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INFRASTRUCTURE DIFFERENCES AS A DETERMINANT OF UNEVEN ECONOMIC DEVELOPMENT BETWEEN BAKU AND THE REGIONS OF AZERBAIJAN

Abstract

The infrastructure disparities between Baku and Azerbaijan's regions create deep economic inequalities. The capital generates the majority of GDP and benefits from advanced transport and logistics systems, modern healthcare and education infrastructure, and a high Human Development Index. In contrast, the regions often suffer from poor road quality, limited public services, and lower welfare levels. These gaps lead to a concentration of economic opportunities and investments in Baku, while regional development remains slow and uneven. New infrastructure projects supported by the government and international financial institutions aim to stimulate growth in the regions and reduce the imbalance. However, the development gap between the capital and the periphery remains a serious challenge. Addressing these disparities is crucial for achieving sustainable and inclusive economic growth across Azerbaijan, ensuring that regional communities can equally benefit from national prosperity.

Keywords: Infrastructure disparities, regional development, Baku and regions, economic inequality, GDP distribution, core-periphery model.

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Introduction

After restoring its independence, Azerbaijan entered a new stage of socio-economic development. The export of energy resources to the world market, the implementation of the oil strategy, and state policies directed toward large-scale infrastructure projects led the country's economy to rapid growth. However, this development has not been evenly distributed across the country. Baku and the Absheron economic region have become the main centers of industry, finance, and services, while other regions have lagged behind in terms of economic and social development.

Existing studies indicate that inequality in economic development is linked not only to the distribution of natural resources but also to differences in infrastructure. Infrastructure disparities are decisive factors shaping the

investment attractiveness, business environment, and labor market of regions.

The aim of this paper is to analyze the role of infrastructure differences as the main determinant of economic inequality between Baku and other regions of Azerbaijan, to examine existing state policies, and to provide scientifically grounded recommendations for balanced development.

Main part

In explaining the regional disparities in Azerbaijan's socio-economic development, several theoretical approaches may be applied. Myrdal's "theory of cumulative causation" is particularly relevant in this context. According to this theory, developed centers attract economic resources, which further strengthens the core while leaving the periphery behind. In Azerbaijan, this pattern is clearly observable in the Baku–Absheron economic region. The

capital has become the hub of major industrial enterprises, financial institutions, and the service sector, drawing both capital and labor from the regions. Consequently, Baku has experienced rapid development, while the regions have faced economic stagnation and deepening social inequality [1, p.243].

Another important framework is Krugman's "new economic geography". This theory explains the concentration of economic activity through transportation costs, market size, and the division of labor. Baku, with its international airport, seaport, railway junctions, and highways, provides broad access to both domestic and international markets [9, p.74]. This has turned the city into an attractive center for producers and consumers alike. In contrast, limited market access, weak infrastructure, and underdeveloped specialization have constrained economic activities in the regions.

The integration and diffusion theory is partially evident in Azerbaijan's experience. Through state-led socio-economic development programs, certain infrastructure and social projects have been "diffused" from Baku to the regions. The reconstruction of roads, expansion of gasification, improvements in water supply, and the construction of schools and hospitals may be seen as results of this diffusion process. However, the impact has been uneven, and in many regions the expected outcomes have not fully materialized [2, p.152].

Modern approaches such as endogenous growth and sustainable development theories emphasize development based on the internal potential of regions. In this regard, the reconstruction potential of Karabakh and East Zangezur, the transit opportunities of Nakhchivan, the agricultural resources of Shaki-Zagatala, and the industrial capacity of Absheron can play significant roles in Azerbaijan's regional development. If these resources are utilized efficiently, the long-term disparities between Baku and the regions could be minimized [10].

Infrastructure is one of the key determinants of Azerbaijan's socio-economic development. As the physical and organizational foundation that enables

production, distribution, and consumption, it directly affects both national economic growth and regional equity [8, p.366].

Baku and the Absheron economic region are in a much more advantageous position in this regard. The capital hosts an international airport, the Baku International Sea Trade Port, major railway junctions, and highway corridors, all of which integrate Azerbaijan into the global economic system. Energy infrastructure is more stable in this area, while digital infrastructure – such as high-speed internet and IT services – has its core concentration in Baku. This has transformed the city into the strategic center of industry, finance, and services. As a result, Baku not only generates the majority of national GDP but also serves as the most attractive destination for foreign investors [5, p.35-37].

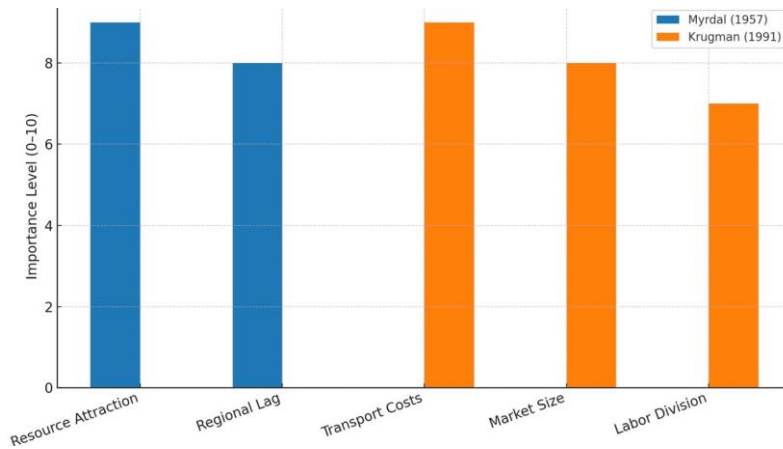
In the regions, the role of infrastructure has manifested differently. State programs have led to significant progress, including the reconstruction of rural roads, the increase of gasification rates to 96%, the implementation of potable water projects, and the construction of schools and hospitals. However, limited transport and logistics capacity, instability in energy supply, and underdeveloped digital infrastructure continue to constrain economic activity. Consequently, regional economies remain largely agriculture-oriented, while processing industries and service sectors are still insufficiently developed [7, p.45-47]. Here I have presented a graph comparing the theories of Myrdal (1957) and Krugman (1991).

- Myrdal (1957) emphasizes the flow of resources to the center and the lagging behind of peripheral regions.
- Krugman (1991), on the other hand, focuses on factors such as transportation costs, market size, and division of labor.

This graph visually compares the focal points of both theories. Baku and the Absheron economic region account for approximately 70% of Azerbaijan's GDP (State Statistical Committee, 2022). The region concentrates the oil and gas industry, large industrial enterprises, international transport corridors, and the financial sector. Infrastructurally, Baku's international airport, seaport, railway

junctions, and highways ensure the country’s integration into the global economic system [3, p. 173]

Figure 1. Comparison of regional development theories.



Other economic regions of Azerbaijan are mainly agriculture-oriented. Although certain infrastructure projects have been implemented through state programs, their share in GDP remains low. For instance, in 2022, the Shaki-Zagatala economic region

contributed only 1.6%, while the Karabakh economic region accounted for 2.3% of GDP (SSC, 2022). These figures show that regional economic potential remains largely unrealized [4, p.35].

Table 1. Regional Economic Landscape of Azerbaijan (2022).

Region	Key Features	Share of GDP (2022)
Baku & Absheron	Oil & gas industry, large enterprises, transport corridors, finance	~70%
Shaki-Zagatala	Agriculture-oriented, limited industrial base	1.6%
Karabakh	Agriculture, reconstruction potential, small GDP share	2.3%
Other Regions	Agriculture-dominated, weak infrastructure	Remaining share

Baku, positioned at key international transport corridors, benefits from advanced infrastructure including the Baku–Tbilisi–Kars railway, sea port, airport, stable electricity, and high-speed internet, making it the national economic and digital hub. In contrast, regions face lower-quality roads, limited logistics, energy shortages, and weaker digital connectivity, restricting agricultural marketing, industrial growth, and innovation. State programs since 2004 improved regional gasification, water supply, rural roads, schools, and small processing enterprises, yet large industrial projects and technology parks remain concentrated in Baku–Absheron.

Despite recent initiatives like smart city projects and regional reconstruction, by 2025 infrastructure and economic disparities between the capital and regions persist [6, p. 145-146].

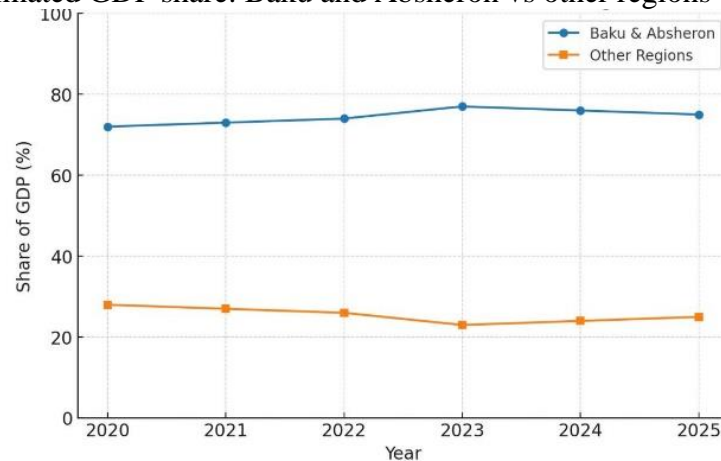
Analysis

Infrastructure disparities are a key driver of uneven economic development between Baku and Azerbaijan’s regions. Myrdal’s cumulative causation explains how the capital attracts resources, deepening regional stagnation. Krugman’s new economic geography highlights Baku’s superior market access via airports, ports, railways, and highways, concentrating production and

services there while limiting regional activity. Endogenous growth theories stress that human capital, social services, and digital networks are concentrated in Baku, fueling “brain drain” from the periphery. Empirically, market access, energy reliability, internet coverage, and social infrastructure can be measured and analyzed with panel or spatial econometrics,

using historical and geographic instruments to address endogeneity. Policy evaluation shows that isolated infrastructure projects are insufficient; only coordinated investments in transport, energy, digital, and social infrastructure can promote long-term convergence and reduce regional inequalities.

Figure 2. Estimated GDP share: Baku and Absheron vs other regions (2020-2025).



Cause-and-effect channels

One of the most important aspects of analyzing uneven economic development between Baku and the regions of Azerbaijan is to identify the mechanisms through which infrastructure disparities transform into unequal outcomes. These cause-and-effect channels can be grouped into several dimensions:

Transport and Logistics

Efficient transport networks reduce effective distance and transaction costs. Better-quality roads, railways, and logistic hubs allow producers to deliver goods faster, with fewer delays and lower inventory needs. In Baku, advanced infrastructure enables firms to access both domestic and international markets with ease, thereby increasing competitiveness. In the regions, however, poor-quality rural roads and the absence of logistics centers create barriers for agricultural producers, leading to higher post-harvest losses and weaker integration into value chains.

Energy Infrastructure

Stable and reliable electricity supply directly affects industrial productivity. In Baku and Absheron, fewer outages and stronger networks reduce downtime, lower equipment

depreciation, and make investments more attractive. Conversely, in many regions where energy shortages and network instability persist, industrial enterprises face higher risks and costs, which discourages large-scale investments and hinders economic diversification.

Digital Connectivity

Digital infrastructure is increasingly decisive in the 21st-century economy. High-speed internet and reliable IT services in Baku have supported the growth of the financial sector, e-commerce, and digital entrepreneurship. By contrast, weaker connectivity in rural areas constrains innovation, prevents the development of service industries, and forces young specialists to migrate to the capital. Thus, digital exclusion amplifies the center–periphery gap.

Social Infrastructure

Access to education and healthcare has a long-term impact on human capital formation. In Baku, prestigious universities and specialized hospitals attract both students and professionals, reinforcing the city’s role as a knowledge hub. In the regions, limited access to advanced education and healthcare reduces labor productivity and opportunities for

upward mobility. This results in the continuous migration of skilled workers to the capital, deepening socio-economic disparities.

Institutional and Governance Quality

Even when physical infrastructure is present, institutional capacity and governance determine its efficiency. Transparent regulation of land use, effective management of public-private partnerships (PPP), and strong local governance structures increase the economic return of infrastructure. Weak institutional frameworks, on the other hand, lead to underutilization of existing facilities and discourage private sector involvement in regional projects.

In short, infrastructure gaps affect Azerbaijan’s regional development not only through physical accessibility but also through their multiplier effects on productivity, investment, and human capital mobility. Transport and logistics determine market access; energy infrastructure drives industrial viability; digital connectivity supports innovation; social infrastructure builds long-term capacity; and governance ensures efficiency. Together, these channels explain why Baku has maintained a disproportionate advantage, while many regions remain locked into agriculture-oriented, low-productivity economic structures.

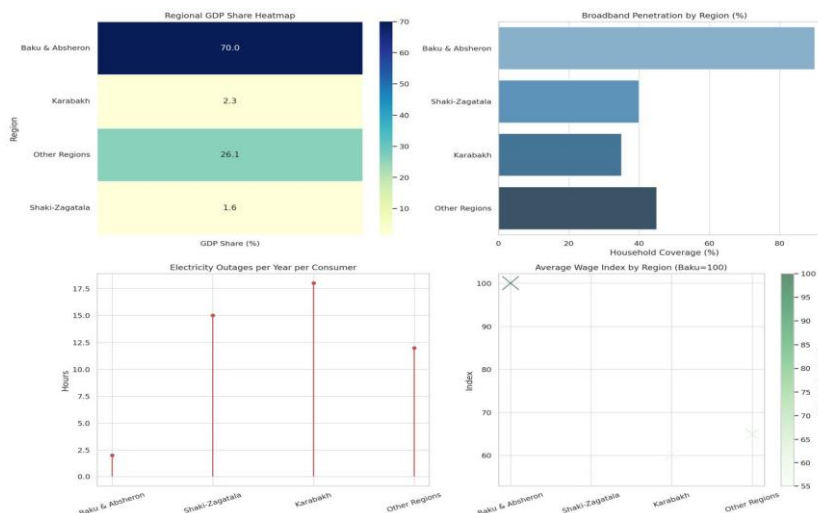
Measurement and indicators

The analysis of uneven development between Baku and the regions of Azerbaijan requires a set of carefully defined measurement tools that can capture how infrastructure differences affect economic outcomes. The first group of indicators relates to market access and effective distance. A commonly used metric is the Harris-type Market Access Index, expressed as

$$MA_i = \sum_j \frac{Population_j}{\tau_{ij}^\theta}$$

where τ_{ij} measures the travel time or transport cost between location i and market j , and θ is an elasticity parameter typically ranging between 1 and 2. For example, if the travel time from a regional center to Baku decreases from 5 hours to 3 hours, the effective market access could increase by nearly 40–50%, depending on the elasticity chosen. Another straightforward indicator is effective distance, measured as travel time to Baku, international ports, or rail hubs. For instance, districts located within a 200 km radius of Baku have access to more than 60% of the domestic consumer market, while those beyond 400 km are effectively excluded from rapid distribution networks.

Figure 3. Infrastructure differences and economic outcomes between baku and the regions.



Energy, digital, and social infrastructure strongly shape regional disparities in Azerbaijan. Electricity reliability—measured by SAIDI/SAIFI and per capita industrial consumption—is far higher in Baku than in rural regions, causing 5–7% productivity losses in manufacturing outside the capital. Digital and social gaps—low broadband, few universities, limited healthcare—drive migration and concentrate IT, fintech, and service firms in Baku. Economic indicators such as GDP per capita, firm entry, wages, and night-time lights reflect these inequalities, with Baku outperforming regions. Governance and investment patterns further reinforce disparities. A multidimensional framework combining market access, energy, digital connectivity, social services, economic outcomes, and governance enables empirical assessment of infrastructure-driven uneven regional development.

Data and Method

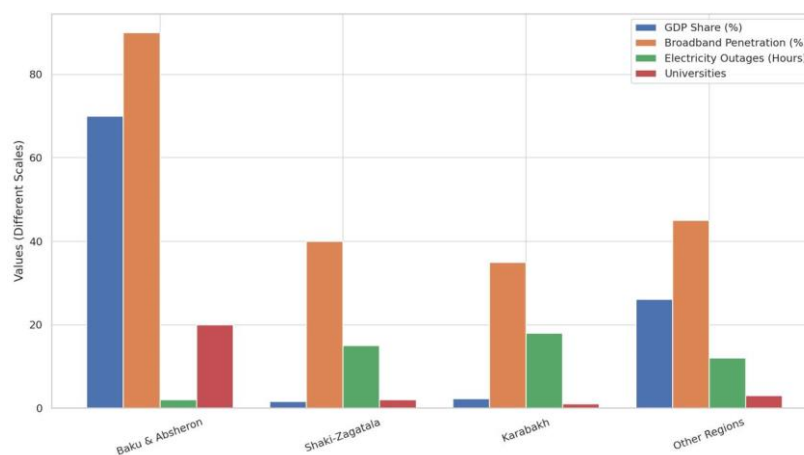
The study of infrastructure disparities in Azerbaijan relies on combining official statistics with proxy indicators, since detailed regional GDP data is limited. Useful proxies

include night-time light (NTL) intensity, tax revenues, firm registrations, social insurance contributions, and industrial electricity consumption. Infrastructure quality is measured through effective travel time to Baku or ports, electricity outage duration and frequency, broadband penetration rates, internet speed, and the availability of schools, universities, and healthcare facilities per capita.

Methodologically, the main challenge is endogeneity, as stronger regions attract more infrastructure investment. To address this, staggered difference-in-differences (DiD) models allow comparison of regions before and after new projects, while instrumental variables (IVs) such as historical railway routes or topography provide exogenous variation. Spatial econometric models capture spillover effects across neighboring regions, and event study approaches help trace the dynamic effects of large projects like the Baku–Tbilisi–Kars railway.

This combination of diverse data sources and causal inference tools ensures that the analysis not only describes disparities but also rigorously tests how infrastructure gaps drive uneven regional development.

Figure 4. Stylized facts: Infrastructure differences between Baku and regions.



Stylized Facts

Azerbaijan’s economic geography is highly centralized, with Baku and Absheron generating about 70% of GDP due to oil, industry, transport, and finance, supported by advanced infrastructure and global connectivity. In contrast, most regions remain

agriculture-focused, with weak roads, limited logistics, and low industrial diversification, restricting market access and economic integration. Energy and digital gaps hinder productivity and the emergence of new industries outside the capital. Social infrastructure—universities, research, and

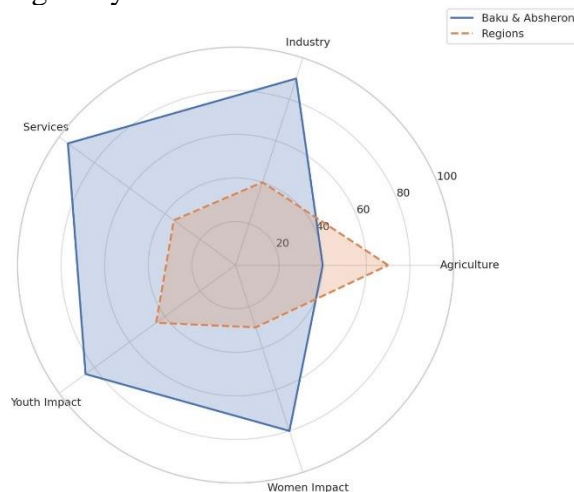
healthcare—is also concentrated in Baku, driving migration and regional “brain drain.” Despite state programs improving utilities and roads, regional disparities persist, making infrastructure inequality a key factor behind uneven national development.

Heterogeneity and distributional effects

Infrastructure disparities between Baku and other regions of Azerbaijan create uneven effects across sectors, populations, and geographies. Manufacturing and trade benefit most from improved transport and logistics, while agriculture gains only if complemented by storage, processing, and market facilities.

Reliable energy supports industry more than agriculture, reinforcing the concentration of high value-added activities in Baku. Social and digital infrastructure gaps limit opportunities for youth, skilled labor, and women in rural areas, exacerbating brain drain and gender inequality. Proximity to Baku or transport corridors amplifies regional advantages, leaving remote areas structurally excluded. Overall, infrastructure gaps accelerate development in the capital while many regions remain in low-productivity sectors, highlighting the need for complementary policies to ensure inclusive growth.

Figure 5. Heterogeneity and distributional effects of infrastructure.



Policy Design Evaluation (Analytical Perspective)

Addressing Azerbaijan’s infrastructure disparities requires evaluating not just investment scale but policy design and effectiveness. Projects must be complementary—linking transport, energy, digital networks, and social services—to generate transformative impacts. Multi-criteria assessment should weigh economic returns alongside equity, human capital, gender inclusion, and sustainability. Expanding public–private partnerships with balanced risk-sharing ensures financial viability and innovation. Investments should be adaptable to future technologies and renewable energy needs, avoiding long-term inefficiencies. Strong local governance, decentralization, and

transparent monitoring are essential for regional relevance. An integrated, inclusive, and flexible approach is key to using infrastructure as a driver of balanced regional development.

Expectations (if the hypotheses are confirmed)

If infrastructure disparities in Azerbaijan are addressed, regional economies would converge in firm entry and productivity, reducing Baku’s dominance and diversifying local economies. Wage gaps would narrow, boosting income and household welfare outside the capital. Migration to Baku would slow as education, healthcare, and digital access improve, retaining local human capital. Enhanced digital and social infrastructure would increase youth and women’s participation in higher-value sectors. Overall, a

more resilient, diversified, and competitive national economy would emerge, with inclusive growth and equitable prosperity across regions.

Conclusion

In Azerbaijan's future development strategy, reducing the existing infrastructure disparities between Baku–Absheron and the regions must be regarded as a top priority. Infrastructure is not merely a physical foundation of production and services; it is also a decisive determinant shaping the spatial distribution of economic activity and ensuring equitable growth across regions. In this context, several strategic directions can be outlined:

1. Strengthening transport and logistics infrastructure.
2. Developing digital infrastructure and accelerating digital transformation.
3. Promoting energy diversification and green growth.
4. Balancing social infrastructure.
5. Strengthening public–private partnerships (PPP).
6. Integrating regional resources into an endogenous growth model.
7. Advancing institutional reforms.

Azerbaijan's regional development hinges on balanced infrastructure, digitalization, energy diversification, and human capital expansion. Improving transport and logistics, including roads, railways, and cold storage, will boost trade and reduce post-harvest losses. Strengthening digital infrastructure and creating technoparks will foster innovation and local employment, reducing migration to Baku. Expanding renewable energy sources will enhance sustainability and regional energy security. Developing universities, vocational schools, and healthcare centers across regions will promote human capital and social equity.

Public–private partnerships are essential to finance infrastructure efficiently. Leveraging each region's unique assets—agriculture in Shaki–Zagatala, reconstruction in Karabakh, transit in Nakhchivan, and industry in Absheron—will drive endogenous growth. Strengthening local governance and institutional capacity will empower regions, reduce centralization, and ensure long-term, balanced national development.

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İdrak liseyi

**İNFRASTRUKTUR FƏRQLƏRİ BAKI VƏ AZƏRBAYCAN BÖLGƏLƏRİ ARASINDA
QEYRİ-BƏRABƏR İQTİSADI İNKİŞAFIN TƏYİN EDƏN AMİLİ KİMİ**

Xülasə

Bakı ilə Azərbaycanın regionları arasında infrastruktur fərqləri ölkənin iqtisadi inkişafında kəskin qeyri-bərabərlik yaradır. Paytaxt ölkə ÜDM-nin əsas hissəsini təmin edir, inkişaf etmiş nəqliyyat-logistika sistemi, müasir səhiyyə və təhsil infrastrukturunu, həmçinin yüksək İnsan İnkişafı İndeksi ilə seçilir. Regionlarda isə yolların keyfiyyəti zəif, kommunal və sosial xidmətlər məhduddur, rifah səviyyəsi isə nisbətən aşağıdır. Bu fərqliliklər iqtisadi imkanların və investisiyaların daha çox Bakıda cəmlənməsinə, regionların isə inkişaf tempinin ləngiməsinə gətirib çıxarır. Dövlət və beynəlxalq maliyyə institutlarının dəstəyi ilə həyata keçirilən yeni infrastruktur layihələri regionların potensialını artırmağa yönəlib. Lakin hazırda paytaxtla bölgələr arasındakı inkişaf uçurumu hələ də mövcuddur və uzunmüddətli iqtisadi sabitlik üçün bu bərabərsizliyin azaldılması vacibdir.

Açar sözlər: İnfrastruktur fərqləri, regional inkişaf, Bakı və regionlar, iqtisadi qeyri-bərabərlik, ÜDM paylanması, periferiya mərkəz-modeli

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РАЗЛИЧИЯ В ИНФРАСТРУКТУРЕ КАК ДЕТЕРМИНАНТ НЕРАВНОМЕРНОГО ЭКОНОМИЧЕСКОГО РАЗВИТИЯ БАКУ И АЗЕРБАЙДЖАНСКОГО РЕГИОНА

Резюме

Различия в инфраструктуре между Баку и регионами Азербайджана создают резкое неравенство в экономическом развитии страны. Столица обеспечивает основную часть ВВП страны, отличается развитой транспортно-логистической системой, современной инфраструктурой здравоохранения и образования, а также высоким индексом человеческого развития. В регионах же качество дорог низкое, коммунальные и социальные услуги ограничены, а уровень благосостояния относительно низок. Эти различия приводят к большей концентрации экономических возможностей и инвестиций в Баку и замедлению темпов развития регионов. Новые инфраструктурные проекты, реализуемые при поддержке государственных и международных финансовых институтов, направлены на повышение потенциала регионов. Однако в настоящее время разрыв в развитии между столицей и регионами все еще существует, и сокращение этого неравенства важно для долгосрочной экономической стабильности.

Ключевые слова: различия в инфраструктуре, региональное развитие, Баку и регионы, экономическое неравенство, распределение ВВП, периферийно-центральная модель

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