ASSESSMENT OF THE STATE OF DEVELOPMENT OF DIGITAL INFRASTRUCTURE IN THE REGIONS OF UZBEKISTAN

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Abstract: *This article discusses the assessment of the state of development of digital infrastructure in the regions of Uzbekistan. The main goal of the study is to identify the main aspects of best practices and develop recommendations for the development of digital infrastructure in the regions of Uzbekistan. The development of digital infrastructure is one of the important factors for the development of countries today. In this regard, Uzbekistan is also implementing digital transformation processes, introducing strategies aimed at diversifying the economy, improving the quality of social services, and improving the living standards of the population. One of the important issues is to evaluate the development of digital infrastructure in the country, to identify the differences between different regions and to eliminate existing problems in this area. For the development of digital infrastructure in the regions of Uzbekistan, the use of digital technologies in all regions of our republic, the level of provision of digital technologies, and the formation of the skills of the population in the full use of digital tools are required.*

Research methodology includes analysis of scientific literature, statistical data and comparative analysis of tax administration practices in different countries. Methods of data analysis, collection and interpretation are used, as well as expert evaluations and surveys of industry experts. The research looked at the availability and availability of digital infrastructure, including broadband Internet, mobile networks, fiber optic communications, and data centers. Also, the causes of digital differences between urban and rural areas of Uzbekistan are analyzed. In particular, attention was paid to the development of digital infrastructure in economically strong and relatively weak regions of the country. In addition, information on the projects, investments and private sector participation in this process implemented by the state for the development of digital infrastructure was also studied.

Keywords: *Region, digital infrastructure, digital infrastructure development, digitalization of regions, digitization, evaluation, digital technologies, digital transformation, digital economy, IT.*

Introduction. Digital infrastructure is rapidly developing in regions of all countries of the world, because the digital economy is growing at a very fast pace in many countries of the world, especially in developed and highly developing countries. Therefore, at a time when digital technologies occupy an important place in all sectors of any country, it is important to pay attention to digital knowledge and information technologies in order for the society to achieve more sustainable development and progress.

There is a lot of research on the development of digital infrastructure in the regions, and as a result of this research, researchers are putting forward different ideas about digital infrastructure. For example, according to Reddy and Reinartz,

digitization of territories has two definitions and one of them is the use of the internet and computer to create economic value effectively compared to the traditional meaning. In a broader sense, it has been shown to represent changes in the operation, interaction, configuration, and wealth creation of new technologies in regions [2]. S.Piyankova, M.Troyankayas suggested that the digitization of countries can be measured by six main characteristics: conditions, convenience, reliability, speed, opportunities and skills [3].

In the process of transition of regions to a digital economy, new digital technologies are rapidly penetrating the economy of various countries and regions, which has a significant impact on the development of its infrastructure and economic efficiency. Wide use of modern information and communication technologies becomes a necessary condition for the emergence and development of new effective regional management technologies, entrepreneurial practices and successful business [4].

If we take into account the assessment of the state of development of the digital infrastructure in the regions of Uzbekistan, the digital economy is in the first place. The task of developing the digital economy in the Republic of Uzbekistan includes the implementation of a number of important works within the framework of national statistics, in particular, the development of a system of indicators related to the digitalization of branches and sectors of the national economy, the formation of a database for this system, special observations, questionnaires, report forms. requires development [5].

Studies show that the construction of digital infrastructure is accompanied by the processes of modern knowledge diffusion. It encourages the unconscious and passive diffusion and penetration of knowledge between enterprises and accelerates the diffusion and utilization of knowledge. Investing in informatization of enterprises in the regions helps to increase the level of informatization of enterprises accordingly. These processes help reduce production costs and product sales prices in industry, stimulate consumer demand, and thereby expand the scale of production and production. In addition, it makes the production technology more scientific and rational, the production management process more convenient and efficient, thereby improving the production efficiency [6].

Material and method. We had to collect enough qualitative and quantitative data within the scope of the research topic in order to get the desired results from our research results. We collected this qualitative and quantitative data from primary and secondary sources. It was necessary to collect electronic and printed publications of the literature created by our country and foreign scientists and researchers about the effective organization of tax administration in increasing the tax potential of the regions, in order to clarify the theoretical aspects of our research topic.

Primary data collection by definition is the collection of raw data collected at the source. It is the process of collecting original data collected by the researcher for a specific research purpose. It can then be analyzed into two segments:

Qualitative research method. Qualitative research methods of data collection do not involve the collection of data that contain numbers or the need to extract them through mathematical calculation, but instead rely on non-quantitative elements such as the researcher's feelings or emotions. An example of such a method is an open questionnaire.

Quantitative Method. Quantitative methods are presented in numbers and

require mathematical calculations to draw conclusions. An example would be using a questionnaire with close-ended questions to arrive at numbers for mathematical calculations. Also, correlation and regression methods can be used as an example.

Results. The development of digital infrastructure plays an important role in the social and economic development of each region. Through benchmarking, analysis and prospective studies, the state of digital infrastructure between regions can be improved and promoted. The development of digital infrastructure may vary across regions. Differences between urban and rural areas, levels of economic development, and the influence of public policies account for these differences. Digital infrastructure is generally well developed in large urban centers. There are fast internet connections, many data centers and extensive mobile networks. Cities are centers of economic development and technological innovation, and are at the forefront of the introduction of new technologies. The development of digital infrastructure in rural areas is often limited. A lack of internet connectivity, mobile coverage and data centers limits access to digital services in these areas. This situation can lead to slow economic development and social inequality in rural areas.

In our country, significant work is being done to assess the state of development of digital infrastructure in the regions. In accordance with the "Digital Uzbekistan – 2030" strategy, in order to assess the state of digital transformation in the regions, a methodology for rating the level of digital development of the regions was developed, and with this, an opportunity was created to diagnose the state of digitization in the regions.

In the rating evaluation methodology, the indicators used by the United Nations (UN) in evaluating the development of information technologies and the introduction of electronic government in the countries of the world were adopted.

The rating evaluation procedure consists of 4 priority areas:

• "Digital infrastructure" (35 points) - coverage of settlements with Internet, mobile communication, "Wi-Fi" points, etc. is assessed;

• "Digital economy" (25 points) - the effective use of electronic invoices and online cash registers, the state of the local IT services market, the introduction of an automated system of accounting and control of electricity and natural gas consumption, etc. are evaluated.

• "Digitalization of the social sphere" (20 points) - assessment of the state of Internet use in social institutions (kindergartens, schools, polyclinics), as well as the state of implementation of educational and other systems and software products.

• "Digital education" (20 points) - schools with computer science teachers with a diploma in the field and the coverage of students under the "One million programmers" program, employment of the population in the IT sector, IT- of educational centers and others.

The final grade of the areas is "green" - a good grade (from 71 to 100 points), "yellow" - a satisfactory grade (from 55 to 71 points) and "red" - with an unsatisfactory assessment result (below 55 points).

If we look at the assessment of the state of "Digital infrastructure" in the rating evaluation procedure, it is necessary to provide the settlements with Internet, mobile communication, and Wi-Fi points. The rate of growth of the volume of services in the field of information and communication by region was quite high (Table 1):

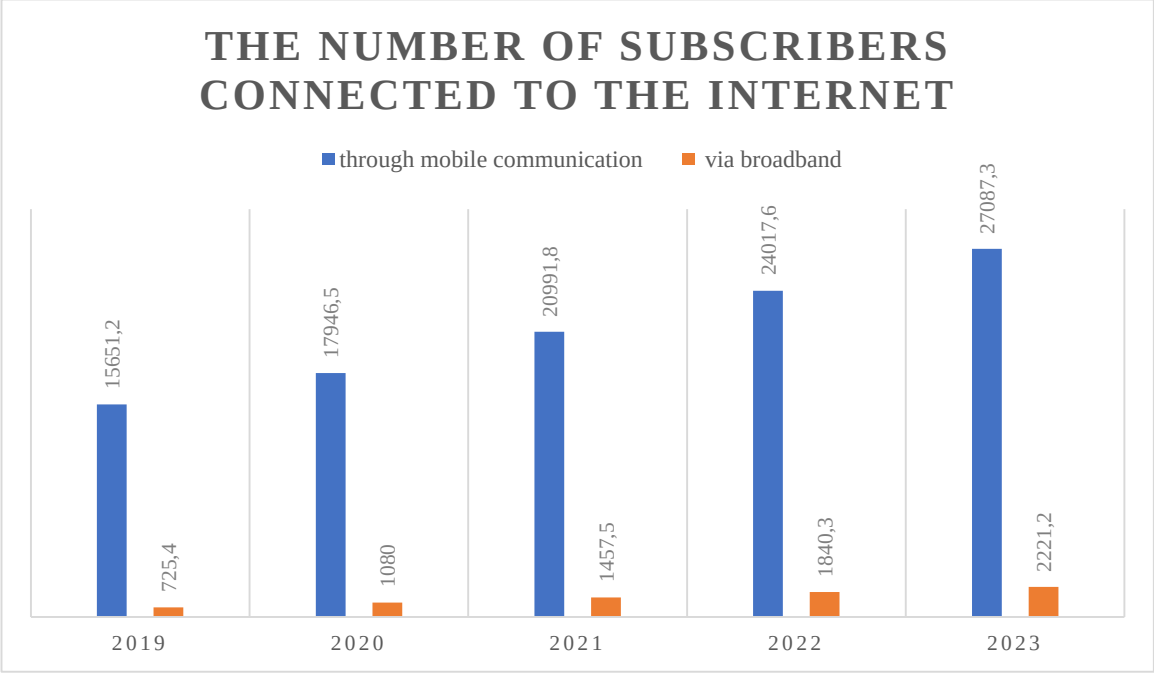
Table 1

Growth rate of the volume of services in the field of information and communication by region (unit of measurement in %)[1]

№	Regions	2019	2020	2021	2022	2023
1	Karakalpakstan Republic	112,2	107,8	114,6	120,5	120,8
2	Andijan region	113,6	113	112,7	129,6	118,3
3	Bukhara region	110,5	107,4	118,8	122,7	117,3
4	Jizzakh region	110,8	119	129,4	125,5	106,8
5	Kashkadarya region	113	111,6	121,8	127	118,2
6	Navoi region	109,9	112,5	113,7	126,2	123,6
7	Namangan region	110,6	109,7	110,2	128,8	124,6
8	Samarkand region	112,7	111,1	115,2	126	125,2
9	Surkhandarya region	110,4	109,7	121,2	127,6	125,5
10	Syrdarya region	112,3	120,5	114,5	127,8	121
11	Tashkent region	107,9	143,1	130,9	128,6	134,3
12	Fergana region	109,2	114,9	116,9	126,2	119,8
13	Khorezm region	109,9	112,7	118,3	128,4	124,6
14	Tashkent city	105,8	132	132,5	130,1	127,2

From the above table, we can see that the volume of services in the field of information and communication provided by regions is increasing compared to previous years. This is mainly happening as a result of the development of digital infrastructure in the regions. That is, the development of the Internet network and the improvement of software tools lead to an increase in the number of its users and an increase in the number of services on it.

The increase in the number of subscribers connected to the Internet is also the reason for the development of digital infrastructure in the regions of Uzbekistan (Figura 1):



[1] https://data.egov.uz/ - prepared by the author based on the information from the open data portal of the Republic of Uzbekistan

Figura 1. The number of subscribers connected to the Internet[2]

According to the data in the above diagram, in 2019 the number of subscribers connected to the Internet through mobile communication was 15651.2 thousand, the number of subscribers connected through broadband was 725.4 thousand, in 2020 the number of subscribers connected to the Internet through mobile communication 17946.5 thousand, the number of subscribers connected via broadband is 1080 thousand, in 2021 the number of subscribers connected to the Internet via mobile communication is 20991.8 thousand, the number of subscribers connected via broadband is 1457.5 thousand, in 2022 the Internet network while the number of subscribers connected to the Internet via mobile communication was 24017.6 million, the number of subscribers connected via broadband was 1840.3 thousand, by 2023 the number of subscribers connected to the Internet network via mobile communication will reach 27087.3 thousand, via broadband the number of connected subscribers reached 2221.2 thousand.

If we pay attention to the evaluation of the state of "Digital infrastructure" in the rating evaluation procedure, the state of the IT services market in our country is developing widely. Uzbekistan's IT sector is experiencing rapid growth: more than 100,000 people work in this sector, and the market size is approaching $1 billion. In 2023, the export volume of IT services in our country will exceed $300 million (Figure 2):

Figure 2. The size of the IT market of Uzbekistan[3]

Such growth in the IT market allows the IT industry not to be dependent on one country or one direction, and the fact that software development is at the forefront indicates that more and more skilled personnel are emerging in the country. In addition, software development opens up enormous opportunities and potential, as the

[2] http://www.stat.uz - prepared by the author based on the information on the website of the State Statistics Committee of the Republic of Uzbekistan

[3] https://it-park.uz/ - prepared by the author based on information from the IT Park website of the Republic of Uzbekistan

market in this field is estimated at hundreds of billions of dollars. This accelerates the development of digital infrastructure in the regions of Uzbekistan.

In the section "Digitalization of the social sphere", which is taken into account in the assessment of the development of digital infrastructure in the regions, cases of introduction of software products related to various fields are taken into account. In our country, funds are allocated for the creation and implementation of software tools for each language (Figura 3):

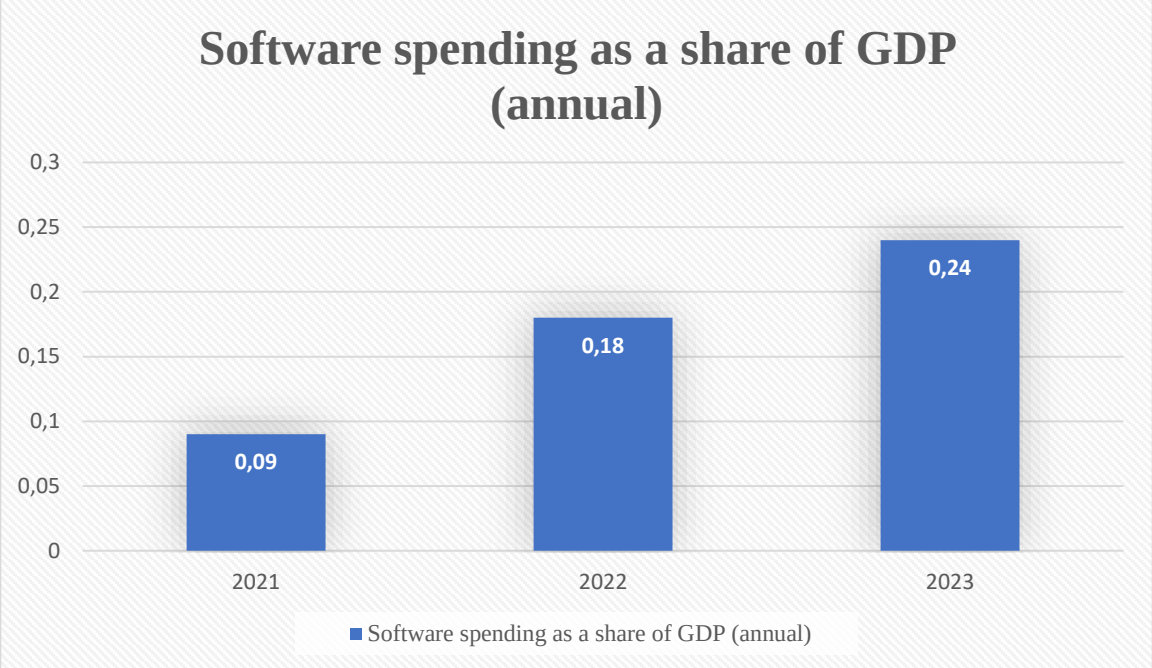


Figure 3. Software spending as a share of GDP (annual)[4]

From the figure above, we can see that software spending was 0.09 percent of GDP in 2021, 0.18 percent of GDP in 2022, and 0.24 percent of GDP by 2023.

In the "Digital education" section, which is taken into account in the assessment of the development of digital infrastructure in the regions, it is envisaged to increase the IT literacy of the population by strengthening knowledge about informatics and IT. More than 10,000 schools across the country are provided with high-speed Internet. About 60 IT higher education institutions operate in the republic. Tashkent University of Information Technologies, its six branches in the regions of Uzbekistan, as well as INHA, Amity and other higher educational institutions annually train more than 29 thousand highly educated personnel in artificial intelligence, data science, information security, engineering and other fields. Thanks to the benefits and preferences provided by the state, the number of private educational institutions that are residents of the IT Park has reached 305. They have over 400 educational IT courses that have been completed by over 15,000 people.

Discussion. Currently, digital infrastructure is rapidly developing in our country. For the rapid development of digital infrastructure, digital transformation and improvement of the digital economy are being implemented in the regions. In accordance with this, the state of development of digital infrastructure in the regions is being evaluated based on the

[4] http://www.stat.uz - prepared by the author based on the information on the website of the State Statistics Committee of the Republic of Uzbekistan

Decision No. 373 of the Cabinet of Ministers of the Republic of Uzbekistan dated June 15, 2021 "On measures to further improve the rating system of the state of development of the digital economy and electronic government".

According to the "Digital Uzbekistan - 2030" strategy in our country, digitalization of economic sectors and regions, implementation of state information systems and electronic services, as well as public education, public services, judiciary, finance and complex measures are being implemented in the banking system.

At the same time, the lack of an effective rating system for the development of the digital economy and electronic government, as well as the lack of an interdepartmental mechanism for its implementation, makes it difficult to analyze the current state of the digital transformation of economic sectors and regions.

In accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated June 15, 2021 No. 373 "On measures to further improve the rating system for the development of the digital economy and electronic government" "Executive authorities of the Republic, economy Associations and local executive authorities on digital transformation and the procedure for rating the state of the digital economy in the regions" was adopted, which includes the main concepts used in the evaluation of the level of digital development of the regions, the main evaluation criteria and the evaluation procedure. The following basic concepts are used to assess the level of digital development of regions (Figure 4):

indicator	**the main indicator by which the effectiveness of the introduction and development of information and communication technologies should be evaluated**
index	**a set of indicators used in rating the state of digital transformation and digital economy**
rating evaluation	**by evaluating the state of digital development with the help of rating indicators and indicators, determining the place of organizations and regions in the list sorted from the highest result to the lowest result**
regions	**evaluated Republic of Karakalpakstan, regions and Tashkent city, district (cities)**
NIS.UZ-information system	**an interdepartmental information system used to automate the processes of digital transformation in organizations and assessment of the state of the digital economy in regions**

Figure 4. Basic concepts used in assessing the level of digital development of regions[5]

The assessment of the level of digital development of the regions presented in the above figure is carried out through the main concepts presented in the above figure. These mainly show the state of digital transformation and digital economy, which serve in the development of digital infrastructure in the regions of our country.

The assessment of the state of development of digital infrastructure in our country is mainly achieved by rating the digital transformation in organizations and the state of the digital economy in regions.

The rating assessment of the state of digital transformation in organizations is carried out according to the main indices in the following directions:

1. Openness and electronic participation index;
2. Index of electronic services;
3. Information security index;
4. Index of digitization of activity.

Rating evaluation activities in organizations are carried out according to the following structure (Table 2):

Table 2

The rating structure of the state of digital transformation in executive authorities, economic associations and local executive authorities in the Republic of Uzbekistan[6]

Steps	Responsible organizations	Events	Deadlines
Stage 1	State bodies and business associations, local executive authorities, Ministry of Digital Technologies	According to the "Index of Openness and Electronic Participation", the structural units responsible for information technologies collect official statistical and analytical data, enter them into the NIS.UZ-information system, analyze and evaluate the entered data.	For 45 days after the end of each semester, January-February, July-August
Stage 2	State bodies and business associations, local executive authorities, Ministry of Digital Technologies	Analyzes and evaluates the information entered into the NIS.UZ-information system according to the "Electronic Services Index".	Every half year, January-June, July-December
Stage 3	State bodies and business associations, local	Analyzes the data entered into the NIS.UZ-information system according to the "Activity	For 45 days every half year, May-June, November-December

[5] Prepared by the author on the basis of the information contained in the Resolution No. 373 of the Cabinet of Ministers of the Republic of Uzbekistan dated June 15, 2021 "On measures to further improve the system for rating the development of the digital economy and electronic government"

[6] Prepared by the author on the basis of the information contained in the Resolution No. 373 of the Cabinet of Ministers of the Republic of Uzbekistan dated June 15, 2021 "On measures to further improve the system for rating the development of the digital economy and electronic government"

	executive authorities, Ministry of Digital Technologies	digitization index", checks the level of implementation of the tasks stated in the information systems implementation documents.	
Stage 4	"Cybersecurity Center" state unitary enterprise, Ministry of Digital Technologies	Performs activities required by the "Information and Cyber Security Index".	Every half year
Stage 5	Ministry of Digital Technologies	Submits rating results and other analytical materials to the Cabinet of Ministers.	Until the 30th of the month following the end of the reporting period

Each step in the structure presented in Table 1 is carried out in the rating assessment of the state of digital transformation. At each of these stages, the responsible bodies and the activities to be carried out by them, as well as the deadlines for their implementation, are defined. The activities carried out within the specified period will allow you to clearly see the state of digital transformation.

The implementation of elements related to the development of digital infrastructure in the regions and the support of the digital economy have a strong place in Uzbekistan's near-term development plan. This, first of all, concerns the task of further increasing the digital transformation and the step-by-step transfer of a certain part of state services to electronic form. Telecommunications infrastructure plays an important role in this process.

Interest in the digital economy has grown significantly due to significant changes in society and the economy. Modern technologies and platforms have helped businesses and individuals to reduce costs by minimizing personal communication with customers, partners and government organizations, and also made it possible to communicate more quickly and easily. The result is a digital or electronic economy based on network resources. Currently, the level of the digital economy is rated and has its own forms (Table 3):

Table 3

The structure of the rating assessment of the level of the digital economy in the regions[7]

Steps	Responsible	Events	Deadlines
Stage 1	Ministry of Digital Technologies	Enters statistical and analytical data on the level of the digital economy in the regions into the NIS.UZ-information system.	By the 15th of the following month at the end of the reporting period

[7] Prepared by the author on the basis of the information contained in the Resolution No. 373 of the Cabinet of Ministers of the Republic of Uzbekistan dated June 15, 2021 "On measures to further improve the system for rating the development of the digital economy and electronic government"

Stage 2	Ministry of Digital Technologies	Based on the information entered into the NIS.UZ-information system, it performs the rating assessment and forms the rating based on the results of the rating assessment of the regions.	Until the 25th of the following month at the end of the reporting period
Stage 3	Ministry of Digital Technologies	Submission of rating results and other analytical materials to the Cabinet of Ministers	Until the 30th of the following month at the end of the reporting period

From the table above, we can see that the rating assessment of the level of the digital economy in the regions consists of 3 stages, and the activities held at each stage are carried out by the Ministry of Digital Technologies.

Digital infrastructure development varies by region. Digital infrastructure is generally well developed in urban centers. There are large data centers, fast internet networks and cloud services. In industrial zones, digital infrastructure is widely used to optimize production processes. IoT technologies and automated systems are introduced. In rural areas, however, the development of digital infrastructure can often be limited. Internet connection, mobile coverage and software services may be limited.

Conclusion. In conclusion, the digital infrastructure of Uzbekistan has been developing significantly in recent years. Digital infrastructure is the main part of modern economy and social development, and the rapid development of digital technologies creates an opportunity to reduce regional differences in our country, stimulate economic growth and provide quality services. Digital infrastructure plays an important role in stimulating economic growth, improving social services and increasing global competitiveness. For Uzbekistan, the digital infrastructure is considered as the main factor supporting the economic and social development of the country. The development of digital infrastructure through high-speed Internet networks, high-quality communication services, cloud technologies and data centers is necessary for the country's integration into the digital economy and strengthening its position in the world market.

The level of development of digital infrastructure is different in each region of Uzbekistan. Although digital infrastructure is relatively developed in Tashkent and other large cities, this process is being implemented more slowly in remote areas and rural areas. In Tashkent, for example, the introduction of high-speed Internet services, digital communication networks and innovative technologies has been successfully implemented. In other regions, especially in industrial and rural areas, additional attention and resources are required for the development of digital infrastructure.

The development of digital infrastructure has a great impact on economic growth. Through digital technologies, it is possible to optimize business processes, create new jobs and increase economic

efficiency. In order to support the economic development of Uzbekistan, it is important to develop the digital infrastructure, in particular, to support small and medium-sized businesses, to encourage e-commerce and to introduce innovations.

There are a number of challenges and challenges in the process of developing digital infrastructure. Rural areas face challenges such as lack of infrastructure, financial constraints, and lack of technological support. Other challenges include the digital divide, i.e. differences in access to digital services. Addressing these challenges requires additional resources, government policies, and private sector investment.

We suggest improving the following directions in the development of the digital infrastructure of Uzbekistan:

• Ensuring digital equity: Providing equal access to digital services in all regions and reducing the digital divide.

• Introduction of innovative technologies: Optimizing economic and social processes by introducing new technologies.

• Interregional cooperation: To ensure the overall development of digital infrastructure through the development of interregional cooperation.

The development of digital infrastructure in the regions of Uzbekistan plays an important role in supporting the economic and social development of the country. Although digital infrastructure is developed in big cities, this process is developing more slowly in remote areas. Through the development of digital infrastructure, it is possible to increase economic growth, improve the quality of social services and introduce technological innovations. In the future, there are opportunities to develop digital infrastructure in all regions by ensuring digital equality and introducing new technologies.

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