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Analysis of the Digital Transformation of Traditional Sectors of Uzbekistan's Regional Economy

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Abstract. *This article examines the economic aspects of the digital transformation of traditional sectors of the regional economy of the Republic of Uzbekistan. It demonstrates that digitalization contributes to a reduction in transaction costs, an increase in labor productivity, greater transparency in business processes, and expanded market access for regional producers. It has been established that the impact of digital transformation is uneven and depends on the level of development of infrastructure, human capital, and the institutional environment.*

Keywords: *digital transformation, regional economy, traditional industries, digitization, productivity, investment, agriculture, regional development.*

АНАЛИЗ ЦИФРОВОЙ ТРАНСФОРМАЦИИ ТРАДИЦИОННЫХ ОТРАСЛЕЙ РЕГИОНАЛЬНОЙ ЭКОНОМИКИ УЗБЕКИСТАНА

Аннотация. *В статье исследуются экономические аспекты цифровой трансформации традиционных отраслей региональной экономики Республики Узбекистан. Показано, что цифровизация способствует снижению транзакционных издержек, росту производительности труда, повышению прозрачности хозяйственных процессов и расширению рыночного доступа региональных производителей. Установлено, что эффект цифровой трансформации носит неоднородный характер и зависит от уровня развития инфраструктуры, человеческого капитала и институциональной среды.*

Ключевые слова: *цифровая трансформация, региональная экономика, традиционные отрасли, цифровизация, производительность, инвестиции, сельское хозяйство, региональное развитие.*

Introduction. Digital transformation is becoming one of the key factors in the structural modernization of national and regional economies. For Uzbekistan, where traditional sectors continue to play a significant role in employment, gross regional product formation and export potential, the economic assessment of digitalization acquires particular relevance. The transition from fragmented automation to systemic digital transformation affects not only technological processes but also management models, market interactions, logistics chains, financial mechanisms and forms of state support.

In the context of regional development, the problem is complicated by spatial heterogeneity. The regions of Uzbekistan differ in the level of industrialization, specialization of agriculture, transport accessibility, availability of qualified personnel, entrepreneurial activity and penetration of information and communication technologies. Therefore, the economic effects of digital transformation cannot be considered uniform for all territories. In Tashkent city and Tashkent region, digitalization is mainly associated with service sectors, financial technologies, industry and logistics, whereas in Samarkand, Fergana, Andijan, Namangan, Kashkadarya, Surkhandarya, Bukhara, Khorezm and other regions, digital transformation is more closely connected with agro-industrial production, small business, trade and regional infrastructure.

The relevance of the topic is also determined by the fact that digital transformation is increasingly viewed not as an auxiliary technological process, but as an independent factor of productivity growth, competitiveness and sustainable regional development. International studies indicate that digital technologies can significantly reduce transaction costs, increase the efficiency of resource allocation and accelerate innovation diffusion[1], [3]. At the same time, empirical evidence shows that the economic return from digitalization depends on complementary investments in human capital, organizational change and institutional quality[2],[4].

The purpose of this article is to conduct an economic analysis of the digital transformation of traditional sectors of the regional economy of Uzbekistan and to identify key factors, constraints and expected effects of this process.

To achieve this purpose, the following research objectives are formulated: to clarify the theoretical content of digital transformation in

relation to traditional regional sectors; to identify the main directions of digitalization in agriculture, industry, transport, trade and services; to analyze the economic effects and risks of digital transformation at the regional level; to propose directions for improving regional policy in the field of digital transformation.

Materials and methods. The methodological basis of the research includes systemic, comparative, institutional and structural-sectoral approaches. The systemic approach makes it possible to consider digital transformation as an interconnected process involving enterprises, households, state institutions, infrastructure organizations and educational systems. The comparative approach is used to identify differences in the digital transformation potential of various regions and sectors. The institutional approach allows assessing the importance of regulatory mechanisms, public administration digitalization, standards, data circulation and support instruments. The structural-sectoral approach is applied to analyze the transformation of traditional industries in accordance with their technological, organizational and market characteristics.

The empirical and informational basis of the study consists of materials from international organizations, including the World Bank, OECD, UNCTAD and FAO, statistical and analytical materials of the Republic of Uzbekistan, publications of Uzbek researchers, as well as scientific works on digital economy, regional development and sectoral modernization[1],[5], [8],[10],[13].

The article applies general scientific methods of analysis and synthesis, abstraction, classification, comparison and economic interpretation. Given the purpose of the study, the emphasis is placed not on constructing a formal econometric model, but on identifying causal relationships between digitalization factors and economic outcomes in traditional regional sectors.

Theoretical foundations of digital transformation of traditional sectors. In contemporary economic literature, digital transformation is usually distinguished from simple informatization and automation. Informatization implies the introduction of information systems into individual business processes, while digital transformation involves a deeper change in the structure of value creation, decision-making mechanisms, business models and forms of interaction between economic agents[3],[4]. In this sense, the digital transformation of traditional industries should be interpreted as a process of integrating digital technologies into production, distribution, exchange and management systems, resulting in qualitative changes in efficiency, competitiveness and institutional coordination.

Traditional sectors of the regional economy include those types of economic activity that historically form the basis of employment and production specialization in a particular territory. In Uzbekistan, these sectors include agriculture, textile and food industries, mining and processing industries, construction materials production, transport, retail trade, tourism and a wide range of personal and business services. Their traditional nature does not mean technological backwardness, but indicates their long-term role in the economic structure and their dependence on material resources, labor, infrastructure and local markets.

The economic mechanism of digital transformation in traditional sectors can be described through several channels.

First, digital technologies reduce transaction costs. Electronic platforms, digital document management, online payments, remote monitoring systems and logistics management tools reduce the costs of searching for information, negotiating, monitoring contract execution and coordinating economic agents[1],[6].

Second, digitalization increases production efficiency. The use of sensors, geoinformation systems, enterprise resource planning systems, automated accounting, predictive analytics and digital control systems improves the allocation of labor, capital, raw materials, water, energy and transport resources[5],[9].

Third, digital transformation expands market access. E-commerce, digital marketplaces, online booking systems, digital marketing and platform employment allow regional enterprises and self-employed producers to interact with consumers outside local markets. This is especially important for small businesses and farms in regions with limited physical access to large distribution networks[11],[14].

Fourth, digitalization changes the structure of employment and human capital requirements. Demand increases for digital literacy, data analysis skills, technical maintenance of digital systems and the ability to work with electronic platforms. At the same time, routine operations may be reduced, which requires adaptation of the vocational education system and retraining mechanisms[2],[7].

Fifth, digital transformation strengthens the role of data as an economic resource. In agriculture, data on soil, weather, irrigation and yields improve planning; in industry, data on equipment operation reduce downtime; in transport, data on routes and demand optimize logistics; in trade, consumer data improve assortment and pricing decisions.

Sectoral features of digital transformation in the regions of Uzbekistan. According to data from the National Statistics Committee of the Republic of Uzbekistan, between 2018 and 2024,

the gross value added of ICT services increased nearly 4.8-fold—from 7.1 trillion to 33.7 trillion sum—which indicates strong growth in the digital sector of the economy (Table 1)[21].

Table 1 Trends in Gross Value Added from ICT Services in the Republic of Uzbekistan

Year	Gross Value Added of ICT Services, billion soums	Growth rate, % compared to the previous year
2018	7 057,8	–
2019	7 461,3	105,7
2020	9 372,5	125,6
2021	12 095,6	129,1
2022	16 692,5	138,0
2023	24 256,0	145,3
2024	33 742,3	139,1

According to data from the National Statistics Committee of the Republic of Uzbekistan, the increase in the share of ICT in GDP from 1.9% in 2023 to 2.7% in 2025 reflects the acceleration of the economy's digital transformation. The fastest-growing sectors are programming, consulting, and digital services (Table 2)[21].

Table 2 Share of ICT Services in Uzbekistan's GDP

Period	ICT's Share of GDP, %
2023	1.9
Q1 2024	2.2
First half of 2024	2.4
2025	2.7

The distribution of digital infrastructure across different regions is of particular importance for regional analysis (Table 3). Despite the overall expansion of access to digital services, disparities persist between the capital region, industrially developed regions, and predominantly agricultural areas. The highest levels of digital activity are generally concentrated in Tashkent City and the Tashkent, Samarkand, Fergana, Andijan, and Namangan regions. This is due to the concentration of the population, business activity, educational institutions, financial organizations, and communications infrastructure[22; 23; 24].

Table 3 Regional Factors Underlying the Digital Transformation of Traditional Economic Sectors in Uzbekistan

Region	Sectoral Specialization	Potential Areas for Digital Transformation	Expected Economic Impact
Tashkent	Financial services, trade, ICT, manufacturing	Fintech, e-commerce, ERP systems, digital logistics	Increased productivity, accelerated capital turnover, and development of platform services
Tashkent Region	Manufacturing, logistics, agriculture	Manufacturing automation, warehouse management systems, digital monitoring of agricultural production	Reduced production and logistics costs
Samarkand Region	Tourism, agriculture, food industry	Online booking, digital marketing, agricultural platforms, quality management systems	Increased tourist traffic and expanded markets for agricultural products
Fergana Region	Light industry, agriculture, trade	Digital accounting, e-commerce, textile production automation	Enhanced competitiveness of SMEs and industrial enterprises
Andijan Region	Machinery manufacturing, agriculture, SMEs	Industrial automation, CRM/ERP, digital services for small businesses	Improved efficiency of supply chains
Namangan Region	Textiles, small businesses, horticulture	Marketplaces, digital payments, agricultural logistics	Expansion of sales and reduction of transaction costs
Bukhara Region	Tourism, gas chemistry, agriculture	Digital tourism, industrial monitoring, water-saving technologies	Improved resource efficiency

Khorezm Region	Tourism, agriculture, services	Online promotion of tourism services, digitalization of farms	Expanding external demand for regional services
Kashkadarya Region	Agriculture, energy, manufacturing	Digital resource monitoring, automated record-keeping, agricultural technologies	Optimizing costs and increasing process transparency
Surkhandarya Region	Agriculture, trade, cross-border logistics	E-commerce platforms, digital logistics, agricultural services	Increasing market access for products
Navoi Region	Mining, chemicals, logistics	Industrial Internet of Things, digital equipment control, logistics platforms	Reducing downtime and improving return on investment
Karakalpakstan	Agriculture, processing, services	Digital land and water monitoring, remote services, e-commerce	Reducing geographical constraints and improving access to services

Table 3 shows that the digital transformation of regions cannot be carried out based on a single, one-size-fits-all model. For industrial regions, the priority is the automation of production processes, the implementation of enterprise resource planning systems, and digital equipment monitoring. For agricultural areas, the greatest importance lies in the digital monitoring of land and water resources, agricultural platforms, e-commerce marketplaces, and digital logistics. Online booking, digital marketing, electronic payments, and customer experience management services play a significant role in tourism regions.

Agriculture and agro-industrial complex. Agriculture remains one of the central sectors of the regional economy of Uzbekistan. Its importance is determined by employment, food security, export potential and its relationship with processing industries. Digital transformation in agriculture is associated with precision farming, remote sensing, digital cadastral systems, automated irrigation management, electronic trading platforms, agricultural advisory services and digital financial instruments.

For Uzbekistan, the digitalization of water use is of particular economic importance. Given the high dependence of agricultural production on irrigation, digital monitoring of water consumption, remote control of irrigation infrastructure and analytical systems for crop planning can significantly improve resource efficiency. International practice shows that digital agriculture contributes to reducing losses, increasing yields and improving the predictability of production[9],[10]. In regional conditions, these effects are especially relevant for areas specializing in cotton, grain, fruit and vegetable production, horticulture and livestock farming.

The introduction of digital platforms can also reduce the imbalance between producers and intermediaries. Small farms often face limited access to information on prices, demand, logistics and quality standards. Digital marketplaces and electronic information systems reduce information asymmetry and create prerequisites for more transparent pricing. However, the realization of these advantages requires access to the Internet, digital literacy of farmers and integration of platforms with logistics, storage and certification infrastructure.

Industry and manufacturing. Industrial digitalization in Uzbekistan is associated with the modernization of production processes, introduction of industrial automation, enterprise resource planning systems, digital quality control, predictive maintenance and energy management systems. For traditional manufacturing industries, including textiles, food processing, chemical production, construction materials and mechanical engineering, digital transformation allows improving productivity and reducing losses.

The textile industry is one of the most relevant examples. Uzbekistan has significant raw material and production potential in cotton and textile value chains. Digitalization can support traceability of raw materials, production planning, quality control, inventory management and export documentation. For enterprises integrated into international supply chains, digital systems also become a tool for compliance with technical standards and customer requirements.

In the food industry, digital transformation improves quality control, sanitary monitoring, warehouse accounting, expiration management and logistics. These factors directly influence the competitiveness of regional producers and reduce losses in the supply chain. In construction materials production, digital technologies contribute to energy efficiency, equipment monitoring and optimization of raw material use.

At the same time, the industrial sector requires relatively large investments in equipment, software and personnel training. Therefore, the economic effect of digital transformation is more pronounced in enterprises that combine

technological renewal with organizational changes and management modernization. Without such complementarity, digital investments may not lead to significant productivity growth[2],[4].

Transport and logistics. Transport and logistics are critical for regional integration in Uzbekistan due to the spatial distribution of production centers, agricultural zones, industrial clusters and consumer markets. Digital technologies in this sector include route optimization systems, electronic freight exchanges, warehouse management systems, GPS monitoring, digital customs procedures, electronic document flow and multimodal logistics platforms.

The main economic effect of transport digitalization is the reduction of time and coordination costs. For agricultural and food products, logistics delays lead to direct losses in quality and value. For industrial enterprises, unreliable logistics increase inventory costs and reduce contract discipline. Digital logistics systems allow increasing vehicle utilization, reducing empty runs and improving the predictability of deliveries.

For landlocked economies, logistics efficiency is an important factor of external competitiveness. Therefore, regional digital logistics infrastructure can support export-oriented sectors and improve integration between production regions and border, railway, airport and warehouse infrastructure. In this context, digital transformation should be coordinated with physical infrastructure development.

Trade, services and small business. In trade and services, digital transformation is most visible through electronic commerce, online payments, delivery platforms, digital advertising, customer relationship management systems and electronic fiscalization. For regional small businesses, digital channels create opportunities to expand demand beyond the immediate local market.

The spread of mobile Internet and payment services contributes to the formalization of business operations, increases transparency of turnover and simplifies interaction with banks and public services. Digitalization also reduces entry barriers for microenterprises, artisans, family businesses and service providers. In tourism-oriented regions such as Samarkand, Bukhara, Khiva and Tashkent, digital platforms for booking, navigation, online promotion and customer feedback have a direct impact on the competitiveness of regional services.

At the same time, platformization may increase dependence of small enterprises on large digital intermediaries. This can lead to new types of costs, including commission payments, algorithmic dependence and requirements for continuous digital marketing activity. Therefore, the development of local digital ecosystems and support for small business digital competencies are important.

Regional differentiation of digital transformation. The digital transformation of traditional sectors in Uzbekistan is characterized by regional differentiation. It is determined by several groups of factors.

The first group includes infrastructural factors: broadband Internet availability, quality of mobile communications, access to data centers, energy supply reliability and availability of digital public services. Regions with better infrastructure have lower costs of adopting digital solutions.

The second group includes economic structure. Industrialized and service-oriented regions usually have higher demand for complex digital solutions, while agrarian regions require applied technologies adapted to farms, water management, land monitoring and agricultural logistics.

The third group is human capital. The availability of specialists in information technologies, engineering, data analysis, accounting and digital management affects the ability of enterprises to implement and maintain digital systems. Regions with universities, vocational institutions and innovation centers have stronger prerequisites for digital modernization.

The fourth group includes institutional and business environment factors. Digital transformation is accelerated when enterprises have access to consulting, financing, public support, tax and administrative services in electronic form, as well as reliable legal mechanisms for electronic transactions and data protection.

The fifth group is investment capacity. Large enterprises and clusters can finance digital transformation independently or attract external investment. Small and medium-sized enterprises often need subsidized financing, leasing, grants, training programs and shared digital infrastructure.

Regional inequality in digital transformation may produce cumulative effects. Regions that adopt digital technologies earlier increase productivity, attract investment and develop new skills faster. Conversely, lagging regions may face deepening technological and income gaps. Therefore, state and regional policy should aim not only at expanding general digital infrastructure, but also at ensuring the sectoral applicability of digital solutions.

Economic effects of digital transformation. The economic effects of digital transformation in traditional regional sectors can be divided into direct, indirect and systemic effects:

Direct effects include reduction of production costs, increase in labor productivity, reduction of losses, acceleration of turnover, improvement of

accounting and control, and increased utilization of fixed assets. For example, digital monitoring in agriculture can reduce inefficient water use, while predictive maintenance in industry can decrease equipment downtime.

Indirect effects are associated with expansion of market access, improvement of quality standards, growth of investment attractiveness, development of new services and increased transparency of business operations. Digital platforms allow regional producers to interact with buyers, suppliers and financial institutions more efficiently.

Systemic effects include the formation of regional digital ecosystems, development of innovation networks, improvement of public administration and strengthening of intersectoral linkages. When agricultural producers, processors, logistics companies, banks, certification bodies and public authorities interact through compatible digital systems, the efficiency of the entire value chain increases.

However, the economic impact of digital transformation is not automatic. It depends on the quality of implementation and the presence of complementary factors. International research emphasizes the productivity paradox of digital technologies: investments in information technologies may not immediately lead to measurable productivity growth if they are not accompanied by changes in management, skills and organizational processes[2],[3]. This conclusion is relevant for traditional sectors of Uzbekistan, where some enterprises still have limited experience in data-driven management.

Constraints and risks. The digital transformation of traditional sectors in the regional economy of Uzbekistan faces a number of constraints.

The first constraint is the digital divide between regions, enterprises and population groups. Unequal access to high-quality Internet and digital services limits the spread of modern technologies in rural and remote areas.

The second constraint is insufficient digital competence. Many small businesses and farms use digital tools mainly for communication and payments, while more complex solutions related to analytics, planning and integration of business processes remain underutilized.

The third constraint is limited access to finance. Digital transformation requires expenditures on equipment, software, cybersecurity, training and consulting. For small and medium-sized enterprises, these costs may be significant.

The fourth constraint is fragmentation of data and platforms. If public, sectoral and private information systems are not interoperable, economic agents are forced to duplicate data entry and bear additional administrative costs.

The fifth constraint is cybersecurity and data protection. As enterprises become more dependent on digital systems, risks related to data loss, fraud, unauthorized access and operational disruptions increase.

The sixth constraint is insufficient adaptation of digital solutions to local sectoral conditions. Technologies developed for large enterprises or foreign markets may not correspond to the scale, financial capacity and organizational practices of regional producers in Uzbekistan.

Directions for improving regional digital transformation policy. To sum up, in order to improve regional digital transformation, following economic mechanism ought to be implemented (Pic. 1).

First, it is necessary to develop sector-specific digital transformation programs for regions. Such programs should take into account the specialization of each territory: agricultural digitalization for agrarian regions, industrial automation for manufacturing centers, logistics platforms for transport nodes, and digital tourism tools for historical and cultural centers.

Second, digital infrastructure development should be combined with productive use policies. Broadband access alone does not guarantee economic transformation. It should be supplemented by training, consulting, access to finance and demonstration projects.

Third, special attention should be paid to small and medium-sized enterprises. For them, it is advisable to develop shared digital services, cloud accounting, electronic marketplaces, subsidized software packages and training programs in digital entrepreneurship.

Fourth, agricultural digitalization should be linked to water management, land monitoring, extension services and agro-logistics. Digital tools will have the greatest effect when they are embedded in the entire agricultural value chain.

Fifth, industrial digital transformation should be supported through clusters and industrial zones. Shared engineering centers, digital laboratories, testing facilities and training centers can reduce individual costs for enterprises.

Sixth, the development of human capital should become a central condition of digital transformation. Regional universities and vocational education institutions should expand programs in applied digital technologies, data analysis, industrial automation, agrotechnology and digital business management.

Seventh, public digital services should be integrated with business processes. Electronic licensing, taxation, customs, certification and statistical reporting reduce administrative costs and support formalization of economic activity.

Eighth, it is necessary to ensure interoperability of digital platforms and data standards. This is especially important for

agriculture, logistics, trade and public administration, where many participants interact simultaneously.



Picture 1. Economic mechanism of Digital Transformation of traditional industries in the regional economy of Uzbekistan

Conclusion. Digital transformation of traditional sectors of the regional economy of Uzbekistan is a complex economic process that affects production efficiency, transaction costs, market access, investment attractiveness and the quality of regional governance. Its significance is especially high because traditional sectors continue to form the basis of employment, specialization and income generation in many regions of the country.

The study shows that the main economic effects of digital transformation are associated with productivity growth, reduction of information asymmetry, optimization of resource use, expansion of sales channels and strengthening of intersectoral coordination. In agriculture, the greatest potential is connected with digital water management, precision farming, remote monitoring and agricultural platforms. In industry, digitalization supports automation, quality control, energy efficiency and integration into value chains. In transport and logistics, digital tools reduce time and coordination costs. In trade and services, digital channels expand market access for regional small businesses.

At the same time, the benefits of digital transformation are distributed unevenly across regions and sectors. The main barriers include infrastructure gaps, insufficient digital skills, limited financing, platform fragmentation, cybersecurity risks and weak adaptation of technologies to local conditions. Therefore, regional digital transformation policy should be differentiated, sector-oriented and focused on the development of complementary factors, including human capital, institutional coordination, financing mechanisms and digital infrastructure.

The practical significance of the research lies in the possibility of using its conclusions in the development of regional digitalization programs, strategies for modernization of traditional industries and mechanisms for supporting small and medium-sized businesses in Uzbekistan.

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