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ASSESSING AND REDUCING DISPARITIES IN THE SOCIO-ECONOMIC DEVELOPMENT OF DISTRICTS: THE CASE OF BUKHARA REGION

Annotatsiya. Hududiy nomutanosibliklarni qisqartirish O'zbekiston ijtimoiy-iqtisodiy siyosatining asosiy maqsadlaridan biridir. Maqolada Buxoro viloyatining 11 ta tumani va 2 ta shahri ijtimoiy-iqtisodiy rivojlanishidagi nomutanosibliklar tadqiq etilib, ularni qisqartirish mexanizmlari taklif qilinadi. Tadqiqotda to'rt blokdan (iqtisodiy, ijtimoiy, infratuzilmaviy va ekologik) iborat 20 ta ko'rsatkich tizimi hamda min-max normallashtirish, entropiya vazn usuli, variatsiya koeffitsiyenti va Teyl indeksiga asoslangan metodika taklif etiladi. Empirik hisob-kitob Buxoro viloyati statistika boshqarmasining 2024-yil bo'yicha barcha tumanlar kesimida e'lon qilinadigan to'rtta ko'rsatkich bo'yicha rasmiy ma'lumotlariga asoslanadi: aholi jon boshiga bozor xizmatlari, aholi jon boshiga qishloq xo'jaligi mahsuloti, bozor xizmatlarining o'sish sur'ati va har 10 000 aholiga to'g'ri keladigan xorijiy kapitalli korxonalar soni. Integral indeksning eng yuqori (Buxoro shahri, 0,857) va eng past (Shofirkon tumani, 0,087) qiymatlari o'rtasidagi farq qariyb o'n baravarga teng; indeksning variatsiya koeffitsiyenti 77,1 foizni tashkil etadi. Teyl indeksi bozor xizmatlari bo'yicha 0,208, qishloq xo'jaligi mahsuloti bo'yicha 0,173 va xorijiy kapitalli korxonalar bo'yicha 0,522 ga teng bo'lib, eng kuchli to'planish xorijiy investitsiyalarda ekanini ko'rsatadi. Hududlar indeks darajasiga ko'ra uch guruhga ajratilgan hamda tumanlarni ixtisoslashtirish, o'sish nuqtalari, investitsiyalarni manzilli taqsimlash va integral indeksga asoslangan monitoring tizimini o'z ichiga olgan nomutanosibliklarni qisqartirishning tabaqalashtirilgan mexanizmi taklif etilgan.

Kalit so'zlar: hududiy nomutanosibliklar, ijtimoiy-iqtisodiy rivojlanish, integral indeks, entropiya usuli, Teyl indeksi, klaster tahlili, o'sish nuqtalari, Buxoro viloyati.

Аннотация. Сокращение региональных диспропорций является одной из ключевых целей социально-экономической политики Узбекистана. В статье исследуются диспропорции социально-экономического развития 11 районов и 2 городов Бухарской области и предлагаются механизмы их сокращения. Предложена система из 20 показателей в четырёх блоках (экономическом, социальном, инфраструктурном и экологическом) и методика, основанная на min-max нормализации, энтропийном методе взвешивания, коэффициенте вариации и индексе Тейла. Эмпирический расчёт выполнен по официальным данным Управления статистики Бухарской области за 2024 год по четырём показателям, публикуемым по всем районам: рыночные услуги на душу населения, продукция сельского хозяйства на душу населения, темп роста рыночных услуг и число предприятий с иностранным капиталом на 10 000 человек населения. Наибольшее (город Бухара, 0,857) и наименьшее (Шафирканский район, 0,087) значения интегрального индекса различаются почти в десять раз; коэффициент вариации индекса составляет 77,1%. Индекс Тейла равен 0,208 по рыночным услугам, 0,173 по продукции сельского хозяйства и 0,522 по предприятиям с иностранным капиталом, что свидетельствует о наиболее сильной концентрации иностранных инвестиций. Территории разделены на три группы по уровню индекса, предложен дифференцированный механизм сокращения диспропорций, включающий специализацию районов, точки роста, адресное распределение инвестиций и систему мониторинга на основе интегрального индекса.

Ключевые слова: региональные диспропорции, социально-экономическое развитие, интегральный индекс, энтропийный метод, индекс Тейла, кластерный анализ, точки роста, Бухарская область.

Abstract. Reducing regional disparities is one of the key goals of the socio-economic policy of Uzbekistan. This article examines the disparities in the socio-economic development of the 11 districts and 2 cities of Bukhara region and proposes mechanisms for reducing them. The study

proposes a system of 20 indicators in four blocks (economic, social, infrastructure and environmental) and a methodology based on min-max normalization, the entropy weight method, the coefficient of variation and the Theil index. The empirical calculation uses official 2024 data of the Bukhara Regional Department of Statistics on four indicators that are published for all districts: market services per capita, agricultural output per capita, the growth rate of market services, and the number of enterprises with foreign capital per 10,000 population. The integral index differs almost tenfold between the highest value (Bukhara city, 0,857) and the lowest (Shofirkon district, 0,087); the coefficient of variation of the index is 77,1%. The Theil index equals 0,208 for market services, 0,173 for agricultural output and 0,522 for enterprises with foreign capital, which shows that the strongest concentration is in foreign investment. Territories are divided into three groups by the level of the index, and a differentiated mechanism for reducing disparities is proposed, including specialization of districts, growth points, targeted allocation of investment and a monitoring system based on the integral index.

Keywords: regional disparities, socio-economic development, integral index, entropy method, Theil index, cluster analysis, growth points, Bukhara region, district.

INTRODUCTION

Balanced territorial development is a necessary condition for sustainable economic growth. When the gap between developed and lagging territories becomes too large, it leads to differences in incomes and living standards, outflow of labour from peripheral areas, unemployment and poverty in rural districts, and overloading of infrastructure in large cities. For this reason, reducing regional disparities is an important direction of economic policy in the European Union, China, the Republic of Korea, Kazakhstan and many other countries [10; 11; 13].

In Uzbekistan, large-scale reforms are being carried out to develop regions in a comprehensive way. The Development Strategy of New Uzbekistan for 2022-2026 approved by the Decree of the President No. PF-60 of 28 January 2022 [16] and the "Uzbekistan - 2030" Strategy approved by Decree No. PF-158 of 11 September 2023 [17] set the tasks of reducing poverty, creating jobs in every district and ensuring balanced development of territories. The system of working at the level of each mahalla, specialization of districts and targeted support of lagging territories have become important tools of regional policy.

Bukhara region consists of 11 districts (Olot, Bukhara, Vobkent, G'ijduvon, Jondor, Kogon, Qorako'l, Qorovulbozor, Peshku, Romitan and Shofirkon) and two cities of regional subordination (Bukhara and Kogon). The region has a rich tourism potential, developed agriculture, oil refining, textile and food industries. At the same time, the levels of development of its districts differ significantly. The city of Bukhara and the districts located close to it have a more diversified economy and better infrastructure, while the peripheral districts located in the desert zone and in the lower reaches of the Zarafshan river face water shortages, soil salinization, a narrow economic base and lower incomes.

The scientific problem of the study is the lack of a comprehensive methodology for measuring disparities between districts of the region and of a differentiated mechanism for reducing them. Official statistics provide many separate indicators, but they are rarely combined into a single assessment that takes into account economic, social, infrastructure and environmental aspects at the same time. The aim of the article is to develop a methodology for assessing disparities in the socio-economic development of the districts of Bukhara region and to propose mechanisms for reducing them.

MATERIALS

The theoretical foundations of the study are formed by several schools of regional economics. F. Perroux developed the theory of growth poles, according to which economic growth does not appear everywhere at the same time, but is concentrated in certain centres and then spreads to the surrounding territories [8]. G. Myrdal formulated the principle of cumulative causation: developed regions attract capital, labour and entrepreneurs from less developed regions, and without state intervention the gap between them tends to increase ("backwash effects") [1]. A. Hirschman, on the

contrary, emphasized that growth in leading regions can create positive "trickle-down" effects for lagging regions [7].

J. Williamson showed that regional disparities tend to increase at the early stages of national development and decrease at later stages, and proposed a weighted coefficient of variation for measuring them [2]. P. Krugman explained the concentration of production in certain territories through economies of scale and transport costs within the framework of the new economic geography [3]. R. Barro and X. Sala-i-Martin developed methods for testing the convergence of regions, that is, whether poorer regions grow faster than richer ones [4]. The World Bank's World Development Report 2009 concluded that economic growth is naturally uneven in space, but living standards can converge if policy ensures access to basic services and connects lagging areas with markets [12].

Recent studies pay special attention to the political and social consequences of regional disparities. A. Rodríguez-Pose argued that the neglect of "places that don't matter" leads to economic stagnation and social discontent, and called for place-sensitive development policies [14]. S. Iammarino, A. Rodríguez-Pose and M. Storper showed that regional inequality in Europe has increased since the 1980s and proposed differentiated policies for regions with different levels of development [13]. The OECD recommends moving from subsidies for lagging regions to policies that use the specific assets and potential of each territory [11].

Methodological works also play an important role. H. Theil proposed an inequality index based on information theory [5], and A. Shorrocks proved that this index can be decomposed into within-group and between-group components [6]. This property is very useful for regional analysis, because it shows what part of total inequality is explained by differences between groups of territories. For multivariate classification of territories, the k-means method proposed by J. MacQueen is widely used [9].

The information base of the study consists of official statistical bulletins of the Bukhara Regional Department of Statistics for 2024: population by districts and cities as of 1 January 2025 [18], market services by districts and cities for January-December 2024 [19], agricultural, forestry and fishery output for January-December 2024 [20], and the number of operating enterprises with foreign capital by districts and cities as of 1 September 2024 [21]. Regulatory documents [16; 17] and publications of international organizations [11; 12] were also used.

METHODS

The study uses the methods of systemic and comparative analysis, statistical grouping, index method, entropy weighting, inequality measures and cluster analysis. The research was carried out in five stages.

At the **first stage**, a system of indicators was formed. Twenty indicators were selected and grouped into four blocks: economic, social, infrastructure and environmental (Table 1). The main criteria for selecting indicators were their availability at the district level in official statistics, comparability between districts (indicators are calculated per capita or as shares), and their importance for the quality of life of the population. Since not all of these indicators are published in open bulletins at the district level, the empirical calculation for 2024 was carried out on four indicators for which explicit district-level data are available (Table 2). Per capita values were calculated using the permanent population as of 1 January 2025; the population of district towns (G'ijduvon, Vobkent, Qorako'l and others) is included in the population of the corresponding districts, and the sum of districts and the two cities equals the regional total of 2,077.0 thousand people.

At the **second stage**, indicators were normalized, because they are measured in different units. For indicators with a positive effect on development (stimulants), the following formula is used:

$$Z_{ij} = \frac{x_{ij} - x_{i,min}}{x_{i,max} - x_{i,min}} \quad (1)$$

where x_{ij} is the value of indicator i for district j ; $x_{i,min}$ and $x_{i,max}$ are the minimum and maximum values of this indicator among the districts. For indicators with a negative effect

(destimulants), such as the unemployment rate or the share of poor families, the numerator is replaced by $(x_{i,\max} - x_{ij})$.

At the **third stage**, the weights of the indicators were determined by the entropy method. This method is objective: an indicator receives a larger weight if its values differ more between districts, that is, if it carries more information about disparities. First, the share of each district is calculated, and then the entropy of each indicator:

$$e_i = -\frac{1}{\ln n} \sum_{j=1}^n p_{ij} \cdot \ln p_{ij}, p_{ij} = \frac{z_{ij}}{\sum_{j=1}^n z_{ij}} \quad (2)$$

The weight of indicator i is calculated as follows:

$$w_i = \frac{1 - e_i}{\sum_{i=1}^m (1 - e_i)} \quad (3)$$

where n is the number of territorial units (11 districts and 2 cities, $n = 13$), and m is the number of indicators ($m = 4$ in the empirical calculation).

The integral index of socio-economic development of district j is calculated as the weighted sum of normalized indicators:

$$I_j = \sum_{i=1}^m w_i \cdot z_{ij} \quad (4)$$

At the **fourth stage**, the level of disparity between districts was measured. Two indicators are used. The coefficient of variation shows the relative spread of the integral index:

$$V = \frac{\sigma}{\bar{I}} \times 100\% \quad (5)$$

The Theil index is used to measure disparities in per capita indicators (for example, per capita output or income), taking into account the population of each district:

$$T = \sum_{j=1}^n s_j \cdot \ln \frac{s_j}{q_j} \quad (6)$$

where s_j is the share of district j in the total value of the indicator in the region, and q_j is the share of the district in the population of the region. $T = 0$ means complete equality; the larger the value, the higher the disparity. The Theil index is decomposed into the between-group and within-group components to determine the contribution of differences between types of districts to the total disparity [6].

At the **fifth stage**, territories were grouped by the value of the integral index using the rule of the mean and half of the standard deviation: group I - high level ($I_j > \bar{I} + 0.5\sigma$), group II - medium level ($\bar{I} - 0.5\sigma \leq I_j \leq \bar{I} + 0.5\sigma$), group III - low level ($I_j < \bar{I} - 0.5\sigma$). This rule was preferred to k-means clustering [9], because with 13 units and two outliers (Bukhara city and Qorovulbozor district) k-means places almost all districts into one cluster. Calculations were carried out in Python (NumPy).

RESULTS

The first result of the study is the system of indicators for assessing the socio-economic development of districts (Table 1). Unlike approaches that compare territories only by output or investment, the proposed system includes social, infrastructure and environmental indicators. This is especially important for Bukhara region, where water availability and land quality largely determine the possibilities for economic activity and the living conditions of the population.

Table 1. System of indicators for assessing the socio-economic development of districts

Block	Indicators
Economic (E1-E6)	E1 - industrial output per capita; E2 - agricultural output per capita; E3 - market services per capita; E4 - investment in fixed capital per capita; E5 - share of small business in the district's economy; E6 - export volume per capita
Social (S1-S5)	S1 - employment rate of the working-age population; S2 - unemployment rate (destimulant); S3 - share of families in need of social protection (destimulant); S4 - average monthly wage; S5 - coverage of children with preschool education

Block	Indicators
Infrastructure (I1-I5)	I1 - provision of the population with centralized drinking water; I2 - provision with natural gas; I3 - density of paved roads; I4 - number of physicians per 10.000 people; I5 - housing commissioned per 1.000 people
Environmental (N1-N4)	N1 - water supply per hectare of irrigated land; N2 - share of strongly and moderately saline land (destimulant); N3 - share of land with favourable reclamation condition; N4 - emissions of pollutants per capita (destimulant)

The second result is the calculation of the integral development index for the districts and cities of Bukhara region on the basis of 2024 data (Table 2). The entropy method assigned the largest weights to the number of enterprises with foreign capital (0,389) and market services per capita (0,372), because these indicators differ most between territories. The weights of agricultural output per capita (0,122) and the growth rate of services (0,118) are lower.

Table 2. Indicators and integral development index of districts and cities of Bukhara region, 2024

District / city	Services	Agri-culture	Growth	FCE	Index I	Rank	Group
Bukhara city	30.69	1.53	112.5	6.03	0.857	1	I
Qorovulbozor	23.28	57.75	108.2	2.96	0.562	2	I
Kogon district	9.00	33.48	111.2	2.90	0.362	3	II
Kogon city	13.42	3.20	110.1	1.98	0.274	4	II
Vobkent	9.74	24.37	113.4	0.53	0.240	5	II
Olot	7.28	26.52	111.1	1.51	0.224	6	II
Bukhara district	6.63	24.66	110.9	1.60	0.212	7	II
Romitan	8.40	28.91	110.3	0.85	0.182	8	II
G'ijduvon	8.58	14.83	111.4	0.40	0.148	9	III
Jondor	6.62	28.17	110.7	0.37	0.130	10	III
Peshku	9.37	30.11	108.5	0.37	0.126	11	III
Qorako'l	5.80	22.10	110.0	0.75	0.115	12	III
Shofirkon	5.55	19.56	109.5	0.64	0.087	13	III
Entropy weight (w)	0.372	0.122	0.118	0.389	—	—	—
Coefficient of variation, %	64.8	55.6	1.3	96.4	77.1	—	—

The results show a very high level of disparity. The integral index of Bukhara city (0,857) is almost ten times higher than that of Shofirkon district (0,087), and the coefficient of variation of the index is 77,1%. Market services are strongly concentrated in the regional centre: Bukhara city accounts for 26.7% of all market services of the region with 14.5% of the population, and its services per capita (30,69 mln soum) are 5.5 times higher than in Shofirkon district (5,55 mln soum). The concentration of enterprises with foreign capital is even stronger: 181 of 341 such enterprises (53.1%) are located in Bukhara city, and the coefficient of variation of this indicator reaches 96,4%. The Theil index confirms this conclusion: it equals 0,522 for enterprises with foreign capital, 0,208 for market services and 0,173 for agricultural output. By contrast, the growth rates of services are very similar in all territories (108.2-113.4%), so the gap in absolute levels is not closing quickly.

The third result is the grouping of territories (Table 3). Group I (high level) includes Bukhara city and Qorovulbozor district. Group II (medium level) includes Kogon district, Kogon city, Vobkent, Olot, Bukhara and Romitan districts. Group III (low level) includes G'ijduvon, Jondor, Peshku, Qorako'l and Shofirkon districts.

Two results require explanation. First, Qorovulbozor district is in group I because of its very small population (20.3 thousand people): the district hosts the Bukhara oil refinery and related transport and service activities, so its per capita values are high, although this does not mean that the living conditions of its population are better than in other districts. Second, G'ijduvon district, which has the largest population in the region (327.5 thousand people) and large absolute volumes of agricultural output and services, is in group III because of its low per capita values and the small number of enterprises with foreign capital. These two cases show that absolute and per capita indicators can give very different pictures, and that the index should be interpreted together with the structure of the local economy.

Table 3. Groups of territories of Bukhara region by the integral index (2024) and directions of policy

Group	Territories	Priority policy directions
I. High level ($I > 0.375$)	Bukhara city, Qorovulbozor district	Development of high value-added services, tourism and logistics in Bukhara city; spreading growth to neighbouring districts; in Qorovulbozor - using the revenues of the industrial base for social infrastructure
II. Medium level ($0.166-0.375$)	Kogon district, Kogon city, Vobkent, Olot, Bukhara district, Romitan	Agro-industrial clusters, deep processing of agricultural products, logistics around the Kogon transport hub, attracting foreign investment to district industrial zones
III. Low level ($I < 0.166$)	G'ijduvon, Jondor, Peshku, Qorako'l, Shofirkon	Growth points (small industrial zones, agro-logistics centres, craft and tourism clusters), support of small business and family entrepreneurship, water-saving technologies, priority investment in infrastructure

The fourth result is a mechanism for reducing disparities between districts. It consists of four interrelated components. The **diagnostic component** includes the annual calculation of the integral index and the Theil index and the publication of the results; it allows the regional administration to identify lagging districts early. The **strategic component** includes the specialization of each district in accordance with its type and the creation of "growth points" in each lagging district, for example, small industrial zones, agro-logistics centres or tourism sites. The **financial component** includes the allocation of part of the regional investment programme and additional local budget revenues according to a formula that gives priority to districts with a low index value. The **institutional component** includes the inclusion of index targets in the development programmes of districts and the evaluation of the work of district administrations by the dynamics of the index.

DISCUSSION

The results of the study are consistent with the theory of cumulative causation of G. Myrdal [1]. The concentration of services, tourism and investment in the regional centre attracts resources from the periphery, and without targeted measures this process can increase disparities. At the same time, the experience of the regional centre as a growth pole, in the sense of F. Perroux [8], can be used to spread development to neighbouring districts, if transport links, supply chains and cooperation between enterprises are strengthened. This corresponds to the conclusion of the World Bank that the integration of lagging areas with leading areas is more effective than trying to create identical economic structures everywhere [12].

The use of the entropy method for weighting indicators has an advantage over expert methods, because the weights are determined by the data themselves. However, the method gives a large weight to indicators with high variation, even if their importance for the quality of life is limited. In our calculation, the growth rate of services received a weight of 0.118, although its coefficient of variation is only 1.3%, because min-max normalization stretches small differences to

the full range from 0 to 1. Therefore, it is advisable to compare the results with those obtained using equal or expert weights, in order to check the robustness of the ranking of districts.

The grouping supports the idea of place-based policy put forward by the OECD and by A. Rodríguez-Pose [11; 14]. The districts of group III do not need the same measures as the regional centre. The low position of large agricultural districts such as G'ijduvon, Jondor and Shofirkon shows that a large agricultural sector alone does not ensure a high level of development if it is not combined with processing, services and investment. For these districts, the main reserves are deeper processing of agricultural products, development of services and small business, and attracting investment. For the regional centre, the main task is to increase value added and to share growth with neighbouring territories.

The study has limitations. The empirical calculation is based on only four indicators for one year, because many important indicators (industrial output, investment, incomes, unemployment, infrastructure and environmental indicators) are not published in open bulletins in a form that explicitly links values to districts. Per capita indicators may be distorted by a very small population, as in the case of Qorovulbozor district. Volumes of services that are not distributed by territory (about 32% of the regional total) are excluded. In further research, it is planned to use the full system of 20 indicators on the basis of official data requested from the regional statistics department, to extend the period of analysis, to test beta- and sigma-convergence of districts, and to build econometric models of the factors of disparity. Satellite data on night-time lights, which have proven to be a reliable proxy for economic activity [15], can also be used to fill gaps in district-level statistics.

CONCLUSION

The study allows the following conclusions to be drawn. First, disparities in the socio-economic development of territories should be assessed in a multidimensional way, taking into account not only economic, but also social, infrastructure and environmental indicators. The proposed system of 20 indicators in four blocks meets this requirement; the 2024 calculation on four indicators available in official bulletins already shows a very high level of disparity between the territories of Bukhara region (coefficient of variation of the integral index 77.1%, tenfold gap between the highest and lowest values).

Second, the combination of min-max normalization, the entropy weight method, the coefficient of variation and the Theil index makes it possible to obtain an objective integral assessment of the development of each district and to measure the level and dynamics of disparities in the region.

Third, the territories of Bukhara region are divided into three groups: high level (Bukhara city, Qorovulbozor district), medium level (Kogon district, Kogon city, Vobkent, Olot, Bukhara and Romitan districts) and low level (G'ijduvon, Jondor, Peshku, Qorako'l and Shofirkon districts). The strongest concentration is observed in enterprises with foreign capital (Theil index 0.522), so attracting foreign investment to district industrial zones should be a key direction of policy for lagging districts. Each group requires its own set of policy measures.

Fourth, it is recommended: to calculate the integral development index of districts annually and to publish the results; to include index targets in district development programmes; to allocate part of the regional investment programme according to a formula that gives priority to lagging districts; to create "growth points" in peripheral districts, including small industrial zones and agro-logistics centres; and to give priority to water-saving technologies, land reclamation and drinking water supply in the desert zone districts. The implementation of these measures will contribute to the balanced development of Bukhara region and to the goals of the "Uzbekistan – 2030" Strategy.

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