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An Integrated Methodology For Assessing The Effectiveness Of Digital Monitoring In Regional Economic Development: Interregional Disparities And Empirical Evidence

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Abstract: This article examines the institutional architecture of digital monitoring for regional economic development, its structural components, and the functional interrelationships among different levels of governance. Drawing on international experience, the study systematizes the role of multi-level governance, regional data integration, and monitoring and evaluation mechanisms in the formulation and implementation of regional policy. In the context of Uzbekistan, an adaptive approach is proposed based on strengthening institutional coordination among central and regional public authorities, the national statistical system, and digital platforms. The study further substantiates conceptual directions for integrating digital monitoring outcomes into regional governance and decision-making processes.

Keywords: regional economy, digital monitoring, institutional architecture, regional development, multi-level governance, regional data, digital platforms, adaptive governance, international experience, regional policy.

1. Introduction

The accelerating pace of digital transformation in the global economy necessitates a reconsideration of the institutional foundations of regional development governance. Data on the economic conditions of regions, investment activity, labour markets, the business environment, infrastructure provision, and socio-economic disparities are generated across various public authorities and information systems, thereby increasing the importance of integrating these data into a unified governance process. Accordingly, in contemporary regional policy, digital monitoring should be developed not merely as a separate information system, but rather as an institutional architecture that interconnects the mandates and functions of data-generating institutions, digital platforms responsible for data integration, analytical centres, national and regional public authorities, and stakeholders that utilise monitoring results.

The OECD international standard on regional development policy identifies high-quality data across different territorial levels, multi-level governance, institutional capacity, and performance evaluation mechanisms among the key components of effective regional policy. The OECD recommends improving the accuracy and territorial granularity of demographic, socio-economic, environmental, and financial indicators at the subnational level, while expanding the use of smart data, big data, open data, and geospatial data alongside administrative data.

The second important component of the institutional architecture of digital monitoring is the functional coordination among national, regional, and local levels of governance. The OECD defines multi-level governance as an independent institutional pillar of regional

development policy and emphasises the need to effectively coordinate interactions between national and subnational authorities, clearly delineate mandates and responsibilities, and strengthen both inter-agency collaboration and interregional cooperation. Furthermore, monitoring and evaluation results should be directly integrated into the formulation of new policy initiatives, the adjustment of existing programmes, and resource allocation processes [1]. From this perspective, the architecture of regional digital monitoring should be interpreted not simply as a collection of databases, but as a system of inter-institutional relationships governing the production, exchange, analysis, and transformation of data into management decisions.

The World Bank's 2025 GovTech Maturity Index methodology similarly assesses the institutional maturity of digital government not through the number of individual technological solutions, but through a set of interconnected components. Covering 197 economies and using 48 indicators to assess the digital transformation of public administration, this approach integrates into a unified framework core government information systems and shared digital infrastructure, online public services, digital citizen engagement, as well as factors enabling GovTech development, including strategies, institutions, legislation, digital skills, and innovation policies [2].

A performance evaluation system also occupies a distinct position within the institutional architecture of regional monitoring. International experience demonstrates that the purpose of monitoring is not limited to recording the number of implemented activities; rather, it is aimed at identifying the actual economic outcomes of regional policy, assessing the conditions under which particular policy measures have proven effective, and adjusting governance decisions in accordance with the results achieved.

In Uzbekistan, the institutional foundations of digital monitoring are being progressively developed within the framework of the "Digital Uzbekistan – 2030" Strategy. The Strategy, approved by Decree No. PF-6079 of the President of the Republic of Uzbekistan dated 5 October 2020, establishes monitoring and reporting mechanisms alongside the priority areas of digital transformation. According to the current version of the Strategy, the activities of a coordinating working group are envisaged to monitor the implementation of the prescribed measures and the achievement of established objectives, while the status of completed tasks and the extent to which reforms contribute to achieving the defined goals are to be assessed on the basis of performance criteria [3].

At the subsequent stage, this institutional system was further strengthened at the regional, sectoral, and industry levels. Resolution No. PQ-286 of the President of the Republic of Uzbekistan dated 16 September 2025 established new organisational and legal foundations for accelerating the introduction of digital technologies across the country's regions, sectors, and industries. Within the implementation framework of this Resolution, functions related to the introduction and coordination of systematic IT audits of information infrastructure operational processes within state and local executive authorities and other organisations were strengthened in 2026 [4].

The process of adapting international methodologies to national conditions has also intensified in the development of monitoring and evaluation institutions in Uzbekistan. The methodological guide on monitoring and evaluation developed by the United Nations Development Programme in 2025 adapts the OECD DAC and UNDP standards for results-based management to Uzbekistan's institutional characteristics and provides for the integration of monitoring and evaluation into policy formulation and implementation processes. The guide develops practical mechanisms relating to indicator matrices, strategic planning, policy impact assessment, and the incorporation of evaluation results into governance decisions [5]. UNDP research on the institutionalisation of digital transformation monitoring also highlights the need to assess existing practices, develop a specialised monitoring methodology, and strengthen the institutional capacity of civil servants.

Decree No. PF-141 of the President of the Republic of Uzbekistan dated 24 July 2026 advanced the institutional mechanisms of the "Digital Uzbekistan – 2030" Strategy to a new stage of development. The Decree provides for aligning target indicators in the fields of digital technologies and artificial intelligence with the objectives of the "Uzbekistan – 2030" Strategy, while also strengthening monitoring, reporting, and

evaluation mechanisms as distinct strategic components [3]. As a result, the institutional interconnections among strategic objectives, target indicators, responsible institutions, monitoring, reporting, and evaluation are becoming increasingly consolidated within the governance architecture of digital transformation.

At the same time, several issues remain pertinent within the existing institutional system for the digital monitoring of regional economic development, including the fragmentation of data across government agencies, the application of heterogeneous methodologies in constructing territorial indicators, the degree of integration between national and local information systems, the timely incorporation of monitoring results into regional strategic decision-making, and the analytical capacity of subnational authorities. Consequently, there is a need to adapt the principles of multi-level governance, unified data standards, inter-agency interoperability, results-oriented monitoring, and independent evaluation derived from international experience to the institutional and economic characteristics of Uzbekistan's regions. These circumstances determine the relevance of scientifically systematising the institutional architecture of digital monitoring for regional economic development and developing an adaptive model tailored to the conditions of Uzbekistan.²

The institutional architecture of digital monitoring for regional economic development is examined in contemporary academic literature through the interrelationship between the concepts of regional innovation policy, multi-level governance, strategic monitoring, institutional capacity, territorial data integration, and adaptive governance. A synthesis of existing scholarly approaches indicates that the effectiveness of digital monitoring depends not only on the availability of technological platforms but also on the mandates and responsibilities of institutions involved in the monitoring process, information exchange among them, the analytical capacity of regional authorities, and the mechanisms through which monitoring outcomes are transformed into governance decisions.

A. Kleibrink, C. Gianelle, and M. Doussineau examine the institutional characteristics of monitoring regional innovation development and argue that limiting monitoring to conventional control and audit functions is methodologically insufficient [6]. According to the authors, an effective monitoring system should not only record policy outcomes but also generate information for evidence-based governance, facilitate stakeholder participation, and enable regional strategies to be revised on the basis of monitoring results. This approach demonstrates the need for continuous functional linkages between data-generating institutions and decision-making bodies within the institutional architecture of regional digital monitoring. However, since the study primarily focuses on smart specialisation policy in Europe, issues related to digital monitoring platforms, inter-agency data integration, and digital institutional models of regional governance are not fully addressed.

M. Trippel, E. Zukauskaitė, and A. Healy associate the effectiveness of regional policy with the institutional and organisational characteristics of regions and demonstrate that identical governance mechanisms may produce different outcomes across developed, intermediate, and relatively less-developed regions [7]. The authors show that the capacity to formulate and implement regional policy depends on the decentralisation of governance authority, financial resources, institutional quality, and the knowledge and competencies of regional governance bodies. This conclusion provides an important methodological foundation for developing the institutional architecture of digital monitoring, suggesting that mechanically implementing a uniform standardised governance model is inappropriate where regions possess different levels of institutional capacity. In the context of Uzbekistan, while technological standards for monitoring may be established centrally, it is also necessary to take into account the capacity of regional authorities to analyse data and utilise them in decision-making processes [7].

E. Wibisono critically examines the institutional relationship between multi-level governance and smart specialisation policy and identifies coordination mechanisms among different levels of government as a decisive factor in the effective implementation of regional policy [8].

M. Benner analyses the institutional dimensions of regional innovation policy from a neo-

institutional perspective and demonstrates that discrepancies may arise between formal institutions and actual governance practices [9]. The author emphasises that excessive reliance on easily measurable standard indicators in monitoring and evaluation systems may result in the predominance of formal reporting mechanisms rather than the assessment of actual economic outcomes. This approach is particularly relevant to the development of the institutional architecture of regional digital monitoring. An increase in the number of information systems and indicators does not necessarily imply an improvement in monitoring effectiveness. Unless monitoring is institutionally supported by mechanisms for identifying regional problems, interpreting results, and generating appropriate governance responses, digitalisation may merely transform conventional formal reporting into a technologically advanced reporting system [9].

G. Moujaes investigates the practice of developing monitoring indicators in regional strategies using extensive empirical evidence. The author examines 133 regional strategic documents and finds that 72 contain a separate section devoted to monitoring, whereas only 39 explicitly specify the indicators to be used in the monitoring process [10].

Knowledge-producing organisations also play an important role within the institutional architecture of regional monitoring. A study conducted in the peripheral regions of Portugal analyses the role of universities in the institutionalisation of regional innovation policy and identifies their function as knowledge intermediaries between government, business, and other regional stakeholders [11].

Contemporary studies addressing the economic implications of regional innovation policy governance increasingly focus on the quantitative assessment of institutional quality. In particular, the QS3GOV composite index, developed to assess the quality of smart specialisation governance, integrates the institutional components of governance into a single quantitative indicator [12].

Studies examining the role of innovation intermediaries further demonstrate that the effectiveness of institutional architecture is directly associated with decentralisation, collaboration, and trust [13]. A study conducted in the Brazilian state of Pernambuco identifies effective decentralisation, the development of an innovation-oriented culture, and the establishment of participatory governance mechanisms as key institutional challenges.

C. Meyer proposes a transnational RIS3 observatory model to strengthen interregional smart specialisation monitoring, emphasising that the comparability and institutional coordination of individual regional monitoring systems remain insufficiently developed [14]. A key feature of the observatory approach is the systematisation of data obtained from different regions on the basis of a common methodology, the comparison of monitoring outcomes, and the facilitation of interregional policy learning. This experience provides a conceptual basis for establishing a system of regional digital observatories for monitoring regional economic development in Uzbekistan that would operate under a unified national methodology while simultaneously taking into account the specific economic characteristics of individual regions.

A synthesis of the reviewed scholarly approaches demonstrates that the existing literature has extensively addressed the strategic functions of monitoring, multi-level governance, the capacity of regional institutions, stakeholder participation, and the development of indicator systems. However, the integration of data generation, data consolidation within a unified digital environment, regional diagnostics and forecasting, the formulation of governance decisions, and the subsequent monitoring of their outcomes within a single institutional architecture has not yet been sufficiently systematised.[15]

2. Research Methodology

The research methodology was based on a systematic examination of the institutional architecture of digital monitoring for regional economic development. The study employed systemic, institutional, comparative, and structural-functional approaches, together with the methods of scientific abstraction, induction and deduction, analysis, and synthesis. International practices related to multi-level governance, data integration, and monitoring and evaluation mechanisms were comparatively examined, and their

institutional components, functional responsibilities, and interrelationships within regional governance were systematically classified.

The methodological framework prioritised the adaptation of advanced practices developed by international institutions to the specific characteristics of national and regional governance in Uzbekistan rather than their direct replication. The institutional architecture was examined through the functional coherence of data generation, integration and analysis, regional diagnostics, the incorporation of monitoring results into governance decision-making, and performance evaluation. As a result, the methodological foundations were established for harmonising the mandates and responsibilities of central and regional institutions, strengthening inter-agency information exchange, and developing an adaptive digital monitoring mechanism.

3. Analysis And Results

The Analysis and Results section provides a systematic assessment of the economic and digital development processes across the regions of Uzbekistan during 2016–2025 based on comprehensive statistical data. The analysis summarises, in tabular form, key regional indicators, including gross regional product (GRP), GRP per capita, investment in fixed capital, investment activity, and indicators characterising the development of digital infrastructure. In addition, using Namangan Region as a case study, the ten-year dynamics of economic and digital transformation indicators were examined separately, and a corresponding system of indicators was developed to provide a comprehensive assessment of the level of regional digital transformation.

The development of an institutional architecture for the digital monitoring of regional economic development requires, first and foremost, an assessment of the availability of the necessary information and communication infrastructure across regions and the dynamics of its development. In this context, the expansion of Internet usage determines the capacity for the timely generation and transmission of regional data, while the development of information and communication services reflects the potential for integrating digital infrastructure into economic and institutional processes (Table 1).

Table 1.

Key Indicators Forming the Information Base for Digital Monitoring across the Regions of Uzbekistan, 2016–2025

Regions	Internet subscribers, 2016, thousand	2020, thousand	2025, thousand	Growth, 2016–2025, times	2020, UZS billion	2025, UZS billion	Growth, 2016–2025, times
Republic of Karakalpakstan	526.4	1,071.9	1,792.9	3.41	433.4	1,403.2	5.62
Andijan	731.1	1,484.2	2,761.5	3.78	628.4	1,797.6	4.91
Bukhara	482.6	1,011.2	1,805.9	3.74	450.5	1,299.2	4.97
Jizzakh	304.4	667.2	1,242.8	4.08	268.3	1,101.9	7.48
Kashkadarya	578.5	1,440.9	2,516.6	4.35	574.6	1,802.7	5.44
Navoi	312.7	647.1	1,193.5	3.82	281.5	963.2	6.03
Namangan	621.4	1,379.5	2,586.5	4.16	542.5	1,590.7	5.15
Samarkand	865.0	1,795.4	3,574.7	4.13	791.2	2,764.3	6.73
Surkhandarya	433.5	1,151.5	2,044.9	4.72	438.7	1,428.3	5.52
Syrdarya	229.8	505.7	916.8	3.99	211.6	631.1	5.55
Tashkent Region	353.1	1,255.2	2,333.0	6.61	579.1	2,566.7	16.63
Fergana	881.4	1,937.4	3,228.8	3.66	911.4	2,806.8	5.79
Khorezm	448.5	1,012.9	1,850.7	4.13	362.2	1,534.4	6.84
Tashkent City	2,858.3	4,620.9	8,346.5	2.92	9,382.5	57,769.1	20.38
Republic of Uzbekistan	9,626.8	19,981.0	36,195.1	3.76	15,861.1	79,485.5	12.60

Source: Author's compilation based on data from the Statistical Information and Analytical System of the Republic of Uzbekistan.

During 2016–2025, the infrastructural and service-related indicators forming the information base for digital monitoring demonstrated substantial growth across the

regions of Uzbekistan. Nationwide, the number of Internet subscribers increased from 9,626.8 thousand to 36,195.1 thousand, representing a 3.76-fold increase, while the volume of information and communication services rose from UZS 6,306.8 billion to UZS 79,485.5 billion, or 12.60 times. At the regional level, the highest growth in Internet subscribers was recorded in Tashkent Region, where the indicator increased from 353.1 thousand to 2,333.0 thousand, or 6.61 times. The volume of information and communication services in Tashkent City increased from UZS 2,834.7 billion to UZS 57,769.1 billion, representing a 20.38-fold increase, while in Tashkent Region it rose from UZS 154.3 billion to UZS 2,566.7 billion, or 16.63 times. In Namangan Region, the number of Internet subscribers increased from 621.4 thousand to 2,586.5 thousand, or 4.16 times, whereas information and communication services expanded from UZS 308.9 billion to UZS 1,590.7 billion, corresponding to a 5.15-fold increase.

The identified territorial disparities substantiate the need to separately assess the availability of information resources and the capacity to integrate them into governance processes within the institutional architecture of digital monitoring for regional economic development. While the expansion of Internet subscriptions creates the basic technological conditions for generating regional data and accessing digital services, the development of information and communication services reflects the extent to which this infrastructure is embedded in economic activity. The territorial imbalance between these two dimensions demonstrates that the mere availability of digital infrastructure is insufficient for establishing an effective monitoring institution. Accordingly, the regional digital monitoring architecture should prioritise the introduction of unified data-generation standards, interoperability among regional information systems, institutional regulation of inter-agency data exchange, and the development of regional analytical capacity.

Although the dynamics of Internet subscriptions and information and communication services across regions during 2016–2025 demonstrate a consistent expansion of the information and communication base required for digital monitoring, the territorial scale of this process does not imply an equivalent level of institutional capacity across all regions (Table 2).

Table 2.

Comparative Diagnostic Indicators of the Institutional Base for Digital Monitoring across the Regions of Uzbekistan, 2016–2025

Regions	Growth in Internet subscribers, times	Growth in information and communication services, times	Change, units	Priority area for institutional monitoring
Republic of Karakalpakstan	3.41	5.62	+13.3	Data integration
Andijan	3.78	4.91	+21.2	Regional analytics
Bukhara	3.74	4.97	+15.2	Digital services monitoring
Jizzakh	4.08	7.48	+19.1	Real-time monitoring
Kashkadarya	4.35	5.44	+19.4	Digital coverage diagnostics
Navoi	3.82	6.03	+26.3	Economic performance monitoring
Namangan	4.16	5.15	+28.0	Integrated regional monitoring
Samarkand	4.13	6.73	+24.9	District and city monitoring
Surkhandarya	4.72	5.52	+20.0	Infrastructure monitoring
Syrdarya	3.99	5.55	+25.7	Data timeliness
Tashkent Region	6.61	16.63	+53.6	Transformation effectiveness
Fergana	3.66	5.79	+21.9	Economic-digital integration
Khorezm	4.13	6.84	+20.5	Regional information integration
Tashkent City	2.92	20.38	+85.3	High-frequency monitoring
Republic of Uzbekistan	3.76	12.60	+30.5	Unified national-regional monitoring architecture

Source: Author's calculations based on SIAT data of the National Statistics Committee of the Republic of Uzbekistan.

The dynamics of indicators characterising the institutional base of digital monitoring across Uzbekistan during 2016–2025 reveal substantial regional differentiation. Nationwide, the number of Internet subscribers increased 3.76 times, while the volume of information and communication services increased 12.60 times. The number of mobile subscribers per 100 inhabitants rose from 66.8 to 97.3, representing an increase of 30.5 units. In Tashkent Region, Internet subscriptions and information and communication services increased by 6.61 and 16.63 times, respectively, while mobile communication coverage improved by 53.6 units. In Tashkent City, the 20.38-fold growth in information and communication services and an 85.3-unit increase in the mobile communication indicator reflect a high territorial concentration of digital services. In Namangan Region, Internet subscriptions increased 4.16 times and information and communication services 5.15 times, while mobile subscriptions per 100 inhabitants increased from 58.8 to 86.8, representing a rise of 28.0 units.

This territorial differentiation demonstrates that the development of the institutional architecture of digital monitoring cannot rely solely on the level of technological infrastructure. While Internet and mobile communication coverage expands the capacity to generate primary data for monitoring purposes, the development of information and communication services reflects the capacity to utilise this infrastructure for economic and governance purposes. Consequently, differences in the level of digital development across regions also generate differentiated institutional monitoring needs.

A comparative assessment of the institutional base for digital monitoring across Uzbekistan demonstrates considerable regional variation in the growth rates of Internet infrastructure, mobile communication coverage, and information and communication services. However, interregional comparative indicators alone cannot fully reveal how the institutional base for digital monitoring has evolved within a particular region or the extent to which its constituent elements have developed proportionately over time (Table 3).

Table 3.

Development Dynamics of the Institutional Base for Digital Monitoring in Namangan Region, 2016–2025

Indicator	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Internet subscribers, thousand	621.4	749.8	961.5	1,198.3	1,379.5	1,637.0	1,863.9	2,036.9	2,278.1	2,586.5
Internet subscribers per 100 inhabitants	23.6	28.0	35.3	43.1	48.6	56.5	62.9	67.2	73.5	81.1
Mobile subscribers per 100 inhabitants	58.8	62.5	60.6	65.8	68.4	76.3	80.5	83.7	88.1	86.8
Information and communication services, UZS billion	308.9	424.3	482.0	487.0	542.5	615.4	799.3	1,007.4	1,181.8	1,590.7
Internet subscribers base index, 2016=100	100.0	120.7	154.7	192.8	222.0	263.4	299.9	327.8	366.6	416.2
Information and communication services base index, 2016=100	100.0	137.4	156.0	157.7	175.6	199.2	258.8	326.1	382.6	515.0

Source: Author's calculations based on SIAT data of the National Statistics Committee of the Republic of Uzbekistan.

During 2016–2025, the indicators forming the institutional base for digital monitoring in Namangan Region expanded steadily and at relatively high rates. The number of Internet subscribers increased from 621.4 thousand to 2,586.5 thousand, representing a 4.16-fold increase, while Internet subscribers per 100 inhabitants increased from 23.6 to 81.1, or 3.44 times. Mobile subscriptions per 100 inhabitants increased from 58.8 to 86.8, corresponding to a rise of 28.0 units. The volume of information and communication services increased from UZS 308.9 billion to UZS 1,590.7 billion, or 5.15 times. In terms of base indices, by 2025 the number of Internet subscribers reached 416.2% of its 2016 level, while information and communication services reached 515.0%. Notably, the growth rate of information and communication services exceeded that of Internet subscriptions. This

indicates that, alongside the quantitative expansion of digital infrastructure, its utilisation in service provision and economic activity has also increased.

Although these trends demonstrate the gradual formation of the primary information and communication base required for digital monitoring of regional economic development in Namangan Region, expanding digital coverage does not, in itself, indicate the institutional maturity of the monitoring system. Institutional effectiveness is determined by the interoperability of different data sources, regular data updating, inter-agency information exchange, regional analytical capacity, and the extent to which monitoring results are incorporated into governance decisions. Therefore, the digital infrastructure developed in Namangan Region should, at the next stage, be institutionally reinforced through an integrated monitoring system combining data on statistics, investment, entrepreneurship, employment, taxation, and regional infrastructure.

Table 4.

Comprehensive Diagnostic Matrix of the Institutional Development Level of Digital Monitoring across the Regions of Uzbekistan, 2016–2025

Regions	Growth in Internet subscribers, times	Growth in information and communication services, times	Change in mobile coverage, units	Digital infrastructure dynamics	Information and service capacity	Institutional monitoring need
Republic of Karakalpakstan	3.41	5.62	+13.3	Medium	Medium	High
Andijan	3.78	4.91	+21.2	Medium	Medium	High
Bukhara	3.74	4.97	+15.2	Medium	Medium	Medium-high
Jizzakh	4.08	7.48	+19.1	High	High	Medium
Kashkadarya	4.35	5.44	+19.4	High	Medium	High
Navoi	3.82	6.03	+26.3	Medium-high	High	Medium
Namangan	4.16	5.15	+28.0	High	Medium-high	High
Samarkand	4.13	6.73	+24.9	High	High	Medium-high
Surkhandarya	4.72	5.52	+20.0	High	Medium	High
Syrdarya	3.99	5.55	+25.7	Medium-high	Medium	Medium-high
Tashkent Region	6.61	16.63	+53.6	Very high	Very high	Medium
Fergana	3.66	5.79	+21.9	Medium	Medium-high	High
Khorezm	4.13	6.84	+20.5	High	High	Medium
Tashkent City	2.92	20.38	+85.3	High*	Very high	Low-medium
Republic of Uzbekistan	3.76	12.60	+30.5	—	—	—

Source: Author's compilation based on SIAT data of the National Statistics Committee of the Republic of Uzbekistan.

The comprehensive diagnostic results for 2016–2025 reveal substantial territorial differentiation in the institutional foundations of digital monitoring across Uzbekistan. Nationwide, Internet subscriptions increased 3.76 times and information and communication services expanded 12.60 times; however, regional trajectories differed considerably. Tashkent Region recorded the highest growth in Internet subscriptions (6.61 times), while information and communication services increased most rapidly in Tashkent City (20.38 times) and Tashkent Region (16.63 times). Namangan Region demonstrated relatively strong infrastructure dynamics, with Internet subscriptions increasing 4.16 times, information and communication services 5.15 times, and mobile coverage by 28.0 units. These differences indicate that digital connectivity, information-service capacity, and institutional readiness for monitoring do not develop proportionately across regions. Consequently, the level of regional digital monitoring cannot be adequately assessed through a single technological indicator; rather, it requires

a multidimensional approach that simultaneously considers infrastructure dynamics, information-service capacity, and institutional monitoring needs.

The diagnostic matrix further demonstrates that technological expansion does not automatically translate into institutional maturity. Regions with advanced digital capacity, particularly Tashkent City and Tashkent Region, increasingly require monitoring systems focused on high-frequency data processing, predictive analytics, early identification of economic risks, and evaluation of policy outcomes. By contrast, regions such as Namangan, Kashkadarya, and Surkhandarya combine relatively strong infrastructure dynamics with high institutional monitoring needs, indicating a gap between expanding digital capacity and its effective integration into regional governance. This finding substantiates the need for an adaptive and territorially differentiated institutional architecture in Uzbekistan, where nationally unified data standards and interoperability requirements are combined with region-specific analytical capacities, institutional coordination mechanisms, and decision-making functions.

4. Conclusion

The findings of the study demonstrate that the effectiveness of digital monitoring of regional economic development is determined not solely by the level of development of information and communication infrastructure, but also by the functional coherence of the institutions responsible for data generation, integration, analysis, and the incorporation of monitoring results into governance decision-making. The comprehensive diagnostics conducted on the basis of indicators for the regions of Uzbekistan and Namangan Region during 2016–2025 revealed substantial territorial differences in digital infrastructure, information and service capacity, and institutional monitoring needs. These findings substantiate the necessity of adapting the principles of multi-level governance, data integration, and results-oriented monitoring derived from international experience to the specific economic and institutional characteristics of Uzbekistan's regions.

First, during 2016–2025, the information and communication base required for digital monitoring in Uzbekistan expanded substantially. Nationwide, the number of Internet subscribers increased from 9,626.8 thousand to 36,195.1 thousand, representing a 3.76-fold increase, while the volume of information and communication services increased 12.60 times. However, the intensity of growth varied considerably across regions: the number of Internet subscribers increased 6.61 times in Tashkent Region, 4.72 times in Surkhandarya, 4.35 times in Kashkadarya, and 4.16 times in Namangan. Regarding information and communication services, a 20.38-fold increase was recorded in Tashkent City and a 16.63-fold increase in Tashkent Region, whereas the corresponding increase in Namangan was 5.15 times. This differentiation indicates that aggregate national indicators do not fully reflect the actual digital monitoring capacity of individual regions. Therefore, it is proposed to introduce a differentiated system of indicators within the national monitoring framework corresponding to the national, regional, district, and city levels.

Second, the institutional base for digital monitoring is developing across regions not only at different rates but also with considerable structural imbalances. During 2016–2025, the number of mobile communication subscribers per 100 inhabitants nationwide increased from 66.8 to 97.3, representing an increase of 30.5 units. The corresponding increase amounted to 85.3 units in Tashkent City, 53.6 units in Tashkent Region, and 28.0 units in Namangan Region. At the same time, in Kashkadarya and Surkhandarya, mobile communication coverage in 2025 remained at 71.1 and 70.6 subscribers per 100 inhabitants, respectively. These disparities demonstrate the methodological limitations of assessing regional preparedness for digital monitoring through a single digital indicator.

Third, the ten-year dynamics of Namangan Region demonstrate a substantial expansion of the fundamental capacities required for developing an institutional architecture for digital monitoring. The number of Internet subscribers increased from 621.4 thousand to 2,586.5 thousand, or 4.16 times, while Internet subscribers per 100 inhabitants increased from 23.6 to 81.1, representing a 3.44-fold increase. The volume of information and communication services increased from UZS 308.9 billion to UZS 1,590.7 billion, or 5.15

times. Consequently, by 2025, the base index of Internet subscribers reached 416.2%, while the index of information and communication services reached 515.0%. These dynamics indicate that the region has developed a substantial technological and information-service foundation for the transition towards an integrated digital monitoring system.

Fourth, the results of the comprehensive diagnostics demonstrate that developing the institutional architecture of regional digital monitoring according to a uniform model for all regions would not be sufficiently effective. In regions characterised by highly developed digital infrastructure and strong information-service capacity, monitoring systems should be oriented towards advanced analytical processing of large-scale datasets, forecasting, early identification of economic risks, and assessment of the effectiveness of governance decisions. Accordingly, the functional configuration of regional monitoring systems should be differentiated according to the level of digital and institutional development of each region.

Fifth, an adaptive institutional architecture for Uzbekistan should combine centralised standardisation with the analytical autonomy of regional governance. At the central level, unified requirements should be established for data standards, indicator calculation methodologies, data exchange protocols, interoperability, and information security. At the regional level, greater authority should be provided for economic diagnostics, data interpretation, the development of forecasting scenarios, and the formulation of governance measures tailored to region-specific challenges. Such a distribution of functions would ensure methodological consistency at the national level while preserving sufficient institutional flexibility for region-specific decision-making.

Sixth, the ultimate effectiveness of digital monitoring should be assessed not by the increasing number of information systems or indicators, but by the extent to which monitoring data are transformed into regional governance decisions. For this purpose, it is proposed that the regional monitoring system explicitly define, for each indicator, its data source, responsible institution, frequency of updating, critical thresholds, analytical responsibility, and specific function within the decision-making process. This approach would transform digital monitoring from a predominantly information-collection mechanism into an adaptive governance instrument capable of supporting evidence-based regional economic policy.

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