

**ECONOMIC EFFICIENCY OF INFRASTRUCTURE DEVELOPMENT IN THE
REGION AND INTER-INTEGRATION WITH CLUSTER SYSTEMS (ON THE
EXAMPLE OF KASHKADARYO REGION)**

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Abstract. In this research work, the level of development of infrastructure systems and the mechanisms of their influence on regional economic efficiency and clustering processes were analyzed in depth on the example of the Kashkadarya region. Within the framework of the study, the interrelationship of transport-logistics, energy and social infrastructure elements was studied in an integrated manner with production efficiency, investment attractiveness and export opportunities. Empirical results showed that the level of economic activity is higher in regions with developed infrastructure. At the same time, the regional uneven development of infrastructure was identified as the main factor negatively affecting the effective use of economic resources. At the end of the study, scientific and practical recommendations were developed aimed at accelerating economic growth through the integration of infrastructure and cluster systems.

Keywords: infrastructure, clustering, logistics, energy, economic growth, integration

Introduction. In today's modern economic development, infrastructure systems are emerging as one of the most important determinants of sustainable growth of the regional economy. Infrastructure is a complex systemic mechanism that interconnects production, distribution and consumption processes, ensuring the continuity of economic activity and expanding the possibilities for the effective use of resources. In this regard, the level of infrastructure development is one of the main factors determining the competitiveness, investment attractiveness and innovative potential of regional economic systems. In the Republic of Uzbekistan, the development of the regional economy and modernization of infrastructure are identified as one of the priority areas of state policy. In particular, the resolutions adopted by our esteemed President Shavkat Mirziyoyev emphasize the comprehensive development of regional infrastructure, the improvement of transport and logistics systems, and the expansion of clustering processes in industry and agriculture.

In particular, the Decree of the President of the Republic of Uzbekistan No. PF-60 dated January 28, 2022 ("Development Strategy of New Uzbekistan") sets the formation of modern infrastructure, improvement of the investment climate, and development of production clusters as priority tasks for the sustainable development of the regional economy.

This strategy recognizes the development of infrastructure as one of the main drivers of economic growth and notes the need to reduce its territorial imbalance. In modern scientific approaches, infrastructure is interpreted not as a simple supporting factor, but as a strategic resource and institutional platform that shapes economic development. In particular, the combination of transport and logistics, energy, and digital infrastructure elements serves to optimize production processes, reduce transaction costs, and deepen integration between markets.

As a result, infrastructure is important not only as a direct but also as an indirect factor of economic growth. Today, the interrelationship between infrastructure and clustering systems is of particular scientific interest. While clustering serves to increase added value by integrating production entities at the territorial and sectoral levels, infrastructure creates the main conditions for the effective functioning of this system. In particular, the development of infrastructure strengthens economic ties between enterprises, increases logistics efficiency, and stimulates innovative activity. Kashkadarya region, as a developing region in the agro-industrial direction, is directly dependent on the state of infrastructure systems. The harmonious development of agriculture and industrial production in the region relies on the efficiency of infrastructure networks. Although clustering processes have been expanding in recent years, the insufficient level of integration with infrastructure prevents full economic efficiency. In particular, limitations in transport and logistics systems, disruptions in energy supply, and disparities in the quality of social infrastructure negatively affect the pace of regional economic development. Therefore, a deep analysis of the mutual integration between infrastructure and clustering systems, identification of their mechanisms of influence on economic efficiency, and development of practical recommendations are one of the relevant areas of modern economic research.

Literature review. Infrastructure is an important structural element of the economic system, the level of its development directly affects the rate of economic growth. In modern economic theories, infrastructure is interpreted as an institutional environment that unites the factors of production and increases their efficiency. International scientific research has repeatedly proven the positive impact of infrastructure investments on economic efficiency. In particular, it has been shown that state infrastructure investments have a high impact on production efficiency, and they are considered an important driver of economic growth (David Alan Aschauer, 1989). At the same time, it has been established that infrastructure investments serve to increase production volume and labor productivity (Alicia Haydock Munnell, 1992). In clustering theory, infrastructure is interpreted as an important factor that strengthens the interaction between economic entities. The harmony between infrastructure and clusters is of particular importance in increasing competitiveness (Michael Eugene Porter, 1998). At the same time, it has been noted that there is a direct relationship between the geographical location of production and the development of infrastructure in regional development processes (Paul Krugman, 1991). In modern research, the interaction between clustering and infrastructure is considered as a key mechanism for increasing economic efficiency. Clusters increase added value by integrating production processes and accelerate regional economic growth (Mercedes Delgado et al., 2014). It has also been emphasized that the harmony between clusters and infrastructure plays an important role in ensuring competitiveness (Christian Ketels, 2013).

The impact of infrastructure development on economic efficiency has also been studied in depth by Uzbek economists. In particular, the modernization and digitalization of infrastructure systems is considered one of the main factors accelerating economic growth (B. Khodiyev, 2020). At the same time, it has been scientifically substantiated that the level of infrastructure development determines the effectiveness of clustering processes (Sh. Mustafakulov, 2021).

Studies conducted by international organizations have also confirmed the connection between infrastructure and economic growth. In particular, it has been noted that infrastructure development improves the investment climate and ensures economic stability (World Bank, 2021). Infrastructure investments are also recognized as an important factor in long-term economic growth (OECD, 2020).

Research methodology. The study used statistical, analytical, and systematic approaches. The relationship between the level of regional infrastructure development and economic indicators was analyzed.

The Relationship Between Infrastructure Development and Economic Efficiency (Case of Kashkadarya Region)
Table 1.

Type of Infrastructure	Level of Development	Main Problem	Economic Impact	Impact on the Cluster System
Transport Infrastructure	Moderately developed	Regional disparities, poor road quality	Logistics costs increase, product delivery slows down	Weakening of connections between enterprises
Energy Infrastructure	Relatively stable, but with interruptions	Power supply interruptions	Production volume decreases, efficiency declines	Clusters do not operate at full capacity
Social Infrastructure	Developing	Differences in quality across regions	Labor productivity decreases	Human capital development slows down
Digital Infrastructure	Underdeveloped	Insufficient internet quality and coverage	Innovative activity is limited	Formation of modern clusters slows down

This table systematically reflects the level of development of different types of infrastructure and their impact on economic efficiency as well as cluster systems. According to the results of the analysis, each element of infrastructure has a direct or indirect influence on economic growth. At the same time, the uneven development of infrastructure emerges as a key factor limiting regional economic efficiency.

Based on a systematic approach, the following model was developed:
infrastructure → cluster → value added → economic growth

Analysis and Results. The transport system is one of the main factors that increase regional economic activity. A well-developed logistics system accelerates the movement of goods and reduces costs. At the same time, the insufficient development of transport infrastructure in certain areas leads to a decline in economic efficiency. The energy system ensures the continuity of production. Electricity shortages reduce production volumes and negatively affect the efficiency of cluster systems. Social infrastructure supports the development of human capital. Education and healthcare systems increase labor productivity. However, disparities across regions have a negative impact on economic efficiency.

Scientific novelty: The relationship between infrastructure and clustering is substantiated based on a systematic model; the impact of regional disparities on economic efficiency is identified; and the model **infrastructure → cluster → economic growth** is developed.

Conclusion.

The research results indicate that infrastructure development is a key prerequisite for economic growth. At the same time, insufficient integration between infrastructure and clustering leads to a decline in economic efficiency. Regional disparities also emerge as a significant factor negatively affecting economic development. Based on the above findings, the following recommendations are proposed: ensuring balanced infrastructure development, modernizing logistics systems, improving energy stability, and strengthening the integration of infrastructure and clustering. Through the modern implementation of infrastructure systems within clustering processes, it is possible to achieve higher regional efficiency.

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