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EVALUATING SITUATION OF LITHUANIA IN THE EUROPEAN UNION: STRUCTURAL INDICATORS AND MULTIMOORA METHOD

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Abstract. According to the Lisbon Strategy, which was adopted in 2000, the European Union (EU) should become the most competitive region in the World. Goals, defined in the strategy, and instruments for seeking them are identified by structural indicators as well as their systems. It is possible to evaluate specific country's situation and compare it with other countries by using various specific indexes or applying statistical – mathematical methods. The aim of this article is to describe main structural indicators, which identify the implementation of Lisbon Strategy as well as progress in sustainable development and to evaluate Lithuania's and other Baltic States' position in the EU using statistical methods. In order to achieve this aim, the following tasks were raised: 1) to describe and classify structural indicators; 2) to overview main methods of quantitative analysis and to apply them when evaluating Lithuania's and other Baltic States' position in the EU. Lithuania's progress in achieving Lisbon Strategy goals was evaluated using the system of 13 shortlist structural indicators from Eurostat database and applying MULTIMOORA (Multi-Objective Optimization by Ratio Analysis plus Full Multiplicative Form) method. The analysis showed that Lithuania is among top EU countries by such indicators as employment rate, youth education attainment rate, comparative price level and greenhouse gas emission. Thus there are no serious environmental problems in Lithuania and its production can successfully compete at international markets due to relative low production costs. Lithuania is backward by GDP per capita, labour productivity and employment rate of older workers. In addition, energy intensity of the economy needs to be optimized. Considering all the above, technologic backwardness is characteristic for Lithuania's industry (due to low labour productivity on the one hand and high energy intensity on the other) which can be eradicated by encouraging innovations and R&D activities. Baltic region is quite homogenous in innovation and research as well as in economic reform areas, thus it can become attractive for investors. Lithuania and Estonia could be assigned to medium performance group and Latvia is on the very limit of the low performance group.

Keywords: multi-objective optimization, MOORA, MULTIMOORA, structural indicators, Lisbon Strategy, strategic management, sustainable development, European Union, international comparison.

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1. Introduction

In the age of globalization more and more states as well as international organizations realize the importance of supporting region's or state's competitiveness against other participants of world economic system. This need caused creation and adoption of many various strategies. Nowadays such areas as sustainable development, knowledge economy and information society are among the most important issues discussed it those strategies. Strategies of sustainable development are analysed in-depth by Hass *et al.* (2002: 51–83) and Wolff (2004: 14–31). Implementation of every strategy is based on certain implementation policy. Statistical indicators identifying respective social, economic or environmental processes enable to perform policy evaluation and preparation functions. Thus, appropriate usage of statistical indicators is of high importance when preparing effective regional policy.

The European Union developed from institutions which were established in 1957 in order to promote integration of European countries in various areas. Among many other strategies of the European Union, so called Lisbon strategy was adopted in 2000, where means to achieve certain goals and thus become the most competitive region in the world are defined. Goals and their achieving means are identified by structural indicators or their sets. Therefore structural indicators represent situation of state among other states in specific area. They bear this name because they describe structures and key aspects within each domain. Structures are basic characteristics which do not in general change rapidly. Therefore structural indicators describe evolution in society in the long-term (Ragnarson 2007: 5).

Synthetic indicators (indexes) are calculated using various methodics (Tvaronavičienė *et al.* 2008). These indexes can help to evaluate economic, social and environmental situation and to compare states among themselves (to provide ranks).

The aim of this article was to describe main structural indicators identifying implementation of Lisbon Strategy goals and by using them evaluate Lithuania's position in the European Union. In order to achieve this aim, following tasks were raised: 1) to describe and classify structural indicators; 2) to overview main methods of quantitative analysis based on use of structural indicators; 3) to apply them when evaluating position of Lithuania in the European Union.

It is possible to evaluate state's progress in seeking goals of the Lisbon Strategy with help of structural indicators and to define problem areas. Appropriate identification of such problems is necessary for preparation of more effective regional policy means. Application of quantitative methods enables to evaluate states, regions or any other objects (Kėdaitis and Vaškevičiūtė 2007: 5–7; Ginevičius and Podvezko 2009: 109–110; Ginevičius *et al.* 2004: 1–2; Brauers *et al.* 2007; Brauers and Ginevičius 2009: 124–125).

Structural indicators, their application areas and methods are overviewed in this article. Multi-Objective Optimization by Ratio Analysis (MOORA) method based on the ratio system and the reference point approach and MULTIMOORA (MOORA plus Full Multiplicative

Form) were applied. Theoretical fundaments (Lisbon Strategy) of the usage of structural indicators and practice of the usage of structural indicators in Lithuania are defined in the second section of this article. Lithuania's position in the European Union is evaluated by quantitative methods in the last section of this article.

2. Structural Indicators: the European Union and development of its Member States

The Lisbon Strategy, which caused establishment of structural indicators practice, and its development history are overviewed in this section. In addition, main structural indicators used in the European Union and Lithuanian statistics practice are defined as well as their importance in identification of European development progresses. Structural indicators (as well as other indicators) are important in evaluating current policies and preparing new ones (Fig. 1).

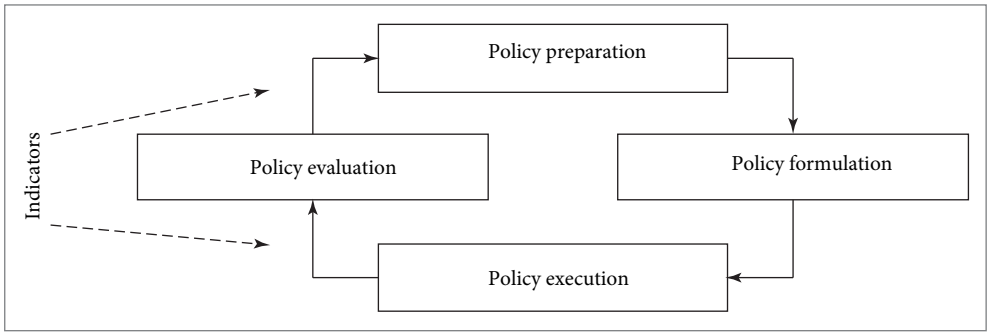

Fig. 1. The policy cycle. Source: Bosch 2001: 2

2.1. The Lisbon Strategy

Main guidelines of the European Union development were drawn on March 23–24, 2000 in meeting of the spring European Council which was held in Lisbon. Hence, these guidelines are called the Lisbon Strategy. The main objective of the strategy was to become *by 2010 the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion* (Zgajewski and Hajjar 2005: 1–3). Goals of the Lisbon Strategy were necessary in order to compete witch such countries as United States or China. In 2000 the greatest attention was paid to economy, social protection and environment. The Lisbon Strategy was extended in 2001 in Stockholm meeting.

The following European Union development directions are outlined in the Lisbon Strategy (Zgajewski and Hajjar 2005: 1–3):

1. Competitive, dynamic and knowledge-based economy:
   1.1. The globalization and growing emergence of information and communications results in the need of European society transformation. To seize on these processes,

necessary progresses must be launched. Information needs to be distributed to all, companies and citizens, to allow them to become credible actors in the knowledge economy. Thus, Internet, e-money, mobile telecommunication are necessary to be enhanced;

1.2. Research needs to be seriously coordinated at the European level. Development of research activities enables to improve at the same time the economic growth, the employment and social cohesion. One of the reasons, placing Europe far away from United States, was so called 'brain drain', which can be avoided by establishing European Area of Research and Innovation;

1.3. Europe has the objective to become the best competitive area in the world. To reach this goal, a friendly business climate helps to its implementation. By consequence, administrative rules leading to the creation of companies and especially small and medium enterprises ought to be simplified;

1.4. Full implementation of the internal market is required for the best functioning of the economy. Therefore, goods, persons, services and capital must circulate freely, all existing barriers being removed. Moreover, the financial markets integration benefits from the circulation of the euro, boosting the competition.

2. The modernization of the European Social model:

2.1. A better level of education and training is essential to revitalize the employment. In this view, the educational system must be re-organized to increase the knowledge of a higher number of persons, to enlarge the participation of women in the working society;

2.2. Unemployment is to be lowered down and an active employment policy should be developed;

2.3. Social exclusion and poverty should be eradicated by favouring the access of employment opportunities and knowledge to all.

3. The environmental perspective:

3.1. The climate change, greenhouse gas emissions are to be lowered down and clean technologies promoted;

3.2. The viable ecological transport;

3.3. The reduction of polluted means via the responsible administration of natural resources.

Every member state of the European Union adopted implementation programmes of the Lisbon Strategy, where goals and indicators identifying them are defined. In Lithuania Lisbon Strategy implementation programme was adopted in 2005 for the first time, currently National Lisbon Strategy implementation programme for 2008–2010 adopted by Government of the Republic of Lithuania (2008) is valid.

The practice of structural indicators statistics is dynamic process. In 2000, European Commission prepared list of 35 indicators, identifying progress in seeking Lisbon goals. In June 2001 Gothenburg European Council decided, that sustainable development and environmental protection should also be considered as parts of the Lisbon Strategy (Commission of the European Communities 2001) and involved appropriate structural indica-

tors into annual reports. European Council of 2002 in Barcelona paid more attention for innovation and research activities and their importance to Lisbon Strategy (Commission of the European Communities 2002). High level group chaired by Wim Kok was established in 2004, which concluded that the Lisbon Strategy will not have been implemented by the year 2010 and proposed for paying more attention to labour market (European Commission 2004: 39–44). In addition, European Commission began preparing annual reports on growth and jobs. Structural indicators are unified in whole European Union, therefore it is possible to compare states among themselves and to evaluate their progress. Thus structural indicators help to identify and forecast implementation of Lisbon Strategy goals and to perform international comparison.

2.2. Indicators and documents of development processes

Implementation of goals, raised in the Lisbon Strategy and other documents, is evaluated by certain structural indicators. Expanded after Gothenburg Council list of structural indicators is divided into six groups (Hass *et al.* 2002: 48): 1) general economic background; 2) employment; 3) innovation and research; 4) economic reform; 5) social cohesion; 6) environment. In addition these indicators identify processes of sustainable development in the areas of environmental, economic and social development (Dėl Nacionalinės … 2003). In 2010 new strategy called *Europe 2020* was prepared, where attention is paid to same aspects of development (European Commission 2010: 30).

Due to the limited volume of this article we will not analyse structural indicators themselves in-depth. They are overviewed in various publications (Commission … 2001; Heinemann *et al.* 2004). Every indicator has its quality profile where quality grades are given according to technical assessment of the indicator based on accuracy and comparability. Methodology of purchasing power parities is interrelated with the practice of economic structural indicators and international comparisons in general (European Communities, OECD 2006).

Main document of the Republic of Lithuania on Lisbon Strategy is National Programme for Lisbon Strategy Implementation in 2008–2010 (Dėl Nacionalinės … 2008). It consists of three parts: I. Implementation of the macroeconomic policy, II. Implementation of the microeconomic policy, III. Implementation of the employment policy. There are 11 goals and 122 tools to seek them defined in this legal act. However, Tamošiūnienė *et al.* (2007: 180) noticed, that implementation of many goals does not coincide with the Lisbon Strategy goals directly.

The most important directives of economic development are provided in Long-term Strategy of Lithuania Economy Development until 2015 (Lietuvos … 2002, 2007). Main instruments for economic development of various sectors are proposed in updated strategy.

Environmental aspects of development are regulated by Lithuanian Environment Protection Strategy (Dėl valstybinės … 1996). Main objective of the strategy is to prepare assumptions for sustainable development of the country while keeping clean environment, biological and landscape diversity and optimization of environmental economics. Overview of other legal acts and recommendations for environmental protection are presented in Strategy of Economic Factors of Environmental Protection (Čekanavičius *et al.* 2002).

3. Lithuania and other European Union Member States

The practice of structural indicators is based on monitoring of indicators (OECD 1990: 7–9). Usually system (set) of indicators, identifying analysed area, rather than single indicator is monitored. Already researched systems of indicators identifying specific goals, indexes calculated according to them and universal multi-criteria methods of indicator analysis are overviewed in this section.

3.1. Specific indexes

It is possible to outline two main groups of composite indexes: 1) indexes, which identify Lisbon Strategy implementation processes; 2) indexes reflecting development of separate sectors or whole countries.

There are special indexes created for evaluation of Lisbon Strategy implementation processes, which are based on certain systems of indicators. World Economic Forum publishes *The Lisbon Review* (Blanke and Geiger 2008), where indexes of competitiveness of various states are announced. This index is based on statistical data (indicators) and survey performed by the forum. Survey helps to mine qualitative data about situation of education system etc. Statistical indicators are normalized and divided into scale of 7 points. Common index and separate indexes showing progress in seeking certain Lisbon goals are calculated.

Another index identifying implementation of the Lisbon Strategy is calculated on the basis of structural indicators and published in *The Lisbon Scorecard* (Tilford and Whyte 2009). This index shows progress of each state as well as common progress in specific areas, advanced and lagging countries in those areas.

One of the main goals of the Lisbon Strategy is promotion of innovations. Summary Innovation Index provides a comparative assessment of the innovation performance of EU Member States (Pro Inno Europe 2010). The index is based on set of 29 structural indicators and varies between 0 and 1. Innovation activities are analysed in three views: enablers, firm activities and outputs. Above mentioned indexes can be used when performing international comparison.

Common development of states can be identified by such indicators as Human Development Index (HDI), Human Poverty Index (HPI) and Gender-related Development Index (GDI), proposed by United Nations (United Nations Development Program 2009: 203–208). HDI is based on such indicators as adult literacy rate, GDP per capita, life expectancy at birth, education level. There are two types of poverty index: HPI-1 for developing countries and HPI-2 for OECD countries. HPI-1 is based on such indicators as probability of not surviving to age 40, adult illiteracy rate, population not using an improved water source and population below income poverty line. HPI-2 is estimated according to indicators of probability of not surviving to age 60, people lacking functional literacy skills, long-term unemployment, population living below 50% of median income. GDI is estimated by dissolving above mentioned indexes by gender.

Physical Quality of Life Index (PQLI) can also be used for international comparison (Ray 2008: 1–3). PQLI is based on illiteracy rate, infant mortality rate and life expectancy.

Thus various composite indexes based on different methodics can be used for international comparisons (Karnitis and Kucinskis 2009: 5–12).

3.2. Universal multi-criteria methods

Differences between the regions can be analysed by mathematical – statistical methods. Such investigations can be based on econometric models, methods of factor analysis (Kėdaitis and Vaškevičiūtė 2007: 12) or multi-criteria evaluation. Usually, in econometric models the dependent variable is GDP per capita and its dependencies from exogenous variables are analysed. Panel models are used for international comparisons over the time (Karagiannis 2008: 192–193). Factor analysis enables to extract factors causing differences between the regions and to classify the regions.

Application of multi-criteria evaluation methods is explored in field of decision making theory (Antuchevičienė *et al.* 2010: 109–112). There are many multiple criteria decision making methods developed. Technique for the Order Preference by Similarity to Ideal Solution (TOPSIS) was proposed by Hwang and Yoon (1981). Zavadskas *et al.* (2010) developed practice of TOPSIS method application. TOPSIS applying Mahalanobis distance measure (TOPSIS-M) method is discussed by Antuchevičienė *et al.* (2010). Application of of Analytic Hierarchy Process (AHP), proposed and developed by Saaty (1980; 1997), is discussed by Podvezko (2009). Methods of Complex Proportional Assessment (COPRAS) (Zavadskas *et al.* 2008; 2009; 2010), ELECTRE (Elimination Et Choix Traduisant la Realite) (Roy 1990; Zavadskas 1986), total rankings, Simple Additive Weighing (SAW) (MacCrimmon 1968; Ginevičius and Podvezko 2009), geometric mean of normalized values, criterion of proportional evaluation (Ginevičius *et al.* 2004: 8–9), summarizing indicator (Kėdaitis and Vaškevičiūtė 2007: 29–31), Multi-Objective Optimization by ratio Analysis (MOORA) (Brauers and Zavadskas 2006; Brauers and Ginevičius 2009: 121) are also suitable for international comparison. The MOORA method was further developed into MULTIMOORA by Brauers and Zavadskas (2010: 5). These methods rely on normalization, conversion into dimensionless numbers and evaluation of deviation from optimum point. Therefore transition from ratio (or interval) to ordinal scale is performed. MOORA method enables non-subjective evaluation, because no weights should be necessarily given to objectives in analysis. Hence, MULTIMOORA method will be used in this article to evaluate Lithuania's position in the European Union.

3.3. The MULTIMOORA method

The fundaments of the MULTIMOORA method (i. e. ratio analysis, reference point theory, full multiplicative form, nominal group technique and Delphi) were laid by Brauers (2004). In order to cope with subjectivity problems arising from the usage of weights in previously known multi-objective methods (such as ELECTRE, PROMETHEE, AHP, TOPSIS etc.), Brauers and Zavadskas linked all these methods together with theories applicable for discrete optimization under the names of MOORA and MULTIMOORA. Rank correlation methods as well as outranking methods appeared to be quite inconsistent (Brauers and Ginevicius 2009: 137–138). Thus normalization of the data by Ratio System was proposed (Brauers 2004:

293–328). Reference Point method uses the ratios obtained from the Ratio System and in this way becomes dimensionless. Combination of the Ratio System and Reference Point method results as the MOORA method (Brauers and Zavadskas 2006). The first application of multiplicative function is reported by Miller and Starr (1969). Brauers (2004: 228–289) analyzed multiplicative forms in depth. Brauers and Zavadskas (2010: 13–14) proposed MOORA to be applied together with the Full Multiplicative Form and therefore the MULTIMOORA method was created. The structure of MULTIMOORA method is shown in Fig. 2. Thus, this section consists of three parts: 1) the Ratio System; 2) the Reference Point Approach; and 3) the Full Multiplicative Form. Nominal group and Delphi techniques can also be used to reduce remaining subjectivity.

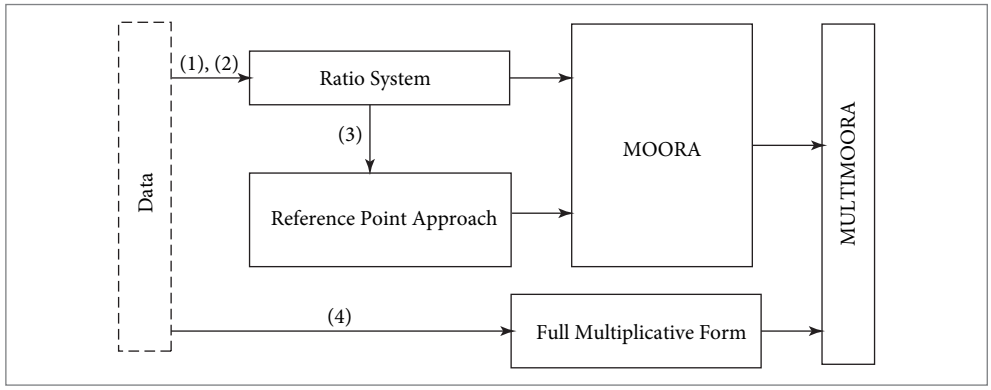

Fig. 2. The procedure of multicriteria evaluation according to the MULTIMOORA method (numbers of respective formulas given in parentheses)

The MOORA method was proposed by Brauers and Zavadskas (2006). MOORA method begins with matrix X where its elements x_{ij} denote i-th alternative of j-th objective (i = 1, 2,..., n and j = 1, 2,..., m). In this case we have $m = 13$ objectives – structural indicators – and $n = 27$ alternatives – European Union Member States. MOORA method consists of two parts: the ratio system and the reference point approach.

3.3.1. The Ratio System of MOORA

Ratio System defines data normalization by comparing alternative of an objective to all values of the objective:

$$x_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^{2}}}, \tag{1}$$

where x_{ij}^{*} denotes i-th alternative of j-th objective (in this case – j-th structural indicator of i-th state). Usually these numbers belong to the interval [–1; 1]. These indicators are added

(if desirable value of indicator is maxima) or subtracted (if desirable value is minima) and summary index of state is derived in this way:

$$y_i^* = \sum_{j=1}^{g} x_{ij}^* - \sum_{j=g+1}^{m} x_{ij}^*, \tag{2}$$

where $g = 1,..., m$ denotes number of objectives to be maximized. Then every ratio is given the rank: the higher the index, the higher the rank.

3.3.2. The Reference Point of MOORA

Reference Point approach is based on the ratio system. The Maximal Objective Reference Point (vector) is found according to ratios found in formula (2). The j-th coordinate of the reference point can be described as $r_j = \max_i x_{ij}^*$ in case of maximization. Every coordinate of this vector represents maxima or minima of certain objective (structural indicator). Then every element of normalized responses matrix is recalculated and final rank is given according to deviation from the reference point and the Min-Max Metric of Tchebycheff:

$$\min_i \left(\max_j \left| r_j - x_{ij}^* \right| \right). \tag{3}$$

3.3.3. The Full Multiplicative Form and MULTIMOORA

Brauers and Zavadskas (2010: 13–14) proposed MOORA to be updated by the Full Multiplicative Form method embodying maximization as well as minimization of purely multiplicative utility function. Overall utility of the i-th alternative can be expressed as dimensionless number:

$$U_i' = \frac{A_i}{B_i}, \tag{4}$$

where $A_i = \prod_{j=1}^{g} x_{ij}$, $i = 1, 2,..., n$ denotes the product of objectives of the i-th alternative to be maximized with $g = 1,..., m$ being the number of objectives (structural indicators) to be maximized and $B_i = \prod_{j=g+1}^{m} x_{ij}$ denotes the product of objectives of the i-th alternative to be minimized with $m - g$ being the number of objectives (structural indicators) to be minimized. Thus MULTIMOORA summarizes MOORA (i. e. Ratio System and Reference point) and the Full Multiplicative Form. Ameliorated Nominal Group and Delphi techniques can also be used to reduce remaining subjectivity (Brauers and Zavadskas 2010: 17–19).

3.4. Evaluation of Lithuania's position in the European Union applying MULTIMOORA method

Sets of certain indicators are needed to perform international comparisons. The analysis of this article is performed using Eurostat database of structural indicators. Various authors

(Tarantola *et al.* 2004: 13; Munda and Nardo 2005) argue that the shortlist of structural indicators correctly represents all structural indicators. Two indexes for every country were calculated: one based on shortlist indicators and other – on full list of indicators. By testing hypothesis of their equality, F test showed that trendline of scatterplot between these two indexes did not differ from 45 degree line significantly. Thus structural indicators belonging to the shortlist (Table 1) of 2008 (latest available at 2010 March) are used for analysis. Data covers 27 Member States of the European Union. Therefore it can be concluded that application of MOORA and MULTIMOORA methods in general satisfies all the conditions of robustness given by Brauers and Zavadskas (2009: 354–356).

Table 1. Structural indicators used in evaluation of Lithuania's position in the EU

	Structural indicator	Desirable value
I. General economic background		
1	GDP per capita in PPS (EU-27 = 100)	Max
2	Labour productivity per person employed	Max
II. Employment		
3	Employment rate	Max
4	Employment rate of older workers	Max
III. Innovation and research		
5	Youth education attainment level	Max
6	Gross domestic expenditure on R&D	Max
IV. Economic reform		
7	Business investment	Max
8	Comparative price levels	Min
V. Social cohesion		
9	At-risk-of-poverty rate	Min
10	Long-term unemployment rate	Min
VI. Environment		
11	Greenhouse gas emissions	Min
12	Energy intensity of the economy	Min
13	Index of inland freight transport volume	Min

According to the above mentioned indicators, response matrix (see Annex A, Table 3a) was created. Elements of the matrix were converted by formula (1). Summarizing index for each state was calculated using formula (2). Ranks were given to each state according to the index. The results are shown in Fig. 3. According to this index, Lithuania is 17th country from 27 European Union Member States. In addition, Lithuania is the last country in the ranking with positive index value. Estonia is five places ahead of Latvia and Lithuania. It can be concluded that Lithuania performs well if compared with South European countries (PIGS states), some Middle Europe former socialist states and new members of the European Union – Bulgaria and Romania.

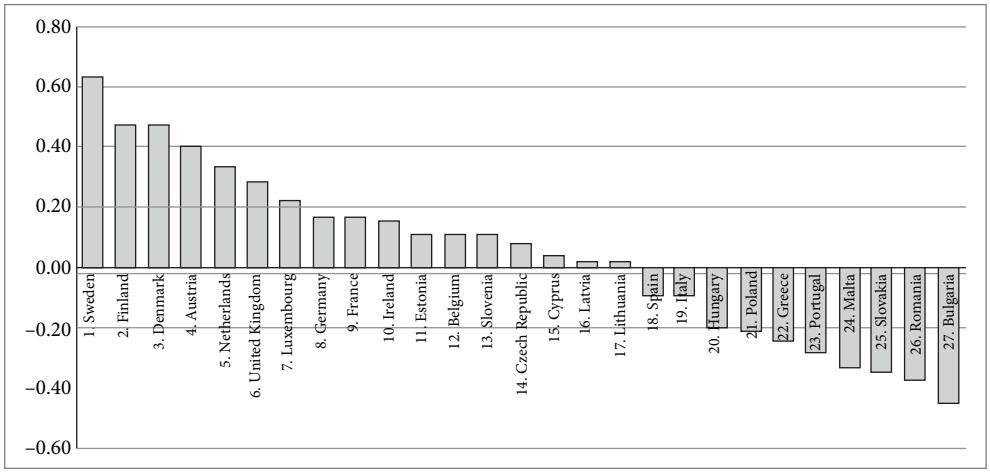

Fig. 3. Indexes and ranks of European Union Member States according to the ratio system, 2008

Ranking of the states was performed according to the reference point approach. Firstly, the reference point r_j was found (Table 3d). Secondly, the response matrix was rearranged by calculating deviations of each element from the reference point (see Annex A, Table 3e). These deviations show state's position in certain area (for example, null value of the first indicator means that respective state has maximum GDP per capita among EU countries). Final ranks were given using formula (3). Comparison of results obtained from application of the ratio system and the reference point approach is given in Table 2. It can be concluded, that ranks did not differ significantly. It is possible to exclude three conditional groups of Member States: first nine – most advanced (Luxemburg, Ireland, Sweden etc.), 10^{th} to 18^{th} states and 19^{th} to 27^{th} – least advanced. Ranks of the states swift inside these groups, but do not tend to differ more significantly. Observed differences occur due to Min-Max Metrics: rank is given accordingly to the worst performing structural indicator. Lithuania has rank of 22 or 17. This difference is caused by low GDP per capita, showing low common development of the economy. This draw-back is uniform for all Baltic States.

In addition, analysis of the Baltic States' position in the European Union in 2008 was performed using the Full Multiplicative Form method. Matrix of responses (see Annex A, Table 3a) was used to estimate the utility of each alternative (i. e. development performance of each European Union Member State) by applying formula (4). This utility function is *n*-power form (Brauers and Zavadskas 2010: 14), therefore the results are given in logarithmic scale for better visualization (Fig. 4). Calculations are given in Table 4 (Annex B) while detailed data can be obtained by contacting the corresponding author.

Lithuania's position in the European Union can be analysed in-depth by using data from the Annex A, Table 3e. Deviations from maxima (minima in case of minimization) of every structural indicator of Lithuania are shown in Fig. 5. Larger deviation means that respective indicator is further from maximum value in the European Union.

Table 2. Ranks of European Union Member States according to the reference point (RP) approach and ratio system (RS), 2008

Member State	$\max_j \left\| r_j - x_{ij}^* \right\|$	Rank	
		RP	RS
Luxembourg	0.232	7	1
Ireland	0.253	10	2
Netherlands	0.254	5	3
Austria	0.274	4	4
Denmark	0.278	3	5
Sweden	0.279	1	6
Finland	0.284	2	7
United Kingdom	0.285	6	8
Germany	0.286	8	9
Belgium	0.287	12	10
France	0.300	9	11
Spain	0.310	18	12
Italy	0.311	19	13
Slovenia	0.330	13	14
Greece	0.346	22	15
Czech Republic	0.349	14	16
Malta	0.356	24	17
Portugal	0.357	23	18
Cyprus	0.358	15	19
Estonia	0.372	11	20
Hungary	0.378	20	21
Lithuania	0.382	17	22
Latvia	0.390	16	23
Poland	0.392	21	24
Romania	0.418	26	25
Slovakia	0.449	25	26
Bulgaria	0.485	27	27

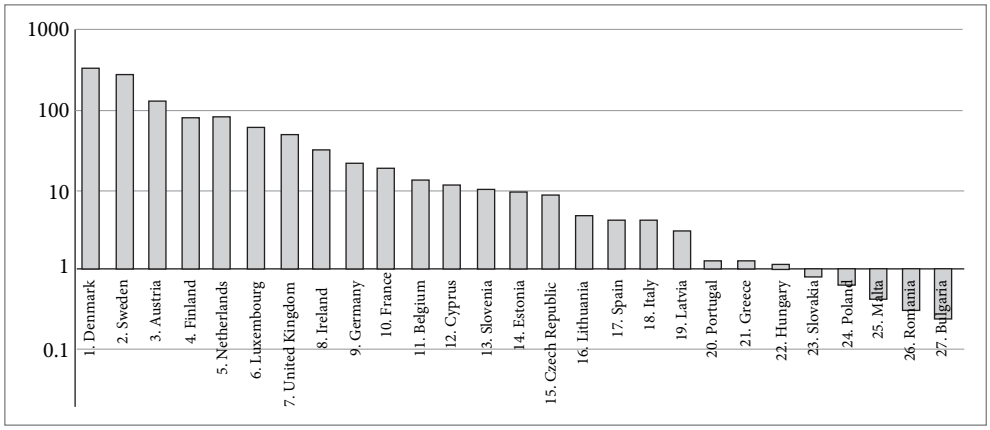

Fig. 4. Ranks given to European Union Member States according to Full Multiplicative Form method, 2008

As we can see in the diagram (Fig. 5), 1st, 2nd and 4th structural indicators in Lithuania are deviated from maximum values. This means, that GDP per capita, labour productivity and employment level of older people are relatively low in Lithuania. Low values of the first two indicators can be explained by assumption that Lithuania has not found its place in world economic (specialization) system yet. Hence its industry is oriented towards production of low demand goods and services using obsolete technologies. Low employment level of older people indicates that Lithuania is not prepared to cope with challenges of ageing society. Estonia copes best with this issue among Baltic States. Inevitable demographic changes should lead to increasing proportion of older people in labour force and whole population. Thus Lithuania's economy is not fully developed and does not meet The Lisbon goals. Further problems of intellectualization and development of Lithuanian economy are analysed by Melnikas (2008a: 115–119; 2008b: 61–64).

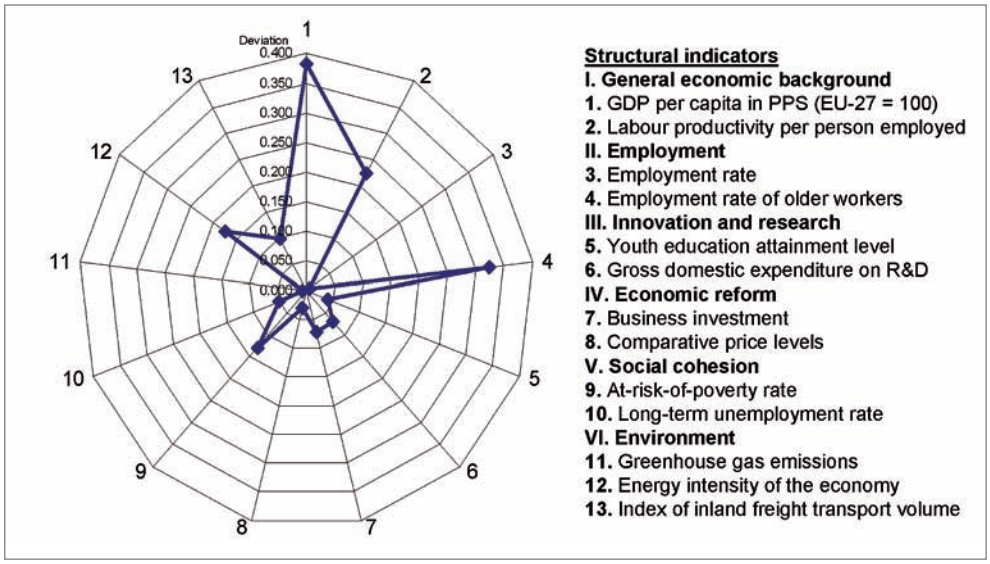

Fig. 5. Deviations of Lithuania's structural indicators values from maxima in the European Union (Reference point approach), 2008

Diagram of deviations shows that 3rd, 5th, 8th and 11th indicators in Lithuania are close to maximum values. Thus Lithuania is among leaders in the European Union by employment level, youth education attainment level, comparative price levels and greenhouse gas emissions. Low comparative price levels mean that Lithuanian production can be competitive in European Union market due to lower costs. There are fewer companies of heavy industry in Lithuania, which pollute environment, thus greenhouse gas emissions are low.

The best situation is in innovation and research area in all Baltic States. Indeed, much more attention for R&D financing and business investments is needed. Lithuania has progressed in the spheres of employment, social cohesion and environment, but employment of older people should be increased and intensity of energy consumption should be lowered (by encouraging

modern energetic technologies). Indicators of general economic background are among the lowest in the European Union, thus structural reforms for Lithuanian economy are needed. Furthermore, it can be concluded that Baltic region is quite homogenous in innovation and research as well as in economic reform areas (indicators 5 to 8), thus it can become attractive for investors (Table 3e in Annex A and Fig. 6).

Estonia has the lowest value of the index of inland freight transport volume, which means that Estonia does not relate its economic development with growing intensity of inland transport. Latvia has the lowest value of greenhouse gas emissions index. Thus it can be concluded that Latvia has advanced in producing environmentally friendly energy. As shown in Fig. 5, Latvia has highest deviation among Baltic States of 9th indicator – at-risk-of-poverty rate – which indicates serious social problems.

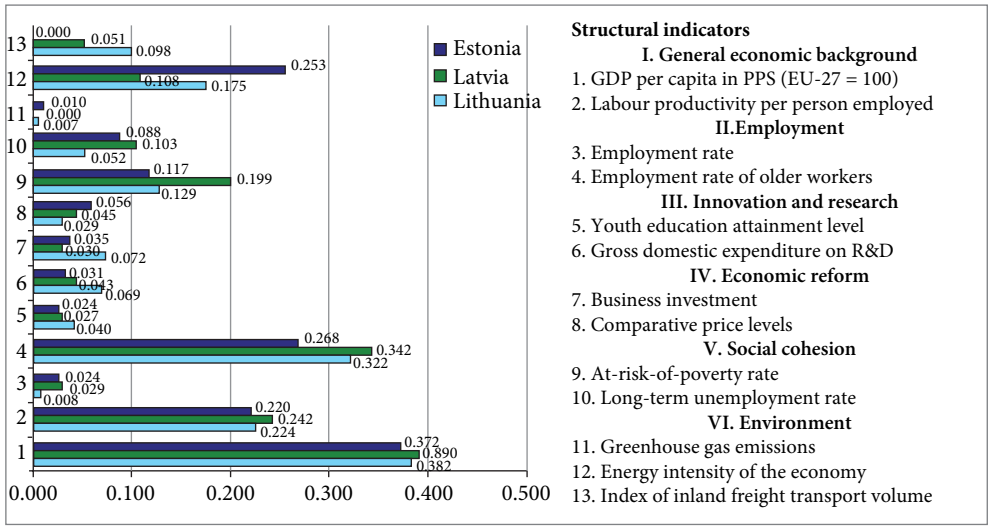

Fig. 6. Deviations of Baltic States' structural indicators values from maxima in the European Union (Reference Point approach), 2008

Appropriate policy of administration of European Union financial support can help to accelerate innovation as well as R&D activities. European Union Regional policy is directed to reduction of social and economic differences between regions, cohesion and development of entire European Union (Dzemyda and Melnikas 2009: 34–37; Tamošiūnienė *et al.* 2007: 178). Four structural funds as well as one Cohesion Fund were instituted to support development. Priorities and tasks for allotting European Union financial support are defined in Lithuanian Single Programming Document. More attention should be paid for mentioned problematic areas in this and other strategic documents.

Ranking by MULTIMOORA method was performed by combining results from MOORA and the Full Multiplicative Form (Annex C, Table 5). Application of MOORA and Full Multiplicative Form methods resulted in giving ranks of 17 (ratio system), 22 (reference point approach) or 16 (The Full Multiplicative Form) for Lithuania. Latvia was given ranks of 16,

23 and 23; Estonia – 11, 20 and 20 respectively among 27 Member States. Thus MULTIMOORA method was applied in obtaining final ranks: 14 for Estonia, 18 for Lithuania and 20 for Latvia. These ranks were given by minimizing sum of ranks acquired by using Ratio Analysis, Reference Point and the Full Multiplicative form methods. In addition, authors computed these ranks into three groups according to progress in implementation of the Lisbon Strategy: best performance (holding ranks 1 to 9), medium performance (10–18) and low performance (19–27). In this way every state was classified in respective group according to Ratio Analysis, Reference Point and the Full Multiplicative form methods (Table 5, Annex C). Then MULTIMOORA method was applied, which resulted in obtaining final rank, showing dependency to one of the above mentioned groups. These results did not differ from those obtained by minimizing sum of ranks; therefore detailed calculations can be obtained only from the corresponding author. Hence Lithuania and Estonia could be assigned to medium performance group and Latvia is on the very limit of the low performance group.

4. Conclusions

1. Main goals of the Lisbon Strategy are: creation of competitive, dynamic and knowledge-based economy, modernization of the European Social model, effective environmental and sustainable development policy. Implementation of the Lisbon Strategy is identified by structural indicators, which are divided into six categories: 1) general economic background; 2) employment; 3) innovation and research; 4) economic reform; 5) social cohesion; 6) environment.
2. Implementation of the Lisbon Strategy in Lithuania is regulated by such main documents as National Programme for Lisbon Strategy Implementation in 2008–2010, Long-term Strategy of Lithuania Economy Development until 2015, Strategy of Economic Factors of Environmental Protection. Implementation of goals defined in these documents is identified by structural indicators.
3. Effective international comparisons based on structural indicators are possible. Many international organizations regularly provide specific composite indexes based on structural indicators: Lisbon Review and Lisbon Scorecard indexes of performance in seeking Lisbon goals, HDI, HPI, GDI, SII, PQLI. Structural indicators can also be analysed by applying econometric, factor analysis and multi-criteria evaluation methods.
4. Lithuania is among leaders in the European Union by employment level, youth education attainment level, comparative price levels and greenhouse gas emissions. Thus Lithuania does not have serious environmental problems and can successfully compete in international market because of relatively low production costs. The Baltic region is quite homogenous in innovation and research as well as in economic reform areas, thus it can become attractive for investors.
5. GDP per capita, labour productivity and employment level of older people are relatively low in Lithuania. In addition intensity of energy consumption should be lowered by encouraging modern energetic technologies. Therefore technological backwardness is characteristic to Lithuanian economy due to low labour productivity on the one hand and high energy consumption intensity on the other. This backwardness can be eradicated by promoting innovations and R&D activities. Hence significant proportion of European Union structural support should be allotted to these problematic areas.

6. The group of countries, namely Austria, Denmark, Finland, Germany, Ireland, Luxembourg, the Netherlands, Sweden and United Kingdom, can be considered as the best performing in implementing the Lisbon Strategy.
7. Member States of the European Union may be classified into three groups according to progress in implementation of the Lisbon Strategy: best performance (holding ranks 1 to 9), medium performance (10–18) and low performance (19–27). Lithuania and Estonia could be assigned to medium performance group and Latvia is on the very limit of the low performance group.
8. The study covers data only until 2008. Indeed the global economic crisis still continues and the whole situation is quite dynamic. Hence Ireland and even the United Kingdom do no more belong to Group 1 with doubts for Spain in Group 2. Such studies could be updated on a regular basis and presented to the European Union institutions.

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Annex A. Evaluation of European Union Member States positions by MOORA, 2008.

Table 3. Ratio System (3a to 3c) and Reference Point (3d–3e) of MOORA
3a. Matrix of Responses of Alternatives on Objectives – Structural Indicators: (x_{ij})

Indicators	max								min				
	1	2	3	4	5	6	7	8	9	10	11	12	13
Austria	122.8	113.5	84.5	2.67	72.1	41	20.7	105.1	12	0.9	111.3	140.73	97.9
Belgium	115.1	125.5	82.2	1.92	62.4	34.5	21	111.1	15	3.3	90.1	198.76	78.3
Bulgaria	41.3	37.2	83.7	0.49	64	46	27.7	50.2	21	2.9	57.2	1016.29	116.6
Cyprus	95.8	87.3	85.1	0.47	70.9	54.8	20.4	90.5	16	0.5	185.3	212.16	76.7
Czech Republic	80.3	71.9	91.6	1.47	66.6	47.6	19	72.8	9	2.2	77.6	553.16	86.4
Denmark	120.1	102.5	71	2.73	78.1	57	19	141.2	12	0.5	96.1	105.7	78
Estonia	67.4	63.8	82.2	1.29	69.8	62.4	24	78	19	1.7	51.7	580.71	67.1
Finland	116.8	111.6	86.2	3.72	71.1	56.5	19	124.3	14	1.2	110.3	229.19	77.3
France	107.9	121.6	83.4	2.02	64.9	38.2	18.7	110.7	13	2.9	94.2	165.38	88.5
Germany	115.6	107	74.1	2.63	70.7	53.8	17.5	103.7	15	3.8	77.6	151.48	111.9
Greece	94.3	102.2	82.1	0.58	61.9	42.8	16.5	94	20	3.6	123.2	181.79	106.8
Hungary	64.4	71	83.6	1	56.7	31.4	18.1	68.1	12	3.6	65.8	400.76	132.2
Ireland	135.4	130.2	87.7	1.43	67.6	53.7	16.5	127.6	16	1.6	124.5	103.13	102.1
Italy	102	109.7	76.5	1.18	58.7	34.4	18.7	105.6	19	3.1	106.9	142.78	95.2
Latvia	57.3	52.6	80	0.61	68.6	59.4	24.6	72.6	26	1.9	46.6	306.6	95.2
Lithuania	61.9	62	89.1	0.8	64.3	53.1	20.2	64.6	20	1.2	50.1	432.5	121.5
Luxembourg	276.3	175.8	72.8	1.62	63.4	34.1	15.8	119.1	13	1.6	98.1	158.53	89.3
Malta	76.3	87.4	53	0.54	55.3	29.2	13.2	78.8	15	2.5	149	198.18	106.8
Netherlands	134	114.5	76.2	1.63	77.2	53	16.9	104	11	1	97.4	177.12	88.7
Poland	56.4	62	91.3	0.61	59.2	31.6	17.5	69.1	17	2.4	70.8	400.1	121.7
Portugal	76	71.2	54.3	1.51	68.2	50.8	19.5	87	18	3.7	136.1	196.85	155.8
Romania	41.6	50.2	78.3	0.59	59	43.1	26.4	60.9	23	2.4	54.7	655.59	165.8
Slovakia	72.2	79.2	92.3	0.47	62.3	39.2	23	70.1	11	6.6	65.2	538.64	92.1
Slovenia	90.9	84.4	90.2	1.66	68.6	32.8	24.6	82.3	12	1.9	101.8	253.29	138.5
Spain	102.6	103.6	60	1.35	64.3	45.6	25	95.4	20	2	152.6	184.19	133.1
Sweden	120	110.6	87.9	3.75	74.3	70.1	16.2	114.5	12	0.8	90.7	156.49	94.4
United Kingdom	116.2	110	78.2	1.88	71.5	58	14.5	100	19	1.4	82	115.46	90.1

3b. Sum of squares and their square roots

Indicators	max								min				
	1	2	3	4	5	6	7	8	9	10	11	12	13
Austria	15079.84	12882.25	7140.25	7.1289	5198.41	1681	428.49	11046.01	144	0.81	12387.69	19804.93	9584.41
Belgium	13248.01	15750.25	6756.84	3.6864	3893.76	1190.25	441	12343.21	225	10.89	8118.01	39505.54	6130.89
Bulgaria	1705.69	1383.84	7005.69	0.2401	4096	2116	767.29	2520.04	441	8.41	3271.84	1032845	13595.56
Cyprus	9177.64	7621.29	7242.01	0.2209	5026.81	3003.04	416.16	8190.25	256	0.25	34336.09	45011.87	5882.89
Czech Republic	6448.09	5169.61	8390.56	2.1609	4435.56	2265.76	361	5299.84	81	4.84	6021.76	305986	7464.96
Denmark	14424.01	10506.25	5041	7.4529	6099.61	3249	361	19937.44	144	0.25	9235.21	11172.49	6084
Estonia	4542.76	4070.44	6756.84	1.6641	4872.04	3893.76	576	6084	361	2.89	2672.89	337224.1	4502.41
Finland	13642.24	12454.56	7430.44	13.8384	5055.21	3192.25	361	15450.49	196	1.44	12166.09	52528.06	5975.29
France	11642.41	14786.56	6955.56	4.0804	4212.01	1459.24	349.69	12254.49	169	8.41	8873.64	27350.54	7832.25
Germany	13363.36	11449	5490.81	6.9169	4998.49	2894.44	306.25	10753.69	225	14.44	6021.76	22946.19	12521.61
Greece	8892.49	10444.84	6740.41	0.3364	3831.61	1831.84	272.25	8836	400	12.96	15178.24	33047.6	11406.24
Hungary	4147.36	5041	6988.96	1	3214.89	985.96	327.61	4637.61	144	12.96	4329.64	160608.6	17476.84
Ireland	18333.16	16952.04	7691.29	2.0449	4569.76	2883.69	272.25	16281.76	256	2.56	15500.25	10635.8	10424.41
Italy	10404	12034.09	5852.25	1.3924	3445.69	1183.36	349.69	11151.36	361	9.61	11427.61	20386.13	9063.04
Latvia	3283.29	2766.76	6400	0.3721	4705.96	3528.36	605.16	5270.76	676	3.61	2171.56	94003.56	9063.04
Lithuania	3831.61	3844	7938.81	0.64	4134.49	2819.61	408.04	4173.16	400	1.44	2510.01	187056.3	14762.25
Luxembourg	76341.69	30905.64	5299.84	2.6244	4019.56	1162.81	249.64	14184.81	169	2.56	9623.61	25131.76	7974.49
Malta	5821.69	7638.76	2809	0.2916	3058.09	852.64	174.24	6209.44	225	6.25	22201	39275.31	11406.24
Netherlands	17956	13110.25	5806.44	2.6569	5959.84	2809	285.61	10816	121	1	9486.76	31371.49	7867.69
Poland	3180.96	3844	8335.69	0.3721	3504.64	998.56	306.25	4774.81	289	5.76	5012.64	160080	14810.89
Portugal	5776	5069.44	2948.49	2.2801	4651.24	2580.64	380.25	7569	324	13.69	18523.21	38749.92	24273.64
Romania	1730.56	2520.04	6130.89	0.3481	3481	1857.61	696.96	3708.81	529	5.76	2992.09	429798.2	27489.64
Slovakia	5212.84	6272.64	8519.29	0.2209	3881.29	1536.64	529	4914.01	121	43.56	4251.04	290133	8482.41
Slovenia	8262.81	7123.36	8136.04	2.7556	4705.96	1075.84	605.16	6773.29	144	3.61	10363.24	64155.82	19182.25
Spain	10526.76	10732.96	3600	1.8225	4134.49	2079.36	625	9101.16	400	4	23286.76	33925.96	17715.61
Sweden	14400	12232.36	7726.41	14.0625	5520.49	4914.01	262.44	13110.25	144	0.64	8226.49	24489.12	8911.36
United Kingdom	13502.44	12100	6115.24	3.5344	5112.25	3364	210.25	10000	361	1.96	6724	13331.01	8118.01
$\sum_{i=1}^{m} x_{ij}^2$	314877.7	258706.2	175249.1	84.1448	119819.2	61408.67	10927.68	245391.7	7306	184.56	274913.1	3550555	308002.3
$\sqrt{\sum_{i=1}^{m} x_{ij}^2}$	561.1397	508.6317	418.6276	9.173047	346.149	247.8077	104.5355	495.3703	85.47514	13.58529	524.3216	1884.292	554.9796

3c. Objectives divided by their square roots (x_{ij}^{*}) and ranks given to member States by Ratio System

Indicators	max								min					Sum	Rank
	1	2	3	4	5	6	7	8	9	10	11	12	13		
Austria	0.21884	0.223148	0.20185	0.29107	0.208292	0.165451	0.198019	0.212165	0.140392	0.066248	0.212274	0.074686	0.176403	0.41	**4**
Belgium	0.205118	0.24674	0.196356	0.209309	0.180269	0.139221	0.200889	0.224277	0.17549	0.24291	0.171841	0.105483	0.141086	0.11	**12**
Bulgaria	0.0736	0.073137	0.199939	0.053417	0.184891	0.185628	0.264982	0.101338	0.245685	0.213466	0.109093	0.539349	0.210098	−0.46	**27**
Cyprus	0.170724	0.171637	0.203283	0.051237	0.204825	0.221139	0.195149	0.182692	0.187189	0.036805	0.353409	0.112594	0.138203	0.04	**15**
Czech Republic	0.143102	0.14136	0.21881	0.160252	0.192403	0.192084	0.181756	0.146961	0.105294	0.16194	0.148001	0.293564	0.155681	0.08	**14**
Denmark	0.214029	0.201521	0.169602	0.297611	0.225625	0.230017	0.181756	0.285039	0.140392	0.036805	0.183284	0.056095	0.140546	0.46	**3**
Estonia	0.120113	0.125435	0.196356	0.140629	0.201647	0.251808	0.229587	0.157458	0.222287	0.125135	0.098604	0.308185	0.120905	0.11	**11**
Finland	0.208148	0.219412	0.205911	0.405536	0.205403	0.227999	0.181756	0.250923	0.16379	0.088331	0.210367	0.121632	0.139284	0.47	**2**
France	0.192287	0.239073	0.199222	0.22021	0.187491	0.154152	0.178887	0.223469	0.152091	0.213466	0.179661	0.087768	0.159465	0.16	**9**
Germany	0.206009	0.210368	0.177007	0.28671	0.204247	0.217104	0.167407	0.209338	0.17549	0.279714	0.148001	0.080391	0.201629	0.17	**8**
Greece	0.168051	0.200931	0.196117	0.063229	0.178825	0.172715	0.157841	0.189757	0.233986	0.264993	0.23497	0.096477	0.19244	−0.24	**22**
Hungary	0.114766	0.13959	0.1997	0.109015	0.163802	0.126711	0.173147	0.137473	0.140392	0.264993	0.125495	0.212685	0.238207	−0.21	**20**
Ireland	0.241295	0.255981	0.209494	0.155891	0.195292	0.2167	0.157841	0.257585	0.187189	0.117774	0.23745	0.054731	0.183971	0.15	**10**
Italy	0.181773	0.215677	0.18274	0.128638	0.16958	0.138817	0.178887	0.213174	0.222287	0.228188	0.203883	0.075774	0.171538	−0.10	**19**
Latvia	0.102114	0.103415	0.191101	0.066499	0.198181	0.239702	0.235327	0.146557	0.304182	0.139857	0.088877	0.162714	0.171538	0.02	**16**
Lithuania	0.110311	0.121896	0.212838	0.087212	0.185758	0.214279	0.193236	0.130408	0.233986	0.088331	0.095552	0.229529	0.218927	0.02	**17**
Luxembourg	0.492391	0.345633	0.173902	0.176604	0.183158	0.137607	0.151145	0.240426	0.152091	0.117774	0.187099	0.084132	0.160907	0.23	**7**
Malta	0.135973	0.171834	0.126604	0.058868	0.159758	0.117833	0.126273	0.159073	0.17549	0.184023	0.284177	0.105175	0.19244	−0.34	**24**
Netherlands	0.2388	0.225114	0.182023	0.177694	0.223025	0.213875	0.161667	0.209944	0.128692	0.073609	0.185764	0.093998	0.159826	0.33	**5**
Poland	0.10051	0.121896	0.218094	0.066499	0.171025	0.127518	0.167407	0.139492	0.198888	0.176662	0.135032	0.212334	0.219287	−0.21	**21**
Portugal	0.135439	0.139983	0.12971	0.164613	0.197025	0.204998	0.186539	0.175626	0.210588	0.272353	0.259574	0.104469	0.280731	−0.28	**23**
Romania	0.074135	0.098696	0.18704	0.064319	0.170447	0.173925	0.252546	0.122938	0.269084	0.176662	0.104325	0.347924	0.29875	−0.37	**26**
Slovakia	0.128667	0.155712	0.220482	0.051237	0.17998	0.158187	0.220021	0.14151	0.128692	0.48582	0.124351	0.285858	0.165952	−0.35	**25**
Slovenia	0.161992	0.165935	0.215466	0.180965	0.198181	0.132361	0.235327	0.166138	0.140392	0.139857	0.194156	0.134422	0.249559	0.10	**13**
Spain	0.182842	0.203684	0.143325	0.14717	0.185758	0.184014	0.239153	0.192583	0.233986	0.147218	0.291043	0.09775	0.239829	−0.10	**18**
Sweden	0.213851	0.217446	0.209972	0.408806	0.214647	0.282881	0.154971	0.23114	0.140392	0.058887	0.172985	0.08305	0.170096	0.63	**1**
United Kingdom	0.207079	0.216266	0.186801	0.204948	0.206558	0.234052	0.138709	0.201869	0.222287	0.103053	0.156393	0.061275	0.162348	0.28	**6**

3d. Co-ordinates of the reference point equal to the maximal objective values

Indicators	max								min				
	1	2	3	4	5	6	7	8	9	10	11	12	13
r_j	0.492	0.346	0.220	0.409	0.226	0.289	0.265	0.101	0.105	0.037	0.089	0.055	0.121

3e. Comparison of the European Union Member States (reference point approach)

Indicators / States	max								min					$\max_j \left\| r_j - x_{ij}^{\star} \right\|$	Rank
	1	2	3	4	5	6	7	8	9	10	11	12	13		
Austria	0.274	0.122	0.019	0.118	0.017	0.117	0.067	0.111	0.035	0.029	0.123	0.020	0.055	0.274	**4**
Belgium	0.287	0.099	0.024	0.199	0.045	0.144	0.064	0.123	0.070	0.206	0.083	0.051	0.020	0.287	**10**
Bulgaria	0.419	0.272	0.021	0.355	0.041	0.097	**0.000**	**0.000**	0.140	0.177	0.020	0.485	0.089	0.485	**27**
Cyprus	0.322	0.174	0.017	0.358	0.021	0.062	0.070	0.081	0.082	**0.000**	0.265	0.058	0.017	0.358	**19**
Czech Republic	0.349	0.204	0.002	0.249	0.033	0.091	0.083	0.046	**0.000**	0.125	0.059	0.239	0.035	0.349	**16**
Denmark	0.278	0.144	0.051	0.111	**0.000**	0.053	0.083	0.184	0.035	**0.000**	0.094	0.001	0.020	0.278	**5**
Estonia	0.372	0.220	0.024	0.268	0.024	0.031	0.035	0.056	0.117	0.088	0.010	0.253	**0.000**	0.372	**20**
Finland	0.284	0.126	0.015	0.003	0.020	0.055	0.083	0.150	0.058	0.052	0.121	0.067	0.018	0.284	**7**
France	0.300	0.107	0.021	0.189	0.038	0.129	0.086	0.122	0.047	0.177	0.091	0.033	0.039	0.300	**11**
Germany	0.286	0.135	0.043	0.122	0.021	0.066	0.098	0.108	0.070	0.243	0.059	0.026	0.081	0.286	**9**
Greece	0.324	0.145	0.024	0.346	0.047	0.110	0.107	0.088	0.129	0.228	0.146	0.042	0.072	0.346	**15**
Hungary	0.378	0.206	0.021	0.300	0.062	0.156	0.092	0.036	0.035	0.228	0.037	0.158	0.117	0.378	**21**
Ireland	0.251	0.090	0.011	0.253	0.030	0.066	0.107	0.156	0.082	0.081	0.149	**0.000**	0.063	0.253	**2**
Italy	0.311	0.130	0.038	0.280	0.056	0.144	0.086	0.112	0.117	0.191	0.115	0.021	0.051	0.311	**13**
Latvia	0.390	0.242	0.029	0.342	0.027	0.043	0.030	0.045	0.199	0.103	**0.000**	0.108	0.051	0.390	**23**
Lithuania	0.382	0.224	0.008	0.322	0.040	0.069	0.072	0.029	0.129	0.052	0.007	0.175	0.098	0.382	**22**
Luxembourg	**0.000**	**0.000**	0.047	0.232	0.042	0.145	0.114	0.139	0.047	0.081	0.098	0.029	0.040	0.232	**1**
Malta	0.356	0.174	0.094	0.350	0.066	0.165	0.139	0.058	0.070	0.147	0.195	0.050	0.072	0.356	**17**
Netherlands	0.254	0.121	0.038	0.231	0.003	0.069	0.103	0.109	0.023	0.037	0.097	0.039	0.039	0.254	**3**
Poland	0.392	0.224	0.002	0.342	0.055	0.155	0.098	0.038	0.094	0.140	0.046	0.158	0.098	0.392	**24**
Portugal	0.357	0.206	0.091	0.244	0.029	0.078	0.078	0.074	0.105	0.236	0.171	0.050	0.160	0.357	**18**
Romania	0.418	0.247	0.033	0.344	0.055	0.109	0.012	0.022	0.164	0.140	0.015	0.293	0.178	0.418	**25**
Slovakia	0.364	0.190	**0.000**	0.358	0.046	0.125	0.045	0.040	0.023	0.449	0.035	0.231	0.045	0.449	**26**
Slovenia	0.330	0.180	0.005	0.228	0.027	0.151	0.030	0.065	0.035	0.103	0.105	0.080	0.129	0.330	**14**
Spain	0.310	0.142	0.077	0.262	0.040	0.099	0.026	0.091	0.129	0.110	0.202	0.043	0.119	0.310	**12**
Sweden	0.279	0.128	0.011	**0.000**	0.011	**0.000**	0.110	0.130	0.035	0.022	0.084	0.028	0.049	0.279	**6**
United Kingdom	0.285	0.129	0.034	0.204	0.019	0.049	0.126	0.101	0.117	0.066	0.068	0.007	0.041	0.285	**8**

Annex B. Evaluation of European Union Member States positions by the Full Multiplicative Form, 2008.

Table 4. The Full Multiplicative Form and ranks of Member States

	Product of indicators to be maximized	Product of indicators to be minimized	U_i	Rank		
				The Full Multiplicative Form	Ratio System	Reference Point
	1	2	3 = 1 / 2	4	5	6
Austria	192420644761.40	1740568082.07	110.5505	3	4	4
Belgium	103065917843.27	7711427839.49	13.36535	11	12	10
Bulgaria	5138449637.17	20722075001.77	0.24797	27	27	27
Cyprus	26513321121.51	2183096112.04	12.14483	12	15	19
Czech Republic	46826535455.51	5345924257.53	8.759296	15	14	16
Denmark	201821467189.59	671241694.03	300.6688	1	3	5
Estonia	47664315121.05	5075390857.86	9.39126	14	11	20
Finland	319028067075.67	4080666299.17	78.18039	4	2	7
France	102475986062.26	5753950642.30	17.80967	10	9	11
Germany	160455757962.17	7775005703.73	20.63738	9	8	9
Greece	20060977991.57	16188712120.63	1.239195	21	22	15
Hungary	12318044689.18	10255871610.25	1.201072	22	20	21
Ireland	132425068198.35	4282237506.37	30.92427	8	10	2
Italy	38140676526.87	9037769153.42	4.220143	18	19	13
Latvia	14743678629.25	4878188580.55	3.022368	19	16	23
Lithuania	18867175664.30	4081726258.20	4.622352	16	17	22
Luxembourg	195680195388.08	3440384816.64	56.87742	6	7	1
Malta	4068061538.49	9319118419.08	0.436529	25	24	17
Netherlands	131774912143.09	1750556791.53	75.276	5	5	3
Poland	6375558632.30	9719201761.46	0.655976	24	21	24
Portugal	29974576864.33	24185467100.62	1.239363	20	23	18
Romania	6476554584.90	19987595112.18	0.324029	26	26	25
Slovakia	13933617613.29	16461161131.11	0.846454	23	25	26
Slovenia	63584904295.97	6701164476.72	9.488635	13	13	14
Spain	63111421084.32	14276015243.58	4.420801	17	18	12
Sweden	369129166535.18	1472795985.20	250.6316	2	1	6
United Kingdom	112996620064.33	2269090581.52	49.7982	7	6	8

Annex C. Final ranks of the European Union member States according to MULTIMOORA, 2008.

Table 5. The MULTIMOORA method and final ranks of Member States

Member State	Ratio System		Reference Point		The Full Multiplicative Form		MULTIMOORA	
	Rank	Group	Rank	Group	Rank	Group	Rank	Group
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Austria	4	1	4	1	3	1	**3**	**1**
Belgium	12	2	10	2	11	2	**11**	**2**
Bulgaria	27	3	27	3	27	3	**27**	**3**
Cyprus	15	2	19	3	12	2	**15**	**2**
Czech Republic	14	2	16	2	15	2	**13**	**2**
Denmark	3	1	5	1	1	1	**2**	**1**
Estonia	11	2	20	3	14	2	**14**	**2**
Finland	2	1	7	1	4	1	**4**	**1**
France	9	1	11	2	10	2	**10**	**2**
Germany	8	1	9	1	9	1	**9**	**1**
Greece	22	3	15	2	21	3	**19**	**3**
Hungary	20	3	21	3	22	3	**22**	**3**
Ireland	10	2	2	1	8	1	**7**	**1**
Italy	19	3	13	2	18	2	**17**	**2**
Latvia	16	2	23	3	19	3	**20**	**3**
Lithuania	17	2	22	3	16	2	**18**	**2**
Luxembourg	7	1	1	1	6	1	**6**	**1**
Malta	24	3	17	2	25	3	**23**	**3**
Netherlands	5	1	3	1	5	1	**5**	**1**
Poland	21	3	24	3	24	3	**24**	**3**
Portugal	23	3	18	2	20	3	**21**	**3**
Romania	26	3	25	3	26	3	**26**	**3**
Slovakia	25	3	26	3	23	3	**25**	**3**
Slovenia	13	2	14	2	13	2	**12**	**2**
Spain	18	2	12	2	17	2	**16**	**2**
Sweden	1	1	6	1	2	1	**1**	**1**
United Kingdom	6	1	8	1	7	1	**8**	**1**

LIETUVOS SITUACIJOS EUROPOS SĄJUNGOJE ĮVERTINIMAS: STRUKTŪRINIAI RODIKLIAI IR MULTIMOORA METODAS

A. Baležentis, T. Baležentis, R. Valkauskas

Santrauka. Pagrindinis Lisabonos strategijos, priimtos 2000 m., tikslas – Europos Sąjunga turi tapti konkurencingiausiu regionu pasaulyje. Tikslai, nurodyti šioje strategijoje, ir jiems siekti naudojamos priemonės identifikuojamos remiantis struktūriniais rodikliais ir jų sistemomis. Įvertinti tam tikros valstybės situaciją ir palyginti ją su kitomis valstybėmis galima naudojantis specifiniais indeksais arba universaliais matematiniais-statistiniais metodais. Straipsnio tikslas – nurodyti pagrindinius Lisabonos strategijoje numatytų tikslų įgyvendinimą identifikuojančius struktūrinius rodiklius ir įvertinti Lietuvos padėtį Europos Sąjungoje. Tikslui pasiekti keliami šie uždaviniai: 1) apibūdinti ir klasifikuoti struktūrinius rodiklius; 2) apžvelgti pagrindinius struktūriniais rodikliais paremtus kiekybinės analizės metodus ir pritaikyti juos vertinant Lietuvos padėtį Europos Sąjungoje. Naudojantis daugiatikslės optimizacijos metodais MOORA ir MULTIMOORA įvertinta Lietuvos pažanga (2008 m.) siekiant Lisabonos strategijoje numatytų tikslų. Tyrimo rezultatai parodė, kad Lietuva yra tarp pirmaujančių ES valstybių tokiose srityse, kaip užimtumo lygis, jaunimo išsilavinimo lygis, santykinis kainų lygis ir šiltnamio efektą sukeliančių dujų emisija. Taigi Lietuva neturi didelių aplinkosaugos problemų ir gali sėkmingai konkuruoti tarptautinėje rinkoje dėl palyginti mažų produkcijos sąnaudų. Labiausiai atsiliekama pagal BVP, tenkantį 1 gyventojui, darbo jėgos našumą ir vyresnių darbuotojų užimtumo lygį. Taip pat reikia mažinti energijos vartojimo intensyvumą (skatinti modernių energetikos technologijų diegimą). Taigi Lietuvos ūkiui būdingas technologinis atsilikimas (žemas darbo jėgos našumas ir didelis energijos vartojimo intensyvumas), kurį galima panaikinti skatinant inovacijas ir MTEP veiklą. Tam tikslui turėtų būti skiriama didžiausia ES struktūrinės paramos dalis. Baltijos valstybių rodiklių, identifikuojančių inovacijų ir ekonominių reformų procesus, reikšmės yra panašios ir gana didelės tarp ES valstybių, taigi šis regionas gali tapti patraukliu investicijoms. Visas ES valstybes sąlygiškai galima suskirstyti į tris grupes, atsižvelgiant į jų pažangą siekiant Lisabonos strategijos tikslų. Lietuva ir Estija priskirtinos vidutinės pažangos grupei, o Latvija yra ties žemos pažangos grupės riba.

Reikšminiai žodžiai: daugiatikslė optimizacija, MOORA, MULTIMOORA, struktūriniai rodikliai, Lisabonos strategija, strateginis valdymas, darnus vystymas, Europos Sąjunga, tarptautinis palyginimas.

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