TECHNOLOGICAL AND ECONOMIC DEVELOPMENT OF ECONOMY
Baltic Journal on Sustainability
2009
15(3): 418–436

# EVALUATING THE CHANGES IN ECONOMIC AND SOCIAL DEVELOPMENT OF LITHUANIAN COUNTIES BY MULTIPLE CRITERIA METHODS

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*Received 28 April 2009; accepted 20 August 2009*

**Abstract.** Under the conditions of the country's economy restructurization, the differences between economic and social development of various regions are becoming more prominent. To smooth these differences, a number of scientific and practical problems associated with the concepts of a region, regional policy and its aims, determination of the boundaries of a region and evaluation of its development, etc., should be thoroughly investigated. To solve such complicated problems, multicriteria evaluation methods have been recently used, which could take into consideration the major aspects of economic and social development of the regions, including the environmental problems, as well as multidimensional character of the criteria, different directions of their changing and significances. Quantitative evaluation of social and economic region's development allows us to determine the changes, taking place in this development. This, in turn, shows the effectiveness of the EU structural funds, national programmes and other facilities used in conducting the regional policy.

**Keywords:** regional development, criteria of development, multiple criteria analysis.

**Reference** to this paper should be made as follows: Ginevičius, R.; Podvezko, V. 2009. Evaluating the changes in economic and social development of Lithuanian counties by multiple criteria methods, *Technological and Economic Development of Economy* 15(3): 418–436.

## 1. Introduction

Under the conditions of country economy restructurization (Brauers *et al.* 2007), the differences between economic and social development of various regions are becoming more prominent. To smooth these differences, a number of scientific and practical problems associated with the concepts of a region, regional policy and its aims, determination of the boundaries of a region and evaluation of its development, etc. should be thoroughly investigated (Snieška, Bruneckienė 2009; Lenz 2008).

ISSN 1392-8619 print/ISSN 1822-3613 online
doi: 10.3846/1392-8619.2009.15.418-436
*http://www.tede.vgtu.lt*

Researchers, examining the problems of regional policy, differently approach the concept of a region, suggesting different criteria of their classification and aims of regional development policy. However, all investigators emphasize the need for smoothing the differences between the regions as the main aim of their development (Brock, Urbonavičius 2008; Paulauskas, S., Paulauskas, A. 2008; Kaklauskas *et al.* 2009; Jakaitis *et al.* 2009; Grundey 2008a, 2008b; Zavadskas, Kaklauskas 2008; Yetgin, Lepkova 2007).

In practice, economic and social development has many different facets, embracing, apart from economic and social aspects, cultural, ethnographical, ecological and other features (Kavaliauskas 2008; Rutkauskas 2008). This makes it difficult to assess the actual state of economic and social development of a region. For example, if the high level of economic development of a particular region has been achieved on the account of heavy environmental pollution, it is hardly possible to talk about sustainable development. Thus, to assess the state of a region, it should be considered from various, often incompatible, perspectives. This approach to evaluating the development of the regions is only paving its way (Jakimavičius, Burinskienė 2007; Lin, Li 2008; Terrados *et al.* 2007; Wang *et al.* 2008; Burinskienė, Rudzkienė 2009; Ginevičius, Podvezko 2007b; 2008a; Ginevičius *et al.* 2004, 2006a, 2006b; Kosiedowski 2008). One of the reasons is the lack of the appropriate evaluation methods. The economic and social development of the state's regions is comprehensively described in the year-book published by the Statistics Department of the government of Lithuania (Counties of Lithuania … 2004, 2005, 2006, 2007, 2008). It presents as many as 87 criteria of evaluating social and economic development. However, it is hardly possible to rank the regions based on their economic and social development. This is because of the nature of the provided criteria, which are better for some regions and worse for the others. Therefore, to get a generalizing solution of the considered problems, they should be integrated into a single value. The situation is also complicated due to the fact that the number of the criteria is large and they are of various dimensions. The latter are either maximizing or minimizing, implying that the growth of the value of some criteria means a higher development level, while for other criteria it shows a lower level. Moreover, the criteria have various significances with respect to the phenomenon considered, i.e. social and economic regions' development.

To solve such complicated problems, multicriteria evaluation methods have been recently used (Hwang, Yoon 1981; Figueira *et al.* 2005; Ginevičius 2007; Ginevičius, Podvezko 2008b, 2008c; Ginevičius *et al.* 2007, 2008a, 2008b; Brauers, Zavadskas 2008; Brauers *et al.* 2008a); this could take into consideration the major aspects of economic and social development of the regions, including the environmental problems, as well as multidimensional character of the criteria, different directions of their changing and significances. The calculations made using the above methods demonstrated the way of evaluating the economic and social development of Lithuanian regions (Ginevičius *et al.* 2006a, 2006b; Ginevičius, Podvezko 2004a, 2004b; Adamiek 2001; Kosiedowski 2001, 2008).

Quantitative evaluation of social and economic region's development allows us to determine the changes, taking place in this development. This, in turn, shows the effectiveness of the EU structural funds, national programmes and other facilities used in conducting the regional policy.

## 2. Regionalising the territory of the country

The term 'region' is perceived differently , though the research in this area has had a long history. The problems associated with its nature, objectivity as a category, as well as the criteria used to define it, etc. are still discussed. Generally, a region is described as a part of the earth's surface, which may be separated from the surrounding territories by applying to it the procedures based on particular criteria (Adamiek 2001; Kosiedowski 2001). On the other hand, both the criteria and procedures used are subjective, therefore, the regionalisation based on them can hardly be considered objective.

The concept of a region may be defined more precisely by analysing the approaches used in various scientific and political spheres, which consider this problem from various perspectives.

The literature analysis of the problem lets us conclude that the essential approaches and aspects, allowing us to define the regions, include geographical, political, sociological, ethnographical and economic factors (Adamiek 2001; Kosiedowski 2001; Andriušaitienė 2007).

From a geographical perspective, a region is a relatively homogeneous surface area, differing from the surrounding territories by the distinct environmental characteristics, such as the territory formed, type of soil, climate, etc.

From the political perspective, the essential region's characteristics are specific political actions, popularity of the respective political doctrines, self-government in the framework of a federal state, the support of the existing administrative-territorial division, the effectiveness of performance of regional authorities, etc.

From the social perspective, the significant criteria of region's delimitation are the status of belonging to a particular nation, the integrity of the local community, the sense of peculiarity in relations with other territories, emotional links with the so-called 'native land', etc.

Ethnically, the regions differ in linguistic features (e.g. language, intellect, jargon), as well as in traditions and culture (art, garments and traditions of the population), etc.

Economically, a region is primarily an outlined territory with specific economy, which was formed based on the available internal and external economic resources, and factors influencing its development, such as capital, labour force, technologies, information, etc.

It is clear that it is hardly possible under real conditions to define a region based only on regional, political, ethnographical or other characteristics. All these interrelated aspects are integrated in the concept of an economical region. On the other hand, this 'applied' approach to a region can hardly allow us to appropriately fix its boundaries, which is required for planning and management of a region. Therefore, its boundaries are usually associated with territorial-administrative division of a country.

A resolution of the Government of Lithuanian Republic (1998) 'On the guidelines of Lithuanian policy of regional development' stated that administrative-territorial units, counties, would be considered the main divisions for conducting the state regional policy of social-economic development. Now, there are ten counties in Lithuania. Therefore, at present, counties are considered to be the regions in this country. This is also confirmed by A resolution of the Seimas of Lithuanian Republic (1999) 'On the concluding-report of the Seimas Committee for European affairs on the EU regional policy and Lithuania's preparation for its implementation'.

Today, territorial-administrative units of Lithuanian Republic are counties and municipalities (The law on territorial-administrative divisions of Lithuanian Republic 1994). A municipality is an administrative unit, exercising control over self-government institutions elected by the inhabitants. A county is the highest administrative unit subordinate to the government of Lithuanian Republic. It consists of self-governed territories, having common social, economic and ethno-cultural interests.

The situation is changing, and the amalgamation of counties into bigger units is planned. The need for extending the existing administrative-territorial divisions had been already emphasized some years ago. Then, it was believed that regional structures formed by integrating several counties, based on common natural, economic and other conditions, could be established in Lithuania. For this purpose, several regions differing from others by their economic and social development were suggested. They were Western, Central, Northern, South-Western, Eastern and South-Eastern regions (Buračas 1997). Today, the problem of integrating the existing regions into larger units is included in the programmes of the political parties of Lithuania.

Lithuania as a member-state of the European Union should coordinate its policy of regional development with the EU policy in this area, which is aimed at harmonizing social and economic development. The particular goals of the EU regional development policy are formulated in the EU Agreement. According to the Article 158, the European Union should strive to smooth the differences in the level of development between various regions and diminishing the backwardness of less developed regions. The European funds of regional development are aimed at supporting the development of these regions as well as structural changes and restructuring of industrial regions experiencing economic decline. Regional development policy was worked out specially for diminishing the gap between the richest and the poorest EU member-states or the level of the development of their regions.

## 3. A system of criteria describing economic and social development of Lithuanian districts

Economic and social development of the state's regions (districts) is reflected in the yearbook of the Statistical Department (Counties of Lithuania 2007). It presents the criteria of social and economic development as a system consisting of separate groups (sets) of criteria describing particular aspects of development (Table 1).

**Table 1.** The criteria of economic and social development of Lithuanian regions (counties)

| No | A generic name of criteria | The criteria of a set |
|---|---|---|
| 1 | Population | 1. Population, area and density<br>2. Live births, deaths, natural increase/decrease<br>3. Vital statistics indicators<br>4. Marriages and divorces<br>5. Mortality by sex and age group, 2007<br>6. Life expectancy at birth<br>7. Mortality by cause of death<br>8. Internal and international migration |

Continuation of **Table 1**

| No | A generic name of criteria | The criteria of a set |
|---|---|---|
| 2 | Health and social security | 1. Physicians<br>2. Physicians by specialty<br>3. Odontologists<br>4. Nurses<br>5. Number of pharmacists<br>6. Number of visits to outpatient facilities<br>7. Number of state social insurance old age pensioners<br>8. Expenditure on benefits |
| 3 | Education and culture | 1. Educational attainment of the population (aged 25–64)<br>2. Preschool education<br>3. Number of general schools<br>4. Number of vocational schools<br>5. Number of colleges<br>6. Number of universities<br>7. Libraries<br>8. Cultural centres |
| 4 | Employment and unemployment | 1. Average annual number of employed persons<br>2. Employed persons by economic activity and sex<br>3. Employed persons and employment rate by sex<br>4. Unemployed and unemployment rate by sex<br>5. Labour force and labour force activity rate by sex |
| 5 | Labour | 1. Average number of employees by the kind of economic activity<br>2. Average gross monthly earnings by the kind of economic activity<br>3. Average number of employees, average gross monthly and hourly earnings and indices |
| 6 | Household income and expenditure | 1. Average disposable income, 2007<br>2. Average consumption expenditure, 2007. |
| 7 | Dwelling | 1. Stock of dwellings<br>2. Number of dwellings by type of ownership, 2007<br>3. Housing provision |
| 8 | Crime | 1. Registered criminal offences<br>2. Investigated criminal offences |
| 9 | Gross domestic product | 1. Gross domestic product (GDP)<br>2. Gross domestic product (GDP) per capital<br>3. Value added |
| 10 | Municipal budgets | 1. Municipal budgets revenue, 2007<br>2. Municipal budgets expenditure by function of the Government, 2007 |
| 11 | Prices | 1. Average retail prices for food and non-food goods, December<br>2. Annual rates of change in prices for main consumer goods and services by group in major cities of the country |
| 12 | Foreign trade | 1. Exports of goods of Lithuanian origin<br>2. Exports of goods of Lithuanian origin to the European Union and to other countries |
| 13 | Foreign direct investment | 1. Foreign direct investment |

Continuation of **Table 1**

| No | A generic name of criteria | The criteria of a set |
|---|---|---|
| 14 | Economic entities | 1. Number of economic entities in operation<br>2. Number of economic entities in operation by economic activity, 2008<br>3. Number of economic entities in operation by personnel, 2008 |
| 15 | Enterprise statistics | 1. Turnover<br>2. Turnover by the kind of economic activity, 2006 |
| 16 | Investment in tangible fixed assets | 1. Investment in tangible fixed assets |
| 17 | Industry | 1. Production of main commodities |
| 18 | Construction | 1. Construction authorized by building permits<br>2. Dwellings completed<br>3. Construction authorized by non-residential buildings permits and new non-residential buildings completed<br>4. Own-account construction work carried out within the country |
| 19 | Domestic trade | 1. Indicators of enterprises of sale, maintenance and repair of motor vehicles and motorcycles, retail sale of automotive fuel<br>2. Indicators of enterprises of retail trade except sale of motor vehicles and motorcycles<br>3. Indicators of restaurants, bars and other catering enterprises |
| 20 | Services | 1. Income of service enterprises |
| 21 | Tourism | 1. Number of accommodation establishments<br>2. Number of guests in accommodation establishments<br>3. Overnight stays in accommodation establishments |
| 22 | Transport and communication | 1. Number of road vehicles, 2007<br>2. National freight transport by road, 2007<br>3. Passengers carried by bus<br>4. Main residential telephone lines<br>5. Number of private passenger cars<br>6. Road traffic accidents |
| 23 | Agriculture | 1. Gross agriculture production<br>2. Utilised agriculture land<br>3. Crop area on all farms<br>4. Harvest of agricultural crops on all farms<br>5. Yield of agricultural crops on all farms<br>6. Number of livestock and poultry on all farms, 2008<br>7. Animal products and productivity per cow on all farms |
| 24 | Environment and climate | 1. Water abstraction and consumption<br>2. Water consumption by purpose, 2007<br>3. Waste water discharge, 2007<br>4. Air pollutant emissions from stationary sources<br>5. Gaseous and liquid emissions from stationary sources<br>6. Climate |
| | **Total value:** | **87** |

As shown in Table 1, 87 criteria presenting 24 groups are used to describe social and economic development of Lithuanian regions. Their analysis shows that some of them may be deduced from the others and expressed either by absolute or relative values, etc. However, the criteria describing social and economic development of the state, which may be perceived as a system reflecting all aspects of development, should be independent. Therefore, it is possible to reduce their number, not decreasing the accuracy of reflecting the level of the development achieved. By performing these operations we obtained a system of criteria, describing social and economic development of the country (Counties of Lithuania 2004–2008) suitable for further calculations (Table 2).

As shown by the values of the criteria presented in Table 2, it is not possible to rank the regions according to economic and social development level because some of these values are better for some particular regions, while others are better for other regions. This can be more clearly seen if the values are expressed in terms of ranks (Table 3).

One can see that, for example, Vilnius region is ranked first according to some criteria, while being the last according to some others. This means that the ways of integrating all the criteria describing social and economic development into a single magnitude should be developed. By equating these values to each other, it would be possible to rank the regions considered according to the level of their social and economic development. To solve this problem, multicriteria evaluation methods, allowing generalization of the criteria, having various dimensions and changing in various directions, should be used (Ginevičius 2008; Podvezko 2008; Ginevičius, Podvezko 2008d, e; Turskis *et al.* 2009; Zavadskas *et al.* 2008a; Brauers *et al.* 2008b; Ustinovichius *et al.* 2007).

## 4. Multicriteria evaluation of social and economic development of Lithuanian regions

As mentioned above, multicriteria evaluation methods are well suited for evaluating economic and social development of regions.

The basis of quantitative multicriteria methods is the matrix $R = \|r_{ij}\|$ of the statistical data of the criteria describing the compared regions (Table 2) and their weight values $\omega_i$, $i = 1, ..., m$; $j = 1, ..., n$ where $m$ is the number of criteria (in this case, $m = 14$) and $n$ is the number of the alternatives (the regions compared) (in this case, $n = 10$). By applying quantitative multicriteria evaluation methods, the type of each criterion, maximizing or minimizing (max or min in row 3 of Table 2), is determined. The criteria of quantitative multicriteria evaluation methods embrace non-dimensional (normalized) criteria values $\tilde{r}_{ij}$ and weights $\omega_i$. Most methods rely on a specific normalization or transformation of the initial data of the criteria.

Four methods – SAW, TOPSIS, COPRAS and COPRAS-M are used in this work. The simplest multicriteria evaluation method VS was used for comparison.

The methods used differ in the sophistication level. The most widely known and used method is SAW (Simple Additive Weighing) (Hwang, Yoon 1981). The criterion of the method $S_j$ fully reflects the aim of quantitative multicriteria evaluation methods of integrating the criteria values and weights into a single magnitude.

**Table 2.** The statistical data on economical and social development of Lithuanian regions from 2003 to 2007

| No | Criterion | Criterion direction | Year | Regions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Alytus | Kaunas | Klaipėda | Marijampolė | Panevėžys | Šiauliai | Tauragė | Telšiai | Utena | Vilnius |
| 1 | Population migration (net migration) per 1000 inhabitants | Max | 2003 | –4.599 | –4.009 | –0.237 | –1.194 | –3.906 | –5.303 | –2.285 | –3.467 | –3.806 | 2.996 |
| | | | 2004 | –6.060 | –5.230 | –1.145 | –3.395 | –5.143 | –5.664 | –4.279 | –4.794 | –4.610 | 2.397 |
| | | | 2005 | –5.217 | –3.611 | –1.429 | –3.759 | –4.583 | –5.688 | –5.917 | –5.474 | –4.604 | 2.185 |
| | | | 2006 | –4.182 | –1.715 | –0.662 | –2.975 | –3.746 | –4.031 | –3.908 | –2.832 | –3.090 | 2.288 |
| | | | 2007 | –4,451 | –1,824 | 0,248 | –2,715 | –4,282 | –6,194 | –5,550 | –4,003 | –4,375 | 2,984 |
| 2 | Municipal budget's revenue (average amount per capita) | Max | 2003 | 1.152 | 1.038 | 1.156 | 1.126 | 1.110 | 1.120 | 1.135 | 1.098 | 1.237 | 1.028 |
| | | | 2004 | 1.308 | 1.199 | 1.337 | 1.294 | 1.294 | 1.278 | 1.299 | 1.284 | 1.418 | 1.199 |
| | | | 2005 | 1.397 | 1.306 | 1.418 | 1.350 | 1.353 | 1.351 | 1.415 | 1.372 | 1.526 | 1.313 |
| | | | 2006 | 1.640 | 1.662 | 1.683 | 1.588 | 1.535 | 1.621 | 1.684 | 1.603 | 1.681 | 1.552 |
| | | | 2007 | 1,774 | 1,702 | 1,753 | 1,722 | 1,688 | 1,792 | 1,816 | 1,731 | 1,873 | 1,583 |
| 3 | Municipal budget's expenditure (average amount, social security) | Max | 2003 | 150.91 | 120.38 | 129.40 | 161.56 | 142.07 | 154.58 | 205.50 | 178.54 | 146.71 | 113.21 |
| | | | 2004 | 190.16 | 158.08 | 187.34 | 211.54 | 189.41 | 209.50 | 234.53 | 212.59 | 188.25 | 183.69 |
| | | | 2005 | 201.49 | 171.96 | 201.37 | 213.89 | 207.13 | 218.50 | 238.87 | 221.18 | 196.59 | 196.81 |
| | | | 2006 | 225.43 | 191.44 | 228.30 | 239.30 | 222.83 | 254.42 | 271.66 | 260.04 | 221.83 | 221.91 |
| | | | 2007 | 144,67 | 138,84 | 139,93 | 149,35 | 160,06 | 173,92 | 195,97 | 153,17 | 156,32 | 148,86 |
| 4 | Unemployment rate (%) | Min | 2003 | 13.6 | 12.1 | 12.5 | 7.5 | 11.4 | 16.9 | 9.5 | 12.5 | 15.3 | 11.7 |
| | | | 2004 | 16.0 | 10.3 | 12.7 | 6.9 | 12.6 | 12.6 | 8.9 | 10.3 | 12.3 | 11.1 |
| | | | 2005 | 8.2 | 8.9 | 7.0 | 3.0 | 10.8 | 10.1 | 6.0 | 7.9 | 6.0 | 8.6 |
| | | | 2006 | 5.1 | 5.9 | 6.8 | 2.6 | 8.0 | 5.7 | 4.2 | 5.6 | 5.9 | 5.0 |
| | | | 2007 | 3,3 | 4,2 | 4,1 | 2,0 | 6,5 | 4,4 | 3,4 | 4,3 | 4,4 | 4,5 |
| 5 | Average gross monthly earnings | Max | 2003 | 912 | 992 | 1060 | 847 | 940 | 871 | 807 | 1059 | 1111 | 1249 |
| | | | 2004 | 975 | 1063 | 1125 | 914 | 1016 | 958 | 859 | 1162 | 1145 | 1328 |
| | | | 2005 | 1072 | 1192 | 1256 | 1001 | 1094 | 1049 | 936 | 1248 | 1231 | 1487 |
| | | | 2006 | 1255 | 1412 | 1474 | 1195 | 1258 | 1239 | 1104 | 1432 | 1389 | 1734 |
| | | | 2007 | 1540 | 1720 | 1765 | 1420 | 1507 | 1498 | 1332 | 1736 | 1621 | 2076 |
| 6 | Average useful floor space per capita | Max | 2003 | 25.0 | 22.5 | 21.0 | 22.4 | 25.3 | 22.4 | 21.7 | 22.0 | 27.9 | 23.0 |
| | | | 2004 | 25.4 | 22.6 | 21.3 | 22.6 | 25.5 | 22.8 | 22.5 | 22.3 | 28.4 | 23.7 |
| | | | 2005 | 25.9 | 22.8 | 21.5 | 22.7 | 25.8 | 23.1 | 22.7 | 22.6 | 28.7 | 24.3 |
| | | | 2006 | 26.0 | 23.0 | 21.7 | 23.0 | 27.0 | 23.4 | 22.9 | 22.7 | 29.1 | 24.5 |
| | | | 2007 | 26,4 | 23,2 | 22,0 | 23,2 | 27,3 | 23,7 | 23,2 | 23,0 | 29,5 | 24,9 |
| 7 | Number of pre – school establishments (places per 100 children) | Max | 2003 | 102 | 89 | 96 | 83 | 97 | 95 | 82 | 83 | 108 | 98 |
| | | | 2004 | 97 | 86 | 97 | 84 | 97 | 97 | 96 | 84 | 102 | 98 |
| | | | 2005 | 109 | 88 | 102 | 95 | 105 | 89 | 95 | 86 | 104 | 96 |
| | | | 2006 | 112 | 83 | 103 | 97 | 108 | 98 | 98 | 90 | 103 | 96 |
| | | | 2007 | 113 | 85 | 101 | 97 | 110 | 97 | 91 | 88 | 104 | 94 |

End of **Table 2**

| No | Criterion | Criterion direction | Year | Regions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Alytus | Kaunas | Klaipėda | Marijampolė | Panevėžys | Šiauliai | Tauragė | Telšiai | Utena | Vilnius |
| 8 | Number of schools (per 1000 of students) | Max | 2003 | 4.08 | 3.00 | 3.06 | 3.15 | 3.50 | 3.80 | 3.29 | 3.75 | 3.75 | 3.06 |
| | | | 2004 | 3.74 | 2.55 | 2.49 | 2.91 | 2.82 | 3.37 | 3.31 | 3.47 | 3.47 | 2.65 |
| | | | 2005 | 2.81 | 2.46 | 2.59 | 3.01 | 2.97 | 3.14 | 3.43 | 3.34 | 3.41 | 2.72 |
| | | | 2006 | 2.94 | 2.47 | 2.69 | 3.18 | 2.97 | 3.24 | 3.49 | 3.29 | 3.58 | 2.84 |
| | | | 2007 | 3,07 | 2,55 | 2,76 | 3,27 | 3,10 | 3,37 | 3,51 | 3,35 | 3,71 | 2,91 |
| 9 | Animal products recalculated in terms of milk (100 kg per 100 ha of agricultural land) | Max | 2003 | 818 | 723 | 772 | 770 | 680 | 648 | 741 | 700 | 693 | 653 |
| | | | 2004 | 782 | 756 | 812 | 717 | 681 | 641 | 741 | 733 | 714 | 630 |
| | | | 2005 | 672 | 681 | 727 | 759 | 627 | 616 | 656 | 637 | 639 | 583 |
| | | | 2006 | 691 | 682 | 747 | 782 | 637 | 631 | 740 | 693 | 632 | 612 |
| | | | 2007 | 701 | 706 | 780 | 827 | 684 | 653 | 838 | 709 | 697 | 645 |
| 10 | Indicators of activity of retail trade enterprises (per capita) | Max | 2003 | 3130 | 4712 | 5044 | 5990 | 3783 | 3854 | 3099 | 3614 | 3833 | 7563 |
| | | | 2004 | 3722 | 5211 | 5706 | 6248 | 4378 | 4133 | 3389 | 3938 | 4002 | 8654 |
| | | | 2005 | 4565 | 6079 | 6490 | 7024 | 5076 | 4866 | 3798 | 4334 | 4533 | 10458 |
| | | | 2006 | 5095 | 6983 | 7387 | 7773 | 5881 | 5694 | 4434 | 4931 | 5259 | 12766 |
| | | | 2007 | 6055 | 8322 | 8720 | 9144 | 7000 | 6783 | 5700 | 5733 | 6169 | 15002 |
| 11 | Investment in tangible fixed assets (per capita) | Max | 2003 | 1880 | 2142 | 2431 | 1403 | 1926 | 1212 | 1036 | 2604 | 1571 | 3955 |
| | | | 2004 | 1858 | 2811 | 3862 | 1701 | 2204 | 1790 | 1136 | 2301 | 2928 | 5686 |
| | | | 2005 | 2508 | 3781 | 6442 | 2007 | 2362 | 2094 | 1268 | 2783 | 3378 | 7179 |
| | | | 2006 | 3386 | 4227 | 6088 | 3445 | 3159 | 3139 | 1865 | 4375 | 2787 | 7362 |
| | | | 2007 | 3887 | 5599 | 7025 | 3852 | 5239 | 3925 | 2363 | 9811 | 3655 | 10666 |
| 12 | Own–account construction work carried out within the country (per capita) | Max | 2003 | 885.0 | 1146.2 | 1416.6 | 797.8 | 693.3 | 676.6 | 758.8 | 915.5 | 1060.5 | 2026.8 |
| | | | 2004 | 904.6 | 1238.7 | 1711.7 | 901.7 | 1047.3 | 814.2 | 552.7 | 915.3 | 1552.5 | 2252.1 |
| | | | 2005 | 1319.6 | 1512.4 | 2483.8 | 958.9 | 1124.6 | 906.7 | 795.3 | 1032.0 | 1553.8 | 2620.0 |
| | | | 2006 | 1786.1 | 2017.2 | 3097.3 | 1725.3 | 1509.1 | 1556.5 | 1025.3 | 1632.5 | 1647.5 | 3432.2 |
| | | | 2007 | 2556,7 | 2794,4 | 4197,4 | 1771,3 | 2405,3 | 1990,5 | 1620,9 | 2697,6 | 1992,9 | 4821,6 |
| 13 | Dwellings completed (per capita ) | Max | 2003 | 0.102 | 0.122 | 0.090 | 0.059 | 0.070 | 0.074 | 0.058 | 0.061 | 0.060 | 0.312 |
| | | | 2004 | 0.117 | 0.194 | 0.138 | 0.081 | 0.095 | 0.085 | 0.099 | 0.076 | 0.060 | 0.446 |
| | | | 2005 | 0.101 | 0.218 | 0.176 | 0.079 | 0.079 | 0.057 | 0.069 | 0.078 | 0.061 | 0.382 |
| | | | 2006 | 0.106 | 0.189 | 0.207 | 0.058 | 0.061 | 0.091 | 0.042 | 0.073 | 0.063 | 0.535 |
| | | | 2007 | 0,164 | 0,214 | 0,187 | 0,122 | 0,082 | 0,102 | 0,058 | 0,083 | 0,100 | 0,696 |
| 14 | Registered criminal offences (misdemeanors per 100000 inhabitants) | Min | 2003 | 103 | 144 | 181 | 90 | 213 | 168 | 168 | 119 | 116 | 237 |
| | | | 2004 | 165 | 204 | 336 | 145 | 265 | 272 | 276 | 158 | 198 | 370 |
| | | | 2005 | 135 | 181 | 270 | 116 | 196 | 208 | 252 | 149 | 165 | 332 |
| | | | 2006 | 122 | 168 | 200 | 118 | 157 | 150 | 186 | 125 | 129 | 315 |
| | | | 2007 | 104 | 168 | 177 | 114 | 145 | 148 | 175 | 107 | 132 | 233 |

**Table 3.** The values of the criteria describing economic and social development of Lithuanian regions for 2007 expressed as ranks

| Criterion | Regions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Alytus | Kaunas | Klaipėda | Marijampolė | Panevėžys | Šiauliai | Tauragė | Telšiai | Utena | Vilnius |
| Population migration (net migration) per 1000 inhabitants | 8 | 3 | 2 | 4 | 6 | 10 | 9 | 5 | 7 | 1 |
| Municipal budget's revenue (average amount per capita) | 4 | 8 | 5 | 7 | 9 | 3 | 2 | 6 | 1 | 10 |
| Municipal budget's expenditure (average amount, social security) | 8 | 10 | 9 | 6 | 3 | 2 | 1 | 5 | 4 | 7 |
| Unemployment rate (% ) | 2 | 5 | 4 | 1 | 10 | 7,5 | 3 | 6 | 7,5 | 9 |
| Average gross monthly earnings | 6 | 4 | 2 | 9 | 7 | 8 | 10 | 3 | 5 | 1 |
| Average useful floor space per capita | 3 | 7 | 10 | 7 | 2 | 5 | 7 | 9 | 1 | 4 |
| Number of pre – school establishments (places per 100 children) | 1 | 10 | 4 | 5,5 | 2 | 5,5 | 8 | 9 | 3 | 7 |
| Number of schools (per 1000 of students) | 7 | 10 | 9 | 5 | 6 | 3 | 2 | 4 | 1 | 8 |
| Animal products recalculated in terms of milk (100 kg per 100 ha of agricultural land) | 6 | 5 | 3 | 2 | 8 | 9 | 1 | 4 | 7 | 10 |
| Indicators of activity of retail trade enterprises (per capita) | 8 | 4 | 3 | 2 | 5 | 6 | 10 | 9 | 7 | 1 |
| Investment in tangible fixed assets (per capita) | 7 | 4 | 3 | 8 | 5 | 6 | 10 | 2 | 9 | 1 |
| Own–account construction work carried out within the country (per capita) | 5 | 3 | 2 | 9 | 6 | 8 | 10 | 4 | 7 | 1 |
| Dwellings completed (per capita ) | 4 | 2 | 3 | 5 | 9 | 6 | 10 | 8 | 7 | 1 |
| Registered criminal offences (misdemeanors per 100000 inhabitants) | 1 | 7 | 9 | 3 | 5 | 6 | 8 | 2 | 4 | 10 |

The sum $S_j$ of the weighted normalized criteria values is calculated for each $j$-th region. It is found according to the formula:

$$S_j = \sum_{i=1}^{m} \omega_i \tilde{r}_{ij} \quad , \tag{1}$$

where $\omega_i$ is the weight of $i$-th criterion; $\tilde{r}_{ij}$ is normalized $i$-th criterion value for $j$-th region $(\sum_{i=1}^{m} \omega_i = 1)$.

In this case, normalization of the initial data may be made using the formula (Ginevičius, Podvezko 2007a):

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sum_{i=1}^{m} r_{ij}}, \tag{2}$$

where $r_{ij}$ is the value of $i$-th criterion for $j$-th region.

The best value of the criterion $S_j$ is its largest value.

In using SAW, minimizing criteria should be transformed into maximizing ones prior to normalization by the formula given below (Hwang, Yoon 1981):

$$\hat{r}_{ij} = \frac{\min_j r_{ij}}{r_{ij}} \; (i = 1, ..., m; j = 1, ..., n), \tag{3}$$

where the lowest positive criterion values are transformed into a maximizing value equal to one.

The method TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) is based on the principle that the alternative having the shortest distance to the ideal variant (solution) and the longest distance to the worst variants should be chosen (Hwang, Yoon 1981; Opricovic, Tzeng 2004). The method can be applied both to maximized and minimized criteria. TOPSIS relies on vector normalization:

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{j=1}^{n} r_{ij}^2}} \; (i = 1, ..., m; j = 1, ..., n), \tag{4}$$

where $\tilde{r}_{ij}$ is normalized value of $i$-th criterion for $j$-th object.

The best variant (solution) $V^*$ and the worst variant $V^-$ are calculated by the formulas:

$$V^* = \{V_1^*, V_2^*, ..., V_m^*\} = \{(\max_j \omega_i \tilde{r}_{ij} \; / \; i \in I_1), (\min_j \omega_i \tilde{r}_{ij} \; / \; i \in I_2)\},$$

$$V^- = \{V_1^-, V_2^-, ..., V_m^-\} = \{(\min_j \omega_i \tilde{r}_{ij} \; / \; i \in I_1), (\max_j \omega_i \tilde{r}_{ij} \; / \; i \in I_2)\},$$

where $I_1$ is a set of maximizing criteria, $I_2$ is a set of minimizing criteria, $\omega_i$ is the weight of the $i$-th criterion.

Overall distance $D_j^*$ of every considered alternative from the best variants and from the worst options, $D_j^-$, are calculated by the formulas:

$$D_j^* = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^*)^2}, \tag{5}$$

$$D_j^- = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^-)^2}. \tag{6}$$

The criterion $C_j^*$ of the method TOPSIS is calculated by the formula:

$$C_j^* = \frac{D_j^*}{D_j^- + D_j^*} \quad (j = 1, \ldots, n) \tag{7}$$
$$(0 \le C_j^* \le 1).$$

The largest value of the criterion $C_j^*$ correlates with the best alternative. The alternatives compared should be ranked in the descending order.

The method COPRAS (Kaklauskas *et al.* 2007; Zavadskas *et al.* 2008b; Banaitienė *et al.* 2008; Vitiekienė, Zavadskas 2007) of complex proportional evaluation and its simplified version (COPRAS- M) can be used if both maximizing and minimizing criteria are available. If only maximizing criteria are used, the results obtained match those of *SAW*. In fact, the value of the criterion for complex proportional evaluation is calculated from the formula:

$$Z_j = S_{+j} + \frac{S_{-\min} \sum_{j=1}^{n} S_{-j}}{S_{-j} \sum_{j=1}^{n} \frac{S_{-\min}}{S_{-j}}}, \tag{8}$$

where $S_{+j} = \sum_{i=1}^{m} \omega_i \tilde{r}_{+ij}$ is the sum of normalized weighted values of all maximizing criteria of the *j*-th alternative, $S_{-j} = \sum_{i=1}^{m} \omega_i \tilde{r}_{-ij}$ is same for all minimizing criteria, $S_{-\min} = \min_j S_{-j}$. As shown by formula (8), the component $S_{+j}$ of the formula matches the value of the *SAW* criterion $S_j$ calculated for maximizing criteria.

The same applies to a simplified method of a complex proportional evaluation suggested by the authors (Ginevičius *et al.* 2004), when the criterion of the method is calculated by the formula:

$$Z_j^* = S_{+j} + \frac{S_{-\max} S_{-\min}}{S_{-j}}, \tag{9}$$

where $S_{-\max} = \max_j S_{-j}$.

The simplest multicriteria method used at the initial stage of evaluation, which was used for comparing the alternatives, is based on the sum of ranks calculated for the alternative, taking into account the values of the criteria describing it (Ginevičius, Podvezko 2007a). This method does not need any transformation of data or positive values as well as the uniformity of units of measurement, being also independent of the particular values of the criteria weights $\omega_i$. The sum of ranks for the *j*-th alternative is calculated in the following way:

$$V_j = \sum_{i=1}^{m} m_{ij}\,, \tag{10}$$

where $m_{ij}$ is the rank (position) of the $j$-th alternative for the $i$-th criterion.

The criteria weights $\omega_i$ were obtained by Saaty's method AHP (Saaty 1980, 2005; Podvezko 2007) and are given in Table 4.

**Table 4.** Weights (significances) $\omega_i$ of the criteria

| No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\omega_i$ | 0.0089 | 0.0744 | 0.0501 | 0.0128 | 0.0163 | 0.1091 | 0.0744 | 0.0744 | 0.0501 | 0.0250 | 0.2030 | 0.1867 | 0.1059 | 0.0089 |

Multicriteria evaluation data on social and economic development of Lithuanian regions obtained by using formulas (1)–(9) are given in Table 5 (see 431 p.).

For the sake of comparison, the ranks of the regions were determined for 2007 by the formula (10), using the VS method. The calculation results are given in Table 6.

**Table 6.** The evaluation results obtained for 2007 by using the VS method

| Region | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_j$ | 70 | 82 | 68 | 73,5 | 83 | 85 | 91 | 76 | 70,5 | 71 |
| **Rank** | 2 | 7 | 1 | 5 | 8 | 9 | 10 | 6 | 3 | 4 |

As shown in Table 6, the ranks of the regions calculated by the VS method differ considerably from those yielded by more precise methods. This confirms the conclusion that the method VS (sum of ranks) may be used only for preliminary evaluation.

The results obtained in the analysis of economic and social development of Lithuanian regions show that only the most highly developed regions (those of Vilnius, Klaipėda and Kaunas) and the least developed regions (those of Tauragė, Šiauliai and Marijampolė) have remained stable in the period considered (see Table 7).

**Table 7.** The ranks of Lithuanian regions obtained by using all multicriteria evaluation methods

| Year | Region | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Alytus | Kaunas | Klaipėda | Marijampolė | Panevėžys | Šiauliai | Tauragė | Telšiai | Utena | Vilnius |
| 2003 | 5 | 3 | 2 | 8 | 7 | 9 | 10 | 4 | 6 | 1 |
| 2004 | 6 | 4 | 2 | 8 | 5 | 9 | 10 | 7 | 3 | 1 |
| 2005 | 5 | 3 | 2 | 8 | 7 | 9 | 10 | 6 | 4 | 1 |
| 2006 | 4 | 3 | 2 | 6 | 9 | 8 | 10 | 5 | 7 | 1 |
| 2007 | 5 | 4 | 2 | 8 | 6 | 9 | 10 | 3 | 7 | 1 |

**Table 5.** The results obtained in multicriteria evaluation of social and economic development of Lithuanian regions in 2003–2007

| Method | Criterion | Region | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alytus | Kaunas | Klaipėda | Marijampolė | Panevėžys | Šiauliai | Tauragė | Telšiai | Utena | Vilnius |
| 2003 m | | | | | | | | | | | |
| SAW | $S_j$ | 0.0986 | 0.1020 | 0.1088 | 0.0867 | 0.0893 | 0.0810 | 0.0799 | 0.0989 | 0.0955 | 0.1597 |
| | Rank | 5 | 3 | 2 | 8 | 7 | 9 | 10 | 4 | 6 | 1 |
| TOPSIS | $C_j^*$ | 0.237 | 0.335 | 0.412 | 0.115 | 0.197 | 0.078 | 0.082 | 0.330 | 0.211 | 0.895 |
| | Rank | 5 | 3 | 2 | 8 | 7 | 10 | 9 | 4 | | 1 |
| COPRAS | $Z_j$ | 0.0985 | 0.1020 | 0.1088 | 0.0863 | 0.0893 | 0.0810 | 0.0799 | 0.0990 | 0.0955 | 0.1597 |
| | Rank | 5 | 3 | 2 | 8 | 7 | | 10 | 4 | 6 | 1 |
| 2004 | | | | | | | | | | | |
| SAW | $S_j$ | 0.0894 | 0.1026 | 0.1168 | 0.0843 | 0.0901 | 0.0823 | 0.0756 | 0.0861 | 0.1056 | 0.1651 |
| | Rank | 6 | 4 | 2 | 8 | 5 | 9 | 10 | 7 | 3 | 1 |
| TOPSIS | $C_j^*$ | 0.187 | 0.370 | 0.517 | 0.149 | 0.228 | 0.142 | 0.081 | 0.212 | 0.382 | 0.918 |
| | Rank | 7 | 4 | 2 | 8 | 5 | 9 | 10 | 6 | 3 | 1 |
| COPRAS | $Z_j$ | 0.892 | 0.1026 | 0.1168 | 0.0844 | 0.0902 | 0.0824 | 0.0756 | 0.0881 | 0.1056 | 0.1650 |
| | Rank | 6 | 4 | 2 | 8 | 5 | 9 | 10 | 7 | 3 | 1 |
| 2005 | | | | | | | | | | | |
| SAW | $S_j$ | 0.0914 | 0.1070 | 0.1355 | 0.0840 | 0.0856 | 0.0770 | 0.0735 | 0.0856 | 0.0997 | 0.1606 |
| | Rank | 5 | 3 | 2 | 8 | 6-7 | | 10 | 6-7 | 4 | 1 |
| TOPSIS | $C_j^*$ | 0.225 | 0.430 | 0.703 | 0.124 | 0.173 | 0.113 | 0.071 | 0.199 | 0.322 | 0.922 |
| | Rank | 5 | 3 | 2 | 8 | 7 | 9 | 10 | 6 | 4 | 1 |
| COPRAS | $Z_j$ | 0.0914 | 0.1070 | 0.1335 | 0.0840 | 0.0856 | 0.0771 | 0.0735 | 0.0856 | 0.0998 | 0.1606 |
| | Rank | 5 | 3 | 2 | 8 | 6-7 | 9 | 10 | 6-7 | 4 | 1 |
| 2006 | | | | | | | | | | | |
| SAW | $S_j$ | 0.0931 | 0.1016 | 0.1259 | 0.0906 | 0.0849 | 0.0870 | 0.0732 | 0.0929 | 0.0878 | 0.1628 |
| | Rank | 4 | 3 | 2 | 6 | 9 | 8 | 10 | 5 | 7 | 1 |
| TOPSIS | $C_j^*$ | 0.250 | 0.375 | 0.601 | 0.228 | 0.186 | 0.193 | 0.077 | 0.292 | 0.189 | 0.922 |
| | Rank | 5 | 3 | 2 | 6 | 9 | 7 | 1 | | 8 | 1 |
| COPRAS | $Z_j$ | 0.0931 | 0.1017 | 0.1260 | 0.0906 | 0.0849 | 0.0871 | 0.0732 | 0.0930 | 0.0878 | 0.1627 |
| | Rank | 4 | 3 | 2 | 6 | 9 | 8 | 10 | 5 | 7 | 1 |
| 2007 | | | | | | | | | | | |
| SAW | $S_j$ | 0.0928 | 0.0990 | 0.1149 | 0.0854 | 0.0913 | 0.0834 | 0.0742 | 0.1077 | 0.0967 | 0.1646 |
| | Rank | 5 | 4 | 2 | 8 | 6 | 9 | 10 | 3 | 7 | 1 |
| TOPSIS | $C_j^*$ | 0.217 | 0.3321 | 0.482 | 0.144 | 0.244 | 0.187 | 0.075 | 0.463 | 0.155 | 0.915 |
| | Rank | 6 | 4 | 2 | 9 | 5 | 8 | 10 | 3 | 7 | 1 |
| COPRAS | $Z_j$ | 0.0928 | 0.0991 | 0.1149 | 0.0854 | 0.0912 | 0.0834 | 0.0742 | 0.1077 | 0.0868 | 0.1646 |
| | Rank | 5 | 4 | 2 | 8 | 6 | 9 | 10 | 3 | 7 | 1 |

In Table 7, one can see that the situation has greatly improved in Telšiai region, which was ranked third after Vilnius and Klaipėda regions according to its social and economic development in 2007. In general, it may be stated that there have not been any considerable changes in the development of Lithuanian regions, with the leaders and those lagging behind remaining the same. It implies that the regional policy of the country has been in effective.

To assess the rate of economic and social development of the regions and their stability over the considered period, the following indicator is suggested:

$$P_j = \frac{1}{(T-1)\,\overline{V}_j} \sum_{t=1}^{T-1} \frac{V_{jt}}{V_{jt+1}} \quad \left( \frac{1}{\mathrm{n}} \le P_j \le 1 \right), \tag{11}$$

where $P_j$ is the indicator of $j$-th region's social and economic development rate and stability; $V_{jt}$ is the rank of $j$-th region in $t$-th year ($t = 1, 2, \ldots, T$); $T$ is the period evaluated; $\overline{V}_j = \dfrac{\sum_{t=1}^{T} V_{jt}}{T}$ is the average rank; $n$ is the number of alternatives (regions).

The results of calculations made by formula (11) are presented in Table 8.

**Table 8.** The development of Lithuanian regions in 2004–2007 according to their stability and growth rate

| **Region** | Alytus | Kaunas | Klaipėda | Marijampolė | Panevėžys | Šiauliai | Tauragė | Telšiai | Utena | Vilnius |
|---|---|---|---|---|---|---|---|---|---|---|
| The value of $P_j$ | 0.204 | 0.285 | 0.500 | 0.142 | 0.161 | 0.114 | 0.100 | 0.230 | 0.200 | 1.000 |
| Rank based on growth rate and stability | 5–6 | 3 | 2 | 8 | 7 | 9 | 10 | 4 | 5–6 | 1 |

As shown in Table 8, the most rapidly developing and stable are the regions of Vilnius, Klaipėda, Kaunas and Telšiai, while the most slowly developing are Tauragė, Šiauliai and Marijampolė.

## Conclusions

1. To determine the level of economic and social development of regions, a great number of various and often incompatible criteria should be considered. This makes the solution of this problem a complicated task. On the other hand, striving for sustainable development of the regions, the level achieved should be quantitatively evaluated. However, it has not been made yet because of the lack of the appropriate evaluation methods. The situation has changed when the researchers began to use multicriteria evaluation methods, allowing them to take into account multidimensional character and different directions of the criterion change as well as different significances (weights) of the criteria describing the development of the regions.

2. Considering the economic and social development of regions, the concept of a region should be defined as precisely as possible. The respective documents of the government of Lithuanian Republic state that the main territorial division is a county (region); therefore, regional development is analysed in the present work.

3. The definition of the country's regions and the analysis of their development are required for the developing and pursuing the effective regional policy, perceived both in the European Union and Lithuania as a means of smoothing the differences in social and economic development between regions and promoting uniform and steady development of the whole territory of the country.

4. Eighty seven criteria describe the economic and social development of Lithuanian regions from various perspectives. Some of them may be deduced from the others; therefore, a set of 14 criteria was used in further calculations.

5. Three main methods – SAW, TOPSIS and COPRAS were used in multicriteria evaluation of social and economic development of Lithuanian regions. To determine the ultimate rank of a region, the average estimate of the values obtained in applying all the considered methods was taken.

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## LIETUVOS REGIONŲ (APSKRIČIŲ) EKONOMINĖS IR SOCIALINĖS RAIDOS POKYČIAI

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Santrauka

Šalies ūkiui iš esmės restruktūrizuojantis ir persitvarkant padidėja ekonominės ir socialinės plėtros skirtumai tarp regionų (apskričių). Juos mažinant susiduriama su daugeliu mokslui ir praktikai aktualių, spręstinų klausimų, tokių kaip regiono, regioninės politikos samprata ir tikslai, jų ribų nustatymas, plėtros supratimas, įvertinimas ir t. t. Tokiems uždaviniams spręsti pastaraisiais metais sėkmingai taikomi daugiakriterinio vertinimo būdai. Jie leidžia įvertinti visus svarbiausius regionų ekonominės ir socialinės plėtros (RESP) aspektus, taip pat ir aplinkosauginius, įvertinti rodiklių daugiadimensiškumą, nevienodą kitimo kryptį bei reikšmingumą. Galimybė kiekybiškai įvertinti RESP leidžia nustatyti šios plėtros kaitą. Būtent ji parodo, koks yra Europos struktūrinių fondų, nacionalinių programų, kitų priemonių, skirtų regioninei politikai įgyvendinti, efektyvumas.

**Reikšminiai žodžiai:** regionų plėtra, plėtros kriterijai, daugiakriteris vertinimas.

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