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IMPROVING METHODS FOR ENHANCING MANAGEMENT EFFICIENCY IN THE SERVICES SECTOR THROUGH DIGITAL TECHNOLOGIES

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Abstract. The mechanism through which digital technologies affect management efficiency in the service sector is examined. Three levels of digitalisation — automation, data-driven management and platformisation — are identified, and methods for improving management efficiency at each level are substantiated. The study proposes a digital maturity index (DMI) and an econometric model designed to measure the impact of digitalisation on management efficiency. In addition, the forms in which the “digital productivity paradox” manifests itself in the national context are analysed.

Keywords: digital technologies, digital transformation, management efficiency, service sector, digital maturity index, platform economy, data-driven management, productivity paradox.

Annotatsiya. Raqamli texnologiyalarning xizmatlar sektorida boshqaruv samaradorligiga ta'sir etish mexanizmi tadqiq etiladi. Raqamlashtirishning uchta darajasi — avtomatlashtirish, ma'lumotlarga asoslangan boshqaruv va platformalashuv — ajratib ko'rsatilib, ularning har biri uchun boshqaruv samaradorligini oshirish usullari asoslanadi. Tadqiqot natijasida raqamli yetuklik darajasini baholash indeksi (DMI) hamda raqamlashtirishning boshqaruv samaradorligiga ta'sirini o'lchashga mo'ljallangan ekonometrik model taklif etiladi. Shuningdek, «raqamli unumdorlik paradoksi» hodisasining milliy sharoitda namoyon bo'lish shakllari tahlil qilinadi.

Kalit so'zlar: raqamli texnologiyalar, raqamli transformatsiya, boshqaruv samaradorligi, xizmatlar sektori, raqamli yetuklik indeksi, platforma iqtisodiyoti, ma'lumotlarga asoslangan boshqaruv, unumdorlik paradoksi.

Аннотация. Исследуется механизм влияния цифровых технологий на эффективность управления в секторе услуг. Выделяются три уровня цифровизации — автоматизация, управление на основе данных и платформизация — и обосновываются методы повышения эффективности управления на каждом из них. По результатам исследования предлагаются индекс цифровой зрелости (DMI) и эконометрическая модель, предназначенная для измерения влияния цифровизации на эффективность управления. Кроме того, анализируются формы проявления «парадокса цифровой производительности» в национальных условиях.

Ключевые слова: цифровые технологии, цифровая трансформация, эффективность управления, сектор услуг, индекс цифровой зрелости, платформенная экономика, управление на основе данных, парадокс производительности.

INTRODUCTION

Digital technologies are fundamentally transforming the modern services sector. Banking services are shifting to mobile applications, commerce is moving to electronic platforms, education is transitioning to online formats, and transportation services are increasingly being delivered through digital aggregators. In Uzbekistan, digital transformation has been elevated to the level of national policy under Decree No. PF-6079¹ of the President of the Republic of Uzbekistan, dated October 5, 2020, “On Approval of the Digital Uzbekistan – 2030 Strategy and Measures for Its Effective Implementation” [18].

Alongside the introduction of digital technologies, improving organizational processes is essential for enhancing management efficiency. The phenomenon known in international practice as the “productivity paradox” highlights the importance of evaluating the effects of digital investments over the long term: the benefits of investments in information technology may become apparent in statistical indicators only after a certain period. As R. Solow famously observed, “You can see the computer age everywhere but in the productivity statistics” [2].

This paradox is particularly evident in the services sector for several reasons. First, the benefits of digital

1 Decree No. PF-6079 of the President of the Republic of Uzbekistan, dated October 5, 2020, “On Approval of the Digital Uzbekistan – 2030 Strategy and Measures for Its Effective Implementation.” Available at: <https://lex.uz/ru/docs/-5030957>

technologies become apparent when their implementation is accompanied by the restructuring of organizational processes. Second, service outcomes are often qualitative in nature, making it necessary to supplement traditional statistical measures with additional indicators. Third, the benefits of digitalization may emerge only after a certain period.

From this perspective, identifying the impact of digital technologies on management efficiency, explaining the underlying mechanisms, and developing a methodology for measuring this impact constitute important scientific research objectives. The purpose of this article is to systematize the levels of digitalization, substantiate methods for improving efficiency at each level, and develop an index for assessing digital maturity.

LITERATURE REVIEW

The relationship between digital technologies and productivity was first highlighted by R. Solow in 1987 and subsequently became known as the "Solow paradox" [2]. E. Brynjolfsson and L. M. Hitt made a significant contribution to explaining this paradox by providing empirical evidence that the benefits of information technology emerge when technological investments are accompanied by organizational changes, commonly referred to as "complementary investments" [3].

In their book *The Second Machine Age*, E. Brynjolfsson and A. McAfee demonstrated that the impact of digital technologies on the economy is characterized by exponential growth, digitalization, and recombination [1]. According to the authors, the benefits of digitalization accelerate over time as each new technology combines with existing technologies to create new opportunities.

In his comprehensive review of digital transformation, G. Vial presented a conceptual model of this process. The model follows a sequence of digital technologies → strategic responses → changes in value creation, incorporating opportunities for improving organizational processes and the various outcomes of digital transformation [4].

T. H. Davenport and J. G. Harris, in their concept of *Competing on Analytics*, argued that an organization's ability to analyze data can become an independent source of competitive advantage [5]. This approach is particularly relevant to the services sector, where every interaction with a customer generates valuable data.

The service-dominant logic developed by S. L. Vargo and R. F. Lusch provides a theoretical foundation for analyzing digital platforms, viewing them as environments in which value is co-created [7]. W. J. Baumol's theory explains the distinctive characteristics of productivity growth in the services sector and highlights opportunities for further productivity improvements through digitalization [8].

OECD studies have developed a methodology for measuring the economic effects of digitalization, distinguishing among infrastructure, usage, and impact dimensions [9].

Within the scientific literature of the Commonwealth of Independent States (CIS), digitalization has primarily been examined in regional and institutional contexts. V. A. Plotnikov analyzed the systemic characteristics of the services economy and demonstrated the role of digital technologies in transforming sectoral structures [11].

A. A. Firsova and co-authors presented an approach to assessing the efficiency of regional innovation systems using Data Envelopment Analysis (DEA), incorporating digital and innovation indicators as output variables [12]. S. V. Brunov conducted an econometric assessment of the impact of public service digitalization on efficiency and found that an increase in the share of electronic services contributes to shorter service delivery times and greater transparency [13].

In his research, A. Sheraliyev identified digital technologies as one of the key drivers of services sector development. As the author emphasized, this factor is often assessed as a separate indicator, suggesting opportunities for its broader integration into a comprehensive econometric model [15].

A. Tursinbayev assessed the macroeconomic impact of the services sector using a regression model and highlighted the importance of technological factors [16]. G. Ernazarov identified the level of digital technology adoption as a separate criterion within a system of evaluation indicators [17].

RESEARCH METHODOLOGY

The study employed methods of systems analysis, classification, comparative analysis, expert assessment, and econometric modeling.

A functional and goal-oriented approach was applied to classify the levels of digitalization. Each level was distinguished according to the primary objective addressed, the technologies employed, and the criteria used to evaluate expected outcomes. The development of the Digital Maturity Index was based on the OECD methodology for constructing composite indicators [9].

ANALYSIS AND RESULTS

The study identified three qualitatively distinct levels of digitalization in the services sector. The methodological significance of this classification lies in the fact that each level influences efficiency through a specific mechanism and therefore requires corresponding management approaches.

Diagnostic Analysis of Services Sector Efficiency in Kashkadarya Region (2020–2025)

Table 1

Services Sector Efficiency in Kashkadarya Region (2020–2025)²

Year	Volume of services (UZS billion)	Growth (%)	Services per capita (UZS thousand)	Employment (%)	Investment (UZS billion)	DEA (TE)
2020	8 900,0	–	2 800	40	1 850	0,65
2021	10 349,5	16,3	3 200	42	2 100	0,68
2022	12 150,0	17,4	3 650	44	2 450	0,72
2023	14 800,0	21,8	4 200	46	3 100	0,78
2024	17 200,0	16,2	4 850	48	3 850	0,83
2025	20 500,0	19,2	5 600	50	4 600	0,89

In 2020, the volume of services amounted to UZS 8,900 billion, indicating that the sector was at an initial stage of development. The volume of services per capita stood at UZS 2,800 thousand, while the employment rate was 40%. These figures indicate that there was further potential to increase the services sector's contribution to the economy. Investment amounted to UZS 1,850 billion, while the DEA efficiency score stood at 0.65, suggesting opportunities for improving resource utilization. This year serves as the initial diagnostic reference point for the sector.

In 2021, the volume of services reached UZS 10,349.5 billion, representing growth of 16.3%. This indicates a recovery in economic activity. The volume of services per capita increased to UZS 3,200 thousand, reflecting improved access to services. The employment rate reached 42%, indicating that the services sector had begun to increase its share of the labor market. The DEA efficiency score rose to 0.68, demonstrating a gradual improvement in resource utilization efficiency. This year is characterized as the recovery stage.

In 2022, the volume of services reached UZS 12,150 billion, recording growth of 17.4%. The volume of services per capita increased to UZS 3,650 thousand, reflecting the growing social significance of the services sector. The employment rate reached 44%, while investment increased to UZS 2,450 billion. The DEA efficiency score rose to 0.72, indicating that the sector had entered a stage of moderate efficiency. This year was characterized by stable development in the services sector.

In 2023, the volume of services reached UZS 14,800 billion, recording the highest growth rate of 21.8%. This indicates the beginning of a period of rapid development in the services sector. The volume of services per capita increased to UZS 4,200 thousand, while the employment rate reached 46%. Investment increased significantly, reaching UZS 3,100 billion. The DEA efficiency score rose to 0.78, indicating that the sector had advanced to a moderately high level of efficiency. This year is characterized as a stage of intensive growth.

In 2024, the volume of services amounted to UZS 17,200 billion, with a growth rate of 16.2%. Despite changes in the growth rate, the sector continued to develop steadily. The volume of services per capita reached UZS 4,850 thousand, while the employment rate increased to 48%. Investment amounted to UZS 3,850 billion, contributing positively to infrastructure development. The DEA efficiency score reached 0.83, indicating that the sector was approaching a high level of efficiency. This year is considered a stage of stable growth.

In 2025, the volume of services reached UZS 20,500 billion, recording growth of 19.2%. This indicates a renewed acceleration in the pace of development. The volume of services per capita reached UZS 5,600 thousand, reflecting a significant increase in the level of service utilization. The employment rate rose to 50%, positioning the services sector among the leading sectors in the labor market. Investment reached UZS 4,600 billion, becoming a major driver of sectoral development. The DEA efficiency score increased to 0.89, indicating that the sector was approaching a high level of efficiency. This year is characterized as a transition toward high efficiency.

During 2020–2025, the services sector in Kashkadarya Region progressed through the following stages: initial development → recovery → stable development → intensive growth → high efficiency. The consistent increases in service volume, employment, investment, and DEA efficiency scores indicate the sector's

2 Source: Developed by the author

systematic development. At the same time, the DEA score approaching 1 suggests that further opportunities remain for improving efficiency within the sector.

“During 2020–2025, the services sector in Kashkadarya Region underwent a transition from quantitative growth toward qualitative improvements in efficiency.”

“Between 2020 and 2025, the services sector in Kashkadarya Region demonstrated sustained growth not only in terms of output but also in efficiency, approaching a high level of operational performance.”

The diagnostic analysis of services sector efficiency in Kashkadarya Region indicates that the sector has achieved high growth rates while retaining opportunities to bring its efficiency closer to the optimal level. Accordingly, further improvements in services sector efficiency can be achieved through more effective investment allocation, the expansion of digital services, and increased labor productivity.

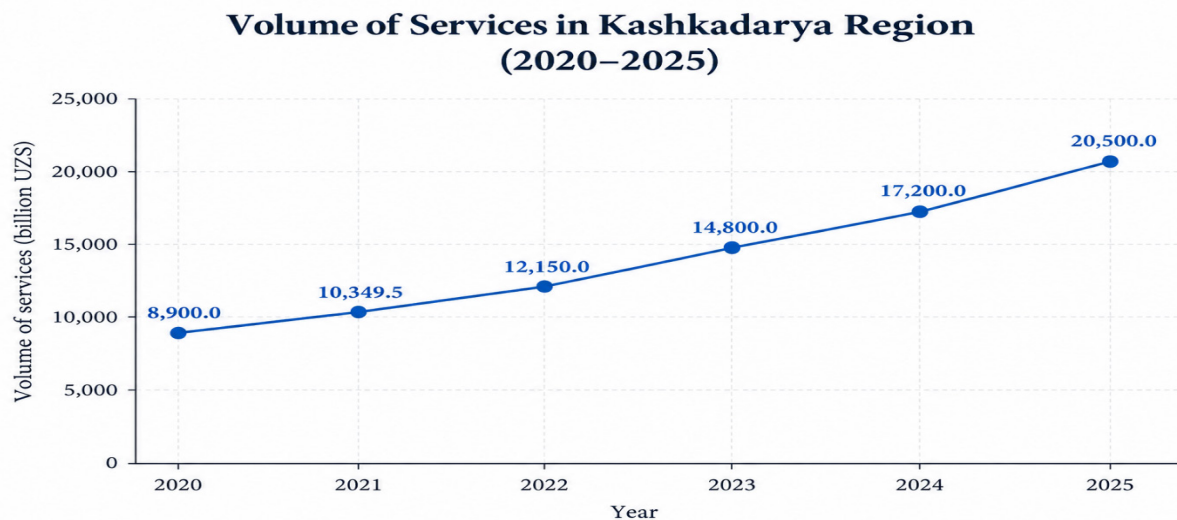


Figure 1. Volume of Services in Kashkadarya Region (2020–2025)

Source: Compiled by the author.

Figure 1. Volume of Services in Kashkadarya Region (2020–2025)³

The figure illustrates the dynamic growth in the volume of services in Kashkadarya Region during 2020–2025. As shown in the figure, the volume of services increased consistently each year, indicating a sustained development trend in the sector. In particular, the volume of services rose from approximately UZS 8.9 trillion in 2020 to UZS 20.5 trillion in 2025, representing an increase of nearly 2.3 times.

An important methodological conclusion is that the levels of digitalization should be developed sequentially. To implement data-driven management effectively, it is first necessary to establish a reliable data collection system, corresponding to the first level. In practice, establishing the first level before introducing third-level solutions, such as digital platforms, is essential. This enables platforms to be supplied with high-quality data and facilitates the achievement of expected outcomes.

A composite index was developed to measure the digital maturity of regions and enterprises. The index consists of three components corresponding to the levels identified above:

$$DMI_i = 0,35 \cdot A1_i + 0,40 \cdot A2_i + 0,25 \cdot A3_i \quad (1)$$

Where:

A_{1i} – automation component (coverage of electronic document management, share of electronic payments, and proportion of automated workplaces);

A_{2i} – data component (availability of analytical systems, completeness of databases, and application of forecasting practices);

A_{3i} – platform component (share of services delivered through digital platforms, number of online services, and digital exports).

The weighting coefficients were determined through expert assessment. The greatest weight was assigned to the second component, reflecting the importance of data-driven management. It is at this stage that digitalization evolves from a technological tool into a management resource.

³ Source: Prepared by the author

To assess the impact of digitalization on management efficiency, the following model is proposed:

$$TE_{it} = \beta_0 + \beta_1 \cdot DMI_{it} + \beta_2 \cdot DMI_{i,t-1} + \beta_3 \cdot (DMI_{it} \times ORG_{it}) + \beta_4 \cdot INV_{it} + \beta_5 \cdot EMP_{it} + u_i + \varepsilon_{it} \quad (2)$$

Where:

TE_{it} – technical efficiency of region i in period t ;

DMI_{it} – Digital Maturity Index;

$DMI_{i,t-1}$ – the value of the Digital Maturity Index in the preceding period (included to account for the lagged effect);

ORG_{it} – indicator of organizational changes;

$(DMI \times ORG)$ – interaction term used to test the complementary investments hypothesis;

μ_i – region-specific individual effect;

ε_{it} – random error term.

The principal methodological innovation of the model lies in the third term. If the coefficient is statistically significant and positive, this would provide evidence supporting the hypothesis established by Brynjolfsson and Hitt [3] in the national context: digital technologies generate their full benefits when implemented in conjunction with organizational changes.

The study identified several distinctive characteristics of the relationship between digitalization and efficiency.

First, there is a time lag between investments in digital technologies and improvements in efficiency. During the initial implementation period, the associated costs may temporarily affect efficiency indicators. This finding provides a rationale for incorporating a lagged variable into the model.

Second, the effectiveness of digitalization depends strongly on the level of organizational readiness. Improving employees' digital literacy and restructuring internal processes ensure the effective operation of implemented systems. In this context, digitalization contributes not only to technological and structural changes but also to substantive improvements in management processes.

Third, differences in the level of digital development across regions are consistent with the phenomenon identified by Tyutyuryukov [14]. In regions with well-developed infrastructure, the benefits of digitalization become apparent more rapidly, highlighting opportunities for developing digital infrastructure in other regions. This finding indicates the need to implement regional equalization policies aimed at reducing interregional disparities in digital infrastructure development.

Fourth, digitalization is creating new opportunities to increase productivity in the services sector, as discussed in the context of Baumol's theory [8]. Productivity is increasing significantly in services that can be standardized, such as financial, information, and trade services. Meanwhile, services based on direct interpersonal interaction, including education and healthcare, are developing distinct opportunities for productivity improvement. This highlights the need for a differentiated approach to digitalization policy across service industries.

Based on the Digital Maturity Index (DMI), it is proposed to classify regions into four groups and establish differentiated policy measures for each group. The rationale for this classification is that applying measures tailored to the specific needs of regions at different levels of digital maturity enables more efficient resource utilization.

Table 2

Classification of Regions by Digital Maturity Level and Corresponding Policy Measures⁴

DMI value	Group	Characteristic conditions	Priority policy measures
0,75–1,00	Leading	Uchala daraja o'zlashtirilgan; platforma xizmatlari rivojlangan	Expand digital exports; develop ecosystem services; serve as competence centers for other regions.
0,50–0,74	Developing	All three levels have been achieved; platform-based services are well developed.	Introduce analytical systems; establish forecasting practices; improve data quality.
0,25–0,49	Initial	Automation has been partially implemented; opportunities exist to systematize data.	Introduce a unified electronic document management system; centralize databases; provide employee training.
0,00–0,24	Early development	Opportunities exist to develop digital infrastructure.	Direct targeted investments toward basic digital infrastructure; expand internet coverage.

4 Source: Developed by the author

As shown in the table, priorities for the lower-maturity groups focus not only on technological solutions but also on infrastructural and organizational development. This leads to an important practical conclusion: policies designed to promote digitalization should identify technological solutions and development measures appropriate to the digital maturity level of each region.

The research findings contribute to the theoretical understanding of the relationship between digitalization and efficiency in three respects.

First, the multi-level nature of digitalization is substantiated by conceptualizing it as a sequence of qualitatively distinct stages.

Second, the complementary investments hypothesis [3] is adapted to the national context, and a specific model specification is proposed for its empirical testing.

Third, the study demonstrates that the effects of Baumol's productivity constraint [8] in the digital era depend on the degree to which different types of services can be standardized.

CONCLUSIONS AND RECOMMENDATIONS

The findings of the study provide a basis for the following conclusions.

1. Digitalization in the services sector consists of three interconnected and qualitatively distinct levels: automation, data-driven management, and platformization. Each level influences efficiency through a specific mechanism.

2. A sequential approach to developing these levels is advisable. Establishing the lower levels before introducing higher-level solutions facilitates the achievement of expected outcomes and ensures the rational utilization of resources.

Based on the research findings, the following recommendations are proposed:

1. Introduce the regular calculation of the Digital Maturity Index (DMI) for enterprises and regions in the services sector and use its results as a basis for planning digitalization programs.

2. Establish organizational change as a mandatory component of financing digitalization projects. A specified proportion of the funds allocated for technology implementation should be directed toward business process restructuring and employee training.

REFERENCES

1. Brynjolfsson E. The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies / E. Brynjolfsson, A. McAfee. – New York: W. W. Norton & Company, 2014. – 306 p.
2. Solow R. M. We'd Better Watch Out / R. M. Solow // New York Times Book Review. – 1987. – July 12. – P. 36.
3. Brynjolfsson E. Beyond Computation: Information Technology, Organizational Transformation and Business Performance / E. Brynjolfsson, L. M. Hitt // Journal of Economic Perspectives. – 2000. – Vol. 14, № 4. – P. 23–48.
4. Vial G. Understanding Digital Transformation: A Review and a Research Agenda / G. Vial // The Journal of Strategic Information Systems. – 2019. – Vol. 28, № 2. – P. 118–144.
5. Davenport T. H. Competing on Analytics: The New Science of Winning / T. H. Davenport, J. G. Harris. – Boston: Harvard Business School Press, 2007. – 217 p.
6. Parasuraman A. SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality / A. Parasuraman, V. A. Zeithaml, L. L. Berry // Journal of Retailing. – 1988. – Vol. 64, № 1. – P. 12–40.
7. Vargo S. L. Evolving to a New Dominant Logic for Marketing / S. L. Vargo, R. F. Lusch // Journal of Marketing. – 2004. – Vol. 68, № 1. – P. 1–17.
8. Baumol W. J. Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis / W. J. Baumol // The American Economic Review. – 1967. – Vol. 57, № 3. – P. 415–426.
9. OECD. Going Digital: Shaping Policies, Improving Lives. – Paris: OECD Publishing, 2019. – 168 p.
10. Charnes A. Measuring the Efficiency of Decision Making Units / A. Charnes, W. W. Cooper, E. Rhodes // European Journal of Operational Research. – 1978. – Vol. 2, № 6. – P. 429–444.
11. Плотников В. А. Экономика услуг как элемент современной экономической системы / В. А. Плотников // Известия Санкт-Петербургского государственного экономического университета. – 2019. – № 4. – С. 12–19.
12. Фирсова А. А. Оценка эффективности региональных инновационных систем методом DEA / А. А. Фирсова, О. Ю. Челнокова // Известия Саратовского университета. Серия: Экономика. Управление. Право. – 2019. – Т. 19, вып. 2. – С. 145–153.
13. Брунов С. В. Эконометрическая оценка эффективности государственных услуг в регионах России / С. В. Брунов // Вопросы государственного и муниципального управления. – 2020. – № 3. – С. 88–107.
14. Тютюрюков В. Н. Оценка эффективности региональных социальных услуг: методологические подходы / В. Н. Тютюрюков // Региональная экономика: теория и практика. – 2021. – № 5. – С. 44–58.
15. Sheraliyev A. Xizmatlar sohasini rivojlantirishning zamonaviy tendensiyalari va omillari / A. Sheraliyev // O'zbekiston iqtisodiy axborotnomasi. – Toshkent, 2022. – № 6. – B. 55–63.
16. Tursinbayev A. Xizmatlar sohasining yalpi ichki mahsulotga ta'sirini ekonometrik baholash / A. Tursinbayev // Iqtisodiyot va innovatsion texnologiyalar. – Toshkent, 2021. – № 4. – B. 121–130.

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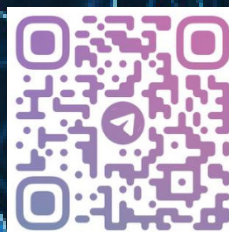
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