



## REGIONAL DEVELOPMENT AND BUSINESS GROWTH SIMULATION PROGRAM – AN APPROPRIATE TOOL FOR CROSS BORDER REGIONAL ANALYSIS

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**Abstract.** The theoretical and practical aspects of cross border regional development are presented in the article. The conceptual view of cross border region, regional development, regional disparities are provided. The specifics of measurement the regional development by the index is provided by the stages of index calculation. The empirical analysis of regional development is done by the help of Regional development and business growth simulation program, which was created on the base of the Latvia – Lithuania Cross Border Cooperation Programme 2007-2013 project “Formation of methodological framework of regional business growth promotion (LT-LV)” (project No. LV-LT/1.1/LLIII-152/2010), which was implemented by three partners: Kaunas University of Technology, Klaipeda University and Liepaja University. The specification and wide range of the use of the Program is presented in the article on the example of Klaipeda-Kurzeme cross border region by the 2008-2011 years. The theoretical and empirical analysis proved that the Regional development and business growth simulation program is an appropriate tool for regional economics analysis.

**Key words:** *cross-border region, regional development, index, simulation program*

**JEL code:** R110

### Introduction

Nowadays as a response to processes of globalization and regional integration, seeking to be economically active, competitive and do not lose own reputation it is significant to invoke all conceivable measures for economical and social stability assurance and business development promotion in regions for so small countries as Lithuania and Latvia in Baltic Sea region and all Europe-wide. In today's economy no one region, especially small country's region, is not autonomous and functions as an integral part of the larger economic system, directly depending on its constituent entities. Therefore, each country and its formative regions are looking for the new niches and unused opportunities for the strengthening of its economic potential and development. However the competitive uniqueness searching itself should not distinguish country from its external neighbours. On the contrary, the economic and social cooperation of cross-border countries, different countries' inhabitants, entrepreneurs, investors use of neighbouring countries advantages promote more rapid development of the regions, as well as contribute for the

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growing of the whole national economy. Otherwise, the lack of cooperation determines that these regions become economically “distant” for the territories of slower development.

In both foreign and Lithuanian and Latvian authors’ research works region and its constituent economic, social and business development is often analysed and evaluated, also are identified the rates determining economic and social development, calculated regional differentiation, attempted to determine causes of regions’ economic and social status differences, finding the ways for the cohesion increasing between the regions. However, scientific literature pays more attention for the problem analysis of the same country regions’ economic-social development. There is a lack of a more academic approach about regions of different border countries’ as one region, problem evaluation of economic-social development. Formation of different countries’ border regions as one region, socio-economic development of methodological basis formation complicates social and economic development indicators of two different countries which are often calculated differently in multifarious countries using heterogeneous methods. The absence of methodological measures and guidelines estimating economic-social development of cross-border regions becomes one of the obstacles hindering the development of real cross-border identification of current situation and promising prevision, what prerequisite condition is necessary for decision making, promoting effective development of cross border regions.

In order to solve the lack of methodological measures on cross border regional analysis, the project “Formation of methodological framework of regional business growth promotion (LT-LV)” (Project No. LV-LT/1.1/LLIII-152/2010), was implementing by Kaunas University of Technology also universities of Klaipeda and Liepaja. This project was implemented on the base of the Latvia – Lithuania Cross Border Cooperation Programme 2007-2013 project. During this project these results were achieved:

- The methodology for determining the cross-border regional business growth promotion factors;
- The statistical analysis of Lithuanian-Latvian cross-border regional business growth and applied business growth promotion means;
- The demand for business growth promotion means of business entities in the cross-border regions;
- The Lithuanian-Latvian cross-border regions business growth promotion strategy.

On the base of the above mentioned results and in order to promote regional development, reduce regional disparities not only between the same countries but also between regions of different countries and to create an easily usable and understandable tool, the Regional development and business growth simulation program (hereinafter,-Program) was created.

**The aim of research:** to present and practically apply the Regional development and business growth simulation program on the example of Latvian-Lithuanian cross-border region.

**Research methods:** systematic and logical comparative literature analysis, empirical research, performed using systematic analysis of secondary information sources.

## Conceptual view of regional development in cross border region

Regional development issues became especially popular among Lithuanian and Latvian scientists when countries joined the European Union and started intensive assimilation of EU Structural Funds support. Regional development problems and aspects were analyzed in Lithuania (Bruneckienė, Palekiene 2012, Bruneckienė, Krušinskas 2011, Baležentis and others 2010, Kilijonienė and others 2010, Kilijonienė, Simanavičienė 2009, 2008, Svetikas, Dzemyda 2009 a, 2009 b, Ginevičius, Podvezko 2009 Snieška, Bruneckienė 2009, Melnikas 2008, Mačys 2005) as in Latvia (Vesperis 2010, Latvian State Regional development agency 2009 Karnitis, Kucinskis 2009, Vanags, Vilka 2006, Vaidere and others 2006, Vanags and others 2005) scientists. In order to analyze the problematic of regional development



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and simply use the Program, the main concepts of regional development should be introduced. On the base of these concepts the use of the Program is created.

Scientists of different fields identify border region differently depending on the research aim, but many of them emphasize the territorial unit consisting of two or more countries' territories. Usually the cross-border region is defined as the administrative territorial unit consisting of two or more neighbouring countries territories' which has its own identity and some common historical, cultural and socio-economic characteristics, but the authorities represent the needs of different countries and political-legal rates. This definition of the border region allows appreciate the cross-border region as the integral region of two or more countries.

Different scientists variously named the region development concept, depending on research aim, but mostly of them emphasized changing of social economical dimensions in respect of time. Usually the regional development is named as a viability and attractiveness change of region's economical and social state by quantitative and qualitative aspect. The application of this definition allows evaluate the regions' development as a cyclical process when the result becomes significant input, determining the result. The analysis of regional development and business development relationship determined that there is a direct relationship between these dimensions. Researches indicated (Dumčiuvienė and others 2011) that regional policy aimed to regional development promoting has direct impact for business development in the region: if regional policy is ineffective, the region will lose the economic, social position against other regions and will attract less investment to the region, human capital, new technologies, etc., thereby suspending business development. Thus, the regional development related with business development in accordance with these two following aspects: the competitiveness of the enterprises themselves and conditions to remain competitive in both local and international measure.

As in foreign as in Lithuanian and Latvian authors' researches more often is analysed regional differentiation, attempting to establish appearing reasons of regions social, economical and environmental state differences and disparities, searching the ways for the union increasing between the regions. Different scientists named the regional development disparities differently, depending on the research aim but many of them emphasized the comparative differences of social and economic dimensions. Usually the regions' development disparities are named as a viability and attractiveness change of region's economical and social state by quantitative and qualitative aspect comparing the different regions.

In the scientific literature and in the Strategic European Union and individual countries also in regional documents were accepted that the social-economic disparities must be reduced, - both between the same and between different countries. In their researches (Perkmann 2007, 2005, 2003, Gabbe 2006) emphasize that active economical and social cooperation of different countries' of cross-border regions can be successful measure enable to activate socio-economic life in these regions, which let successful potential use of the cross-border region, transforming this region to growth area centre. In addition, formed cross-border co-operation provides more power and opportunities for local and regional authorities to participate in decision-making processes, creates a new control (multi) level over the entire of all national and European institutional system.

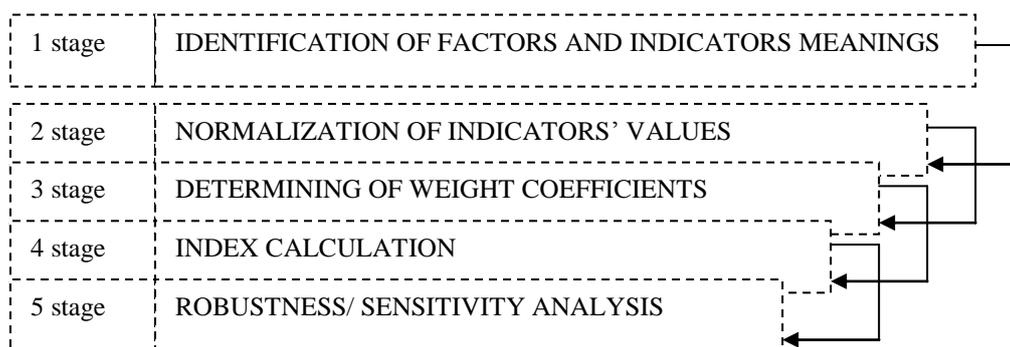
Seeking to promote regional development and reduce regional disparities not only between the same country but also different countries' regions it is necessity of patient and consistent work of government, business and academic institutions, also individual communities', creating cooperation of cross-border regions promoting measures and initiatives. If government authorities or other interested parties will not have the tools or measures how to analyse the economic and social problems of cross-border regions, they will not always can identify them and justify the solution of them. If situation in cross-border region will be not constantly evaluated and analysed, it will raise the danger of the wrong development directions choosing and issues related with them. Also, it will not be possible to compare it in accordance with time change aspect and in this way it will prevent the effectiveness of initiated decisions.



## Index calculation stages

Before presenting the areas of the use of the Program, it is important to shortly introduce the algorithm of regional economic analysis by an index. Studies have shown, that in order to examine the problem in a complex way, it is recommended to analyse it in indexes. Mathematicians and statisticians (Giovannini and others (2005), Saisana and others (2005)) defined the index as the combination of mathematical parameters and their groups. Representatives of social groups (Huggins 2003, Wignaraja et al., 2004, Freudenberg (2003)) define a composite index as an artificially made-up instrument of quantitative and qualitative measurement of a particular sphere. The index consists of sub-indicators; hence, the objects under examination can be ranked on the ground of it. It is emphasized that multi-criteria conceptions (e.g. competitiveness, industrialization, coherence, the integration of markets, the development of knowledge society, etc.) are measured by the index most accurately as they cannot be measured by a single index only. By the assistance of the index is pursuing complex evaluating of economical and / or social country's or region's development aspects therefore, according to it interested parties (e.g. economists, politicians, scientists, entrepreneurs and others.) analyse economic environment, economic policy and competitiveness strategy effectiveness, private and public sector activities, competitive strengths and weaknesses, and other information.

The calculation stages of the index are distinguished in figure 1.



It is very important to have the methodological principles how to analyse the regional economics. For this purpose it is important to identify the factors of regional development, classify them and identify the indicators, presenting them. In the scientific literature are distinguished different models for analysing of countries' economical and business development: M. Porter's the "National Diamond" model, Rugman, D'Cruz and Verbeke "Double Diamond" model, Cho "Nine factors" model, Martin "Regional competitiveness hats" model, Lengyel "Pyramid model of Regional Competitiveness", De Vet "Regional competitiveness tree" model, Rutkauskas "Harmonious competitiveness of country/region, Gardiner, Martin, Tyler "Pyramids of regional competitiveness", Begg "Labyrinth of regional competitiveness" and others. Although the analysed models are theoretically and empirically reasonable, they are not designated for the analysing of cross-border regions development and can not be directly adapted, especially those, which were created for analysing of large and economically developed countries competitiveness and development evaluation. This proves the importance of the 1 stage in the process of index calculation.

On purpose to assess statistical significance of cross-border economical-social development, it is significant to consider the unified system of indicators. It is emphasized, that the main problem choosing indicators representing cross-border development, – the limited opportunities of official statistical data



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receiving (Lithuania and Latvia), and different calculation methods of the same data among the countries. For economical-social and business development evaluation of cross-border region are recommended relative indicators. If relative indicators are not submitted by statistics departments of Lithuania and/or Latvia, it is proposed to calculate them using the primary data of statistics departments. If there is a lack of statistical data for the certain indicators calculation, they should be eliminated from the further research. In case when in one of the countries are impossible to calculate the indicator, this indicator should be rejected in another country too.

Regional development is a complex phenomenon, which is determined by numerous factors, expressed in various indicators and metrics. In order to compare different indicators, their values must be normalized. Although for the index calculation are applied various methods of data normalization, though for the economical-social problems analysing, especially for the regions of the different countries, the most commonly used standard deviation from the average, distance from minimal and maximal meaning and the distance methods from the group leader or average.

Weight coefficients are determined for each factor and their groups promoting regional development. This phase is assigned to the complex one because the index size and rank depend directly on weight coefficients existence, their size and means of coefficients' determination. It is advised to check, how the calculated index and rank vary with the different weight coefficients' determination methods.

The scientific literature analysis reveals that the weight coefficients' determination sources may include:

- Authors' opinion, who have established competitiveness index;
- Social opinion, based on public hearing, various economic researches, conclusions of expert group;
- Strategic plans of development or priorities identified by the government;
- Statistical-mathematical techniques.

At index calculation stage, is formed function of the index calculation and calculating the final result. Although the mathematical expression of the index can have additive or functional expression however it is recommended to express the function by additive expression in business development region.

The value of index and its rank can change, depending on variables, rating and ponderability coefficients granting and calculation methods of the same index. Due to this reason analysis of index reliability is performing in the fifth stage. Researches have showed that the mostly often are used methods of robustness and sensitivity. Saisana and others (2005) stated that the robustness and sensitivity analysis describes index reliability and substantiates clearness of its calculation. Researches have shown that most potential sources of uncertainty include: selection of factors and indicators and combination into the general system methodology, data quality, data rating and methods of ponderability coefficients ranking. For the analysis of index reliability scientists often use the correlation analysis. If there is a strong correlation (between the variables of the same or different groups), then the index is less sensitive for the lack of data or ponderability coefficient fixing problems.

### **Specification of Regional development and business growth simulation program**

This program is the analysis tool of regional economic and social development, which allows to calculate a composite index from the different indicators and to make the statistical reliability analysis of the gained results. The novelty of the program is based on the fact, that:

1. For the first time a programme on economic modelling was created both in Lithuania and Latvia allowing calculating indexes and ranks automatically.
2. The programme allows every researcher to create his/her personal research and basing on it to



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perform the economic and social analysis as well as the analysis of business development of the region considering the particularity of the research.

The benefit of the use of the program is based on the fact, that:

1. The programme reflects the means of economic analysis well known in the world (the Competitiveness Index of the World Economic Index; Corruption Perceptions Index of Transparency International)
2. It is convenient to use because the general result (Index) is expressed in one meaning (it is much more convenient than to search for tendencies among many of different indexes) and the results may be ranked.
3. The programme performs a lot of boring calculations for the researcher.
4. The languages of the programme – Lithuanian, English and Latvian; thus excellent conditions for cooperation exist.
5. The programme is associated with Excel – it allows to export and import data and thus facilitate the entry of data and its further analysis.

The wide range of the use of the Program is based on the fact, that:

1. Allows entering unlimited number of regions, periods and indexes;
2. In case of the shortage of the inputted data allows removing the data, to replace by the average or to foresee the missing values;
3. Allows grouping the indexes;
4. Allows rationing the values of the indicators according to 4 different rationing methods;
5. Allows establishing the weight ratios for each indicator and / or their groups.
6. Allows calculating the index of each region and performing ranking according to it following the order of the descending importance.
7. Allows performing the analysis of the received results:
  - Pearson and Kendall correlation analysis of factors;
  - The analysis of the results applying different methods of rationing;
  - The analysis of the results applying different scenarios of the establishment of weight ratios;
  - The analysis of the results applying different indicators.
8. Allows providing the results in tables and diagrams.

The results of practical use of the program are presented further in the article.

### **Methodology of the analysis of Lithuanian-Latvian cross border region development**

In this article the cross border region of Lithuania-Latvia is referred as one region consisting of Klaipeda (Lithuania), and Kurzeme (Latvia) regions. The statistical data of 2008-2011 years will be used in order to measure the development of Klaipeda and Kurzeme regions.

The factors for regional development evaluation in Lithuanian and Latvian cross-border region are grouped into three categories: activity's conditions, demand's conditions and companies competitiveness. The factors characterizing activity's conditions are divided into human and knowledge resources, capital (investment attraction), engineering and social infrastructure. The factors defining demand's conditions are divided into local and external market demand. The factors characterizing companies' competitiveness are distinguished into the companies' productivity, competitive strategy and business



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strategy groups. The index of cross-border regional development (CMRDI) is expressed by linear equation:

$$CBRDI = (w_1) AC + (w_2) DC + (w_3) CC \quad (1)$$

$$AC = (w_4) HR + (w_5) KR + (w_6) K + (w_7) ESI \quad (2)$$

$$DC = (w_8) DLM + (w_9) DEM \quad (3)$$

$$CC = (w_{10}) CPS + (w_{11}) BS \quad (4)$$

$$HR = (w_{12}) RM + (w_{13}) RA \quad (5)$$

$$KR = (w_{14}) SE \quad (6)$$

$$K = (w_{15}) IA \quad (7)$$

$$ESI = (w_{16}) EI + (w_{17}) SI \quad (8)$$

$$EI = (w_{18}) TI + (w_{19}) ITT \quad (9)$$

$$SI = (w_{20}) HSS + (w_{21}) CS + (w_{22}) PS \quad (10)$$

$$DLM = (w_{23}) SSLMD + (w_{24}) MW \quad (11)$$

$$DEM = (w_{25}) TA \quad (12)$$

$$CPS = (w_{26}) WPP + (w_{27}) PGDP \quad (13)$$

$$BS = (w_{28}) CEA \quad (14)$$

where:

- PRPI – index of cross-border region development;
- AC – activity's conditions;
- DC – demand's conditions;
- CC – competitiveness of companies;
- HR – human resources;
- KR – knowledge resources;
- K – capital;
- ESI – Engineering and social infrastructure;
- DLM – Demand of the local market;
- DEM – Demand of the external market;
- CPS – productivity of companies and competitiveness strategies;
- BS – business structure;
- RM – Number of residents and migration;
- RA – structure of residents' age;
- SE – Infrastructure of studies and education;
- IA – investment attractiveness of the region;
- EI – Engineering infrastructure;
- SI – Social infrastructure;
- TI – transport infrastructure;
- ITT – Information Technologies and Telecommunications;
- HSS – Health and social security;
- CS – culture and sport;
- PS – Public security;
- SSLMD – Scale and structure of local market demand;
- MW – level of material welfare;
- TA – tourist attractiveness;
- WPP – number of created work places and productivity;
- PGDP – part of created GDP;
- CEA – abundance of companies and economical activity;
- $W_i$  – weight coefficient of  $i$  factor.

For the analysis of cross border regional development, 26 indicators, which are available at Lithuania and Latvia, were selected (see table 1).



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Table1

## The factors and indicators of regional development of Lithuania and Latvia cross-border region

Factor	Indicator, the units of measurement
<b>ACTIVITY'S CONDITIONS</b>	
<i>HUMAN RESOURCES</i>	
Number of residents and migration	Number of residents, persons
	Residents' migration (local and international) balance per 10 000 residents, persons
Age structure of residents	Percentage of working age residents, per cent
	Residents of dependent age (0-14 years)
<i>KNOWLEDGE RESOURCES</i>	
Infrastructure of studies and education	Number of persons pursuing the high education (at Universities and Colleges) per 1000 residents.
<i>CAPITAL (INVESTMENT ATTRACTION)</i>	
Regional investment attraction	Capital investments per 1 person, the monetary unit
<b>ENGINEERING AND SOCIAL INFRASTRUCTURE</b>	
<i>ENGINEERING INFRASTRUCTURE</i>	
Transport infrastructure	The density of the asphalted roads, km/km <sup>2</sup>
	The quantity of goods transported by land roads 1 million tones per 1000 residents.
Information technologies and telecommunications	The part of the households having computer, in per cents.
<i>SOCIAL INFRASTRUCTURE</i>	
Health and social security	Number of beds per 10 000 residents, in pieces
	Number of social risk families, per 1000 residents.
Culture and sport	Number of art collectives per 1000 residents
	Number of participants of sport competitions and health events per 1000 residents
Public security	Recorded criminal activities per 100.000 residents.
<b>DEMAND'S CONDITIONS</b>	
<i>DEMAND OF LOCAL MARKET</i>	
Measure and structure of local market demand	The density of residents for 1 km <sup>2</sup> for person.
	Comparative part of city residents, in per cents (urbanization level)
	Average consumption expenditures for a member of household per month, the monetary unit.
Level of material welfare	Gross average monthly wage, the monetary unit in cross-border region.
	Average disposable income for one member of the household per month, the monetary unit.
<i>DEMAND OF EXTERNAL MARKET</i>	
Tourist attraction	Number of accommodated quests in accommodation institutions per 1000 residents.
	Level of hotels occupation in per cents.
<b>COMPETITIVENESS OF COMPANIES</b>	
<i>COMPANIES' PRODUCTIVITY AND COMPETITIVE STRATEGIES</i>	
Number and productivity of created workplaces	Created value-added of 1 employee working in processing industry
	Unemployment level in per cents
The part of created GDP	The relative part of region GDP, from country's GDP in per cents.
<i>BUSINESS STRUCTURE</i>	
Companies' abundance and economical activity	Number of active economy subjects per 1000 residents.
	Number of large companies (250 and more employees) per 100.000 residents.



Because of the space limitation in the article, the wide range of the use of the Program is not able to present in the article. The main results, gained by applying the equal weight coefficients to all factors of regional development and by using the distance from an average method of the normalization, will be presented in the article.

## Results of the development analysis of Lithuanian-Latvian cross border region

The Program, according to the method of data normalization and weight coefficients scenarios indicated by research author automatically calculates the index and ranks providing the results in the table and diagram (see Fig. 2).

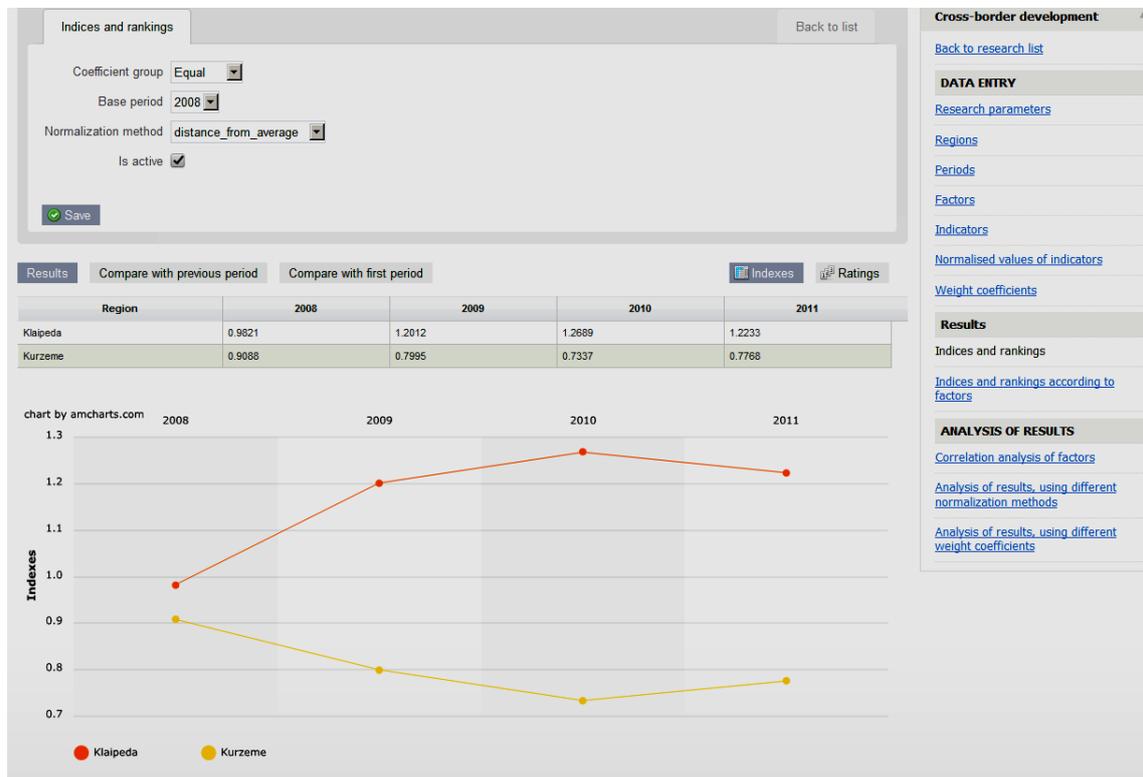


Fig. 2. The index of cross-border regional development in 2008-2011 years

The regional development disparities of Klaipeda and Kurzeme shows CMRDI width (see Fig. 2). The biggest difference in cross border region was in 2010. During the analysed period, the lowest regional disparity was in 2008. After the effect of the worldwide economic crisis, the regional disparities started expand. This shows that the cross border region is developed unequally, if we look to that region as whole region.

The Program allows analyse not only the general indexes and ranks, but also indexes and ranks in accordance with individual factors or their groups. The analysis of separate factors let identifying the



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strengths and weakness of the region. Main strength of cross-border region is the closeness of the sea. It has a great importance in the development of the region, since it contributes the economic cooperation with other countries. The favourable location ensures a transportation corridor for both Europe and CIS country cargo and passenger flows, and it is attractive for domestic and foreign tourists. All transport types are represented in cross-border region. The export of native origin goods in the cross-border region concludes the bigger part of the region's GDP, than at an average in both countries. The main weaknesses of cross-border region are decreasing density of population and negative change of population quantity. Despite of similar location, political and socio-economical situation of Klaipeda and Kurzeme region, both frontier areas have the differences, too. Main differences are in infrastructure; such characteristics are strengths for Klaipeda region and weaknesses for Kurzeme region: quality of roads, situation in seaports and airport. Differences are in development tendencies; strengths for Klaipeda region are increased disposable income and increasing monthly (gross) wages, direct foreign investments for one inhabitant, which increased more than at an average; increased tourists flow and decreased amount of social risk families. Strengths for Kurzeme region are decreased criminality and sufficient set of social services.

Seeking to analyse the relationship between the strength of the factors, the program automatically calculates correlation coefficients of Pearson and Kendall and provides them in the correlation matrix (see Figure 3).



Fig. 2. The Pearson correlation coefficients of factors groups.

The Program doesn't calculate the statistical reliability of calculations and this should be done in other programs, such as Excel or SPSS. From the gained results we can see, that the competitiveness of companies and the demand condition have biggest influence on development of Klaipeda and Kurzeme cross border region.

The program allows detailed relationship analysis of individual factors or their groups, choosing corresponding region, period, data normalization method and ponderability coefficients scenarios and indicating variables for Pearson and Kendall correlation coefficients. It is identified, that the number of residents and migration, transport infrastructure, level of material welfare, tourist attraction and number and productivity of created workplaces have the biggest influence on the development of Klaipeda and Kurzeme cross border region. This information is useful for strategic planning and identification of priorities of cross border regional development.

The program also allows analyse and compare results obtained by different methods of data normalization applying or determining different weight coefficients scenarios. This type analysis of reciprocal results allows make conclusion for the research author about sensitivity of obtained results from selected index calculation method. The analysis proved, that determining of weight coefficients have more impact on the results of regional development analysis than data normalization method.



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## Conclusions, proposals, recommendations

1. Regional development cannot be completely defined by one or several indicators, thus complex measurement of development is a must. The researches proved that the measurement by an index helps to solve the problem of a complex measurement of regional development.
2. It is suggested to calculate the index via the following stages: Identification of factors and indicators meanings; Normalization of indicators' values; Determining of weight coefficients; Index calculation and Robustness/ sensitivity analysis.
3. Empirical application of the Program proved that it is appropriate means for analysis of regional development, strategic planning, information and advertisement of a region.
4. The empirical analysis of cross border regional development index showed, that Klaipeda-Kurzeme region is not equally developed. The biggest regional disparity was in 2010.
5. The empirical analysis let to identify the priorities of Klaipeda-Kurzeme cross border regional development:
  - Increasing of initiative and business activities. It is an engine of economics' activity in cross-border region.
  - Sufficient qualitative and quantitative amount of human resources. Entrepreneurs have increasing need in work force; local demand (consumption) should be increased, too.
  - Infrastructure and accessibility. Cross-border region territories and business offers should be accessible and easily exploitable.
  - Increasing of external demand, promoting cross-border tourism attraction. Local businesses should develop competitive tourism directions and tourism products.
  - Cross-border region economic cooperation should be improved in priority in the sphere of promoting business growth and tourism development.
6. The Program as an analysis tool can be useful for:
  - Ministries and municipalities responsible for equal development of the country's regions;
  - Companies and organizations analysing and assessing the development of Lithuania's and Latvia's regions and business sector;
  - Students and scientists analysing the economy of regions and the strategic planning of regions.
7. The Program is only the tool for analysis of economic and social development. It can help for researcher, economist or politician to identify the main problem of regional development, to justify the problem solving solution and analyse effectiveness of its implementation. It is expected that created methodological basis will contribute to business development, economical and social cooperation promoting and social-economical development between cross-border region of Lithuania and Latvia and other regions.

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