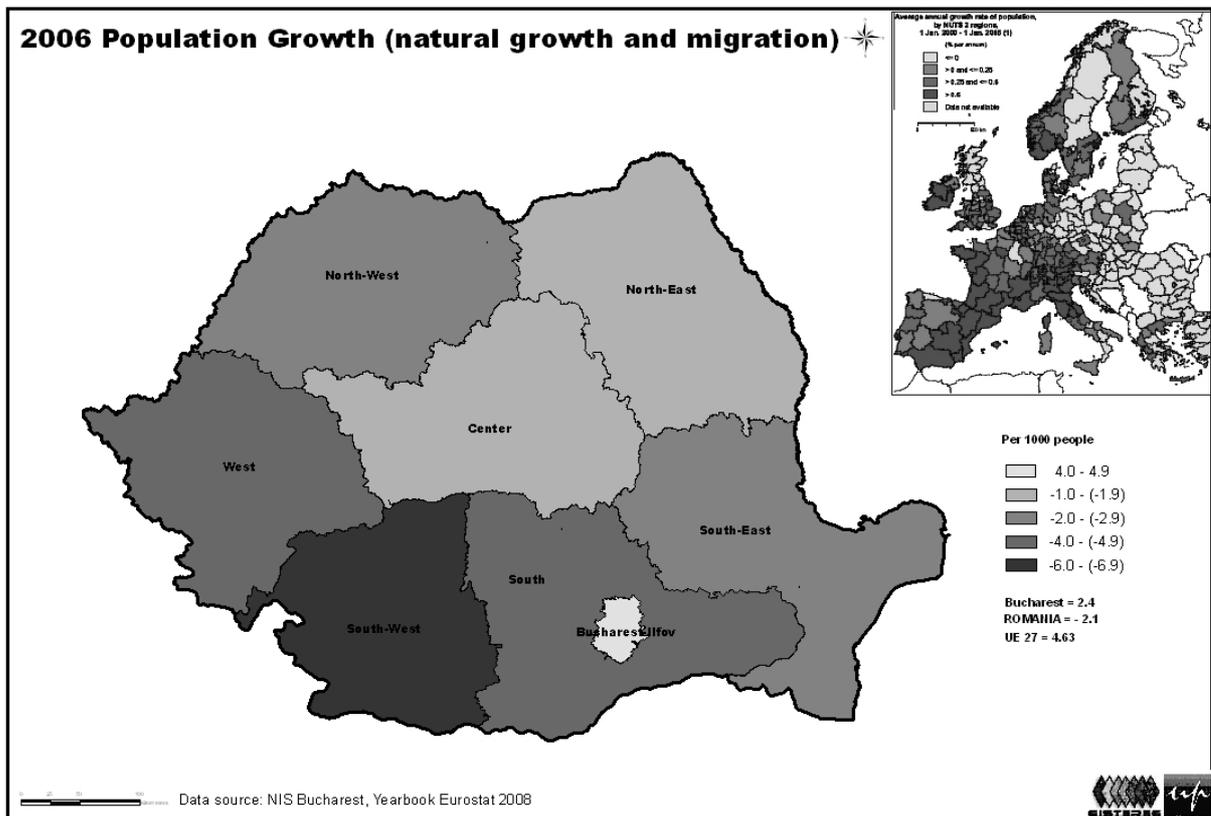


Figure 2. Population growth in Romania

2. Health and security: the analysis of indices reveals the lack of highly educated medical personnel especially in the South, the Southeast and the Northeast, and also generalized in the rural areas. In the most recent period, the lack of average qualified medical personnel has become prominent, as a consequence of migration to other European countries providing better workplaces in terms of the salary. The provision of medical services has been improved due to the expansion of private medical services.

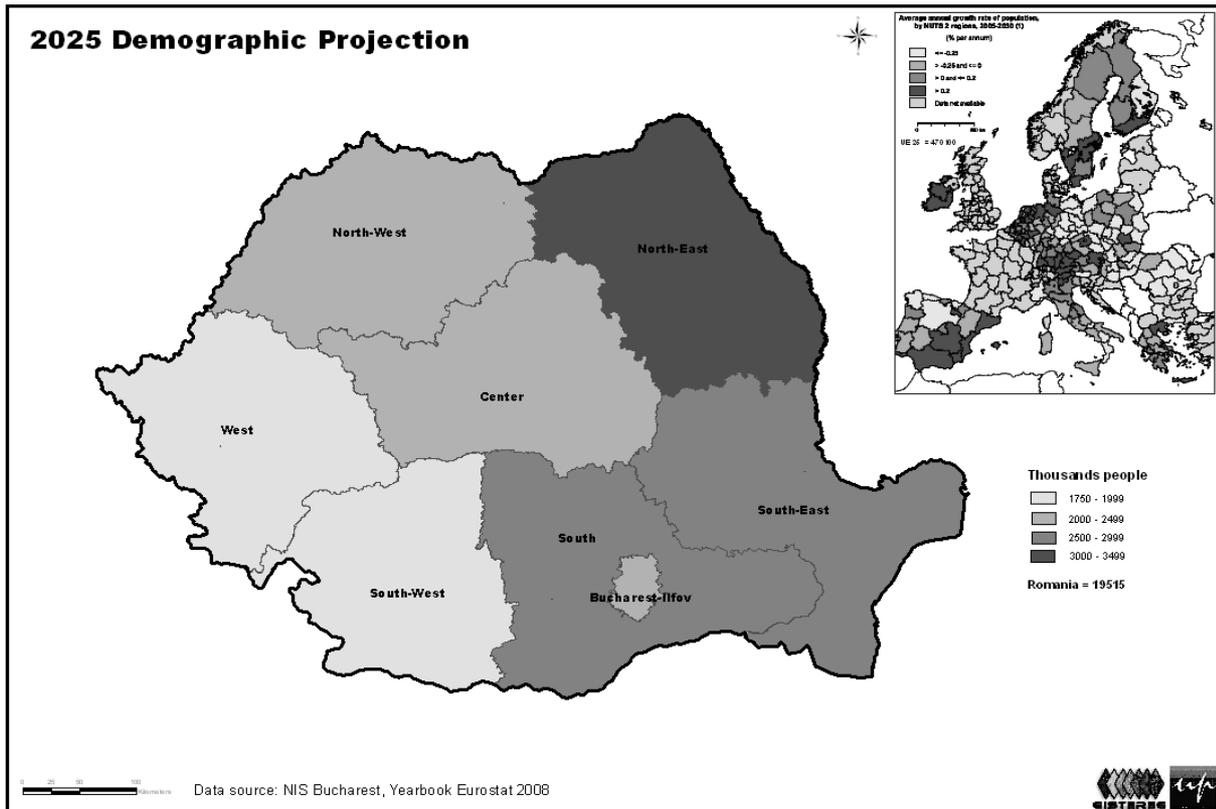


Figure 3. Forecasts for 2025 population of Romania

3. Education and training: the main indices do not reveal essential regional differences, while such differences manifest within each region between urban and rural areas through a deficit of qualified teaching personnel in rural areas and small cities. The main problems of education are: (a) insufficient material endowments needed in order to provide for an acceptable quality of education, especially with respect to modern technologies required by the labour market; (b) increased rate of people aged 18-24 abandoning education, especially if originating from disfavoured environments; (c) the need to produce a stock of the human capital educated according to the requirement of an economy performing on the European market; and (d) enlarged training opportunities for people aged 24-64 in order to provide them possibilities to integrate in new domains of activity, meeting the emerging requirements of socioeconomic development (Figure 4).

4. Workforce market: 2006 indices reflect: (a) a low rate of occupied population, under the European average for men and women as well; (b) lower occupation of elder population, with higher values in predominantly agricultural regions from the Northeast, the Southwest, and the South, where female work force is used more in the agriculture; (c) low unemployment rate (Figure 5); (d) an inefficient structure of the occupation, by maintaining a large part of the population occupied in agriculture, which has a very low input on the GDP; (e) insufficient correlation between current qualifications and the demands of the labour market, *i.e.*, a deficit of education units and training opportunities for people over 25 years; and (f) poor geographic coverage of the offer for professional training, since such centres are concentrated exclusively in urban areas.

5. Housing and life conditions: no major critical aspects concern quantitative indices; the main problems refer to low comfort degree of a large part of the building stock, due to the complete or partial lack of basic endowments.

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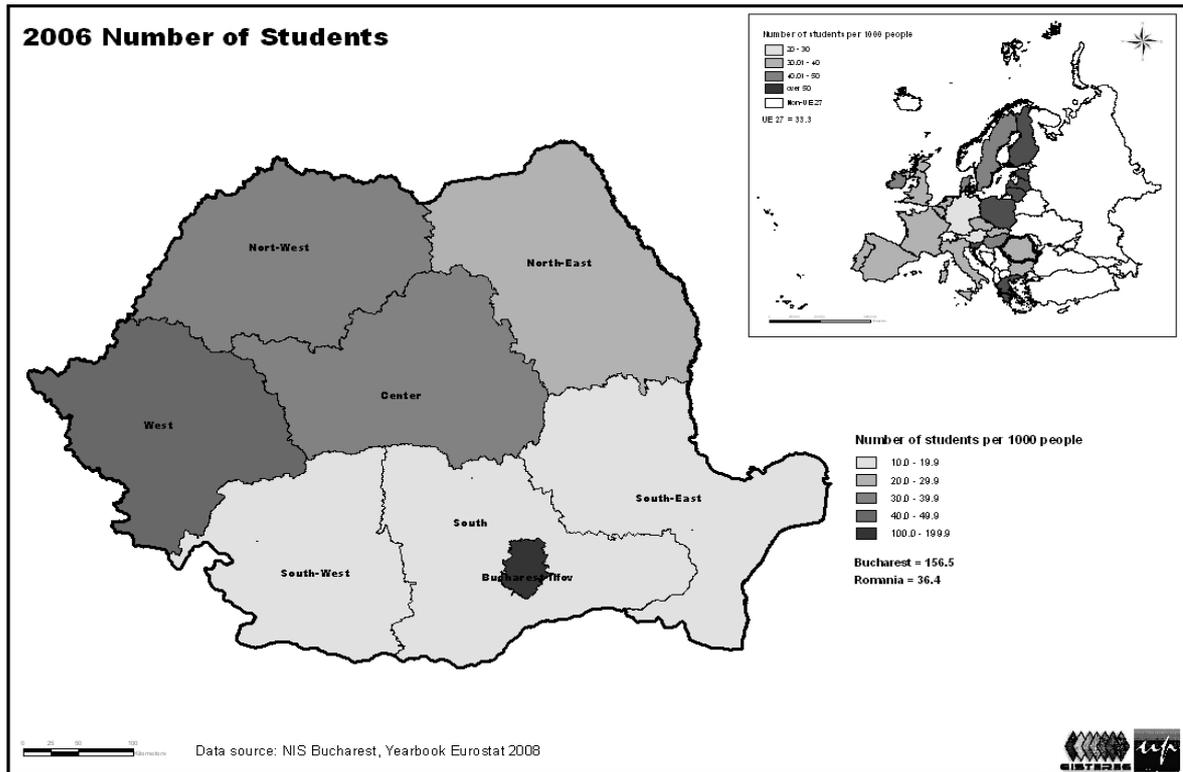


Figure 4. Education in Romania. Figure displays the 2006 number of students per 1000 people

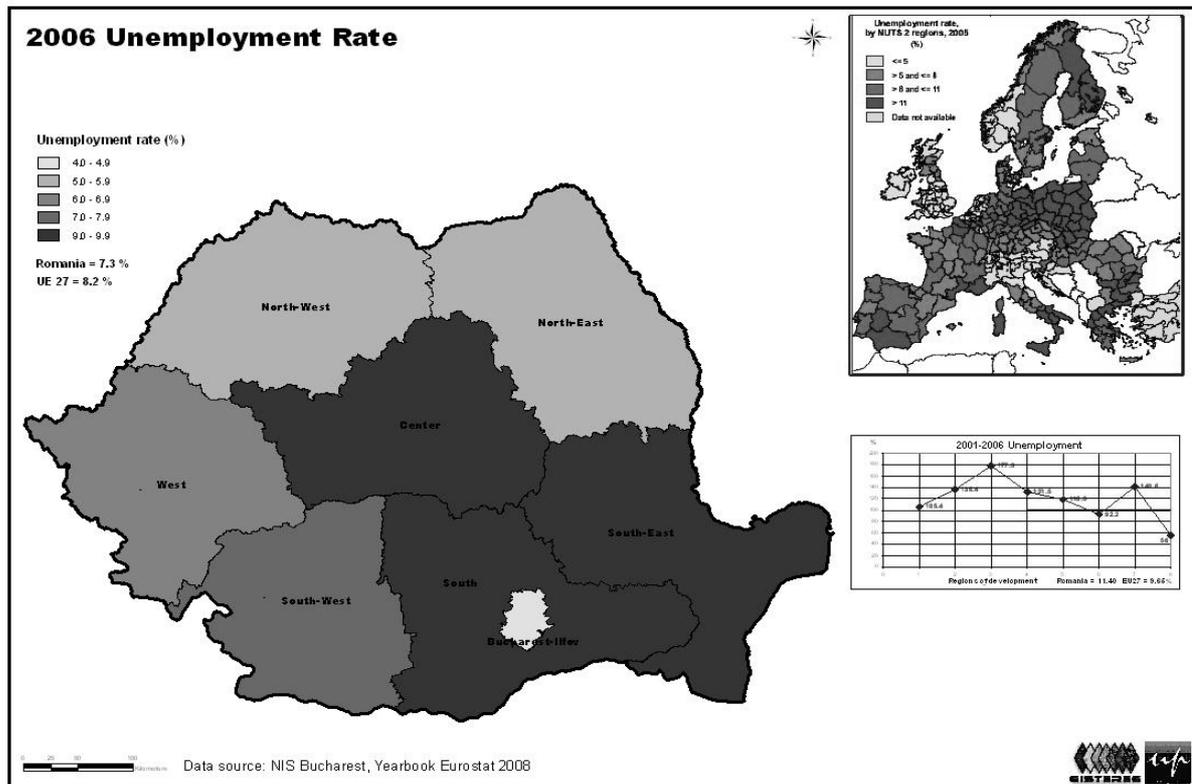


Figure 5. Workforce market in Romania

6. Economy: the main critical aspects are determined by (a) a low level of GDP/inhabitant compared to the European average, representing only 37% of the Purchasing Power Parity of the European continent, suggesting that serious efforts are needed to recover the gap (Figure 6); (b) serious regional gaps - very low values are found in the Northeast, the Southeast, the South, and the Southwest; (c) very low competitiveness of the European economy revealed by a work productivity per occupied person representing in 2006 only 38.3% of the European average (Figure 7); (d) large gaps between regions with respect to the productivity; values in Bucharest-Ilfov are twice or thrice the national average and 3.3 times greater than those in the Northeast; in order to increase the competitiveness of the Romanian economy, work productivity must increase only as the result of a plus-value generating economy, bringing benefits to both investors and employees; higher productivity could result from improved work efficiency, better management, better use of the capital, increased production due to investments in the productive capital, equipment, technology, and human capital; (e) gaps between the average salaries among regions - values are higher in Bucharest-Ilfov in all domains; (f) monthly inflation rate of 2006 was 6.6%, three times the European average; and (g) the rate of the poverty risk, resulted from the inclusion of all social transfers in computing the incomes, was 18% while the European average was 16%.

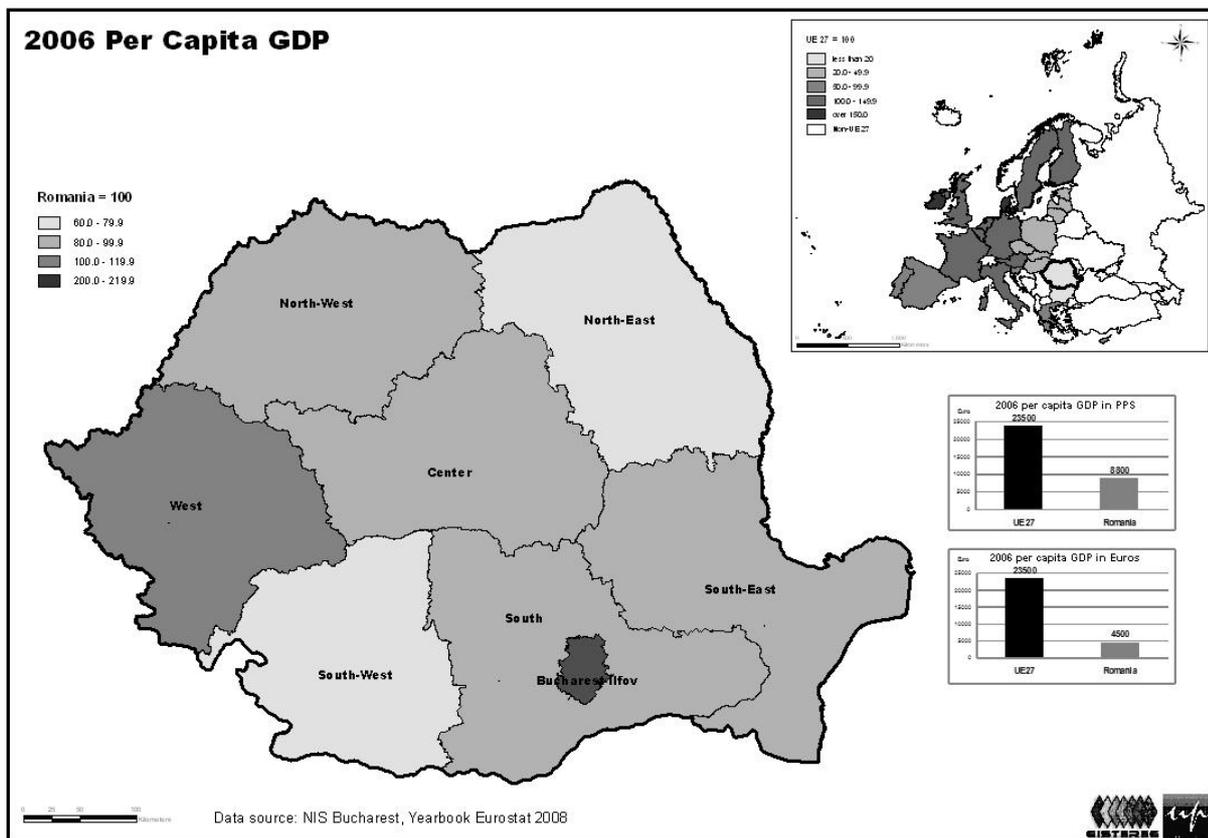


Figure 6. 2006 per capita GDP in Romania

7. Research-development: the weight of expenses for research and development in the GDP was 0.45%, four times lesser than the European average (1.84%) and 8 times lesser than the average in Sweden or Finland. This value ranks Romanian on the last place in Europe.

8. Industry: indices analyzing the volume of business, number of personnel and gross investment per 1000 people reveal higher values in Bucharest-Ilfov, West and the Center.

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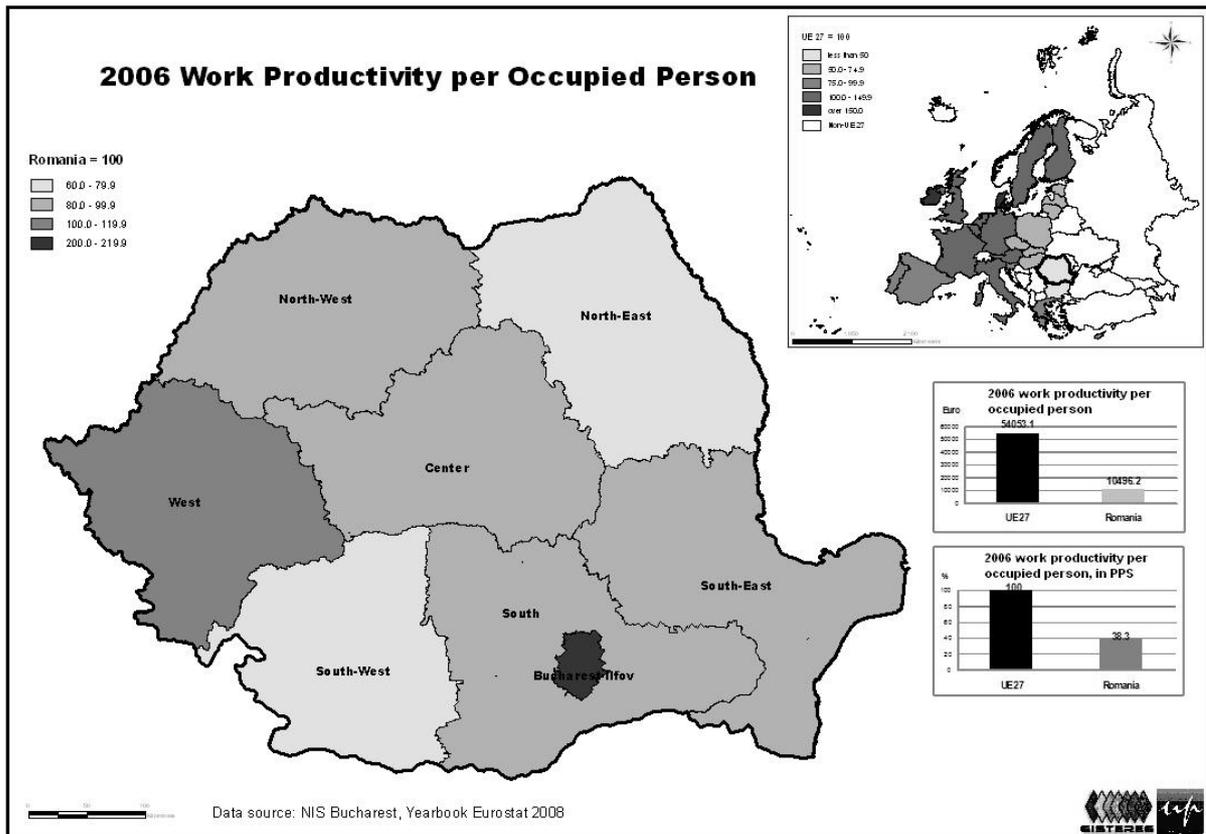


Figure 7. 2006 work productivity of occupied people in Romania

9. Transportation: railroad and highway infrastructure are situated in all regions below the European standards. The situation is due to the low modernization rate of transportation means and public highways and poor development of the multiple lane expressways network.

10. Energy: energy intensity in Romania exceeds 3.5 times the European average (using the exchange rate). Analyses also indicate (a) many aged equipments used to produce, transport and distribute energy, resulting into high exploitation costs; (b) an increased dependence of imported natural gas from a single supplier; and (c) low energy efficiency in the production-transportation-distribution-final use chain.

11. Agriculture is mostly represented by household production with its own endpoint (30.5% in 2006), out of which an important part consist of sub-occupation forms and has a very low contribution to the formation of the GDP (Figure 8).

12. Silviculture: the weight of the forested area out of the total surface of the country (28.3%) is lower compared to other European countries and decreases due to successive cuts followed by reforestations covering lesser areas.

13. Tourism: despite of the potential, the degree of valorisation is insufficient. Analyzed indices revealed regional differences in attracting tourists and using the accommodation capacity, which could be explained by both the preferences of tourists and existing infrastructure, differently distributed (Figure 9). However, regions possess a capacity of balancing the distribution of tourism development more than it is actually shown.

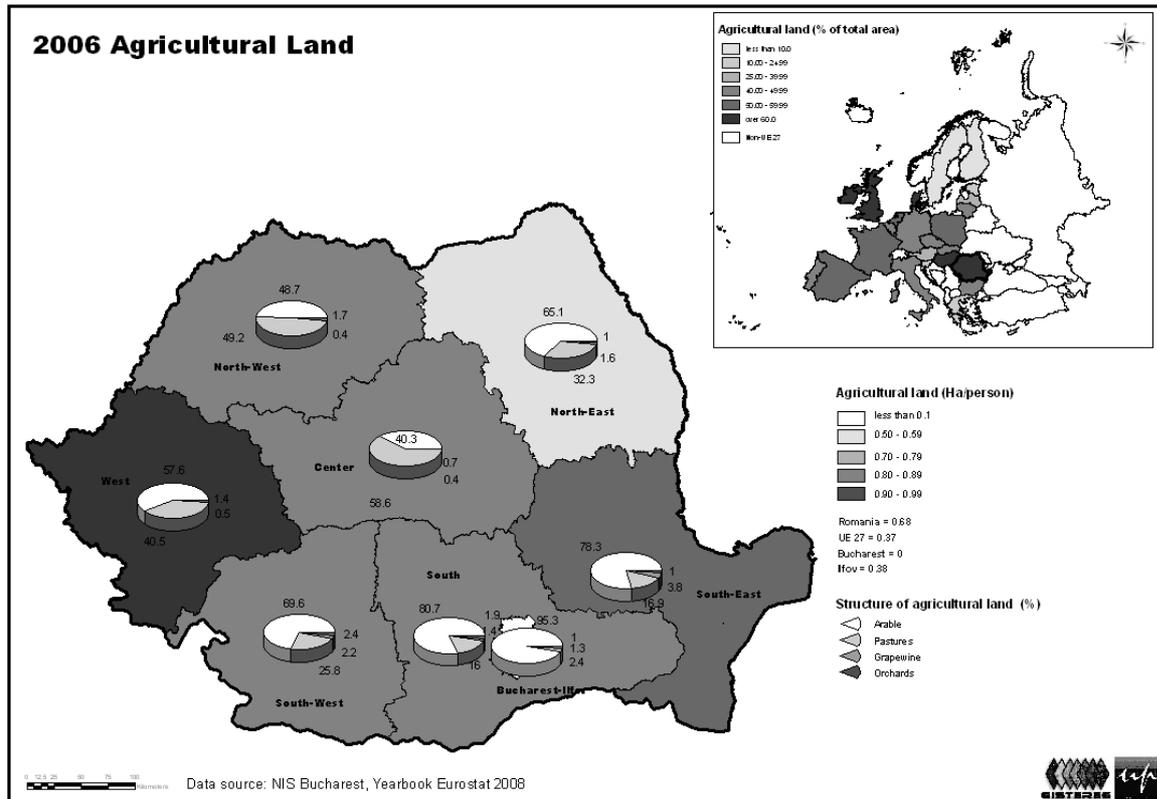


Figure 8. Agriculture in Romania. The usage of agricultural land

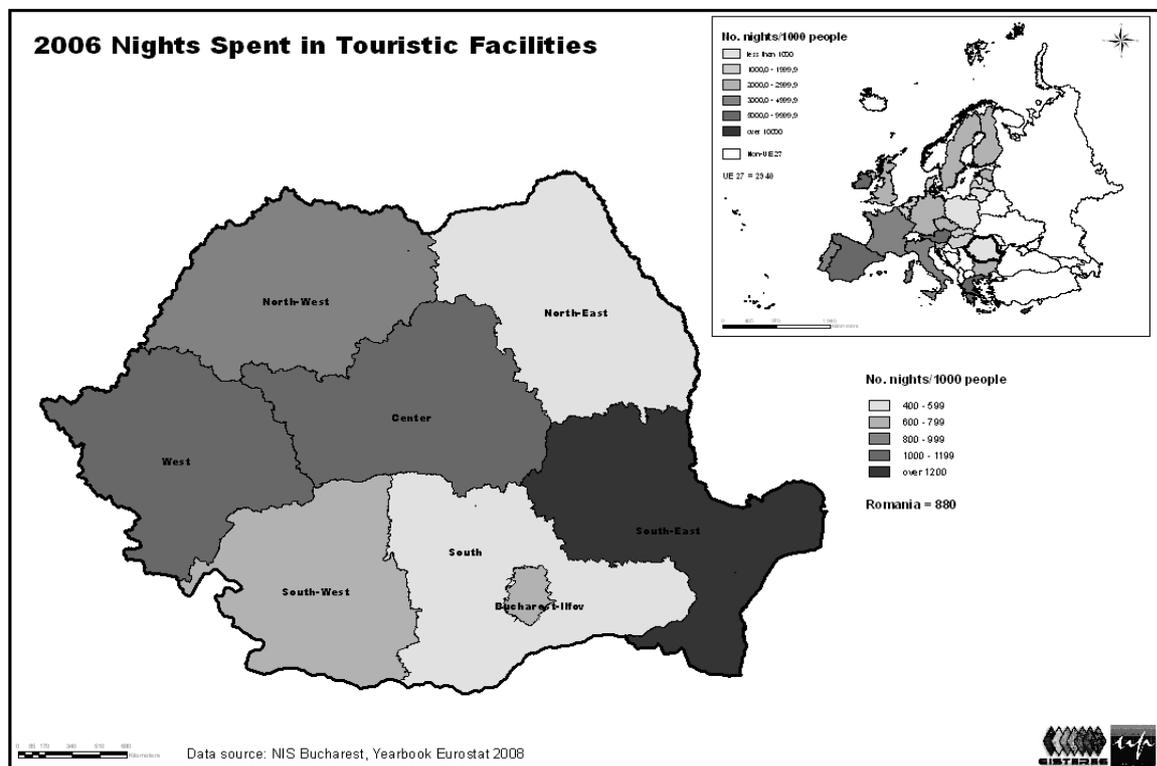


Figure 9. Tourism in Romania. The number of nights spent in tourist facilities

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14. Environment: the analyses revealed that (a) Romania has the most diverse and valuable natural heritage in Europe. Protected areas of national interest cover 7% of the territory, while Natura 2000 sites cover 17.84% of it; (b) sulphur dioxide emissions vary among regions (values are 40 times larger in the South and the Southwest compared to the Northwest and Bucharest-Ilfov); (c) emissions of nitrogen oxides also vary among regions (values are 10 times larger in the South than in the Northwest, and are also large in the Southwest); (d) most greenhouse gases are emitted in the South and least in the Northwest; (e) most pesticides were used in the Southeast and the South, and least in Bucharest-Ilfov and the Southwest; however, when looking at the amount of pesticides per surface unit, the highest values are found in Bucharest-Ilfov and smallest in the Southwest; and (f) largest household waste amounts are produced in the Northeast and the Southeast, and least in the Southwest (nearly three times lesser) (Figure 10).

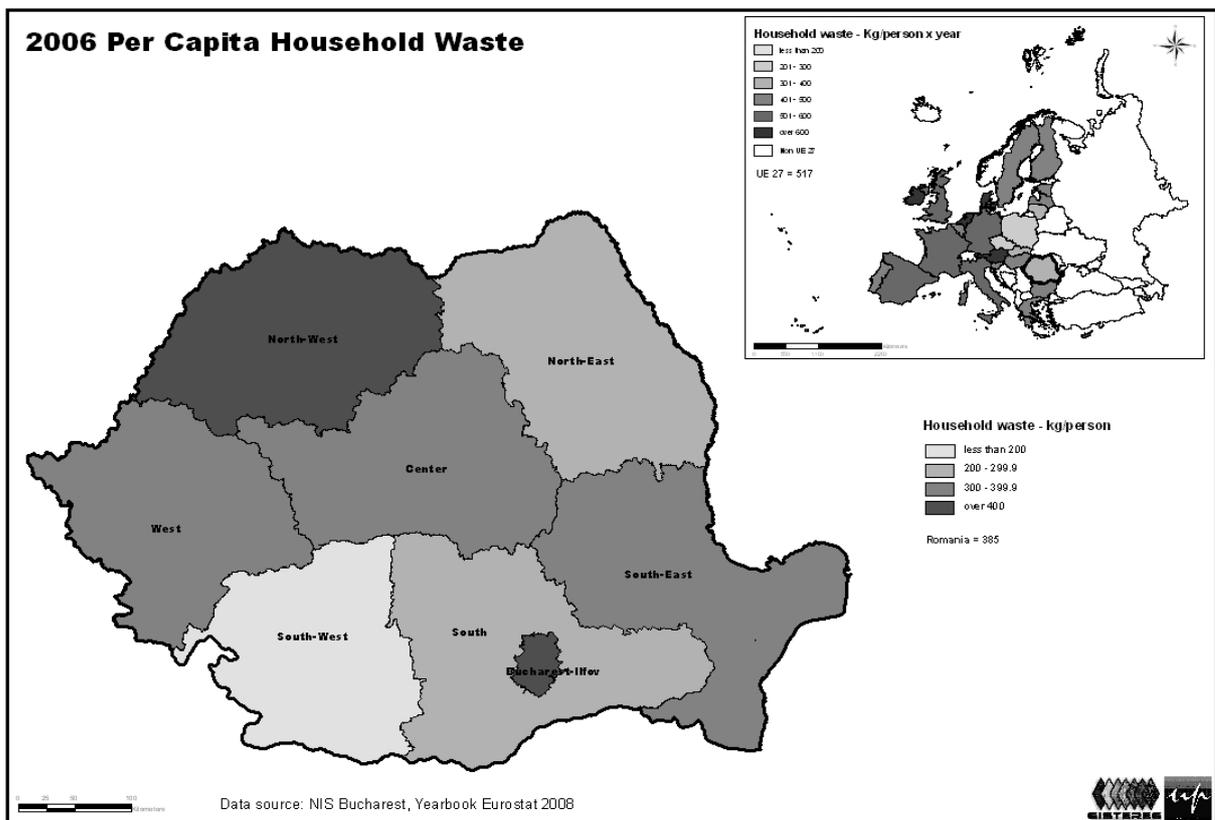


Figure 10. 2006 household waste generated in Romania (per capita)

15. Spatial structure: the 320 municipalities and cities concentrate some 55% of the 2006 population; the value is lesser than the European average and situates Romania among the poorly urbanized countries. The degree of urbanization varies among regions, in correlation with the general level of development per region. The Northeast, the South, and the Southwest are less developed and concentrate less than 50% of the population in urban areas (the South: 41.6% and the Northeast: 43.7%). The highest percentage is found in Bucharest-Ilfov: 92.5% (due to the capital city) and the West: 63.5%. As a result of economic, social, and historical evolution, urban population from the West and Center of the country has reached higher proportion compared to the Northeast, the South, and the Southwest regions, predominantly rural. The concentration of population in the municipalities-county residence ranges between 2.23% in the South and 15.72% in the West, excepting for Bucharest-Ilfov, where Bucharest concentrates 87.12% of the population of the region. A network of poles of development is shaped over the Romanian territory, consisting of: metropolitan poles, national poles,

supra-regional poles, regional poles, sub-regional poles, local poles and poles with metropolitan potential. According to the European programs for spatial development, a balanced and polycentric spatial development could sustain territorial cohesion and balance social, economic, and environmental conditions.

CONCLUSION

The very low competitiveness of the Romanian economy is underlined by the low values of indices such as GDP per capita and work productivity for an employed person. In addition, disparities between regions have increased in the last two decades instead of decreasing; especially the region Bucharest-Ilfov, including the capital city, presents twice or thrice the values of some of the indices compared to poorly developed regions: the Southwest - Oltenia and the Northeast (Ianoș *et al.*, 2009). Compared to the 90's poverty has been increasing especially in the South (particularly Oltenia and the counties of Teleorman and Giurgiu), while development appears to be more intense in the West. We could anticipate that such gaps would deepen even more in the context of the current global economic crisis.

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