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## **ASSESSMENT OF DISPROPORTIONATE TERRITORIAL DEVELOPMENT BASED ON THE EXAMPLE OF THE REPUBLIC OF ARMENIA**

*Alleviation of regional development disparities is one of the most important issues faced by every country. The process of making territorial development proportional begins with the process of recognizing the existing disparities and first of all implies an assessment of disparities in territorial development. In that context, the article is aimed at presenting a calculation model with which it will be possible to measure the disparities of territorial development of countries. The application of the obtained model has been ensured by performing calculations on the example of the Republic of Armenia, and the credibility of the obtained results has been verified by conducting comparisons with another model. By using the model, it is possible to measure the development levels of territorial units, as well as the existing imbalances between the development levels of territorial units. The results obtained on the example of the RA prove that there are some upper medium level disparities of territorial development between Yerevan, the capital of the Republic of Armenia, and the regions, which are characterized by clear tendencies of expansion.*

**Keywords:** *territorial development, development disparities, territorial policy, assessment of development disparities, assessment model.*

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**INTRODUCTION.** Disparities in territorial development are characteristic to all countries of the world. And for each country, there is a need to develop a methodology by the help of which it will be possible to measure the differences between the degrees of development of the territorial units of the given country. International experience and the study of literature show that there are similar models for different countries of the world. There are also attempts to develop such models for the RA. However, the methodology proposed in the article is significantly different from the others, as it measures development disparities by calculating one specific indicator, in addition, the methodology proposed in the article makes it possible to measure the development levels of territorial units. In order to evaluate the effectiveness of the methodology developed in the article, the obtained indicators, using the model developed in the article, were also compared with the results received using another model, thereby ensuring the reliability of the given model. The developed methodology can also be applied to different countries of the world, because it is based on 9 main groups of indicators characterizing territorial development, and the weights of these indicators have been determined not only on the base of the RA indicators, but by expert assessment (number of experts: 131), which makes the model applicable to all countries of the world.

**LITERATURE REVIEW.** The study of the development levels of territorial units and the existing disparities between these levels has always been the focus of field researchers. Both Armenian and a number of foreign researchers have regularly carried out studies aimed at identifying the development levels of territorial units or evaluating existing disparities in that regard.

The methodology proposed by Felix Haifeng Liao and Yehua Dennis Wei (2016) for the assessment of regional development disparities in the case of China is based on the calculation of the coefficient of the variation for indicators and indices characterizing socio-economic development. Umit Sermagambet, Zaira Satpayeva, Gulzhyhan Smagulova, Wieslaw Urban and Raikul Yessenzhigitova (2022) developed an index (consisting of socio-economic sub-indexes) for the assessment of development levels of regional units in Kazakhstan. Depending on the level of the development index, territorial units are classified into this or that class, that classification being precisely the disclosure of disproportion.

In Romania, the model for assessing territorial development disparities proposed by Cătălina Ancuța (2010) seems to combine the main features of the previous two models, resulting in a territorial model, according to which territorial units are classified into 6 groups with 6 separate functional links. The classification is based on broad indicators characterizing socio-economic development and their variation.

Luca Salvati, Giuseppe Venanzoni, Margherita Carlucci (2016) attempted to assess the regional development disparities in Italy. Their proposed model is

also based on indexing, but it consists of 3 sub-indexes: social, economic and environmental.

In order to assess the regional development disparities in Europe, the European Parliament (2007) studied the indicators of socio-economic development in European countries, emphasizing the degree of their standard deviation. Annekatriin Niebuhr and Silvia Stiller (2003) carried out a research about European countries based on a dynamic analysis of development indicators, considering countries according to 6 groups.

Attempts to study the given topic have also been made many times by Armenian researchers. Zoya Tadevosyan et al. (2020) have developed a methodology for measuring the level of development of the RA regions, based on the dynamic and structural observation of the socio-economic development indicators, on the example of the assessment of the development level of the Shirak region, the RA. Sos Khachikyan et al. (2022) also carried out a similar experiment on the example of the RA Syunik and Vayots Dzor regions, conducting an analysis of the development indexes. Hovhannes Melkumyan (2021) has carried out an assessment of the levels of development of the RA regions in his research, calculating sub-indexes of demographic, social, economic, educational and medical development.

However, no matter how numerous the studies in the field are, still, the models evaluating the asymmetries of territorial development based on the example of the RA, are quite few. The article is aimed at filling the existing gap in that regard. The methodology proposed in the article also takes into account the applicable provisions within the presented literature.

**RESEARCH METHODOLOGY.** A methodology for the assessment of territorial development disparities is developed in this article, where the first step is the assessment of the development levels of territorial units. The calculated index for evaluating the level of development of territorial units is based on the weighted average formula. The independent variables of the calculation are 9 indicators characterizing the socio-economic development, relative to the population or the area of the territorial unit, and the weights were obtained by conducting an expert survey among a sample of 131 experts. Based on the development estimates, the article calculates an index of territorial uneven development, which is based on the relative standard deviation calculation formula.

In order to verify the reliability of the model results, they are also compared with the results calculated by using the model developed by Hamazasp Galstyan and Gagik Badadyan (2020) in their article "Socio-Economic Problems of Disproportionate Territorial Development of the Republic of Armenia in the Current Conditions".

The calculations were completely made according to the example of the Republic of Armenia. The main source of data are the publications of the Statistical Committee of the Republic of Armenia.

In order to present the results of the article, five tables and four charts have been created in the article. The results presented through them are dynamic, structural or comparative in nature.

Since the main result of the article is the developed model, the analytical part of the article presents the most detailed interpretation of the model and formulas for calculating indicators.

**ANALYSIS.** The calculation of the variations between the development levels of territorial units is necessary for the assessment of territorial development disparities. The evaluation of territorial units' development levels serves as a starting point for the calculation of the latter. The following formula will be applied to calculate and measure the development levels of territorial units (1):

$$DI_{nj} = \sum(W_i * (X_{nij}/\max(X_{nij}))) / \sum(W_i) \quad (1)$$

Where:

$DI_{nj}$  - the development index of the territorial unit "n" in the year of "j",

$W_i$  - the weight of the index "i",

$X_{nij}$  - the index "i" in the year of "j" of the territorial unit "n",

$\max(X_{nij})$  – the highest value of the series including the indicator "i" in the year of "j" of the territorial units.

The index has been calculated using nine factors that have a direct comparative relationship with the degree of development. All indicators are relative to the number of the population or the area of the territorial unit. Nine indicators are standardized in the range of 0-1 according to the maximum value of the series. The possibility to aggregate and compare the data was made possible by processing this series. In order to calculate the weights of the indicators included in the index, an expert survey was conducted among Doctors of Economics, PhDs in Economics, managerial employees of the RA Ministry of Territorial Administration and Infrastructure, the RA Finance Ministry and the RA Ministry of Economy. The number of participants in the survey is 131, among which there are 101 PhDs, 5 Doctors of Economics, and 34 are representatives of the ministries (9 of them are also PhDs). The survey participants evaluated the indicators on a scale of 1-9 points, after which the average ratings of the indicators were calculated. The weights of the indicators were calculated using average scores and the "Analytic Hierarchy Process" method.

The indicators and their weights used for evaluating the development levels of territorial units are presented in Table 1.

Table 1

**Weights assigned to indicators in the evaluation of development levels**

The indicator	The weight
Gross product per capita	12.719
Access to medical services: number of medical personnel	11.805
Access to educational services: number of teachers	11.691
Average consumptions spending of households	11.373
Employment rate	11.335
Share of the population not considered poor	11.145
Average monthly nominal salary	10.802
Share of the population considered young	9.622
Population density	9.507
<i>Total</i>	<i>100.00</i>

Based on the evaluations of the development levels of the territorial units, an assessment of the asymmetries of the RA territorial development is carried out in this study. The following formula, based on the calculation of the relative standard deviation, is applied (2):

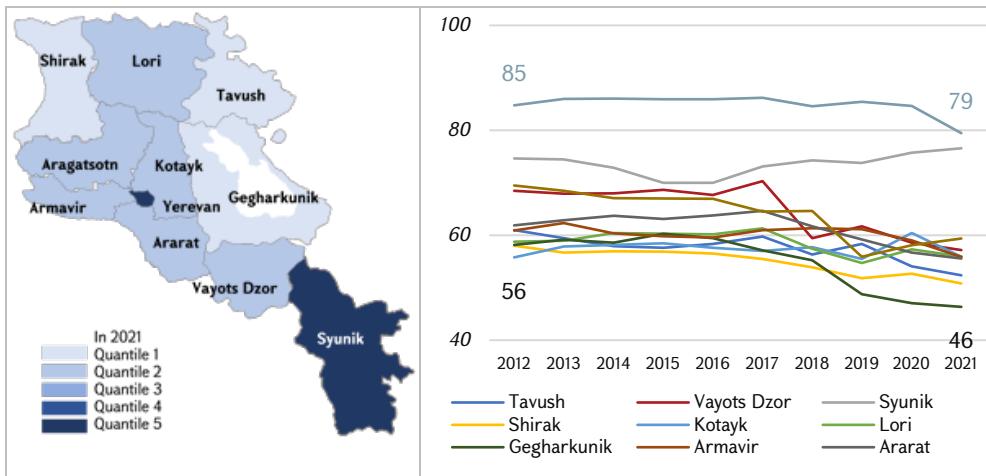
$$DDI_j = \sqrt[2]{(\sum(DI_{nj} - mean(DI_{nj}))^2)/n} / (mean(DI_{nj})) \tag{2}$$

Where:

- DDI<sub>j</sub> - in the year of "j", the country's territorial uneven development index,
- DI<sub>nj</sub> - the development index of the territorial unit "n" in the year of "j",
- mean (DI<sub>nj</sub>) - average development index of territorial units in the year of "j",
- n – the number of territorial units.

Based on the presented methodology, the coefficients characterizing the levels of socio-economic development of the RA regions and the capital - Yerevan, and coefficients characterizing the disparities of the RA territorial development are calculated.

The development indexes of the 10 regions of the Republic of Armenia and Yerevan, calculated for the years 2012-2021, are presented in Chart 1.



**Chart 1. Development indexes of the RA regions and Yerevan in 2012-2021**  
(Statistical Committee of the RA, Publications, n.d.)

The leading regional units in terms of development in the RA are Yerevan and the Syunik region. According to the data of 2021, the development index of Yerevan is 79,457 points, and the development index of Syunik is 76,581 points. The difference between the development indexes of Syunik and Yerevan in 2012-2021 has considerably decreased. In 2012, this difference was 10.153, and in 2021 it was 2.877. At first sight, the reduction of this difference creates the impression that regional development disparities in the RA are reduced, but this claim can be refuted because the reduction of the differences between the indicators of Syunik and the capital city of Yerevan is accompanied by the existing and increasing differences between other regions and those two territorial units. However, the fact, that two poles of development are already clearly formed in the RA, can be considered a positive phenomenon. To some extent, it is the result of the formation of these poles that the regions adjacent to Syunik and Yerevan (Ararat, Aragatsotn, Armavir, Kotayk and Vayots Dzor) have advanced in their development compared to other regions.

However, in order to verify the reliability of the development indexes calculated by the developed methodology, it is necessary to compare the results obtained by this methodology with the results of other methodologies. For this purpose, we consider it necessary to carry out an assessment of territorial development levels according to factor analysis, which has been carried out using the SPSS statistical package (Methodology: Galstyan, Badadyan, 2020).

The list of indicators used for factor analysis and the significance of these indicators in the model are presented in Table 2 (all indicators are weighted by population size or territorial unit area).

Table 2

***Significance of Factor Analysis Variables (Author's calculations with SPSS)  
(Statistical Committee of the RA, Publications, n.d.)***

<i>The variable</i>	<i>The Significance</i>
Volumes of industrial production	<b>0.982</b>
Mining volumes	<b>0.901</b>
Volumes of manufacturing industry	0.577
Volumes of agricultural production	<b>0.987</b>
Volumes of livestock breeding	<b>0.974</b>
Volumes of crop production	<b>0.955</b>
Construction volumes	<b>0.910</b>
Retail turnover	<b>0.973</b>
Volumes of services	<b>0.992</b>
Nominal consumption expenditures of households	0.806
Average monthly nominal salary	<b>0.963</b>
Poverty level	0.740
Employment rate	<b>0.942</b>
Population density	<b>0.989</b>
The number of teachers	<b>0.912</b>
The number of schools	<b>0.911</b>
The number of medical staff	<b>0.991</b>
Number of hospital beds	0.860
Volumes of atmospheric emissions	<b>0.984</b>

Fifteen of the nineteen observed variables are significant in the model at the 10% level of significance, and the significance of the remaining 4 variables can also be considered acceptable. In this case, in terms of variables, the model can be considered high-quality, as 79% of the applied indicators are significant. The method of "principal component analysis" is used to perform factor analysis using the presented variables, as a result of which, with the precondition of 1 eigenvalue, 4 factors are obtained by factor analysis (Table 3).

Table 3

*Total variation explained by the factors*

<i>The factor</i>	<i>The Eigenvalue</i>	<i>Explained variation</i>	<i>Cumulative</i>
I	9.2	48.4%	48.4%
II	4.6	24.4%	72.8%
III	2.3	12.3%	85.2%
IV	1.2	6.2%	91.3%

Cumulatively, the factors explain 91.3% of the variation, or in other words, contain 91.3% of the initial data. In this respect, the model can be considered high-quality.

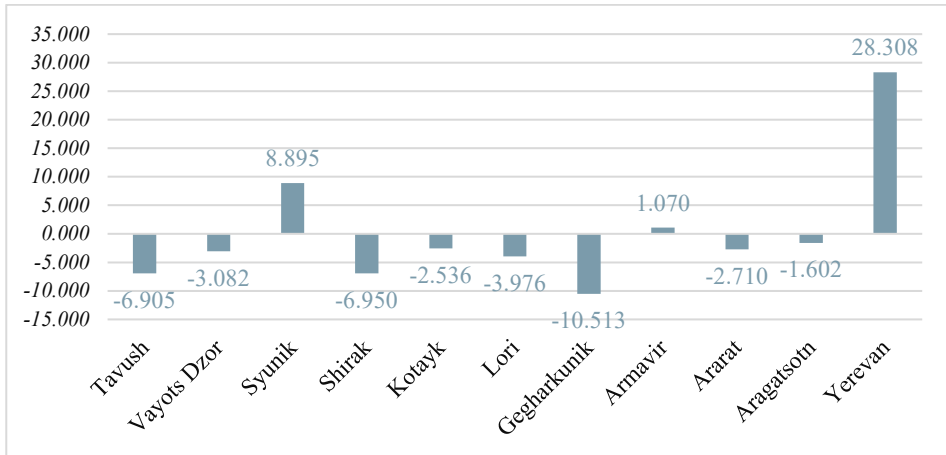
The factor evaluations of the regions of the Republic of Armenia and Yerevan are presented in Table 4.

Table 4

*Factor evaluations of the RA regions and the capital city of Yerevan*

	<i>Factor I</i>	<i>Factor II</i>	<i>Factor III</i>	<i>Factor IV</i>
Tavush	-0.176	-0.703	-0.491	-0.747
Vayots Dzor	-0.073	0.003	-0.929	-0.207
Syunik	-0.335	2.811	-0.430	-0.049
Shirak	-0.202	-0.730	-0.245	-0.770
Kotayk	-0.596	0.210	1.200	-0.719
Lori	-0.125	-0.205	-0.500	-0.604
Gegharkunik	-0.652	-0.843	0.025	-0.567
Armavir	-0.104	-0.458	0.555	2.437
Ararat	-0.824	0.051	1.808	0.338
Aragatsotn	0.208	-0.226	-1.656	1.204
Yerevan	2.878	0.091	0.762	-0.316

To calculate the development indexes of territorial units by means of factor analysis, it is necessary to multiply the factor estimates of territorial units with the eigenvalues of the factors in the variation explained by the factors and calculate the sum of these weighted estimates. Development indexes of territorial units according to factor analysis, with the data of 2021, are presented in Chart 2.



**Chart 2.** *Development indexes of the RA regions and Yerevan in 2021 according to factor analysis (Statistical Committee of the RA, Publications, n.d.) (Methodology: Galstyan, Badadyan, 2020)*

In this context, it should be noted that the 3 backward regions included in the 1st quantile (Tavush, Shirak and Gegharkunik) and the 2 leading territorial units included in the 5th quantile (Yerevan and Syunik) by the developed methodology occupy the same development positions also with the development indexes calculated by factor analysis. The remaining regions, having a relatively average level of development, are in the 3rd-8th positions in both cases (Table 5). Such a situation testifies to the fact that the applied methodology is effective, because the results obtained by factor analysis justify the results of the developed methodology.

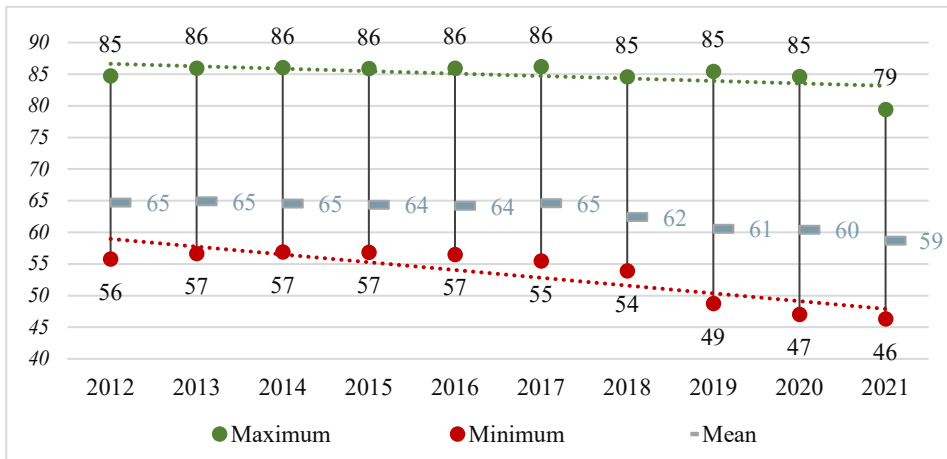
**Table 5**  
*A comparative matrix of the methods used to assess the development levels of the RA regions and Yerevan*

Region	The position occupied by the development index (development index = $\Sigma$ (9 relative indicators * indicator weights calculated by expert survey))	The position occupied by the factor analysis (developmental rate by factor analysis = $\Sigma$ (factor estimates of 4 factors calculated on the basis of 19 indicators * eigenvalues of the factors in the variance explained by the factors))	The quantile of the developmental index
Yerevan	1	1	V
Syunik	2	2	V
Aragatsotn			
Ararat			
Armavir			
Kotayk	3-8	3-8	II
Vayots Dzor			
Lori			
Tavush	9	9	I
Shirak	10	10	I
Gegharkunik	11	11	I



Within the framework of the study of the development levels of the RA territorial units, it is also necessary to understand how the existing differences between these levels are changing, and what trends have been formed in this regard. For this purpose, the minimum and maximum indicators of the development indexes of the RA regions and Yerevan for 2012-2021 are studied. The trends of these indicators are also subject to observation.

As it can be seen from Chart 3, the situation regarding the expansion of territorial development disparities in the RA is quite worse, as the difference between the maximum and minimum indicators of the development indexes of territorial units increased in 2012-2021, being 28.985 in 2012 and 33.109 in 2021. The difference in the volume of the minimum and maximum indicators proves that the disparities of territorial development in the RA are deep enough, moreover, they are characterized by expansion. This argument is also supported by graphical observation, according to which the distance between the minimum and maximum indicator trends has a tendency to widen due to the degree of curvature.

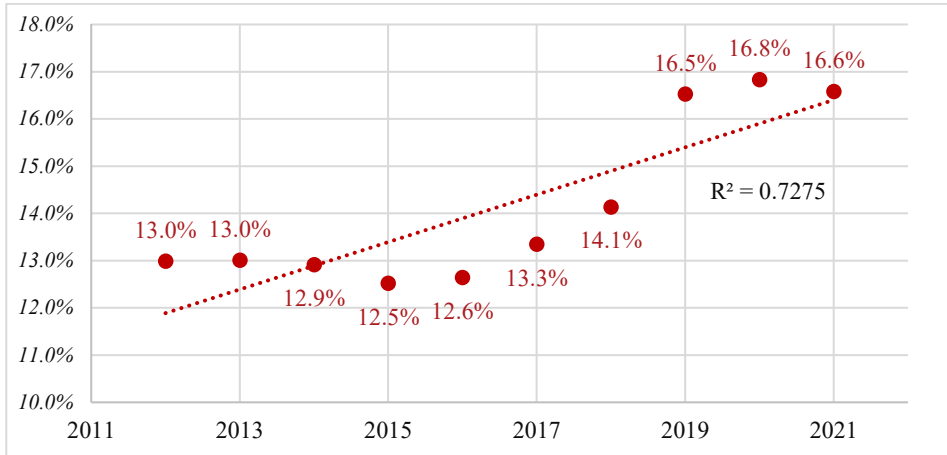


**Chart 3. The dynamics of changes in development indexes of the RA regions and Yerevan in 2012-2021 (Statistical Committee of the RA, Publications, n.d.)**

The high level of regional development disparities and their expansion are also evidenced by the territorial uneven development index (Chart 4), the latter was 16.6% in 2021, which is a considerably high indicator taking into account that the calculation is an average for 11 territorial units.

The trend position of the territorial uneven development index indicates the expansion of regional development disparities: it is a straight line with a positive slope, and the  $R^2$  indicator, which characterizes the degree of deviation of the actual indicators from the trend, calculated by the method of least squares, is 0.7275, which is sufficiently high, taking into account the characteristics of the index and the length of the series (the closer  $R^2$  is to 1, the more actual indicators are close to the arranged trend, and the quality of the trend construction is high).

It should be also noted that the disproportionate development index increased by 4.1 percentage points in 2015-2021, which is evidence of a fairly high degree of deterioration in 6 years.



**Chart 4.** *Index of the regional development disparities in the RA in 2012-2021*

**CONCLUSIONS.** Thus, summarizing the evaluations of the development levels of the RA territorial units and the asymmetries of the RA territorial development, it can be concluded that there are upper medium level disparities of territorial development in the RA.

The main reason for the disparities is the progressive development of the capital Yerevan. Syunik also stands out with a relatively high level of development. The rest of the regions, compared to those two territorial units, lag far behind. The most worrying thing is that the development disparities in the RA are expanding. Therefore, it is necessary to take steps that can lead to the improvement of the situation, which can be based on the development poles, that is, territorial units with a progressive level of development.

The model developed in the article for the assessment of territorial development disparities gives the desired results. This is confirmed by the fact that the results obtained by the model are comparable with the indicators obtained by another model, which shows the effectiveness of the given model whose effectiveness depends on both the selection of indicators and the expert assessment of their weights. The model can also be used to assess the disparities of territorial development in other countries, just the indexes of disparities of territorial development cannot be directly compared between different countries, this is due to the fact that the index is averaged and can be differentiated depending on the number of territorial units included in the country. The index is more observable in dynamics. A comparison between countries can be made if they have the same or similar number of territorial units.

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