CONSTANTINE PORPHYROGENETUS INTERNATIONAL ASSOCIATION

Journal of Management Sciences and Regional Development
Issue 4, July 2002
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http://www.stt.aegean.gr/geopolab/GEOPOL%20PROFILE.htm
ISSN 1107-9819
Editor-in-Chief: Arie Reichel

EVALUATION OF REGIONAL DEVELOPMENT AND (IM)BALANCES: THE CROATIAN CASE

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Abstract. The paper deals with an evaluation of the regional development level and (im)balances. The evaluation is based on the multicriterial evaluation of a set of the chosen indicators representing single dimensions in a complex regional structure. To evaluate the relative level of regional development (*on the example of Croatian regions / counties*) in terms of single dimensions and in terms of all dimensions we have applied an increasingly popular, linear-programming-based method - *Data Envelopment Analysis* (DEA).

Special attention has been paid to *the possibility of arbitrary determination of weight for single indicators* of regional development and *their input into the appropriate DEA - model*. For that purpose we have applied *the modified 'weights-based' DEA-model with reducing weight flexibility,* and compared the results obtained by standard 'output maximization based' DEA model and by modified 'weights-based' DEA-model.

We have used the obtained results as the basis to determine global recommendations for the build-up of a new model, i.e. *the new regional development policy* in Croatia.

Keywords: regional development, relative efficiency, multicriterial evaluation, Data Envelopment Analysis, weights-based model

1. INTRODUCTION

The paper deals with an evaluation of *regional development levels and balance evaluations*, or more precisely, with an evaluation of spatial development balances. The spatial development balance is determined by social, economic and natural elements and therefore is a very complex phenomenon. Moreover, it is influenced by the changes occurring in the continuous development of nature, economy and society, which renders it also a dynamic phenomenon.

Spatial regional balance tries to point out the potential harmony of each and all economic sectors in a particular space and between regional units of a unique national territory. In fact, it is a twofold balance. First, it implies the balance between the economy, nature and society, which is permanently expressed through the process of progress, social content and a healthy environment. Secondly, it is the balance between individual regional units regarding economic development, natural resources and social content. This analysis is related to the latter consideration, i.e. *to the regional (im)balance between regional units.* Balance is analyzed through social, economic and natural values of regional units *in the Republic of Croatia.*

Evaluation of the regional development level and (im)balances in this paper is based on the multicriterial evaluation of a set of chosen indicators representing single dimensions in a complex regional structure. To evaluate the relative level of regional development (*on the example of Croatian regions / counties*) in terms of single and all dimensions of regional structure we applied an increasingly popular, linear-programming-based method - *Data Envelopment Analysis* (DEA).

The conditions of social, economic and natural values in a certain region are recorded at a particular *moment of time*. However, scientific research tends to analyze *the process* these conditions are going through i.e. *the change* of the conditions over time. In the last ten years, Croatia has undoubtedly gone through extraordinary large changes in the regional structure caused by the global transition process and particularly by the war in its territory. War destruction, intensive migrations, and decline of economic activities induced by the war, by loss of market and even by inefficiency inherited from the earlier non-market economic system, are the most important factors of changes in the regional structure. However, the important limitation to the analysis of these changes is the availability and quality of the statistical-documentary basis. Significant changes in administrative-territorial organization limit the comparability of earlier, pre-transitional regional statistical units (regional associations of municipalities) to the present ones (counties). Besides, in the recent years the national statistical system has been transformed and adapted to the System of National Accounts (SNA) concept, which additionally restricts the dynamic comparison of the regional statistical data.

Nevertheless, expecting the consolidation of systematic statistical records and the very important census year (2001) to provide a more reliable basis for such analysis, in this paper we have evaluated conditions in the pre-war 1991, taking this year as the implementation basis for the dynamic analysis of changes in the Croatian regional structure in the immediate future.

2. REGIONALIZATION OF CROATIA

The analysis of overall national territory according to the elements of natural homogeneity indicates that Croatia is divided into two typical natural environments: *Panonian* and *Mediterranean*. These two can be referred to as supra regions. Natural regionalization at the supra region level is characterized by the homogeneous natural elements while all subsequent divisions produce less homogeneous territorial and natural units.

The first recognizable level of division according to the functional regionalization principle establishes macro regions. In the Croatian case, these are: *Slavonia, Middle Croatia, Lika and Upper Adriatic, and Dalmatia*. Functional regionalization at the macro region level implies functional gravitation which reflects the development level of Croatian cities as well as historical and cultural values at this level of the regional system.

Political regionalization starts at the *county level*. The Republic of Croatia is divided into *21 counties* each of which is further divided into *towns* and *municipalities*. As far as the administrative structure is considered, the county is the lowest level of state authorities, while the town represents the highest level of local governance.

The objective of the above overview is to point out the favorable features of the existing organization of national territory for the purposes of the analysis, planning and management of regional development. As a matter of a fact, both the analysis and the prospect of regional (im)balance in Croatia are based on the functional and political regionalization.

3. REGIONAL STRUCTURES IN THE REPUBLIC OF CROATIA

This part of the paper focuses on the development of particular dimensions of a complex regional structure in Croatia in the pre-transitional period; analysis encompassing the population, the urbanization process, the regional economic development, social and cultural events, standard of living and the level of (im)balances in the regional development in Croatia. Below we discuss our most significant findings.

The number of inhabitants in an area is determined primarily by the natural population growth and migrations. Since the natural population growth was relatively low in Croatia in general, the main driving force of demographical growth or decline in particular regions were the migrations. According to the criterion of population growth, all Croatian counties in the period from 1965 to 1991 can be divided into three main groups. In the first the number of inhabitants absolutely decreased (eight counties). The second comprises the counties where the number of inhabitants increased in absolute terms, but whose relative share in the total population of Croatia simultaneously decreased (six counties), and the third group consists of the counties whose population grows in both absolute and relative terms (seven counties). Consequently, a new demographical chart of Croatia was created that completely changes territorial distribution of population. The number of inhabitants grew in the counties developing around big cities, causing, at the same time, a population drain in their wider surroundings. The decrease in the number of inhabitants in the counties where there are no big cities proved to be almost a rule.

Unfortunately, the period after the year of 1991 (the last census) was characterized by

an even greater tendency to both absolute and relative population growth in the four counties with the four biggest cities of Croatia (Zagreb, Rijeka, Split and Osijek) accompanied by a simultaneous desertion of the areas between these cities/counties. This process was considerably encouraged by exodus from the war areas, since refugees were given shelter around big cities and later decided to make their residence there a permanent one.

Croatia has a relatively small population in respect to its territory, and the regional distribution of population is not balanced. In fact, the population density was above average in only one macro region (Middle Croatia 113.8 persons/km^2) in 1991, while in the other macro regions it was below (Slavonia 79.4) or far below average (Dalmatia 67.5; Lika and Upper Adriatic 59.0). Therefore, demographical, economic, social, cultural and other aspects of spatial capacities are brought into question as well as objective conditions for attainment of development balance in the entire national territory of the Republic of Croatia.

The larger Croatian cities (*Zagreb, Split, Rijeka and Osijek*) determine the economy and its structure in their gravitation areas. Geographical indentedness of the Croatian territory along with insufficient traffic connections did not allow homogenization of the Croatian economy in the past. Thus, closed economies developed within each macro region while cities were merely providing internal economic balance. Modern development processes in economy and society are also mostly based on the strength and development of cities. Over 70% of Croatia's population are situated in the cities, further strengthening the role of the cities in its present and future development. Moreover, the policy of regional balance is successfully carried out through urban centers of the regions, and precisely that is the role of the leading Croatian cities.

By analyzing the *economic base of regional (im)balances*, it can be claimed even at this point that the processes such as intraregional migrations, transfer of population involved in agriculture to other economic sectors, urbanization and others, have had multiple effects. They improved the standard and conditions of living but, at the same time, unfavorably influenced economic and social development not only of particular regions but also of Croatia as a whole. This statement is based on the fact that structural changes and consequently initiated process of increased migrations towards urban areas caused a discontinuity between demographical and economic components of development. On one hand, in the immigrating counties, there was an ever-increasing number of working-age population. Its employment provoked the process of an extensive economic growth based on the maintenance and even enlargement of the traditional labor-intensive industrial structure. The share of the employed in these areas in relation to the total number of the employed in Croatia was increasing all the time. On the other hand, emigrating counties permanently lost the most important segment of the working-age population. Moreover, productive funds and investments were directed only to the economic activities of low profitability and efficiency, which were the only ones left in these counties with low skilled labor.

At present, the development process has reached the point where the issues regarding territorial (interregional) redistribution of labor and thus of migration flows have to be solved. Traditional activities have completed their role in the developed regions for they changed the social and economic structure. Nevertheless, in the process, they have lost their power as generators and multipliers of development. Therefore, the changed regional conditions in the developed regions demand new high-growth economic activities as well as activities of high technical and technological standards. Less developed regions should focus on sophisticated activities that are in accordance with their natural, social and cultural environment. In other words, assuming that the problem of regional development was directly dependent on its economic structure (dynamic changes in the sectoral development

poles), the solution to the problems of less developed regions is to be sought in identification of appropriate development poles, and one possibility lies in tertiary activities.

Last but not least, the analysis of education as an integrative nucleus of the entire social system indicated that the quality of education systems and its adaptability to structural changes are not satisfactory. In fact, ever since 1981 there is a strong negative correlation between the domestic product and the professional education of adults in all the counties except in the four big cities. The analysis also pointed out a rather uneven distribution of Croatia's youth in high schools, starting from 21.7% in the least developed, to 89.1% in the most developed county.

To analyze the processes of development (im)balance would be incomplete if the analysis did not comprise the standard of living sector. Namely, the significance of the standard of living is in its positive correlation with the economic development level. The standard of living is therefore included as a separate component in our analysis.

The critique of the regional development model implemented so far stresses:

- The main content of the regional development policy was only economic development while the other development elements were of minor importance and extracted from the economic development framework.
- The previous regional development policy was focused only on the problem of the undeveloped regions while there was a mediator mechanism between developed and undeveloped regions in the process of regional development management.
- The institutional framework of the regional development policy contributed to the widening of the gap between the developed and the undeveloped.
- The policy of regional development made much more effort transferring the economic patterns of developed regions to the undeveloped ones than activating regional comparative and competitive advantages.

4. MULTICRITERIAL EVALUATION OF REGIONAL DEVELOPMENT AND (IM)BALANCES

Taking into account all of the above, in the final phase of the analysis of conditions and processes that have affected the (im)balances in the Croatian territory in the last thirty years, a summary estimation of relative development level of Croatian counties and macro regions was made for 1991 as a characteristic year of the pre-war period. The estimation of relative development was obtained in the process of multicriterial evaluation based on a number of indicators, each of which represents a particular dimension in a complex regional structure. The estimation was obtained by Data Envelopment Analysis (DEA).

4.1. Defining selected indicators (criteria)

For selecting the basic development indicators we followed several criteria: a) ability to show appropriately the application of integral development concept; b) ability to show appropriately the multidimensional nature of development; c) availability of the necessary statistical information on the potential development indicators was essential.[1] However, one

[1] The source of necessary statistical information is specially prepared *data base* for the project "Regional balance in Croatian area". That was the project of Croatian Ministry of Physical Planning, Construction and Housing which realised in 1995.

of the elementary conditions in criteria construction was also their adaptability to different methods of evaluation. Also, due to methodological reasons, the whole system of indicators (28) was divided into three smaller, characteristic global components:

a) ***The global material component*** includes 6 indicators (criteria) related to the global and sector efficiency and economic system modernization level, and 6 indicators representing the development of infrastructure ('min' or 'max' determines the desired direction for a particular indicator):

A1)	National product per capita	max
A2)	National product per square km of the total area	max
A3)	Global productivity	max
A4)	Productivity in the primary sector	max
A5)	Productivity in the secondary sector	max
A6)	Energy consumption in industry in comparison to the number of inhabitants working in the secondary sector	max
A7)	Inhabitants per 1 km of roads	min
A8)	Total area per 1 km of roads	min
A9)	Inhabitants per 1 km of modern roads	min
A10)	Inhabitants per one vehicle	min
A11)	Inhabitants per one water connecting pipe	min
A12)	Inhabitants per one telephone line	min

b) ***The global human component*** comprises a set of relevant aspects of the 'human factor' essential not only in goods and services production processes but also the basic factor of the size and structure of demand for those goods and services.

B1)	Share of the employed in the total population	max
B2)	Share of the employed in the secondary sector in comparison to the total working population	max
B3)	Share of population with secondary education	max
B4)	Share of population with college or university education	max
B5)	Number of scientific researchers in comparison to the number of inhabitants	max
B6)	Share of urban population in the total population	max
B7)	Share of agricultural population in the total population	min
B8)	Average household members	min
B9)	Population density - inhabitants per square km	max

c) ***The standard of living*** is the global component including several characteristic indicators of general living conditions in a particular area. It refers primarily to education conditions, living conditions, health care potentials, supply of basic living resources (e.g. water), but also conditions of leisure, entertainment, recreation etc.:

C1)	Share of secondary school students in the 15-19 contingent of population	max
C2)	Share of children in pre-school education	max
C3)	Number of inhabitants in comparison to the number of medical workers	min
C4)	Inhabitants per one apartment	min
C5)	Inhabitants per one TV subscriber	min
C6)	Inhabitants per one personal vehicle	min
C7)	Household water consumption per capita	max

4.2. Multicriterial evaluation of the achieved development level by the DEA

Here we present the results of the multicriterial evaluation of the achieved development level of Croatian counties and macro-regions in terms of the single global components and all the global components taken together, which we attained by Data Envelopment Analysis. This method was chosen because it fulfils the basic condition - the ability to synthesize a great number of indicators (which are different in terms of measure units and characteristics) into a single evaluation measure.

4.2.1. Methodological basis of multicriterial evaluation

Data Envelopment Analysis (DEA) (*Charnes, Cooper and Rhodes, 1978*) is an increasingly popular, linear programming-based method which *assesses the relative efficiency of homogeneous organizational units* (or DMUs - *Decision Making Units*) such as bank branches, schools, hospitals, and other primarily non-profit organizations.

The condition of criterion uniformity for all the units compared requires that the same resources-inputs produce the same outputs for all DMUs. In that way, each DMU is comparable with all the others according to the level of the output realized per unit of the resource-input used.

The relative efficiency of a DMU in DEA is obtained as follows. Let X_{ij} and Y_{rj} be respectively the i_{th} input and the r_{th} output of DMUj. Then the relative efficiency of $DMUj_0$ is defined *as the maximum value of* h_{j0}, determined as follows (*Charnes, Cooper, and Rhodes, 1978*):

$$\text{Max } h_{j0} = \frac{\sum_{r=1}^{s} u_r Y_{rj_0}}{\sum_{i=1}^{m} v_i X_{ij_0}} \qquad (1)$$

$$\frac{\sum_{r=1}^{s} u_r Y_{rj_0}}{\sum_{i=1}^{m} v_i X_{ij_0}} \le 1 \quad , j=1,2,...j_0...n \qquad (2) \qquad \textbf{(M1)}$$

$$u_r \ge \varepsilon$$

$$v_i \ge \varepsilon, \quad \forall r, i \qquad (3)$$

where s is the number of outputs produced by the DMUs, m is the number of inputs they

use, u_r and v_i are the *weights* associated with r_{th} output and i_{th} input and are treated as variables in the above model. n is total number of DMUs to be assessed, and ε is a *'very small positive value'*.

Therefore, the relative efficiency of $DMUj_0$ is expressed as the ratio of the sum of *weighted* outputs to the sum of *weighted* inputs of the base $DMUj_0$. Because of that, model **M1** is known as the ***'weights-based' DEA model***. This *linear fractional program* can be equivalently stated as the following *linear programming problem*:

$$\text{Max } h_{j0} = \sum_{r=1}^{s} u_r Y_{rj_0} \qquad (1)$$

$$\sum_{i=1}^{m} v_i X_{ij_0} = 1 \qquad (2)$$

$$\sum_{r=1}^{s} u_r Y_{rj} - \sum_{i=1}^{m} v_i X_{ij} \le 0, \quad j=1,2,...j_0...n \qquad (3) \qquad \textbf{(M2)}$$

$$u_r \ge \varepsilon$$

$$v_i \ge \varepsilon, \quad \forall r, i \qquad (4)$$

These two formulations of the 'weights-based' DEA model actually give the same information. DEA assigns a score 1 or 100% to a $DMUj_0$ only when comparisons with other relevant DMUs do not provide evidence of inefficiency in the use of any input or output. DEA assigns an efficiency score less than one to (relatively) inefficient units. A score less than one means that a linear combination of other units from the sample could produce the same vector of outputs using a smaller vector of inputs.

Before analysing the practical results, it is necessary to point out some significant aspects of DEA methodology, which determine *expectations* of multicriterial evaluation carried out by this method.

The first issue is related to the one of basic conditions of efficient application of DEA methodology. It is that the number of the selected criteria (input/output) has to be smaller than the number of units compared (DMU-decision making unit). A stricter condition requires the product of selected inputs and outputs to be smaller than the number of DMUs. Namely, the closer the number of inputs and outputs to the number of DMUs, the closer is the number of the so called efficient DMUs to the same number, i.e. the low level of DMUs discrimination in terms of efficiency cannot satisfy the aim of the analysis. Therefore the whole system of indicators (28) in this work was divided into three smaller groups ("A", "B", and "C") satisfying the condition that every group has to represent a characteristic aspect of development.

The second issue is related to the transformation of original indicators in order to adopt them to the application of DEA method. Namely, the original indicators (from A1 to C7) are given as ratios of corresponding values. Viewed in terms of DEA methodology these ratios are not always the ratios of output and input, therefore some of them are transformed into reciprocal values. In that way, *maximization* becomes desirable for all the indicators. On the other hand, the attempt to divide these ratios into outputs and inputs would result by a greater number of hidden ratio-indicators which do not have logical interpretation, and the total number of indicators would be different from the given one. This problem has been solved by considering all previously connected ratios-indicators as "*outputs*" which are maximized (*output maximization oriented DEA model*), and a "*fictitious input*" is introduced with equal values for all the DMUs in order to ensure its neutrality in terms of efficiency evaluation.

The third, specially important issue refers to the determination of *importance coefficients - weights* of selected indicators. The researchers dealing with regional development differ in their opinion whether development indicators should be evaluated in different ways, and if it is so, how can it be carried out objectively. DEA models do not involve any previous information *on the relative importance* of individual input/output variables. Only by solving the *"weights-based" DEA model* are the weights allocated to individual I/O to obtain such combination of I/O which will ensure the *greatest* possible evaluation for the efficiency of the DMU observed, on condition that the efficiency evaluation of other DMUs does not exceed '1'. Thus, in this case we do not deal with weights given in advance, but with the judicious choice of weights.[2] This can be a *disadvantage* at least in two different respects: a) Some input or output may in fact be more important than others. b) The corresponding DMU in such procedure can achieve a significantly greater efficiency by simply ignoring (assigning weight '0') some I/O, which does not affect the objective measurement of relative efficiency (*See: Dyson, and Thanassoulis, 1988*).

These shortcomings significantly restricted application of DEA method *in concrete case,* and that is why DEA-model has been *modified* in order to restrict the values obtainable by particular weights with the used inputs (outputs). It is actually a modification of the M2. *Model modification* is an *additional restriction on the values* u_r *and* v_i, i.e. the so called *"raw weights" produced by "weights-based" DEA model.* For example, weights of certain variables can be forced to have a certain relationship. In the concrete case, the weights-based DEA model is completed with restrictions in which we set-up *the desirable relation of weights between output-indicators in each of the three global components*, and according to the 'given' relations from the next weight table:[3]

Table 1. **Weights for the "A", "B" and "C" group of criteria**

Criteria group "A"	*Weight*	***Criteria group "B"***	*Weight*	***Criteria group"C"***	*Weight*
A1	130	B1	75	C1	30
A2	60	B2	70	C2	10
A3	90	B3	30	C3	30
A4	30	B4	30	C4	100
A5	50	B5	20	C5	30
A6	50	B6	25	C6	20
A7	45	B7	10	C7	20
A8	45	B8	10		
A9	20	B9	20		
A10	30				
A11	20				
A12	30				

[2] As this model is solved for every one of N different DMUs, there are N vectors of I/O, i.e. N different sets of value weights defined by the model, which additionally compounds the problem of weights in DEA model.

[3] In a recent similar work [*Grcic, and Babic, 1998a*] we choose the eigenvector method, which in fact is the basis of one of the most popular multicriterial method - analytic hierarchy process - AHP. The reason for this choice was that we already had a team of experts choosing the relevant indicators, and then they also worked on the eigenvector method. Namely, in this method, the decision-maker or the expert has to evaluate the importance relations of pairs of criteria and from matrixes obtained, we have to calculate their eigenvalues and consequently evaluations of the criteria weights.

E.g. in the global component *"standard of living"* (criteria group 'C') the relationships between outputs are given in the following way:[4]

$$u_1 \geq 3u_2 \quad (w_{c1}=30,\ w_{c2}=10)$$
$$u_3 \geq 3u_2 \quad (w_{c3}=30)$$
$$u_4 \geq 10u_2 \quad (w_{c4}=100)$$
$$u_5 \geq 3u_2 \quad (w_{c5}=30)$$
$$u_6 \geq 2u_2 \quad (w_{c6}=20)$$
$$u_7 \geq 2u_2 \quad (w_{c7}=20)$$

Expectations referring the results of relative efficiency evaluation after introducing additional weights restrictions are the following: a) *Increase of the discriminatory power of DEA;* b) *Reduction of efficiency coefficient h_j for more DMUs.*[5] Naturally, these expectations are to be tested by an analysis, which follows.

However, this approach is not flawless, as can be seen from the following facts: The "raw" weights produced by "weights-based" DEA model *depend on the scaling of each O/I variable. This is no problem in the case of the original M2-model because it allows great flexibility in the determination of weights. However, in the case when the weight flexibility is reduced, and particularly in this case where relatively firm weight relations are given (modified M2 model), the dependence of weights on the scaling of each output and input variable makes it difficult to solve the linear program M2. This problem is solved* by normalization of output and input values reducing them to index values based on Croatian average (*Croatia = 100*).

4.2.2. The results of multicriterial evaluation

The results of ranking Croatian counties by DEA method with indicators in *"A", "B"* and *"C"* development component for 1991 are given in Table 2. For each group of criteria the evaluation of relative efficiency is carried out by the original M2 *model (scores and ranks in the columns with the sign 'DEA')* and the modified M2 *model (scores and ranks in the columns with the sign 'DEA*')*.

The detailed analysis of the results obtained *by original M2 model* confirmed the expectations regarding the exclusion of a number of indicators from evaluation of relative efficiency of a DMU. As a result, the relative efficiency of a DMU may not really reflect its performance on the indicators taken as a whole. For example, in the criteria group "A" in no case does the number of used outputs exceed *four (*out of 12 possible). In the criteria group "B" in no case does the number of used outputs exceed *four (*out of 9 possible). In the criteria group "C" in no case does the number of used outputs exceed *two (*out of 7 possible). The dominant indicators among the few ones used are precisely those according to which the DMU observed is top-ranked. This results in relatively high efficiency

[4] Generally, the weights are marginal rates of substitution between the variables. Thus using, for example, $u_1 \geq 3u_2$ implies we would deem a DMU's efficiency is unaffected if for every unit reduction in the level of output 1 the DMU raises its level output 2 by 3 units.

[5] It has already been said that the weight-based model allocates weights to outputs (inputs) by ensuring the maximal efficiency of the DMU observed. In the modified model with additional hard restrictions on weights, the share of individual virtual output/input is changed giving as a rule a lower efficiency mark than that obtained by the original model.

Table 2. **Counties and macroregions ranked by DEA method**

Counties/macroregions	Criteria group "A"				Criteria group "B"				Criteria group "C"			
	DEA		DEA*		DEA		DEA*		DEA		DEA*	
	Eff. Score	*Rank*	*Eff. Score*	*Rank*	*Eff. Score*	*Rank*	*Eff. Score*	*Rank*	*Eff. Score*	*Rank*	*Eff. Score*	*Rank*
VUKOVARSKO-SRIJEMSKA	93,30	11	32,05	23	93,54	18	35,54	20	86,93	19	57,43	22
OSJEČKO-BARANJSKA	92,42	12	35,24	18	90,64	23	39,54	12	92,44	8	66,54	9
BRODSKO-POSAVSKA	90,63	18	31,50	25	93,12	20	34,44	21	85,77	21	60,63	19
POŽEŠKO-SLAVONSKA	84,21	23	31,90	24	97,31	9	34,29	22	90,69	12	62,30	15
VIROVITIČKO-PODRAVSKA	97,25	7	33,60	20	87,77	25	31,14	24	96,15	6	60,59	20
SLAVONIA	91,68	14	33,20	21	91,13	22	35,97	19	89,98	16	62,24	16
BJELOVARSKO-BILOGORSKA	96,62	8	36,90	15	89,26	24	31,86	23	97,31	5	65,05	13
KOPRIVNIČKO-KRIŽEVAČKA	99,76	6	38,90	9	96,91	11	36,20	17	89,48	17	59,19	21
MEĐIMURSKA	92,28	13	38,00	14	100 (13)	3	39,66	11	81,32	25	56,59	23
VARAŽDINSKA	84,70	22	38,30	12	100 (7)	5	41,69	8	84,48	24	65,89	12
ZAGREBAČKA	77,19	26	23,20	26	96,32	12	29,79	25	90,41	14	41,61	26
KRAPINSKO-ZAGORSKA	89,41	19	38,20	13	100 (1)	7	36,95	14	85,95	20	60,80	18
SISAČKO-MOSLAVAČKA	87,18	21	36,20	17	94,93	15	36,85	15	87,86	18	61,70	17
KARLOVAČKA	82,05	24	33,00	22	93,88	17	36,61	16	92,53	7	64,29	14
GRAD ZAGREB	100 (19)	2	100	1	100 (13)	2	100,00	1	100 (7)	2	100	1
MIDDLE CROATIA	91,62	15	40,71	8	95,81	14	47,44	4	91,27	11	72,53	5
PRIMORSKO-GORANSKA	91,13	16	43,60	5	96,21	13	55,54	2	100 (23)	1	86,57	2
LIČKO-SENJSKA	100 (10)	5	38,70	11	87,45	26	29,77	26	92,34	9	54,63	25
ISTARSKA	100 (20)	1	50,60	3	93,26	19	44,91	5	100 (3)	3	85,66	3
LIKA AND UPPER ADRIATIC	95,36	10	43,70	4	91,77	21	43,91	6	98,63	4	81,77	4
ZADARSKA	95,76	9	33,70	19	100 (10)	4	36,14	18	80,67	26	56,66	24
ŠIBENSKO-KNINSKA	100 (16)	3	66,50	2	97,24	10	38,77	13	91,65	10	66,31	10
SPLITSKO-DALMATINSKA	79,73	25	36,70	16	100 (17)	1	47,57	3	84,78	23	68,45	8
DUBROVAČKO-NERETVAN.	100 (14)	4	41,30	6	100 (2)	6	40,08	10	90,12	15	71,68	6
DALMATIA	89,06	20	40,80	7	99,29	8	41,61	9	85,26	22	65,95	11
CROATIA	91,00	17	38,80	10	94,41	16	42,71	7	90,44	13	70,28	7

coefficients, and a larger number of efficient DMUs in each criteria group, which can be seen from the data in Table 2.

Reduction of weight flexibility *in the modified M2-model* has contributed to the objectivity of relative efficiency evaluation of the DMUs observed. This reduction enabled this evaluation to include all the indicators according to the weights determined in advance. The data from the columns marked "DEA*" confirm the expectations of the higher discrimination degree between the single DMUs. This is proved by a significant reduction of almost all the coefficients of relative efficiency and a reduced number of efficient units in each criteria group.

This objectivization of relative efficiency evaluation by modified M2 model is confirmed by testing the assumption on *positive correlation between ranks of individual components or criteria group.*[6] The rank differences were tested by *Spearman rank order correlation coefficient.* The results given in *Table 3* show that *there is significant positive correlation only in the case of 'A'/'C' pair of components* when rank obtained by original *M2-model (the columns with the sign 'DEA').* In the other two cases, the counties that are relatively highly ranked according to the first component are ranked lower according to the second component and *vice versa.* On the other hand, *Spearman rank order correlation coefficients* for the ranks obtained by *modified* M2-model *(the columns with the sign 'DEA*')* show that *there is significant positive correlation* in rank agreement between all global components ($\alpha \approx 0$ *for the all the three pairs of components*).

Table 3. **Spearman rank order correlation coefficient between global components obtained by DEA method**

Pair of components	DEA		DEA*	
	r_s	α	r_s	α
"A" / "B"	-0,2132	0,8519	0,7008	0,00000
"A" / "C"	0,4133	0,0181	0,6615	0,00015
"B" / "C"	-0,5036	0,9957	0,8169	0,00000

The practical importance of the results obtained by the modified M2 model lies in a clearer and more realistic expression of development imbalance in Croatian regions. It is confirmed by the significantly increased ranges of relative efficiency coefficients: 23,20-100 in criteria group "A", 29,77-100 in criteria group "B", and 41,61-100 in criteria group "C". Judging according to average Croatian coefficients (38,80 in criteria group "A", 42,71 in "B", and 70,28 in "C") we can conclude that imbalance is particularly expressed within the "material component", less expressed within the "human component", and least within the "standard of living component". According to all criteria groups, the city of Zagreb ranks first, while according to most of them the Zagreb County is at the bottom[7]. Among the macro-regions, according to almost all components, Middle Croatia and Lika and Upper Adriatic rank first, while Dalmatia and particularly Slavonia are lagging.

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[6] The null hypothesis and the alternate hypothesis are: Ho: $\rho = 0$, and H_1: $\rho \geq 0$.

[7] As these two regions are immediate and interdependent neighbors, the example of their opposite position on the development scale is indicative for evaluation of the total policy of regional development management. This also disputes the adequacy of the present administrative-territorial organization of local government in terms of its efficiency in development management.

Finally, the results of ranking Croatian counties by DEA using selected indicators (*16 in total*)[8] from *all the components* are given in *Table 4*.

Table 4. **Counties and macroregions ranked by DEA method (all criteria group)**

	DEA		DEA*	
Counties/macroregions	*Eff. Score*	*Rank*	*Eff. Score*	*Rank*
VUKOVARSKO-SRIJEMSKA	93,31	13	56,64	19
OSJEČKO-BARANJSKA	94,41	11	61,65	11
BRODSKO-POSAVSKA	90,25	21	55,69	22
POŽEŠKO-SLAVONSKA	91,21	20	56,31	21
VIROVITIČKO-PODRAVSKA	97,87	9	55,40	23
SLAVONIA	92,31	18	58,20	16
BJELOVARSKO-BILOGORSKA	98,46	7	59,56	14
KOPRIVNIČKO-KRIŽEVAČKA	98,30	8	60,85	13
MEĐIMURSKA	93,28	14	59,02	15
VARAŽDINSKA	85,78	26	62,49	9
ZAGREBAČKA	91,57	19	38,08	26
KRAPINSKO-ZAGORSKA	89,17	22	56,50	20
SISAČKO-MOSLAVAČKA	89,06	23	55,22	24
KARLOVAČKA	93,12	16	57,45	18
GRAD ZAGREB	100 (15)	2	100	1
MIDDLE CROATIA.	93,25	15	68,83	7
PRIMORSKO-GORANSKA	100 (11)	3	75,81	3
LIČKO-SENJSKA	93,44	12	52,21	25
ISTARSKA	100 (21)	1	80,63	2
LIKA AND UPPER ADRIATIC	99,06	6	73,71	4
ZADARSKA	95,26	10	57,57	17
□IBENSKO-KNINSKA	100 (9)	4	71,15	6
SPLITSKO-DALMATINSKA	87,76	24	61,28	12
DUBROVAČKO-NERETVAN.	100 (2)	5	72,07	5
DALMATIA	87,59	25	62,27	10
CROATIA	92,34	17	65,60	8

Note: The figure in brackets with efficient DMUs in the "Eff. Score" column shows the frequency of appearance of the DMU in the "Reference set" of inefficient DMUs. It is possible to discriminate efficient DMUs based on the assumption that the DMU with higher frequency has also better performance in relation to other efficient DMUs.

The detailed analysis of these results shows that in the measurement of efficiency for individual counties *by original M2-model* in no case the number of used outputs exceeds *four* (out of 16 possible). In most cases *only one* of the indicators has a remarkably highest contribution: "Global productivity - A3" (10 cases with contribution higher than 60%) and "Inhabitants per one apartment - C4" (14 cases with contribution higher than 70%). Efficiency evaluation based on the *modified M2-model* provided the ranks given in the last column of *Table 4*. The results of analysis shows, similarly to the case of single components, that it was justified to expect that the evaluated efficiency for individual DMUs

[8] It is well known that all the three global components comprise 28 indicators in total. To evaluate efficiency by DEA (see Footnote 1) a smaller number of more important indicators is selected (with relatively greater weights). The selected indicators are: A1, A3, A4, A5, A8, A10, A11, A12, B1, B3, B4, B6,C1, C3, C4 and C5.

will be *decreased* by weights restriction. Finally, the expectation of *higher discriminatory power* of the modified DEA model is confirmed too (e.g. total discrimination of 1 efficient DMU is achieved as opposed to 5 in the *original M2- model*).

5. INSTEAD OF CONCLUSION OR: WHERE SHOULD THE PROCESSES BE DIRECTED TO?

Previous analysis undoubtedly shows that there are numerous areas of imbalances in the Republic of Croatia. Nevertheless, one must not neglect objective problems and shortcomings of the methodology applied. Namely, the analysis shows that merely by using different models within the same methodology (DEA) one obtains different evaluation of relative development. Expectations are similar in application of alternative methods of multicriterial decision-making[9], in application of a different system of development indicators, in the choice of different expert team to create the weights, etc.

In spite of the mentioned shortcomings, we can reliably state that the analysis clearly confirms regional imbalances in all the essential components of the complex regional structure. These imbalances are the strongest in the global material component, a bit weaker in the global human component, and the weakest in the standard of living component. Equally, this imbalance is confirmed by common, but partial range of more important indicators from all the three components. Finally, we can generally conclude that this analysis confirms one of the basic theses in the criticism of the previous model of the regional development in Croatia, the thesis that inefficiency of such policy has caused the deep development gap between the regions.

The above conclusions provide enough information and reason for elaboration of a *new active development policy* towards a balanced regional development. The starting points for a new model of regional development are:

- The new concept considers the entire development process as a subject of regional development; it means that regional development encompasses social, economic, spatial and human structures.
- The new policy of regional development must be founded on the national development policy appreciating valorization of regional wealth. It should encourage faster growth of each region as well as of the national territory as a whole.
- The new development model, instead of stressing development differences, puts the accent on the functions and their effectiveness in achieving a balanced development, distribution of productive functions, as well as faster development of the single regions and of the entire national territory.
- The specific feature of a new model is the appreciation of functional and regional principles. In practice, they create new development fluid between national and regional level. The basis of functional and polycentric system are cities, while differences in size, economic and functional development between city nodes and their gravitating areas

[9] Still, Babić and Grčić (1998b) show that by an adequate adaptation of different models it is possible to obtain a high degree of correlation in the result of multicretirial evaluation. Namely, they compare the results obtained by PROMETHEE and by DEA (modified weights-based DEA model) based on the same system of indicators and weights. Spearman rank order correlation coefficient between ranks obtained by PROMETHEE and DEA was 0.946.

provide the dynamics of the entire system.

Consequently, an overall development strategy of Croatia and development strategies of single regions can be highly correspondent if the starting points of the regional development model were considered as strategic guidelines in the elaboration of the regionally balanced development. The differences occur in the management mechanisms and instruments for the implementation of policy of overall and regional development. Although regional policy can, in the short run, decelerate the dynamics of overall development, it will surely encourage the increase of average growth rate and the satisfaction of population in the long run. Regional imbalances and the problem of undeveloped areas in Croatia can only be solved according to a unique development policy based on the principles of functional hierarchical polycentrism. Moreover, the best results can be achieved only if polycentrism is founded on the competition principles, i.e. if the undeveloped areas are approached not on social but market rules, thus creating a sound foundation for an internally based development in the future (market instead of social allocation of investments).

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