

**THE EFFECT OF THE REGIONS' HOMOGENEITY ONTO THEIR RESILIENCE AND
COMPETITIVENESS**
ON THE EXAMPLE OF WESTERN TRANSDANUBIAN REGION (HUN) AND BURGENLAND (AUT)
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Recently, many international studies have concentrated on the examination of the regions' resilience trying to find out which factors can influence the reactivity's quickness of the economical crises and environmental catastrophes, the quality and effectiveness of the responses. The regions' reactivity, adaptability, resistivity and the quality of the responses were measured by the temporal change of the typical regional indicators. By measuring the regions, it is not merely enough to have knowledge of all of the regions' indices, but it is necessary to learn the regions' inner structures as well.

During this research those factors are selected, which were considered the most important by the inhabitants in the aspect of the regions' resilience and competitiveness. This research measures these factors complex on an example of two (Hungarian and Austrian neighbour regions) NUTS 2 statistical regions. For analysing these indicators, a suitable methodology is applied, with the help of which it is defined the examined regions' most important regional and local-environmental connections, and the most important features of the regions' companies. The elaborated indicator can be useful for a wider explanation of the regions' resilience and which can lead us to define the competitiveness of the regions. With the help of the applied methodology and the prepared indicator system this research analysed the strengths and weaknesses on the example of the two NUTS 2 regions and the study defined the regions' homogeneity regarding to the characteristics.

A complex modern analysis is made on the gained results, which can be helpful to define the regions' economic development and the strengths of the crisis reactions, starting from the below-regional, territorial levels. The study verifies, that the examination and analysis of the regions' territorial structures is necessary to get a real picture of the regions' competitiveness and resilience.

A region's competitiveness not only depends on the economic development, but also on the purposefully developments, the population's interest in developments, its culture, qualification and on the ethical norms and traditions to be kept. Consequently, the endogenous and exogenous erodations can weaken the regional competitiveness. The created methodology and indicators may be suitable in the European regional pilot research projects as well.

Keywords: region; homogeneity; heterogeneity; Western Transdanubia; Burgenland

INTRODUCTION

Over the years many international studies (Dawley, et al., 2010; Foster, 2010; Gunderson, Holling, 2002; Martin, Simmie, 2010) had concentrated on the research of the regions' resilience. In their analysis, they were looking for the answer, how could the regions respond to the economical challenges of the business environment. In the literature (Martin, 2010; Pendall, et al., 2007) traceable studies and models usually interpret and examine the whole region as a single entire. In the models used indices observe the temporal changes of the economic indicators, which are concerned for the whole region.

In the course of the foregoing regional studies numerous questions have stayed unanswered: During the competitiveness analysis, is it eligible to examine the region originally as a single entire? Do the regions act like a homogeneous entire and do they respond to the economic and social crises? Does the regions' homogeneity and heterogeneity influence their resilience and competitiveness? Which new endogenous variables could influence the regions' resilience and competitiveness? Is it possible to create a new methodology starting from the territorial (deeper than the regional) level, with which we can get an answer for our questions? How can be all these inserted into the regional development politics?

This research is trying to find those most important indicators, which can define the regions' strength and play a role to get successful responds for crisis situations. According to the authors' main suppositions, the regions' social and economic homogeneity plays an important role in this question. During this research the authors analysed two regions on NUTS 2 (second, planning and statistical level of the Nomenclature of Territorial Units for Statistics, developed by the European Union) level (Burgenland region in Austria and the Western Transdanubian region in Hungary) and in the NUTS 2 regions settled NUTS 3 (third level of NUTS, Hungarian counties and Austrian political districts) territories. 225 surveys from the Western Transdanubia and 74 surveys from Burgenland were proved to be competent for analysis. The authors measured the region's most typical environmental and corporate functioning determinant indices with factor analysis and their territorial distribution within the region with cluster analysis. The authors compared the received results with official statistical data (KSH-TEIR¹; Statistik Austria; Bundesministerium für Verkehr, Innovation und Technologie²). This research examines, that according to the results of the factor analysis how far is the analysed region homogeneous or heterogeneous. For the further analysis the authors suggest a new methodology and a region homogeneity index.

The researchers presupposed, that the NUTS 2 planning and statistical regions – considering their development (economical, social, etc.) – not always consist flush or equal pace developed NUTS 3 territories and the regions' resilience and their reaction to crisis are influenced by the NUTS 3 territories' development level, reactivity and resilience. The interaction of these areas affects the region's resilience level.

The authors considered a more detailed examination of the region formed territorial structures to receive a more realistic picture of the regions' competitiveness and resilience.

The researchers presupposed, that beside the economic natured ('hard elements') indicators, which can influence the regions' resilience, there exist some not primarily economic natured ('soft elements') indices, which can be coupled with the regions' adaptability and therefore they can influence the regions' resilience as well.

The authors believe, that the most important indices deemed by the local society, are definable in every region and these indices have an effect on the locations' environmental, economical, social, cultural development and on the companies' adaptability and their own development.

According to the authors' opinion, with this new methodology the mostly development-connected indicators are definable and also their influence onto the regions' homogeneity or heterogeneity.

¹ Hungarian Central Statistical Office – National Local Developmental and Integrational Information System (Központi Statisztikai Hivatal – Országos Területfejlesztési és Területrendezési Információs Rendszer)

² Federal Ministry of Austria for Transport, Innovation and Technology

ABOUT THE REGIONAL RESILIENCE, COMPETITIVENESS AND HOMOGENEITY

In the international literature the definition of the regional resilience is approached differently by many authors (Foster, 2007; Hill, et al., 2008; Christopherson, et al., 2010; Hassink, 2010). Its interpretation and definition are varied, too. The examination of the regional resilience is a new research direction, which has been in an initial phase between those researchers, who have been dealing with this topic. There is no settled, universally accepted definition as well.

Christopherson, Michie, Tyler (2010) mean, that the resilience is a conceptual dilemma, which changes according to how the single authors handle the in space and time changing processes. According to some researchers resilience is a temporal concept, its changes are measured in particular moments, for example in the moment before crisis ('pre-shock'), during the crisis ('shock') or after the crisis ('post-shock'). In other researchers' opinion resilience marks spatial changes, which can be found in human acts and social relations. The regional resilience is also expressible in those political and economic processes, which may yield to investments or the lack of these.

In the course of the resilience examinations erected path dependence theories measured the historical background of the crises' conformation (Pendall, 2007), and also the effect of the vision created by certain social systems' onto the region's development (Grabher, 1993). According to Martin's (2010) path development model, the ensuing structure change in the region and the combining of resources can give a more beneficial and more efficient answer in short term, than the continuous correction of the existing construction. The success of the structure change depends on how can the local companies and institutions form an alliance.

The international literature deals with the concept of the competitiveness since decades; and it exists international institutions and periodically, continuously published international studies, which have been specialised to rank the world's and the different countries' competitiveness.

Every region has unique economic and social combination, so there are different inputs (for ex. know-how, natural resources, etc.) and different competitions (for ex. corporate, municipal, international, etc.) on different markets (for ex. labour market, product market, etc.). The measurement of the competitiveness is complex, it is hard to measure it with only one indicator, but it can show us a panoramic view of the certain area's skills and development level (Lengyel, 2000).

A HOMOGENEOUS OR HETEROGENEOUS REGION

At the defining of a region's homogeneity the marking off the certain area is based on the similarity principle. If identical economic, social, natural elements and similar values characterize the space structure, which exist continuously and permanently, then we may talk about a homogeneous region or area. If these features are visibly well varied or separated from each other, then we could call them a heterogeneous region. We can establish the regions' homogeneity or heterogeneity with statistical and mathematical methods.

According to Dusek (2004), we need a partition of spaces, since homogeneous space does not exist. In his opinion 'social space is generated by human acts, but humans are different from the perspective of their age, gender, educational level, mother tongue, religion, habits, taste and million other factors' (Dusek, 2004, p. 63.), so generally the spaces should be considered as heterogeneous.

The indicators used for the examination of the regional inequality are for example the dual indicator (Éltető–Frigyes-index), weighted relative scattering, logarithmic scattering, the Hoover-index and its 'relatives', and the Gini-index. All indicators take different contents into consideration, but it is difficult to use them for wide-ranging regional comparative analysis (Nemes Nagy, 2009).

Since the usage of the listed indices is limited, in this research the authors elaborated an index, which can be used for measuring regional inequality and also could be uniformly suitable for the examination of the single regions' different features. This index is the so called 'region homogeneity index' (RHI), which does not depend on the parameters' unit of measurement, it can be used uniformly, because it shows the certain area's homogeneity or heterogeneity by the difference from the average value and by the 30 percentage change from the quotient of average value.

REGION HOMOGENEITY INDEX (RHI)

By examining a certain economic indicator, for example in the course of the examination of economic development's temporal change due to the given answers in the questionnaire the authors came to the following conclusion:

The average of the answer results of the NUTS 2 region (*1. figure*), which is a totality of the given answers on a scale from 1 to 7, divided by the number of persons, who filled out the questionnaire;

$$\overline{x_R} = \frac{\sum_{i=1}^n x_i}{n} \quad \begin{array}{l} R = \text{the examined NUTS 2 region} \\ n = \text{number of elements in the NUTS 2 region} \end{array}$$

1. figure: Average of the answers of the NUTS 2 region
(Source: own elaboration)

The average of the answer results of the NUTS 3 territories (*2. figure*), which is a totality of the given answers on a scale from 1 to 7, divided by the number of persons, who filled out the questionnaire;

$$\overline{x_{T_1}} = \frac{\sum_{j=1}^m x_j}{m} \quad \begin{array}{l} T_1 = \text{the first examined NUTS 3 region} \\ m = \text{number of elements in the first} \\ \text{NUTS 3 region} \end{array}$$

⋮

$$\overline{x_{T_r}} = \frac{\sum_{k=1}^o x_k}{o} \quad \begin{array}{l} T_r = r^{\text{th}} \text{ examined NUTS 3 region} \\ o = \text{number of elements in the} \\ r^{\text{th}} \text{ NUTS 3 region} \end{array}$$

$$n = m + \dots + o$$

2. figure: Averages of the answers of the NUTS 3 territories
(Source: own elaboration)

The extent of the differences between the results of the NUTS 3 and NUTS 2 territorial averages (3. figure), which consists the disparities of the average R of the NUTS 2 region and separately the averages of the NUTS 3 territories;

$ RAE_1 = \bar{x}_R - \bar{x}_{T_1}$	RAE_1 = the first NUTS 3 region's average difference from the NUTS 2 region R = examined NUTS 2 region T_1 = first examined NUTS 3 region
$\vdots$	
$ RAE_r = \bar{x}_R - \bar{x}_{T_r}$	RAE_r = the r^{th} NUTS 3 region's average difference from the NUTS 2 region R = examined NUTS 2 region T_r = examined r^{th} NUTS 3 region r = number of the NUTS 3 regions

3. figure: Formula for the difference of the region average
(Source: own elaboration)

In terms of the sample of the variance analysis, the authors defined the acceptable limit value of the difference in 0,3. Of course this limit value is also definable in other ways, but generally it is advisable, that the limit value should be smaller, than the quotient of the average's difference and the average. If $|RAE_r| \geq 0,3$; then the examined NUTS 3 region exceeds the limit value of 0,3. The researchers marked these transgressions inside the NUTS 2 region with KE (number of critical deviation, 'kritikus eltérés' in Hungarian) (4. figure).

$\frac{KE}{r} = RHI_a$	RHI = region homogeneity index for the values of the principal components KE = number of critical deviation a = number of principal component values r = number of NUTS 3 regions
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4. figure: Formula for the region homogeneity index (RHI), as the variables in the principal components
(Source: own elaboration)

The authors calculated the RHI as every single principal component variable, this means ' a '-times, RHI value is expressed in percentage (%) in all cases (5. figure).

$\frac{\sum_{l=1}^a RHI_l}{a} = RHIF$	RHI = region homogeneity index for the values of the principal components a = number of principal component values $RHIF$ = region homogeneity index for the examined whole principal component
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5. figure: Formula for the region homogeneity index, calculated for the whole examined principal component

(Source: own elaboration)

If in a NUTS 2 region, all of the NUTS 3 territorial data is *within* the limit value, the authors consider the region as a **homogeneous** one.

If in a NUTS 2 region, less than 35% of the NUTS 3 territorial data vary from the limit value, the authors consider the region as a **weakly heterogeneous** (mild unsteady) one.

If in a NUTS 2 region, more than 35% but less than 70% of the NUTS 3 territorial data vary from the limit value, the authors consider the region as a **heterogeneous** (unsteady) one.

If in a NUTS 2 region, more than 70% of the NUTS 3 territorial data vary from the limit value, the authors consider the region as a **strongly heterogeneous** (strongly unsteady) one.

With the region homogeneity index calculated differences from the average are giving an opportunity to examine not only the homogeneity, but also the direction and the measure of the average's difference, what makes the region's deeper analysis possible as well.

With the help of this method, the region's homogeneity or heterogeneity can be estimated well. It is acceptable though, that this method can only gain an informative picture, a first impression of the region, taking it into consideration that some indicators may define the behaviour of the areas with various strengths.

THE COMPARATIVE ANALYSIS OF THE WESTERN TRANSDANUBIAN AND BURGENLAND REGIONS

On the basis of the questionnaire analysis defined principal components fulfilled homogeneity examinations present the following results in both NUTS 2 regions (1. table).

1. table: Common examination of the analysed principal components in Western Transdanubian and Burgenland region, on NUTS 3 levels

Common examination of the analysed principal components in Western Transdanubian region, on NUTS 3 levels						
NUTS 3	<i>'Area development and presence of interest representation'</i>	<i>'Healthy population with good living standard'</i>	<i>'Existence of corporate culture'</i>	<i>'Developed companies, healthy, future conscious and tradition keeper employees'</i>	RHI (average of principal components percentage (%))	Characterization
Győr-Moson-Sopron County	0%	33,33%	80%	60%	43%	heterogeneous
Vas County	25%	0%	80%	20%	31,25%	weakly heterogeneous
Zala County	25%	33,33%	0%	60%	29,58%	weakly heterogeneous
Common examination of the analysed principal components in Burgenland region, on NUTS 3 levels						
NUTS 3	<i>'Environment consciousness and deficiency of corruption'</i>	<i>'Existence of local and infrastructural development, healthy lifestyle'</i>	<i>'Developed corporate culture and public safety'</i>	<i>'Developed working conditions, infrastructure and community participation'</i>	RHI (average of principal components percentage (%))	Characterization
North-Burgenland	0%	0%	0%	0%	0,00%	homogeneous
Central-Burgenland	25%	0%	33,33%	100%	39,58%	heterogeneous
South-Burgenland	0%	0%	66,67%	0%	16,67%	weakly heterogeneous

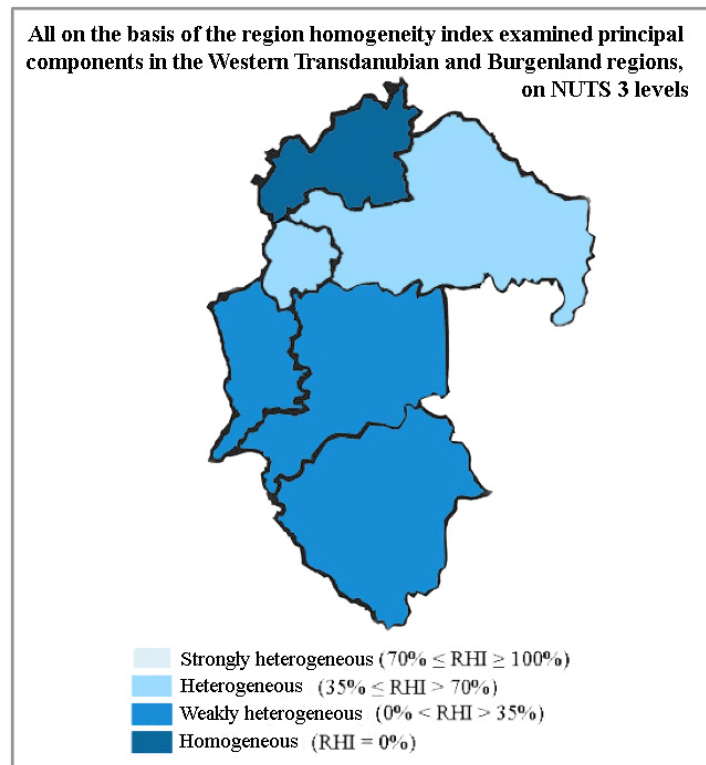
(Source: own elaboration)

In the 1. table indicated NUTS 3 regions' principal components are visualised on the following map (6. figure). It is visible, that only the respondents from North-Burgenland have similar, homogeneous opinion about their region. Based on the heterogeneous results of the neighbour Győr-Moson-Sopron county, the authors of this study can say, that this Hungarian county

would need a bigger development to reach tighter contact and to body and achieve more dynamic, cross-border programs and improvements.

The same can be said about the Central-Burgenland district, its development would further not only the common development and cooperation of the cross-border area, but it could also serve the collective interest of the Austrian NUTS 2 province.

The weakly heterogeneous results are also distributed in the immediate neighbourhood of South-Burgenland district, Vas and Zala counties. In these NUTS 3 regions there would be a need for smaller developments to achieve a tighter, more resilient common cross-border cooperation.



6. figure: All on the basis of the region homogeneity index examined principal components in the Western Transdanubian and Burgenland regions, on NUTS 3 levels
(Source: own elaboration)

RESEARCH RESULTS

From the aspect of development politics it is not enough to know only the regional indexes but to know the inner structure of the region as good as possible. With a complex methodology it is possible to know and examine the inner qualities of the regions which otherwise would be difficult to measure. Such indicators are makeable, which are more accurate and sensitive for the region's competitiveness flexibility and more complex definition of the effectiveness of the regional development policy. The developed methodology and indicators may be useful in the future for European regional level pilot projects, for research use.

Empirically proved, that in the regions studied, the most important economic and social characteristics based on the NUTS 3 units do not have the same vitality, their characteristics and values do not correspond to the NUTS 2 level indicators values. The authors determined the

most important properties and their distribution within the region is typical of the regions examined. A close relationship was also found between the studied regions, the development and recognized in the principal component analyzes the main characteristics of the region. The authors determined the homogeneity regions examined, and found to determine the economic efficiency are available in both national and regional data. However, for the examination of the population indicated by additional indicators influencing the life of the NUTS 3 regions is very difficult to access data and incomplete in some areas.

The researchers confirmed, that the regions forming spatial structures may be different from each other, it was the most important groups of properties defining the principal component analysis of their development are different, but the region is also characterized and analyzed the distribution of these. The cluster analysis has given different results within each property group. The authors confirmed that the investigation and analysis of spatial structures forming regions are necessary in order to gain a realistic picture of the competitiveness and flexibility of the regions.

The main components of the regional correlation analysis and principal component analysis was confirmed by examining, in addition to the nature of economic indicators in all regions, there are important 'soft' indicators, which were placed in contact with the development of the regions.

The regions examined, determined on the basis of regional, environmental and corporate qualities considered the most important by the surveyed population can be determined, and it is related to the economic and social development in all regions was placed in contact with public awareness about development, and future environmental awareness and motivation. In addition, the economic development of the region was associated with the impact of corporate activities.

The authors have selected the ways in which complex analysis of the regions as a model used to determine the regions most associated with the development of indicators and their relationship strength distribution within the contact region strengths and regional heterogeneity and homogeneity. The flexibility of this region, the competitiveness and efficiency uniformly defining formula bar can be worked out, but it requires more complex analysis, which has foundations, examined the calculation methodology the authors propose the following, with additional research opportunities.

ON THE WAY TOWARDS THE REINTERPRETATION OF THE REGIONS' COMPETITIVENESS

In the authors' opinion, the region's competitiveness depends on adaptability, and this also depends on how flexible the region is, how quickly it can respond to external and internal changes.

That is how the region's resilience, flexibility can be linked in defining indicators of the region's competitiveness. Therefore the researchers investigated whether the people in the regions according to indicators may play a role in proposing and flexibility, if these are really new research directions of the regions in determining the competitiveness of the regions (question has been asked in an indirect sense).

As Professor Imre Lengyel writes: competitiveness mainly signalled market share, profitability and business success grows (Lengyel, 2000). The definition of welfare indicator is the subject of further research, according to some authors of welfare policy changes (e.g. profit, price index, unemployment, export etc.) results can be measured (Batey-Friedrich, 2000). The regional competitiveness is fundamentally the effectiveness of the region, namely the well-being and

economic efficiency achieved thus determined. The effectiveness, economic efficiency and welfare context of our proposal can be written as follows (7. figure):

$$E_R = E_{ER} \cdot W_R$$

E_R = regional efficiency
 E_{ER} = regional economic efficiency
 W_R = welfare of the regional population

7. figure: Formula of the regional efficiency
(Source: own elaboration)

The territorial or regional economic efficiency changes over time in the study area of all goods produced in a given time (GDP) can be measured, so how quickly the area is evolving and changing in terms of the region's economy and fiscal capacity. Temporal changes measured in purchasing power standards (PPS) GDP per capita is an indicator, that can be used in territorial units, regions, countries or even smaller geographical units within a region (e.g. counties) to compare, too. If the test is carried out within a country, the GDP and the GDP (PPS) is obviously the same.

Profitability in terms of regions development are classified as uniform (homogeneous) or not uniform (heterogeneous) areas. The produced goods and economic development depend on the economic structure of the company and sectorial distribution, also on how the companies are operating in the region, divided by the proportion of the agricultural, industrial and service sectors.

Based on this theory, the following formula can be created for the regional economic efficiency (8. figure):

$$E_{ER} = \Delta \frac{GDP(PPS)_R}{P_R} \quad \Delta \frac{GDP(PPS)_R}{P_R} = \text{GDP per capita changes in Purchased Power Standard (PPS)}$$

E_{ER} = regional economic efficiency

8. figure: Formula of the regional economic efficiency
(Source: own elaboration)

The temporal change and extent of the regional economic efficiency can be measured with the following formula (9. figure):

$$\Delta \frac{GDP(PPS)_R}{P_R} = \frac{GDP(PPS)_{Rt}}{P_{Rt}} = \frac{GDP(PPS)_{R(t-i)}}{P_{R(t-i)}}$$

t = the examined year
 $t-i$ = i^{th} year before the examined year
 $GDP(PPS)_R$ = GDP of the region, in Purchased Power Standard (PPS)
 P_R = population of the region

9. figure: Formula of the temporal change of the region's economic efficiency
(Source: own elaboration)

The regions' responses given to the crisis situations depend on not only the territorial efficiency, but also on the quickness and characteristic of changes and replies, which was formulated as regional resilience (Foster, 2010; Hassink, 2010; Christopherson, et al., 2010). The typical regional development indicators of the countries are also defined (Srebotnjak et al., 2014). Beside the regional efficiency (E_R), the regional resilience (R_R) is a determining factor at the efficiency analysis of crisis situations (K_R) as well. These can be defined with the following formula (10. figure):

$R_R \cdot E_R = K_R$	R_R = regional resilience
	E_R = regional efficiency
	K_R = regional crisis-efficiency

10. figure: Formula of the region's crisis-efficiency
(Source: own elaboration)

The regional resilience can be influenced by the regions' homogeneity or heterogeneity (RHI) and by their adaptability (A_R). So it can be write down the following formula for regional resilience (11. figure):

$R_R = A_R \cdot RHI$	R_R = regional resilience
	A_R = regional adaptability
	RHI = regional homogeneity index

11. figure: Formula of the region's resilience
(Source: own elaboration)

In the course of the examination of a region's competitiveness (C_R), the authors compare the region's crisis-efficiency (K_R) with the other regions' crisis-efficiency of with the regions' average (12. figure). In formula:

$C_R = \frac{K_R}{K_{\bar{Ri}}}$	C_R = regional competitiveness
	K_R = regional crisis-efficiency
	$K_{\bar{Ri}}$ = arithmetic average of the regional crisis-efficiencies in the examined regions

12. figure: Formula of the region's competitiveness
(Source: own elaboration)

By replacing the foregoing formulas into the formula of competitiveness, the following formula comes out (13. figure):

$C_R = \frac{K_R}{K_{\bar{Ri}}} = \frac{R_R \cdot E_R}{R_{\bar{Ri}} \cdot E_{\bar{Ri}}} = \frac{A_R \cdot RHI \cdot E_R}{A_{\bar{Ri}} \cdot RHI_{\bar{i}} \cdot E_{\bar{Ri}}} = \frac{A_R \cdot RHI \cdot E_{ER} \cdot W_R}{A_{\bar{Ri}} \cdot RHI_{\bar{i}} \cdot E_{\bar{ERi}} \cdot W_{\bar{Ri}}}$

13. figure: Formula of the region's competitiveness – detailed explanation
(Source: own elaboration)

This formula can be opened onwards, if the regional economic efficiency (E_{ER}) is also replaced according to the 9. figure.

In the authors' further investigations, they are going to try to find those most important indicators ('soft' indicators), with which the region's crisis efficiency (K_R) could become determined as well. It is necessary to measure and determine with some kind of indicators the above deducted competitiveness, resilience and efficiency. It is the future's task to study this.

Trying out the applied methods of the study and the further research of the *region homogeneity index* – in the course of regional pilot projects on European level – would be essential to get to know whether if this idea is suitable for comparing bigger regional areas. To this, it is necessary to know the statistical data of the NUTS 3 territories or these data should be collected during pilot researches.

The NUTS 3 regions' efficiency needs further analysis, on the one hand to analyse their economic efficiency comparatively and on the other hand to define and examine the indicators of population welfare. These researches would help the authors finding those indicators, with which they could define the regions' adaptability and resilience.

All these would provide facilities for comparative regional competitiveness analysis. Moreover, it could resolve the diverse development between cross border regional areas. These all could motivate people for corporate development and could provide new bases for efficient distribution and use of cross border sources.

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