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THE KMRI METHODOLOGY FOR COMPREHENSIVE ASSESSMENT OF REGIONAL DEVELOPMENT: THEORETICAL FOUNDATIONS AND PRACTICAL ASPECTS

ABSTRACT

Regional development assessment remains one of the most complex and contested methodological challenges in economic science. Traditional approaches relying predominantly on single-indicator measures such as gross regional product or per capita income have demonstrated significant limitations in capturing the inherently multidimensional nature of regional development. This article presents the KMRI (Kompleks Mintaqaviy Rivojlanish Indeksi — Comprehensive Regional Development Index) methodology, a multi-criteria composite assessment framework developed for the systematic evaluation of regional development in Uzbekistan. The KMRI integrates five weighted dimensional indices — economic productivity, social development, institutional quality, infrastructure endowment, and environmental sustainability — into a unified composite score enabling both inter-regional benchmarking and longitudinal monitoring. Pilot application to all thirteen administrative regions of Uzbekistan and the Republic of Karakalpakstan using 2019–2023 data reveals pronounced inter-regional disparities (KMRI range: 0.251–0.831) and a pattern of divergence rather than convergence over the study period.

Keywords: *regional development, composite index, KMRI methodology, multi-criteria assessment, regional disparities, Uzbekistan, regional policy, development monitoring, human development, economic indicators, index method*

1. INTRODUCTION

The measurement and evaluation of regional development has long occupied a central position in economic science. In practice, however, regional development assessment is frequently reduced to one or two aggregate measures — most commonly gross regional product or per capita income — which fail to capture the inherently multidimensional character of development as a simultaneously economic, social, institutional, and environmental phenomenon (Stiglitz, Sen & Fitoussi, 2010) [10].

A range of composite development assessment approaches have been elaborated in international practice. The Human Development Index (HDI), introduced by UNDP in 1990, remains the most influential methodological innovation, demonstrating that combining health, education, and income into a single composite score generates analytically richer insights than any single component alone [11]. The European Union's Regional Competitiveness Index (RCI) extends this logic to encompass eleven pillars of competitiveness [7]. While each of these frameworks contributes important methodological insights, none has been comprehensively adapted to the specific structural characteristics, statistical data environment, and policy priorities of Uzbekistan's administrative regions.

Uzbekistan's economic and administrative context provides additional motivation for a region-specific composite index. The country is characterized by pronounced agro-climatic, demographic, and economic heterogeneity across its thirteen administrative units. These structural specificities argue for a composite index calibrated to Uzbekistan's context rather than a direct application of international frameworks. The KMRI methodology presented in this article is designed to address this gap.

Table 1. International Composite Development Indices: Methodological Comparison

Index	Developer	Dimensions / Pillars	Weighting Method	Territorial Level	Adapted to Uzbekistan?
Human Development Index (HDI)	UNDP	3 (health, education, income)	Equal weights	Country / sub-national	Partially (UNDP Uzbekistan 2022)
EU Regional Competitiveness Index (RCI)	European Commission	11 pillars	PCA-based	EU NUTS-2 regions	No
Worldwide Governance Indicators (WGI)	World Bank	6 governance dimensions	Unobserved components	Country level	No
Global Competitiveness Index (GCI)	World Economic Forum	12 pillars	Expert + statistical	Country level	No
KMRI (Present Study)	Nazarov (2024)	5 dimensions, 21 indicators	Delphi + PCA dual	Uzbekistan regions (13)	Yes — fully adapted

Table 1. Comparative overview of international composite development indices and the KMRI methodology. Sources: UNDP (2022); European Commission (2022); World Bank (2023); WEF (2023); author's elaboration.

2. MATERIALS

The theoretical and empirical foundation of the KMRI methodology rests on three principal groups of sources: economic measurement theory, the regional economics literature, and the methodological experience of international development organizations.

From a theoretical standpoint, the study draws primarily on Amartya Sen's (1999) capability approach, according to which development should be oriented not toward income growth per se but toward the expansion of people's substantive freedoms and capabilities [9]. The landmark report by Stiglitz, Sen and Fitoussi (2010) provides a comprehensive critique of single-indicator approaches and proposes a multi-dimensional framework encompassing material living standards, health, education, personal activities, political voice, social connections, environment, and economic insecurity [10].

From the regional economics literature, Krugman's (1991) New Economic Geography explains the mechanisms through which inter-regional development disparities arise and persist through agglomeration economies, cumulative causation, and spatial concentration of economic activity [8]. Barro and Sala-i-Martin's (1992) regional convergence theory provides an analytical baseline — the prediction of beta-convergence — against which empirical development trends can be benchmarked [5]. Camagni and Capello's (2013) framework of territorial capital and regional competitiveness motivates the inclusion of institutional quality and infrastructure endowment as KMRI dimensions [6].

Table 2. Theoretical Foundations of the KMRI Framework

Theoretical Framework	Key Author(s)	Year	Core Contribution to KMRI Design
Capability Approach	Sen, A.	1999	Rationale for social & institutional dimensions beyond income; development = capability expansion
Beyond-GDP Framework	Stiglitz, Sen & Fitoussi	2010	Multi-dimensional measurement imperative; critique of single-indicator approaches
New Economic Geography	Krugman, P.	1991	Agglomeration economies → divergence mechanism;

			interpretation of KMRI temporal trend
Regional Convergence Theory	Barro & Sala-i-Martin	1992	Beta-convergence baseline; KMRI divergence finding benchmarked against convergence prediction
Territorial Capital & Competitiveness	Camagni & Capello	2013	Institutional quality and infrastructure as regional competitive dimensions
Human Development Index	UNDP	1990–2022	Normalization procedure (min-max); composite score aggregation methodology
Index Method (district level)	Nazarov Sh.I.	2023–2026	Direct methodological prototype; 5-dimensional coefficient system; PCA/Delphi validation

Table 2. Theoretical and methodological sources informing the KMRI framework design, indicator selection, and analytical interpretation.

3. METHODS

The KMRI methodology is grounded in the principle of multi-dimensional composite index construction and was developed through five sequential and methodologically interdependent steps: (1) identification of dimensions and indicators; (2) data normalization; (3) weighting procedure; (4) composite index calculation; and (5) regional classification.

3.1. Identification of Dimensions and Indicators

Five core KMRI dimensions were identified through a combination of systematic literature review, international framework analysis, and expert evaluation. For each dimension, between three and five measurable indicators were selected, yielding a total of 21 indicators governed by three selection criteria: data availability, temporal comparability, and theoretical alignment.

Table 3. KMRI Framework: Five Dimensions, Indicators, and Weights

Dimension	Weight	Indicators (4–5 per dimension)	Source of Data
1. Economic Productivity	0.30 (30%)	GRP per capita; industrial output growth rate; FDI volume attracted; registered business entities per capita	Statistics Committee of Uzbekistan; Ministry of Economy
2. Social Development	0.25 (25%)	Life expectancy at birth; secondary & tertiary educational attainment; per capita healthcare expenditure; official poverty rate (inverse)	Statistics Committee; Ministry of Health; UNDP
3. Institutional Quality	0.20 (20%)	Local executive authority performance ratings; business environment quality index; digitalization of administrative services; citizen corruption perception surveys	Ministry of Economy; UNDP; expert surveys
4. Infrastructure Endowment	0.15 (15%)	Road network density per 100 km²; safe drinking water provision rate; electricity supply reliability; mobile internet access share	Statistics Committee; Ministry of Transport; World Bank
5. Environmental Sustainability	0.10 (10%)	Atmospheric pollution index (inverse); land degradation indicator (inverse); renewable energy share; waste recycling rate	State Ecology Committee; UNDP;

			Ministry of Energy
TOTAL	1.00 (100%)	21 indicators across 5 dimensions	2019–2023 annual data, all 13 regions

Table 3. KMRI five-dimensional framework: dimensions, weights (Delphi+PCA), indicators, and data sources. Inverse indicators (poverty rate, pollution index, land degradation) are reverse-normalized so that higher scores consistently indicate better performance.

3.2. Data Normalization

To render indicators expressed in heterogeneous units comparable within a unified composite framework, the min-max normalization method was applied. The normalized value (Iij) for each indicator was calculated as:

$$Iij = (Xij - Xij\_min) / (Xij\_max - Xij\_min)$$

where Xij is the actual value of indicator j for region i; Xij_min and Xij_max are the minimum and maximum values across all regions in the reference year. For inverse indicators — the poverty rate, atmospheric pollution index, and land degradation indicator — the normalization formula was reversed so that higher scores consistently indicate better performance.

3.3. Weighting Procedure

Two complementary approaches were applied to ensure robustness. First, structured expert evaluation using the Delphi method (18 specialists, 2 iterative rounds). Second, Principal Component Analysis (PCA) to identify statistical redundancies among indicators. Final weights represent the equally-weighted average of Delphi and PCA results: Economic Productivity — 0.30; Social Development — 0.25; Institutional Quality — 0.20; Infrastructure Endowment — 0.15; Environmental Sustainability — 0.10.

3.4. Composite Index Calculation and Regional Classification

The KMRI composite score for each region i was calculated as a weighted sum of normalized dimensional scores:

$$KMRI\_i = \Sigma (W\_k \times D\_ik)$$

Regions were then classified into four development tiers: High Development (KMRI ≥ 0.70); Medium Development (0.50 ≤ KMRI < 0.70); Below-Average Development (0.35 ≤ KMRI < 0.50); and Low Development (KMRI < 0.35). Thresholds were calibrated through sensitivity analysis to ensure stability with respect to small variations in threshold values.

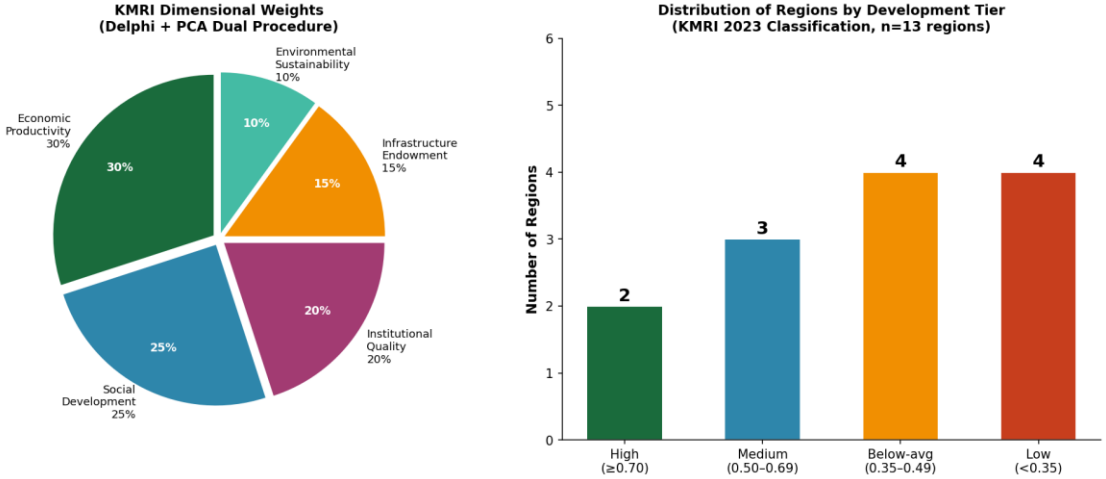

Figure 1. Left: KMRI dimensional weights (Delphi + PCA dual procedure). Right: Distribution of Uzbekistan's 13 regions across four development tiers (KMRI 2023 classification).

4. RESULTS

4.1. KMRI Composite Scores by Region (2023)

KMRI composite scores computed from 2019–2023 data reveal significant and structurally consistent development disparities across Uzbekistan's regions. Tashkent city (KMRI = 0.831) and

Tashkent region (0.714) constitute the High Development group. The Medium Development group comprises Samarkand (0.631), Fergana (0.618), and Bukhara (0.587). The Below-Average group includes Andijan (0.498), Namangan (0.476), Jizzakh (0.451), and Navoi (0.439). The Low Development group comprises Khorezm (0.342), Kashkadarya (0.318), Surkhandarya (0.297), and the Republic of Karakalpakstan (0.251).

Table 4. KMRI Composite Scores and Development Tier Classification (2023)

Rank	Region	KMRI 2023	KMRI 2019	Change 2019→2023	Development Tier
1	Tashkent city	0.831	0.789	+0.042	High Development
2	Tashkent region	0.714	0.674	+0.040	High Development
3	Samarkand region	0.631	0.594	+0.037	Medium Development
4	Fergana region	0.618	0.581	+0.037	Medium Development
5	Bukhara region	0.587	0.549	+0.038	Medium Development
6	Andijan region	0.498	0.462	+0.036	Below-Average Development
7	Namangan region	0.476	0.441	+0.035	Below-Average Development
8	Jizzakh region	0.451	0.417	+0.034	Below-Average Development
9	Navoi region	0.439	0.405	+0.034	Below-Average Development
10	Khorezm region	0.342	0.311	+0.031	Low Development
11	Kashkadarya region	0.318	0.286	+0.032	Low Development
12	Surkhandarya region	0.297	0.267	+0.030	Low Development
13	Rep. of Karakalpakstan	0.251	0.265	–0.014	Low Development
—	Uzbekistan Average	0.495	0.457	+0.038	—

Table 4. KMRI composite scores for all 13 regions of Uzbekistan and the Republic of Karakalpakstan (2023 and 2019 baseline). Data: Statistics Committee of Uzbekistan (2024); Ministry of Economy and Finance (2024); author's calculations.

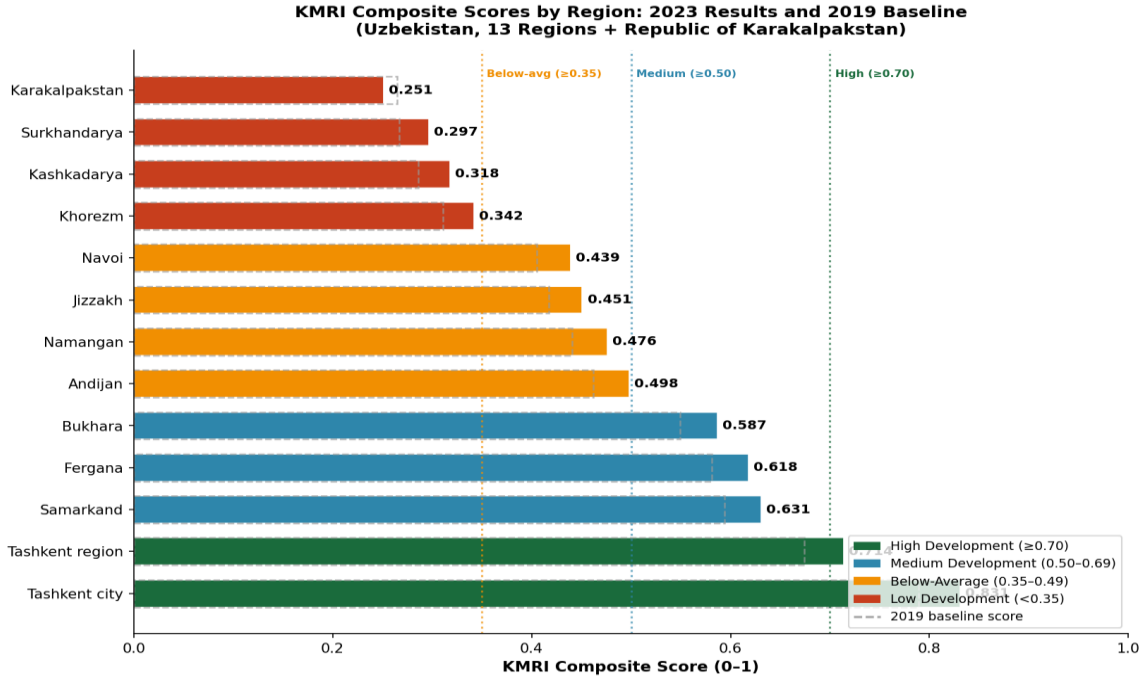

Figure 2. KMRI composite scores by region (2023, solid bars) and 2019 baseline (dashed outline). Color coding reflects development tier classification. Vertical dotted lines indicate tier thresholds. Source: author's calculations.

4.2. Dimensional Analysis

Analysis of KMRI scores disaggregated by dimension reveals dimension-specific patterns of strength and weakness masked in the composite score. Navoi region records a high Economic Productivity score (0.703) driven by large-scale mining and chemical industry investment, but a moderate Social Development score (0.452) — a clear illustration of the disconnect between capital-intensive extractive growth and broad-based human development. Karakalpakstan records its lowest dimensional score on Environmental Sustainability (0.121), reflecting the compound ecological legacy of the Aral Sea disaster.

Table 5. KMRI Dimensional Scores for Selected Regions (2023)

Region	Economic Productivity (w=0.30)	Social Development (w=0.25)	Institutional Quality (w=0.20)	Infrastructure Endowment (w=0.15)	Environmental Sustainability (w=0.10)	KMRI Composite
Tashkent city	0.912	0.889	0.741	0.798	0.712	0.831
Tashkent region	0.748	0.712	0.668	0.692	0.641	0.714
Samarkand	0.651	0.624	0.601	0.587	0.598	0.631
Bukhara	0.621	0.574	0.531	0.512	0.487	0.587
Navoi	0.703	0.452	0.498	0.441	0.423	0.439 (*)
Andijan	0.521	0.498	0.471	0.452	0.467	0.498
Karakalpakstan	0.198	0.214	0.312	0.198	0.121	0.251
Uzbekistan Avg	0.512	0.498	0.487	0.461	0.449	0.495

Table 5. Disaggregated KMRI dimensional scores for selected regions (2023). (*) Navoi region: high economic productivity score (0.703) but below-average composite (0.439) due to low social development and infrastructure scores — illustrating the analytical value of multi-dimensional assessment. Source: author's calculations.

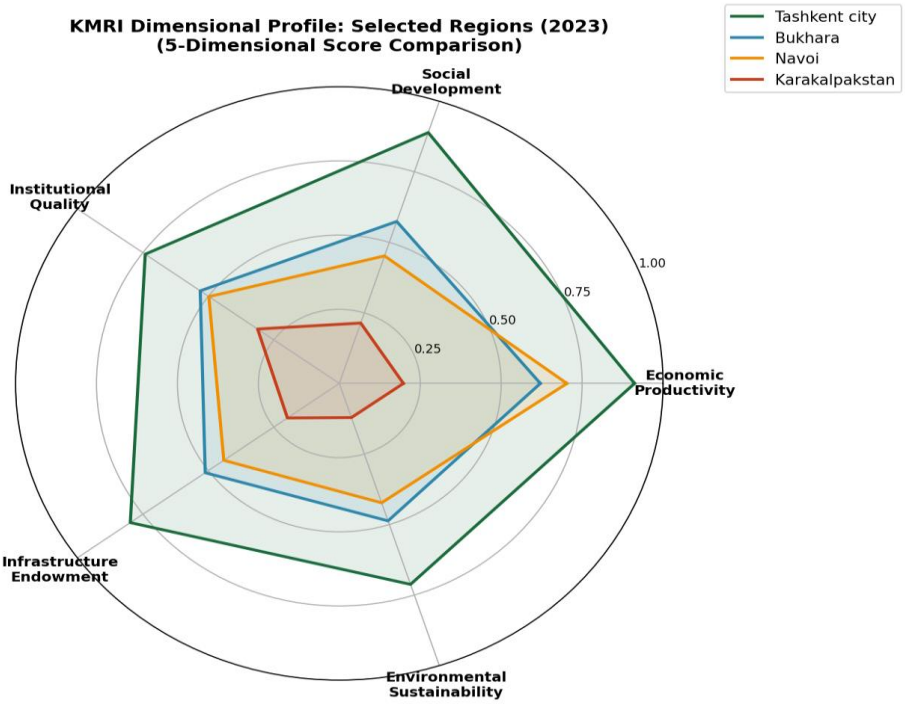

Figure 3. Radar chart of KMRI dimensional profiles for four selected regions (2023): Tashkent city (highest composite), Bukhara (mid-tier), Navoi (high economic / low social divergence), and Karakalpakstan (lowest composite). Source: author's calculations.

4.3. Temporal Dynamics (2019–2023)

Dynamic analysis of KMRI scores over the study period reveals an overall positive trend: all thirteen regions recorded KMRI increases over 2019–2023, with a mean improvement of 0.038 points. However, the Republic of Karakalpakstan is the only region that recorded a decline (–0.014 points), reflecting the compound deterioration of ecological and economic conditions. The critical finding is that the absolute gap between the High and Low Development groups has simultaneously widened: the KMRI difference between Tashkent city and Karakalpakstan expanded from 0.524 points in 2019 to 0.580 points in 2023 — a 10.7% widening of the inter-regional development gap. This pattern of divergence is consistent with Krugman's (1991) cumulative causation mechanism [8].

Table 6. KMRI Temporal Dynamics: Mean Annual Growth by Development Tier (2019–2023)

Development Tier	Regions Included	KMRI 2019 (avg)	KMRI 2023 (avg)	Absolute Change	Growth Rate (%)
High Development	Tashkent city, Tashkent region	0.732	0.773	+0.041	+5.6%
Medium Development	Samarkand, Fergana, Bukhara	0.575	0.612	+0.037	+6.4%
Below-Average Development	Andijan, Namangan, Jizzakh, Navoi	0.431	0.466	+0.034	+7.9%
Low Development	Khorezm, Kashkadarya, Surkhandarya, Karakalpakstan	0.282	0.302	+0.020	+7.1%
Uzbekistan overall (avg)	13 regions	0.457	0.495	+0.038	+8.3%
Inter-group gap (High – Low)	—	0.524 pts	0.580 pts	+0.056 pts	+10.7% widening

Table 6. KMRI temporal dynamics 2019–2023 by development tier. Despite universal improvement, the inter-group development gap widened by 10.7%, signaling divergence rather than convergence. Source: author's calculations.

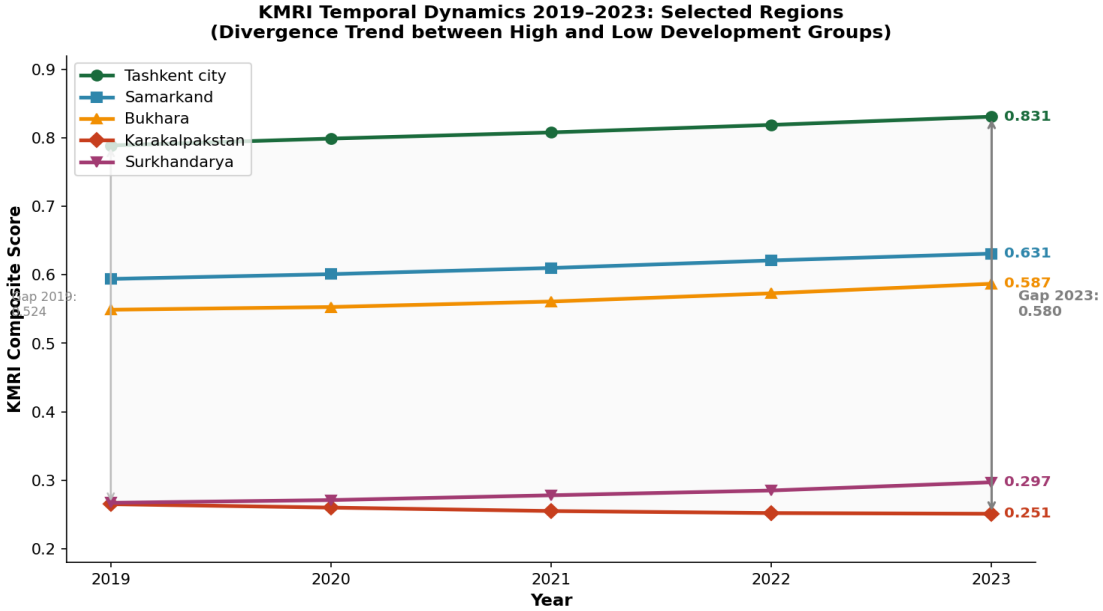

Figure 4. KMRI temporal dynamics 2019–2023 for selected regions. Note widening gap between Tashkent city (top) and Karakalpakstan (bottom): 0.524 pts in 2019 → 0.580 pts in 2023 (+10.7%). Source: author's calculations.

5. DISCUSSION

The findings of this study generate several important implications for both regional development theory and practice. At the theoretical level, the KMRI results provide empirical support for three established propositions in the development economics literature. First, they corroborate Stiglitz, Sen and Fitoussi's (2010) central argument that GDP-based measures systematically misrepresent the development status of regions [10]. Navoi region's divergence between high economic productivity (0.703) and moderate social development (0.452) is a particularly clear illustration of this phenomenon. Second, the finding of divergence over the study period aligns with Krugman's (1991) cumulative causation mechanism [8], suggesting that without corrective policy intervention, existing inter-regional disparities are likely to persist or widen. Third, the KMRI results confirm the analytical value of multi-dimensional composite frameworks pioneered by the HDI [11].

For regional governance practice, the KMRI results support three specific policy conclusions. First, resource allocation frameworks should be recalibrated to reflect multidimensional development gaps. The Republic of Karakalpakstan requires not only economic investment but simultaneously targeted interventions in ecological rehabilitation, infrastructure modernization, and social services delivery. Second, the institutional quality dimension's relatively small inter-regional variation suggests that second-generation institutional reforms — focused on implementation quality and local administrative capacity — represent the next priority frontier. Third, the divergence trend argues for a structural increase in equalization transfers to low-development regions, coupled with performance-based monitoring using the KMRI framework.

6. CONCLUSION

This article has presented the KMRI methodology for the comprehensive assessment of regional development in Uzbekistan, making three substantive contributions.

First, the article proposes and methodologically grounds a five-dimensional composite index integrating economic productivity, social development, institutional quality, infrastructure endowment, and environmental sustainability — adapted to Uzbekistan's regional data environment and calibrated through a dual Delphi/PCA weighting procedure.

Second, the pilot application of the KMRI to 2019–2023 data reveals a widening development gap between Uzbekistan's leading and lagging regions, with KMRI scores ranging from 0.831 (Tashkent city) to 0.251 (Republic of Karakalpakstan). The temporal analysis finds a divergence trend — the inter-regional development gap widened by 10.7% over the study period.

Third, the KMRI provides a practical, transparent, and replicable analytical instrument for evidence-based regional policy design. Its adoption as an official monitoring framework by the Ministry of Economy and Finance of the Republic of Uzbekistan would substantially strengthen Uzbekistan's capacity to design targeted, differentiated, and measurable policies for equitable territorial development — directly supporting commitments under the UN Sustainable Development Goals and the New Uzbekistan Development Strategy 2022–2026.

REFERENCES

1. Nazarov Sh.I. Conceptual basis of socio-economic development of districts of Bukhara region // "IQTISODIYOT VA TURIZM" xalqaro ilmiy va innovatsion jurnali. — 2023. — №6(14). — P. 88–95.
2. Nazarov Sh.I. Shaxsning iqtisodiy xavfsizligini ta'minlash strategiyasini ishlab chiqish // "Yashil Iqtisodiyot va Taraqqiyot" jurnali. — 2023. — №8. — P. 320–326.
3. Nazarov Sh.I. Natural-economic potential of rural districts and opportunities for their efficient utilization // "IQTISODIYOT VA TURIZM" xalqaro ilmiy va innovatsion jurnali. — 2025. — №6(26). — P. 43–51.
4. Nazarov Sh.I. Analysis of the interrelationship between small business activities and poverty levels in regional districts // "IQTISODIYOT VA TURIZM" xalqaro ilmiy va innovatsion jurnali. — 2026. — №1(27). — P. 26–36.
5. Barro, R.J., & Sala-i-Martin, X. (1992). Convergence. Journal of Political Economy, 100(2), 223–251. https://doi.org/10.1086/261816

6. Camagni, R., & Capello, R. (2013). Regional competitiveness and territorial capital: a conceptual approach and empirical evidence from the European Union. Regional Studies, 47(9), 1383–1402. https://doi.org/10.1080/00343404.2012.681640
7. European Commission (2022). Regional Competitiveness Index 2022. Publications Office of the European Union, Luxembourg.
8. Krugman, P. (1991). Increasing returns and economic geography. Journal of Political Economy, 99(3), 483–499. https://doi.org/10.1086/261763
9. Sen, A. (1999). Development as Freedom. Oxford University Press, Oxford.
10. Stiglitz, J.E., Sen, A., & Fitoussi, J.P. (2010). Mismeasuring Our Lives: Why GDP Doesn't Add Up. The New Press, New York.
11. UNDP (2022). Human Development Report 2021/2022: Uncertain Times, Unsettled Lives. United Nations Development Programme, New York.
12. UNDP Uzbekistan (2022). National Human Development Report: Uzbekistan 2022. UNDP, Tashkent.
13. World Bank (2023). Uzbekistan Country Economic Memorandum. World Bank Group, Washington D.C.
14. World Economic Forum (2023). The Global Competitiveness Report 2023. WEF, Geneva.
15. Statistics Committee of the Republic of Uzbekistan (2024). Regional Socio-Economic Development Indicators 2019–2023. Tashkent.
16. Ministry of Economy and Finance of the Republic of Uzbekistan (2024). Regional Ratings Methodology and Results. Tashkent.
17. Decree of the President of the Republic of Uzbekistan No. UP-60, dated January 28, 2022, "On the Development Strategy of New Uzbekistan for 2022–2026". Tashkent.
18. Nardo, M., Saisana, M., Saltelli, A., & Tarantola, S. (2005). Tools for Composite Indicators Building. European Commission Joint Research Centre, Ispra.
19. OECD/JRC (2008). Handbook on Constructing Composite Indicators: Methodology and User Guide. OECD Publishing, Paris. https://doi.org/10.1787/9789264043466-en
20. Saisana, M., & Tarantola, S. (2002). State-of-the-Art Report on Current Methodologies and Practices for Composite Indicator Development. European Commission, EUR 20408 EN.
21. Annoni, P., & Dijkstra, L. (2019). The EU Regional Competitiveness Index 2019. European Commission Working Papers WP 02/2019.
22. Crescenzi, R., & Rodríguez-Pose, A. (2012). Infrastructure and regional growth in the European Union. Papers in Regional Science, 91(3), 487–513. https://doi.org/10.1111/j.1435-5957.2012.00439.x