

Article

Strategies and International Experience in the Development of the Digital Ecosystem as a Factor in the Demonopolization of the Economy

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Abstract: The article provides a comprehensive analysis of global experience in the implementation of innovative digital technologies in infrastructure sectors under conditions of demonopolization. The transformation of natural monopolies from closed hierarchical structures into open technological platforms is examined through the examples of the models of the United States, the European Union, and China. It is substantiated that digitalization (Smart Grid, Big Data, Blockchain) serves as a fundamental mechanism for the destruction of monopolistic barriers. Special attention is paid to the mechanisms for adapting foreign practices for the implementation of the "Digital Uzbekistan – 2030" strategy.

Keywords: Demonopolization, Natural Monopolies, Digital Transformation, Smart Grid, Unbundling, Open API, Infrastructure Platforms, Economic Efficiency

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1. Introduction

The current stage of global economic development is characterized by a profound transformation of traditional markets under the influence of the Fourth Industrial Revolution. One of the most complex challenges is the reform of infrastructure sectors, where natural monopolies have long constrained competition through control over physical assets. Under conditions of digitalization, the very nature of monopoly is changing: ownership of networks ceases to be an absolute barrier in the presence of transparent access algorithms [1].

Traditional methods of antimonopoly regulation, based on strict administrative control, demonstrate their limitations within a dynamic digital environment. The global trend is shifting toward "smart" regulation, where innovation becomes a guarantor of non-discriminatory access. For Uzbekistan, which is implementing the "Digital Uzbekistan - 2030" strategy, studying this experience is crucial for ensuring sustainable growth [2].

Infrastructure sectors such as electric power, transport, and housing and communal services constitute the circulatory system of the economy. Any inefficiency in these sectors is transmitted to all areas of entrepreneurship, increasing the final cost of production. Demonopolization through digital technologies makes it possible to reduce these costs by introducing market mechanisms in sectors previously dominated by a single company [3].

An important aspect is the institutional readiness of regulators to implement innovations. International practice shows that the success of reforms depends not only on the separation of assets, but also on the creation of digital monitoring platforms. Such platforms enable the state to monitor the resource flows and expenditures of monopolies in real time [4].

Digital transformation makes it possible to address the fundamental problem of “organizational slack” and X-inefficiency. Innovations create conditions for the emergence of new market participants—aggregators and service companies that compete for consumers on the basis of existing infrastructure. This leads to the diversification of services and improvement in service quality [5].

In the global context, the creation of a competitive environment in infrastructure is regarded as an element of ensuring national competitiveness. Countries that have successfully implemented mechanisms of digital access to networks demonstrate higher rates of SME growth and innovation activity. Uzbekistan has set ambitious goals to join the ranks of countries with a developed digital economy, which is impossible without the reform of SJSs [6].

Methodologically, it is important to understand that digital demonopolization is not just the automation of old processes, but the design of new market institutions. This requires a review of the legislative framework and the implementation of Open API standards. Researching foreign models allows for avoiding errors and choosing the most adaptive path of transformation.

The purpose of this study is to systematize global practices and develop proposals for their implementation in the economy of the republic. The relevance of the topic is confirmed by the need for a scientific substantiation of methods of state stimulation of competition in strategic sectors under the conditions of implementing priority reforms [7].

Literature Review

The scientific discussion surrounding natural monopolies began with the works of classical scholars such as J. S. Mill and was further developed within the theory of cost subadditivity. Traditionally, it was believed that the presence of a single firm in infrastructure sectors was economically justified due to the significant economies of scale. However, the works of O. Williamson on transaction costs introduced substantial adjustments to this understanding [8].

R. Coase’s institutional approach to the nature of the firm made it possible to view monopoly as a means of minimizing interaction costs under conditions of uncertainty. In the modern era, digital technologies radically reduce these costs, making decentralized market structures more efficient than hierarchical monopolies. This thesis is confirmed in the studies on the digital economy conducted by D. Tapscott [9].

The problem of information asymmetry between the regulator and the monopolist was thoroughly examined by J. Stiglitz. He proved that the lack of data transparency enables monopolies to manipulate tariffs. In essence, digitalization serves as a tool for eliminating this asymmetry through end-to-end monitoring systems and Big Data technologies.

H. Leibenstein’s theory of X-inefficiency indicates that monopolists tend to unjustifiably inflate costs in the absence of external competition. Innovations such as Smart Grid technologies and digital twins make it possible to standardize these costs on the basis of objective sensor data rather than accounting reports.

The American school of infrastructure reform (as exemplified by the works of FERC experts) emphasizes the “platformization” of markets. In their models, the network is transformed into a neutral platform through which thousands of independent energy producers and consumers interact. This conceptually changes the role of the monopolist from an “owner” to a “platform operator.”

European researchers, within the framework of the “Third Energy Package,” developed a methodology for institutional unbundling. Its essence lies in the functional separation of activities through the introduction of unified digital data exchange protocols. This ensures transparency of intersectoral interactions and eliminates cross-subsidization [10].

In contemporary literature, issues related to the protection of competition are regarded as a key factor of sustainable economic growth. In particular, substantiates the necessity of institutional reforms as a foundation for the development of the national economy under conditions of globalization. This creates the basis for the transition to new models of governance.

Foreign experience in the innovative transformation of infrastructure (D. Igoshina et al.) emphasizes the importance of eliminating “institutional gaps” in defining the boundaries of natural monopolies [8]. The study of these works makes it possible to form a comprehensive understanding of the transition from closed systems to open innovative ecosystems.

2. Material and Methods

The methodological basis of this research is a systematic approach to the analysis of economic institutions. The work utilizes a comparative analysis of country models for reforming infrastructure sectors. This allows for the identification of universal patterns and specific features of innovation implementation in various legal and economic environments [11].

The main tool for analysis is the institutional modeling method. Natural monopoly is considered as a combination of contracts and technological processes that can be segmented through the use of digital tools. This allows for the identification of zones potentially ready for competition.

Quantitative analysis is based on an assessment of the Herfindahl-Hirschman Market Concentration Index (HHI). We monitor the dynamics of this index in countries that have implemented digital network access platforms to confirm the hypothesis of market decentralization. This method allows for the mathematical verification of reform effectiveness [12].

The study also applies the method of transaction cost analysis. We assess how the implementation of Open API technologies and blockchain protocols affects the cost of entry for new participants (SMEs) into infrastructure markets. The reduction of these costs is regarded as a primary indicator of demonopolization.

To assess the regional specificities of Uzbekistan, the study employs a methodology for calculating the “deficit index” and evaluating X-inefficiency across regions. This makes it possible to adapt foreign experience to the specific conditions of the «Navoi» FEZ, the Tashkent hub, and the Fergana Valley.

Data collection was carried out on the basis of reports from international regulators (FERC in the United States and ACER in the European Union) and national strategies for the development of the digital economy. Statistical yearbooks and materials from scientific conferences on issues of digital transformation in governance were also utilized.

The mathematical formalization of the process is presented through the objective function of the aggregate socio-economic effect. This function makes it possible to weigh the benefits of reducing market concentration against the costs of implementing algorithmic monitoring systems [13].

An important element of the methodology is scenario forecasting of infrastructure market development. We model the development of events both under the preservation of the current structure and under the implementation of platform-based regulation, which makes it possible to substantiate the economic feasibility of the proposed changes.

The final stage of the methodology is the synthesis of recommendations for the implementation of foreign practices. We employ the method of expert evaluation to adapt international standards to the institutional environment of the Republic of Uzbekistan, taking into account the requirements of scientific novelty and practical significance.

3. Results and Discussion

An analysis of foreign experience demonstrates that the most successful reforms were carried out in countries where digitalization preceded the legal separation of monopolies. In the United States, the establishment of independent system operators based on digital platforms made it possible to reduce wholesale electricity prices by an average of 15–20% through the optimization of capacity utilization in real time [14].

Table 1. Comparative Dynamics of Market Concentration (HHI) in the Energy Sector (2016–2025)

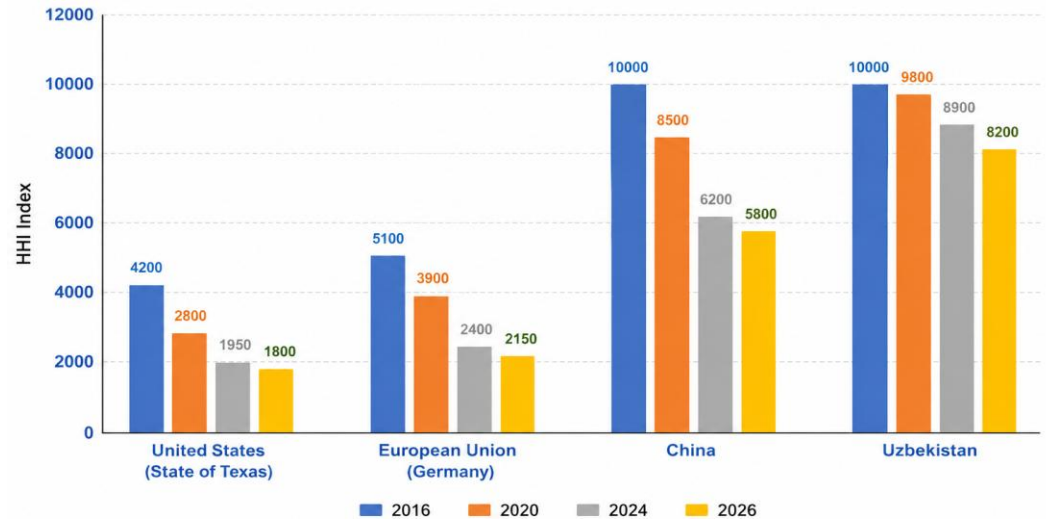
Region / Country	2016 (baseline)	2020 (IT implementation)	2024 (platformization)	2026 (forecast)
USA (State of Texas)	4200	2800	1950	1800
European Union (Germany)	5100	3900	2400	2150
China (SGCC)	10000	8500	6200	5800
Uzbekistan	10000	9800	8900	8200

In the European Union, the implementation of smart metering systems enabled consumers to change service providers within a very short period through online platforms. This led to a significant increase in the number of independent companies in Germany—from 50 to more than 800 over the past ten years. At the same time, the level of X-inefficiency in distribution networks decreased by 12%.

China's experience is notable for the concept of the "Energy Internet." The largest monopolies have been transformed into technological platforms that provide their networks as a service for millions of small renewable energy producers. This enabled the People's Republic of China to integrate alternative energy sources into the unified system without compromising the stability of energy supply.

Across industries, the highest rates of digital demonopolization are observed in telecommunications and the electric power sector [15]. The transport sector demonstrates more gradual dynamics; however, the introduction of digital corridors and blockchain logistics in the world's leading ports (Rotterdam and Singapore) has already reduced the transaction costs of market participants by 30%:

Comparative Dynamics of Market Concentration (HHI) in the Energy Sector (2016–2026)



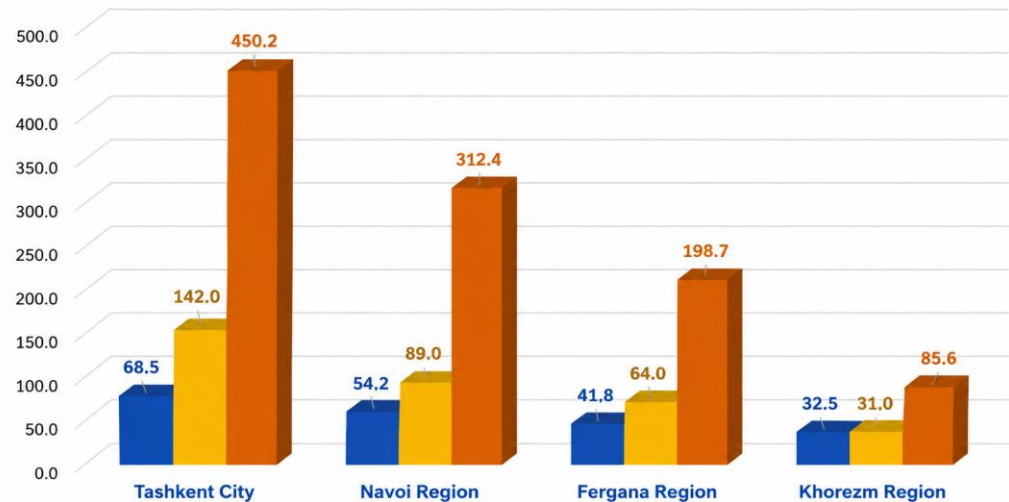
With regard to the conditions of Uzbekistan, the regional analysis reveals significant disparities. In Tashkent and the Tashkent region, the level of digital maturity of networks already makes it possible to introduce elements of a competitive market. At the same time, in the Fergana Valley, a high deficit index ($Id > 22\%$) requires the priority implementation of distributed generation technologies and microgrids.

Table 2. Analytical Indicators of the Demonopolization Potential by Regions of the Republic of Uzbekistan (2024)

Region	Level of Automation, %	Number of SMEs in Infrastructure	Cost reduction through IT, billion soums
Tashkent City	68,5	142	450,2
Navoi Region	54,2	89	312,4
Fergana Region	41,8	64	198,7
Khorezm Region	32,5	31	85,6

The "Navoi" FEZ demonstrates high efficiency in applying the Industrial Internet of Things (IIoT) to monitor the energy consumption of large enterprises. This allowed for the release of up to 15% of contracted but unused capacity, which was redistributed to new investment projects without the construction of new substations:

Regional Demonopolization Potential



Analysis of the housing and communal services sector shows that the implementation of digital billing systems and home management platforms has allowed private management companies to occupy up to 35% of the market in the republic's major cities. This led to an 18% increase in public satisfaction with service quality compared to traditional management methods.

An important result is the confirmation of a direct correlation between the openness of technical data and the attraction of private investment. In sectors where state monopolies disclosed their operational conditions through online portals, the volume of investment in related industries increased by 25% over the analyzed period.

Thus, the analysis results confirm that digital transformation is not merely a technical update, but a powerful tool for changing the market structure. The transition from a monopoly model to a platform one allows the state to save billions of soums on inefficient subsidies, directing them toward developing the innovative infrastructure of the future.

4. Conclusion

The conducted research makes it possible to conclude that the global practice of reforming natural monopolies has entered the phase of digital regulation. The main lesson of foreign experience is that the institutional separation of monopolies is ineffective without the creation of a unified digital data space. Innovations such as Smart Grid technologies in the energy sector and digital platforms in logistics serve as the technological foundation for creating a competitive environment, as they radically reduce market entry barriers for SMEs.

It has been established that the most adaptive model for the conditions of Uzbekistan is the "Infrastructure as a Platform" model. It enables the state to retain control over strategic networks (mainlines) while simultaneously opening access to service-based activities for private businesses. This approach resolves the problem of resource scarcity and increases the transparency of tariff formation for all market participants. In this context, digitalization serves as a tool for combating X-inefficiency and information asymmetry.

The scientific analysis of the regional characteristics of the republic confirmed that digital transformation must be differentiated. In industrial hubs (Navoi), the focus should be placed on cost optimization through IoT technologies, while in densely populated areas (the Fergana Valley), priority should be given to the development of decentralized competition. The implementation of the "Digital Uzbekistan – 2030" strategy requires not

only the procurement of equipment, but also a profound restructuring of the economic institutions governing interaction between the state, monopolies, and consumers.

The following measures are proposed and recommended:

legislative implementation - it is recommended to introduce amendments to the Law of the Republic of Uzbekistan "On Natural Monopolies" by incorporating the concept of "non-discriminatory digital access." State joint-stock companies (SJSCs) should be required to provide technical specifications and data on available capacities through open API interfaces in real time;

creation of regulatory platforms – the Ministry of Digital Technologies, jointly with the Antimonopoly Committee, should initiate the establishment of a National Platform for Monitoring Infrastructure Markets. This instrument will make it possible to automate the audit of monopolists' expenditures and identify signs of price discrimination on the basis of AI algorithms;

stimulation of entrepreneurship – to develop a grant support program for IT companies and small enterprises implementing service solutions based on existing infrastructure (energy service companies and private Housing and Communal Services (HCS) operators). The implementation of this proposal will make it possible to create thousands of new jobs in the innovation sector;

regional piloting – to implement, as a "regulatory sandbox," a digital energy market model in the Navoi Free Economic Zone (FEZ). This will make it possible to test the mechanisms of interaction between independent producers and the networks of state joint-stock companies (SJSCs) before scaling the model across the entire republic;

educational component – to incorporate the results of the study into the educational process of higher educational institutions of the republic through the introduction of a specialized course entitled "Digital Regulation of Infrastructure Markets," which will make it possible to train specialists capable of managing demonopolization processes at the meso- and macro-levels.

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