Measuring Regional Development with RIV Models: A Case Study for Romania and the European Union

Ph.D. Professor Romeo Ionescu*

Abstract*:*
The paper deals with the analysis of the regional development using RIV model which uses a regional sphere. The regional development is analysed as a sum of boundless number of sphere sectors. We must carry out a translating process that should make the passage from a two to a three-dimension space. Each specific influence is allotted certain, clearly cut sphere sector as shown by the pattern.

We consider standard life as the element aimed at by the study at issue. Using specific factors, RIV model can obtain a diachronic time-progress diagram.

More, a series of relevant comparisons can be made between regions, between regions and the country mean or between regions and the E.U. average.

RIV model allows completing forecasts using scenarios method which is able, for example, to provide the regional decisions makers with a wide range of possible involvements.[1]

1. Introduction

RIV model represents an original component of the Romanian regional modelling. It is a new success for regional analysis because it allows a pertinent regional analysis using an unlimited number of restrictions. The model is based on the concept of regional sphere, in which socio-economic connections can be transferred on a sphere using some areas or spherical sectors. We used in this paper spherical sectors as in figure no.1. Such a spherical sector describes using its volume the importance of every factor of regional development. The volume of the spherical sector is:

$$V = \frac{2\pi R^2 I}{3}$$

(1)

* Ionescu Romeo, Aurel Vlaicu no.10, 800508 Galatz, Romania, Dunarea de Jos University, Galatz, Romania, phone 0040236, fax 0040236, <u>*ionescu_v_romeo@yahoo.com*</u>*, Vice-president of the Romanian Regional Science Association (A.R.S.R); Founder member of Romanian General Association of the Economists (AGER); Laureate of the Romanian Government Ordain for Teaching Activity as Knight; Member of Research Board of Advisors, American Biographical Institute, U.S.A.; Member of European Regional Science Association; Member of European Regional Science International; Multiplication of European information under European Commission in Romania; Member of International Advisory Board for Romanian Journal of Regional Science, listed in DOAJ database.*

where: R- sphere's radius and I- height of spherical zone which bounds the sector.

We consider that measuring regional standard life has to be the result of this analysis. This standard life is dimensioned by elements like the following: percentage of urban population, infant mortality, unemployment rate, average number of doctors per 1000 inhabitants and regional GDP per capita. Using these elements, RIV model can realise a diagram of regional development

The ideal situation is that in which percentage of urban population, average number of doctors per 1000 inhabitants and regional GDP per capita have maximum values and infant mortality and unemployment rate have minimum values. The results of these calculations will be represented in the following figure no.2.

Using a three-dimensional plane, we can transfer the dates from figure no.2 into spherical sectors like in figure no.3.

A bettering of this model is that which considers that the influences of positive and negative factors can be represented as a lot of spherical areas. In according to this, we have to realise a translation from a bi-dimensional into a three-dimensional space like in figure no.4. In this case, we use percentage dimensions. Any influence will have a sphere sector like the patterns one.

In order to translate this sector on the sphere area, we used a point from it by (z,y) coordinates. We can do it because the sphere sector is bounded by two functions: y=bx and y=ax.

Another situation is that in which the sphere sector is irregular, like in figure no.5. Any point of (x,y) coordinates can be transpose in a regular area (a triangle or a rectangle) using relation:

$$(x,y) \rightarrow \left(\frac{x}{1-z}, \frac{y}{1-z} \right) \tag{2}$$

That implies two steps. First of them is the translation on the outline and the second translation inside outline. The statistical database allows us to realise a comparison between E.U.27, Romania and two Romanian regions. The analysis uses information for 2000 and 2007 which are synthesized into the table no. 1.

2. Methodology

In order to obtain a realistic approach about regional disparities, we used statistical dates about E.U.27 and Romania. We considered that average E.U.27 regional development level represents the ideal situation for Romania.

For the beginning, we used a bi-dimensional plane as a circle with a radius of 5 cm. In such a circle, we used percentages in order to determine the ideal level of regional development (as in the E.U.27):

2000 E.U.
Percentage of urban population: $5 \times 80\% = 4.0$ cm (height of the spherical sector (3)
Infant mortality: $5 \times 4.8\%_0 = 0.02$ cm (4)

Unemployment rate: $5 \times 7.6\% = 0.38$ cm (5)

Average number of doctors per 1000 inhabitants: $5 \times 4.5\%_0 = 0.02$ cm (6)

regional GDP per capita: $5 \times 20.25\% = 1.01$ cm (7)

2007 E.U.

Percentage of urban population: $5 \times 77\% = 3.85$ cm (8)

Infant mortality: $5 \times 4.9\%_0 = 0.02$ cm (9)

Unemployment rate: $5 \times 5.0\% = 0.25$ cm (10)

Average number of doctors per 1000 inhabitants: $5 \times 4.5\%_0 = 0.02$ cm (11)

regional GDP per capita: $5 \times 28.47\% = 1.42$ cm (12)

Using these calculations, we can realise regional development diagrams for the E.U. in 2000 and 2007. These five indicators describe five spherical sectors with different volumes in connection with their importance at regional level.

An important element will have a greater spherical sector volume. So, for the beginning, we used information in order to describe E.U.'s regional development as in figure no.6.

The next step is to represent statistical dates using tri-dimensional spherical sectors. We used three spherical sectors: first of them for the E.U.'s ideal situation, second for E.U.'s situation in 2000 and third for E.U.'s situation in 2007.

In first situation, percentage of urban population, average number of doctors per 1000 inhabitants and regional GDP per capita have maximum values (100%), infant mortality has minimum value (0%) and unemployment rate is considered about 4% (equilibrium unemployment rate).

In the same manner, we calculated the dates for Romania, using results from E.U. 2000 and 2007.

2.1 Romania 2000 Reported to E.U.'s 2000 Situation

Percentage of urban population: $4.0 \times 54.6\% = 2.18$ cm (height of the spherical sector); (13)

Infant mortality: $0.02 \times 18.6\%_0 = 0.01$ cm (14)

Unemployment rate: $0.38 \times 6.6\% = 0.25$ cm (15)

Average number of doctors per 1000 inhabitants: $0.02 \times 1.9\%_0 = 0.01$ cm (16)

regional GDP per capita: $1.01 \times 5.26\% = 0.53$ cm (17)

2.2 Romania 2007 Reported to E.U.'s 2007 Situation

Percentage of urban population: $3.85 \times 54.9\% = 2.11$ cm (18)

Infant mortality: $0.02 \times 15\%_0 = 0.01$ cm (19)

Unemployment rate: $0.25 \times 7.2\% = 0.18\,\text{cm}$ (20)

Average number of doctors per 1000 inhabitants: $0.02 \times 1.8\%_0 = 0.01\,\text{cm}$ (21)

regional GDP per capita: $1.42 \times 9.45\% = 1.34\,\text{cm}$ (22)

These results are represented in figures no. 6 and 7.

Using ideal situation from figure no.3, the regional development in Romania can be represented as in figure no.8.

In order to stand out the evolution of the Romania's regional development during 2000-2007, we used two supplementary figures 9 and 10.

In 2007, the disparities between Romania and E.U. started to reduce in some specific situations. We speak about percentage of urban population, infant mortality and regional GDP per capita. The values of these indicators in Romania are little than in 2000, but the disparities between regional development in Romania and in E.U. are still great.

More, there are great disparities between Romanian regions too. So, we referred to two opposite regions, one from the South-East and the other from the North-West of Romania in order to conclude that the regional disparities are greater in 2007 than in 2000. Unfortunately, it is not an optimistically conclusion but it is real.

2.3 Regional Level

The next level of present analysis is the regional one in Romania. First Romanian region is 2 South-East. Using statistical dates from table number 1, we can calculate the regional indicators for this region comparing with E.U.'s situation from the same year.

South-East Region 2000

Percentage of urban population: $4 \times 56,8\% = 2,27\,\text{cm}$; (23)

Infant mortality: $0.02 \times 19.1\%_0 = 0.01\,\text{cm}$ (24)

Unemployment rate: $0.38 \times 8\% = 0.3\,\text{cm}$ (25)

Average number of doctors per 1000 inhabitants: $0.02 \times 1.4\%_0 = 0.01\,\text{cm}$ (26)

regional GDP per capita: $1.01 \times 23\% = 0.0.23\,\text{cm}$ (27)

South-East Region 2007

Percentage of urban population: $3.85 \times 55.5\% = 2.14\,\text{cm}$ (28)

Infant mortality: $0.02 \times 16.5\%_0 = 0.01\,\text{cm}$ (29)

Unemployment rate: $0.25 \times 8.3\% = 0.3\,\text{cm}$ (30)

Average number of doctors per 1000 inhabitants: $0.02 \times 1.3\%_0 = 0.01\,\text{cm}$ (31)

regional GDP per capita: $1.42 \times 31.6\% = 0.45\,\text{cm}$ (32)

Using tri-dimensional spherical sectors, the comparison between regional development in 2000 and 2007 in South-East region becomes like in

figures no.12 and 13.The North-West Region has a better situation than South-East in order to estimate regional development. We follow the same procedure to calculate regional indicators for North-West Region in 2000 and 2007.

North-West Region 2000

Percentage of urban population: $4 \times 52.6\% = 2,10\,\text{cm}$; (33)

Infant mortality: $0.02 \times 17.3\%_0 = 0.01\,\text{cm}$ (34)

Unemployment rate: $0.38 \times 4.8\% = 0.18\,\text{cm}$ (35)

Average number of doctors per 1000 inhabitants: $0.02 \times 2.1\%_0 = 0.01\,\text{cm}$ (36)

regional GDP per capita: $1.01 \times 30\% = 0.30\,\text{cm}$ (37)

North-West Region 2007

Percentage of urban population: $3.85 \times 53.1\% = 2.04\,\text{cm}$ (38)

Infant mortality: $0.02 \times 13.5\%_0 = 0.01\,\text{cm}$ (39)

Unemployment rate: $0.25 \times 7\% = 0.18\,\text{cm}$ (40)

Average number of doctors per 1000 inhabitants: $0.02 \times 1.9\%_0 = 0.01\,\text{cm}$ (41)

regional GDP per capita: $1.42 \times 35.1\% = 0.5\,\text{cm}$ (42)

So, we can see differences in time and between this region and E.U. too. These differences are presented in the same manner as before in figures no.14 and 15. We consider that this is the moment for the final comparison between E.U., Romania and those two Romanian regions. This new comparison allows us to see the disparities and their evolution and to focus on the instruments of reducing those disparities, like in figure no.16. It is very easy to see that the disparities between Romania and E.U. are still great. On the other side, there are great disparities inside Romania between its regions too.

3. Conclusion

So, we can conclude that we could realise a diagram of the potential of regional development. More, we can realise relevant comparisons between regions, between regions and average level of national development and between regional, national economies and E.U.'s average level of development. RIV model allows realising forecasts, using scenario method for example, which are able to offer alternatives for management organisms at regional level. More, RIV model can use an unlimited number of socio-economic indicators in order to assist management organisms in their regional policy implementation. It is able to spotlight positive aspects which have to be supported and negative aspects which have to be eliminating too.

RIV model can be an instrument which can support a country to eliminate the disparities between its regions or between its regions an E.U.'s average. RIV

model can be use for any country and any region at any time because it is a dynamic open model.

References

1. **Ionescu R.,** *Forecasts and Economic Perspectives,* Academic Fundation Danubius, Galatz, 2006.
2. **Eurostat**, *Yearbook*, Office for Official Publications of the European Communities, Luxembourg, 2001.
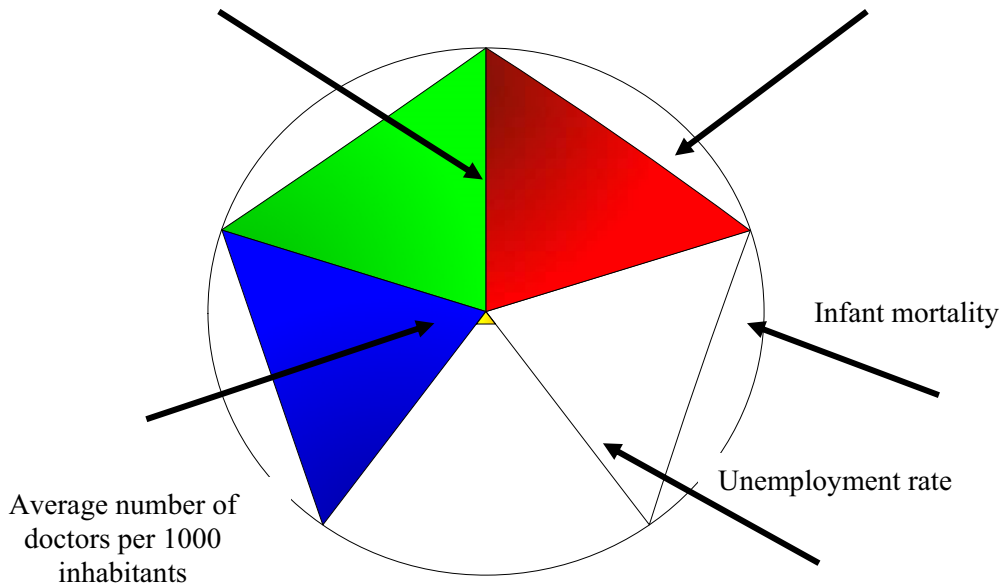3. **Eurostat**, *Europe in figures, Eurostat yearbook 2006-2007*, Luxembourg, 2007.
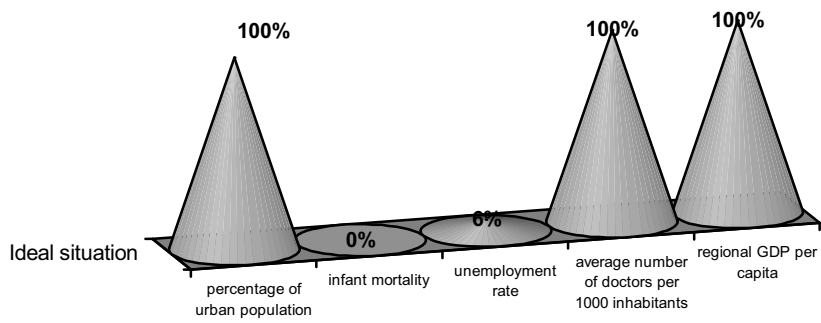
APPENDIX: FIGURES-TABLES
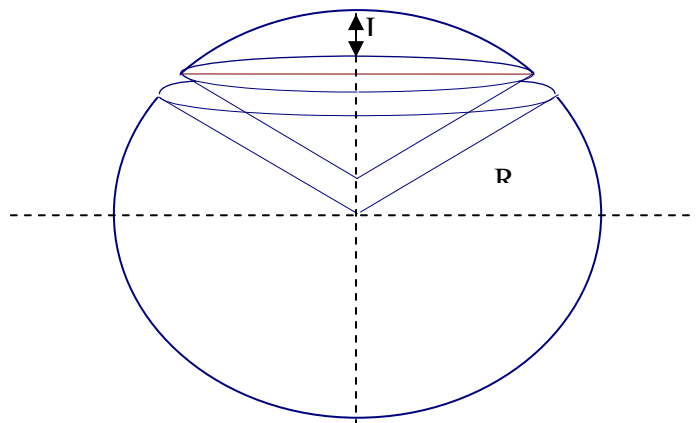
Figure no.1. Regional sphere in RIV model

Regional GDP per capita   Percentage of urban population

Figure no. 2. Regional development (ideal situation)

Figure no. 3. Ideal regional development
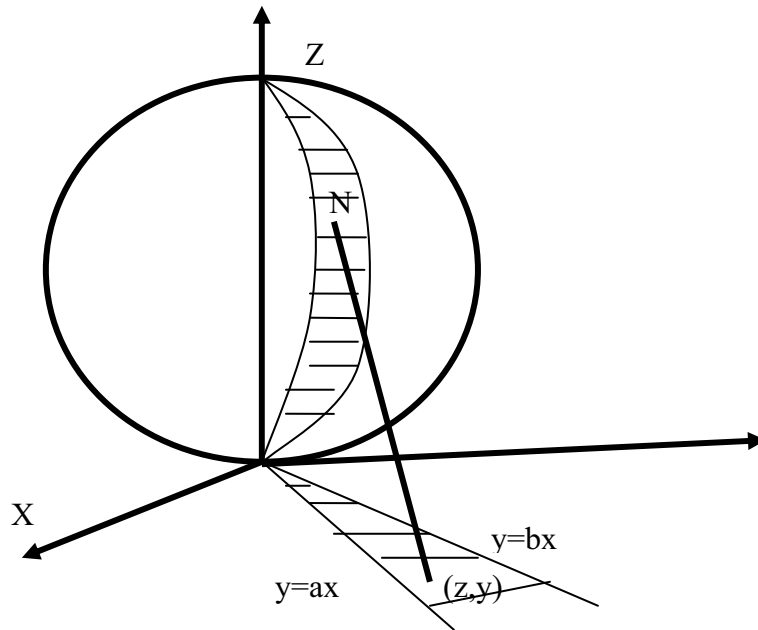
Figure no. 4. Translation from a bi to a three-dimensional space
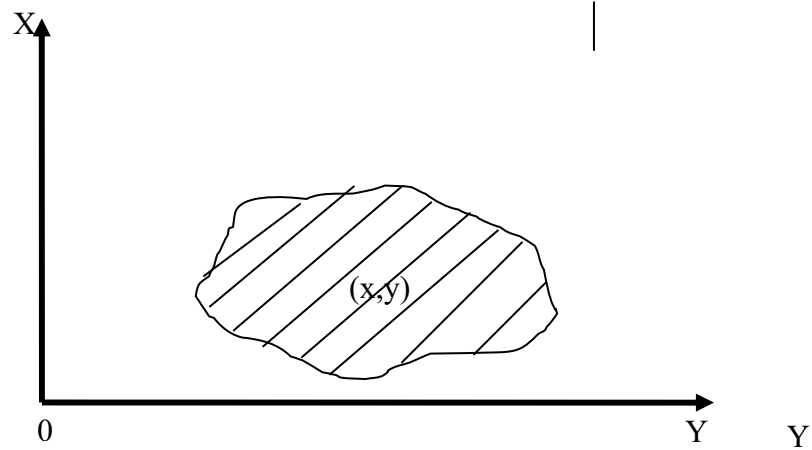
Figure no. 5. Irregular spherical sector

2000 Regional GDP per capita   2007 Percentage of urban population

Unemployment rate   Infant
mortality
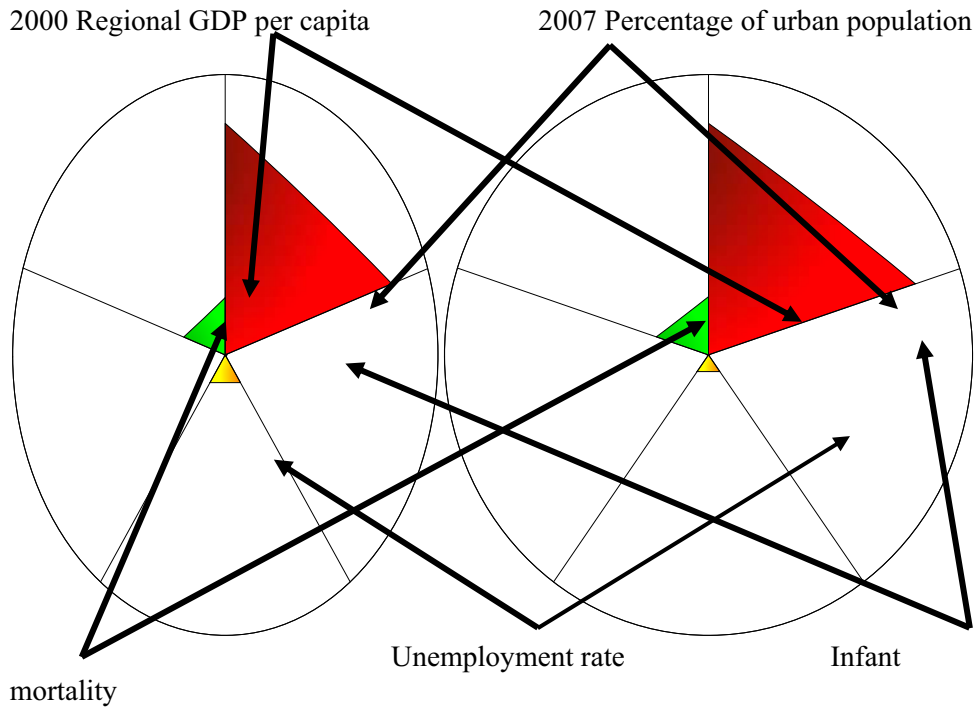
Average number of doctors per 1000 inhabitants

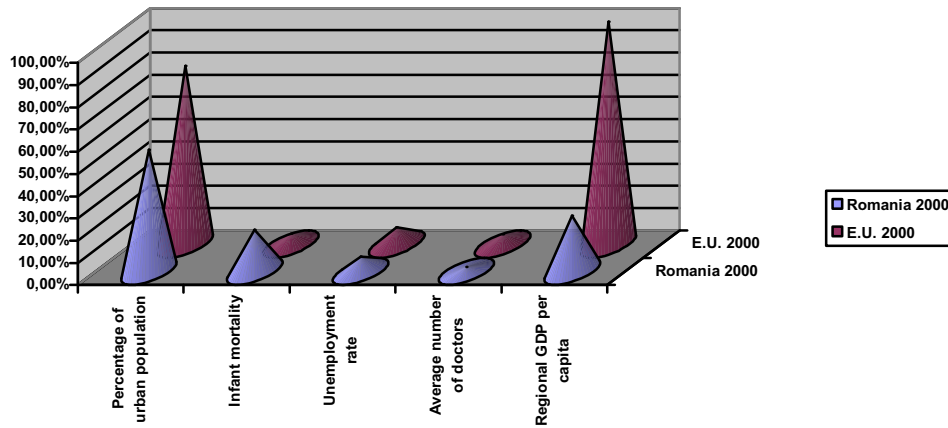**Figure no. 6. European regional development in 2000 and 2007**
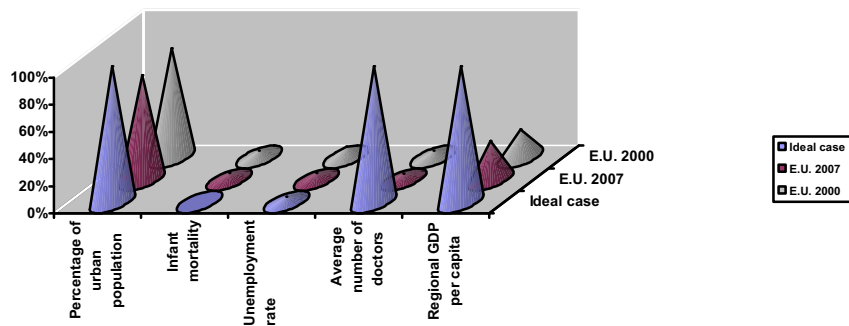
Figure no. 7. Regional development in the E.U.

2000 Regional GDP per capita   2007 Percentage of urban population

Average number of doctors

Unemployment rate   Infant

mortality
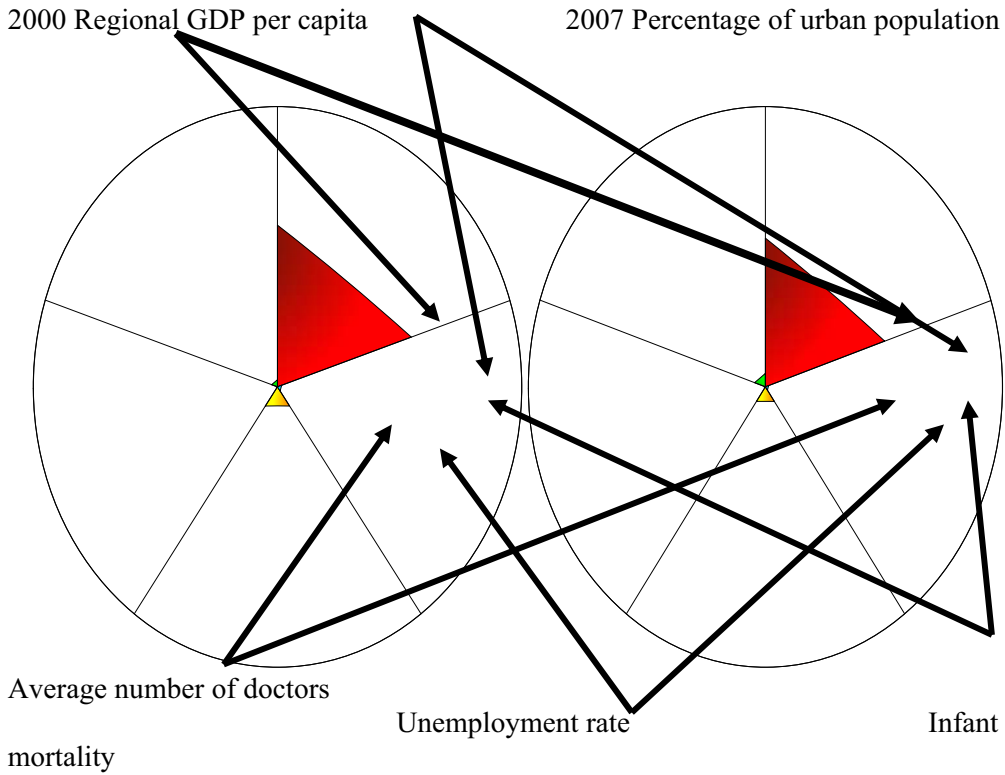
Figure no. 8. Regional development in Romania comparative with E.U.'s average
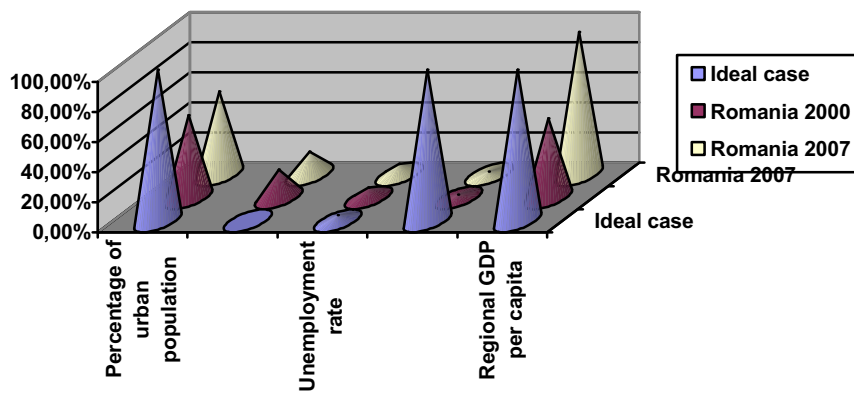
Figure no.9. Romania vs regional ideal situation

Figure no. 10. Romania 2000 reported to E.U.'s 2000 situation
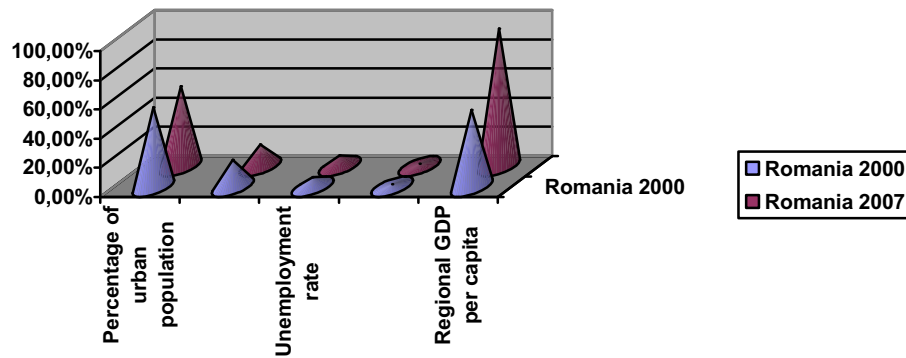
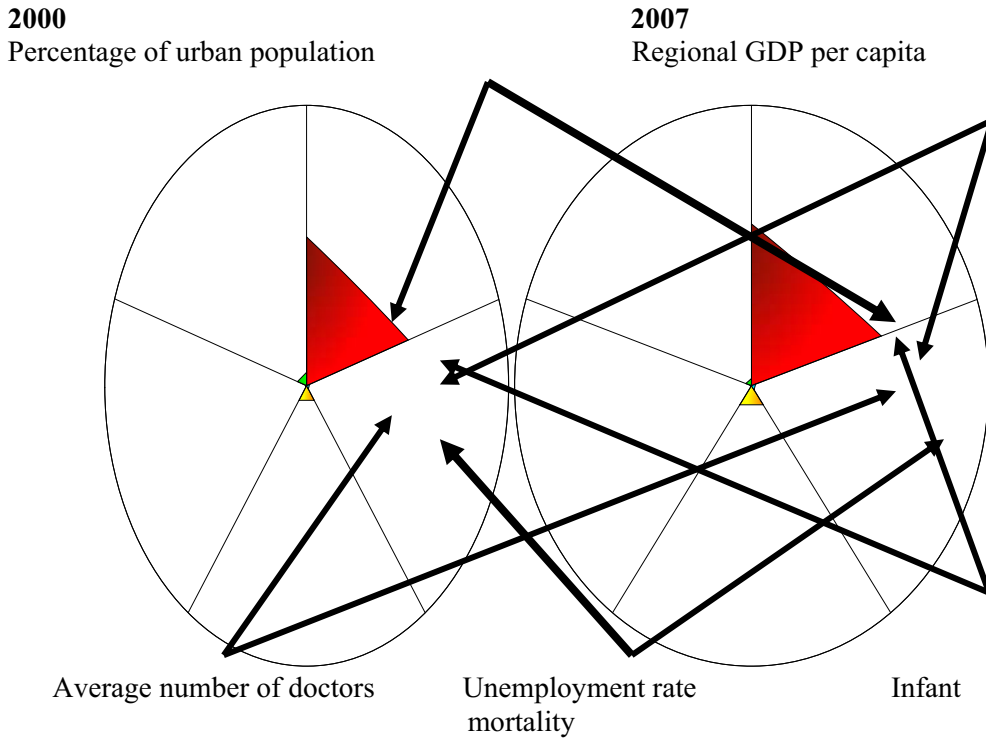**Figure no.11. Regional disparities in Romania between 2000 and 2007**

2000   **2007**
Percentage of urban population   Regional GDP per capita

Average number of doctors   Unemployment rate   Infant
                                 mortality
Figure no. 12. 2 South-East Region vs E.U. in 2000
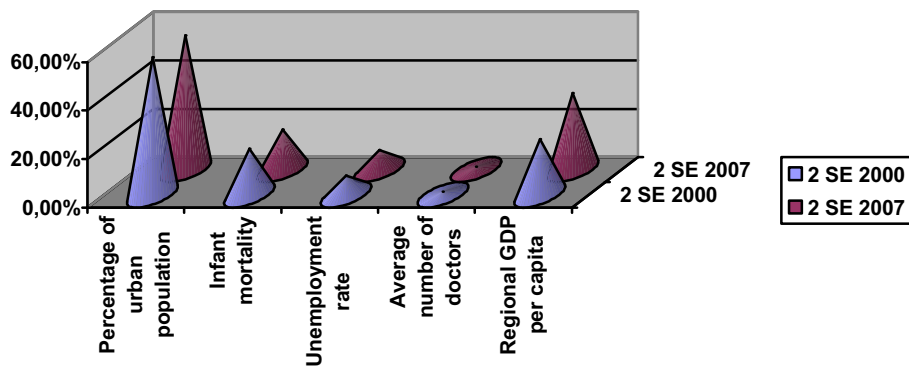
Figure no. 13. Regional development in South-East

2000
Regional GDP per capita

2007
Percentage of urban population

Average number of doctors   Infant mortality
rate   Unemployment
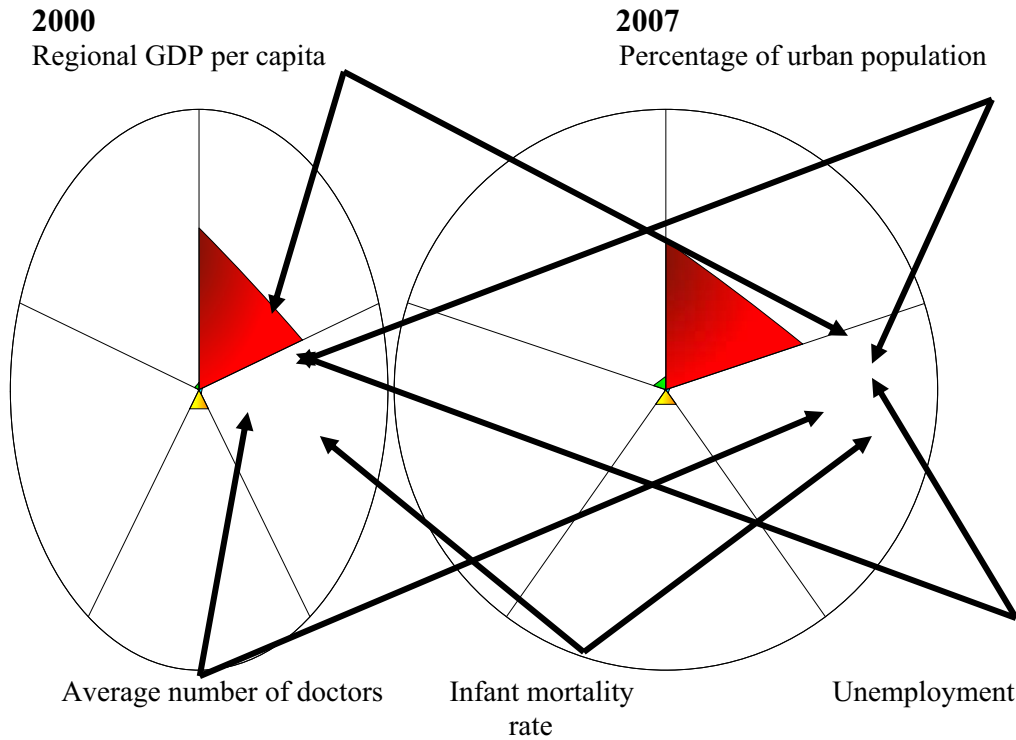
Figure no. 14. 6 North-West Region vs E.U.
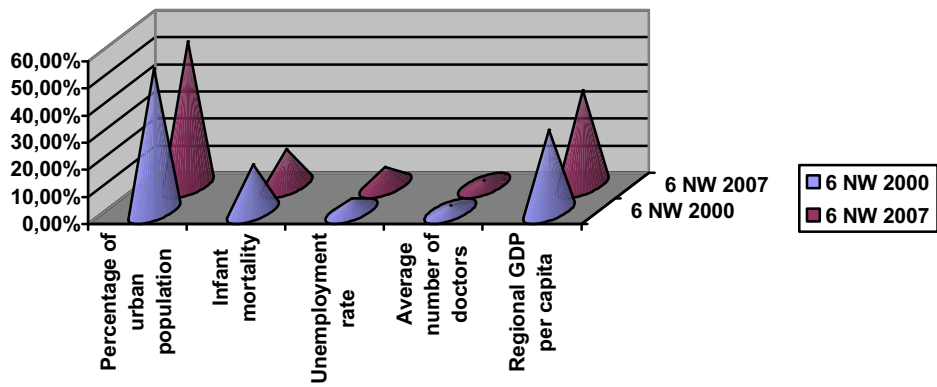
Figure no. 15. Regional development in North-West
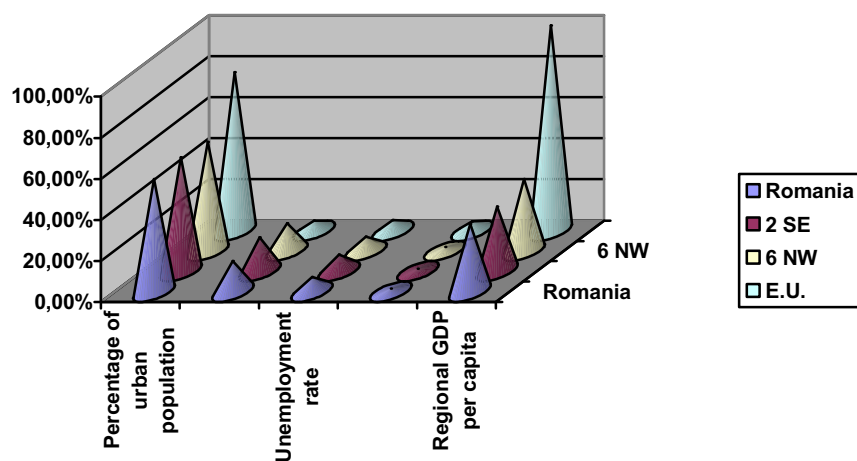
Figure no. 16. Regional disparities in 2007

Table no.1. Regional statistical dates

Region	Statistical dates									
	percentage of urban population		infant mortality ($\permille_0$)		unemployme nt rate (%)		average number of doctors per 1000 inhabitants		regional GDP per capita (Euros)	
	2000 [2]	2007 [3]	200 0	200 7	2001	2007	200 0	200 7	2003	2007
Romani a	54.6	54.9	18.6	15.0	6.6	7.2	1.9	1.8	5265	9446
2SE	56.8	55.5	19.1	16.5	8.0	8.3	1.4	1.3	4658	9003
6NW	52.6	53.1	17.3	13.5	4.8	7.0	2.1	1.9	6075	1001 1
E.U.	80.0	77.0	4.8	4.9	7.6	5.0	4.5	4.5	2025 0	2847 7

[2] **Eurostat**, *Yearbook*, Office for Official Publications of the European Communities, Luxembourg, 2001.
[3] **Eurostat**, Europe in figures, Eurostat yearbook 2006-2007, Luxembourg, 2007.