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DIGITALIZATION OF PUBLIC ADMINISTRATION IN WORLD PRACTICE AND ON THE EXAMPLE OF THE REPUBLIC OF KAZAKHSTAN

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Abstract. The relevance of this research is driven by the rapid spread of digital technologies in public administration and the transformation of governance models shaped by e-government, open data, and big data. In developing countries, including Kazakhstan, digitalization is accelerating under global trends while facing infrastructural, institutional, and socio-cultural constraints. This study provides a systematic analysis of the stages, models, and results of digital transformation in the public sector, focusing on problem identification and practical solutions. Purpose. The aim is to generalize intermediate global results of digitalization in public administration and conduct an in-depth analysis of its development in Kazakhstan, considering formation stages, conceptual definitions, and implementation mechanisms. Methodology. A qualitative strategy was applied, based on content analysis of international reports, policy documents, and statistical data. Inductive analysis was used to identify key concepts, patterns, and trends in digital governance. Results. The study examined the evolution of e-government from narrow (G2C, G2B, G2G) to broader models including B2G and C2G. The stages of Kazakhstan's transition from informational to transformational e-government were identified. Key barriers include regional disparities, limited integration of best practices, and human capital constraints. Conclusions. Sustainable transformation requires combining

technological modernization with institutional reform, enhancing open data systems, and expanding citizen participation. Promising directions involve longitudinal studies, cross-country comparisons in Central Asia, and integration of quantitative and qualitative indicators for comprehensive assessment.

Keywords: Digitalization, public administration, electronic government, open government, big data, digital transformation of public administration

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ӘЛЕМДІК ТӘЖІРИБЕДЕ ЖӘНЕ ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ МЫСАЛЫНДА МЕМЛЕКЕТТІК БАСҚАРУДЫ ЦИФРЛАНДЫРУ

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Аннотация. Зерттеудің өзектілігі мемлекеттік басқаруда цифрлық технологиялардың қарқынды таралуымен және электрондық үкімет, ашық деректер, Big Data сияқты заманауи тұжырымдамалардың ықпалымен басқару модельдерінің сапалы өзгеруіне байланысты. Бұл өзгерістер тек техникалық жаңғыртумен шектелмей, басқару философиясын, шешімдердің ашықтығы мен тиімділігін, сондай-ақ азаматтар мен бизнес құрылымдарының мемлекеттік институттармен өзара іс-қимыл форматтарын түбегейлі өзгертеді. Дамушы елдерде, соның ішінде Қазақстанда, цифрландыру үдерістері жаһандық үрдістердің әсерімен жедел қарқын алып, бір мезгілде инфрақұрылымдық, институционалдық және әлеуметтік-мәдени шектеулермен бетпе-бет келеді. Бұл жағдай мемлекеттік сектордағы цифрлық трансформацияның кезеңдерін, үлгілерін және нәтижелерін жүйелі түрде талдауды, проблемаларды айқындауды және тиімді практикалық шешімдер әзірлеуді талап етеді. Зерттеудің мақсаты — мемлекеттік басқарудағы жаһандық цифрландырудың аралық нәтижелерін жинақтау және Қазақстандағы оның даму серпінін терең талдау, қалыптасу кезеңдерін, тұжырымдамалық анықтамаларды және іске асыру тетіктерін кешенді қарастыру. Әдістеме. Зерттеу сапалық стратегияға негізделді, халықаралық есептер, стратегиялық және саяси құжаттар, ресми статистикалық деректер бойынша контент-талдау жүргізілді. Индуктивті талдау негізгі ұғымдарды, заңдылықтарды және үрдістерді айқындауға мүмкіндік берді. Нәтижелер. Электрондық үкіметтің тар (G2C, G2B, G2G) үлгілерінен

B2G және C2G қамтитын кеңейтілген үлгілерге дейінгі эволюциясы көрсетілді. Қазақстанның ақпараттықтан трансформациялық электрондық үкіметке өту кезеңдері айқындалды. Аймақтық теңсіздіктер, үздік тәжірибелерді жеткіліксіз енгізу және адами капиталдың шектеулілігі негізгі кедергілер ретінде анықталды. Қорытындылар. Тұрақты трансформация технологиялық жаңғыртуды институционалдық реформалармен үйлестіруді, ашық деректер жүйесін жетілдіруді және азаматтардың қатысу тетіктерін кеңейтуді талап етеді. Перспективті бағыттарға басқару сапасының ұзақ мерзімді мониторингі, Орталық Азиядағы салыстырмалы зерттеулер және сандық пен сапалық көрсеткіштерді үйлестіретін бағалау жүйелерін әзірлеу жатады.

Түйін сөздер: Цифрландыру, мемлекеттік басқару, электрондық үкімет, ашық үкімет, үлкен деректер, мемлекеттік басқарудың цифрлық трансформациясы

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ЦИФРОВИЗАЦИЯ ГОСУДАРСТВЕННОГО УПРАВЛЕНИЯ В МИРОВОЙ ПРАКТИКЕ И НА ПРИМЕРЕ РЕСПУБЛИКИ КАЗАХСТАН

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Аннотация. Актуальность исследования определяется стремительным распространением цифровых технологий в сфере государственного управления в мире и трансформацией моделей управления под влиянием концепций электронного правительства, открытых данных и Big Data. Эти процессы меняют не только техническую инфраструктуру, но и принципы принятия управленческих решений, повышают их прозрачность и эффективность, а также формируют новые форматы взаимодействия государства с гражданами и бизнесом. В развивающихся странах, включая Казахстан, цифровизация ускоряется под воздействием глобальных тенденций, сталкиваясь с инфраструктурными, институциональными и социокультурными ограничениями. Это обуславливает необходимость системного анализа этапов, моделей и результатов цифровой трансформации государственного сектора, выявления проблем и разработки практических решений. Цель исследования — обобщить промежуточные результаты глобальной цифровизации государственного управления и

провести углубленный анализ ее развития в Казахстане, с учетом этапов формирования, концептуальных определений и механизмов реализации. Методология. Применена качественная исследовательская стратегия, основанная на контент-анализе международных отчетов, стратегических и нормативных документов, а также статистических данных. Для выявления ключевых понятий, закономерностей и тенденций использован индуктивный анализ. Результаты. Рассмотрена эволюция электронного правительства от узких моделей (G2C, G2B, G2G) к расширенным, включающим B2G и C2G. Определены этапы перехода Казахстана от информационного к трансформационному электронному правительству. Выявлены ключевые барьеры: региональные диспропорции, ограниченная интеграция лучших практик и дефицит человеческого капитала. Выводы. Устойчивое развитие цифровой трансформации требует сочетания технологической модернизации с институциональными реформами, совершенствования систем открытых данных и расширения механизмов гражданского участия. Перспективными направлениями являются долговременный мониторинг качества управления, сравнительные исследования в Центральной Азии и интеграция количественных и качественных индикаторов для комплексной оценки результатов.

Ключевые слова: цифровизация, государственное управление, электронное правительство, открытое правительство, большие данные, цифровая трансформация государственного управления

Introduction. The digital transformation of public administration is one of the most significant developments in contemporary governance worldwide. Digitalization in public administration is a relatively recent phenomenon that emerged in the late twentieth century. Despite its youth, it is rapidly evolving, multifaceted, and elicits mixed reactions from scholars, practitioners, and citizens. It is widely viewed as a boon that can expand efficiency, transparency, and accessibility of public services, and can catalyze positive outcomes in governance modernization. At the same time, skeptics note path dependency, cost overruns, and uneven institutional capacity that may blunt anticipated gains, so only time and comprehensive empirical analysis will determine whether the promises are fulfilled. Although a definitive verdict may be premature, sufficient time has passed to draw meaningful conclusions about implementation patterns, challenges, and preliminary outcomes. The rapid evolution of information and communication technologies (ICT) has fundamentally altered the landscape of public administration by enabling new forms of citizen engagement, service delivery, and governmental transparency. Concurrently, these developments have introduced challenges related to the digital divide, cybersecurity, data privacy, algorithmic accountability, and the need for organizational and cultural change within public institutions. Before proceeding with the analysis required to meet the research objectives outlined below, it is essential to define key concepts, establish shared terminology, and develop a comprehensive understanding of the subject. The conceptual framework of public administration digitalization encompasses

interconnected elements that include e-government systems, open government initiatives, big data analytics, digital identity management, interoperability and data governance, and citizen-centered service delivery platforms. Each component warrants careful examination to clarify its contribution to the broader digitalization ecosystem and to identify the mechanisms through which it shapes administrative practice and outcomes.

The global experience with digitalization in public administration shows substantial variation in approaches, implementation strategies, and outcomes across countries and regions. Developed nations such as Estonia, South Korea, and Denmark are often cited as leaders in comprehensive initiatives, whereas many developing states confront infrastructure deficits, resource constraints, and capacity building needs. Understanding these divergent trajectories is essential for identifying best practices and lessons that can inform future efforts across varied administrative contexts and levels of institutional maturity.

The relevance of this research stems from several linked factors. First, the range and scope of applications continue to grow across all sectors of public administration, from basic information provision to complex transactional services and participatory governance. Second, the reach of digitalization is expanding to include not only central agencies but also local administrations, judicial systems, and regulatory bodies. Third, there is increasing recognition that most countries are only beginning to realize both the opportunities and the risks posed by this phenomenon, which underscores the need for systematic analysis of current developments and likely trajectories. The COVID-19 pandemic further accelerated the adoption of digital technologies in public administration, revealing both the potential benefits and the inherent vulnerabilities of digitalized governance. The crisis demonstrated the importance of robust digital infrastructure for maintaining essential public services and citizen communication during periods of social distancing and lockdowns by supporting policy continuity and data-driven coordination. At the same time, it exposed major gaps in digital preparedness and underscored the urgent need for more comprehensive and resilient digitalization strategies.

The purpose of this research is to provide a comprehensive analysis of the development of digitalization in public administration by synthesizing intermediate results from global experience and conducting an in-depth examination of digitalization processes in the Republic of Kazakhstan. Kazakhstan represents a particularly compelling case, as the country has experienced rapid digital transformation over the past two decades, moving from limited digital infrastructure to recognized performance in international e-government rankings. This study contributes to the academic literature on public administration digitalization and provides practical insights for policymakers and practitioners engaged in digital transformation initiatives.

In line with this purpose, the study pursues the following objectives:

- analyze global developments in public administration digitalization;
- compile a consolidated glossary of key terms used in this field;

- examine the stages in the development of public administration digitalization in the Republic of Kazakhstan.

Literature review. The research topic of public administration digitalization has been actively evolving since the mid-1990s, when the first systematic conceptual approaches emerged, resulting in an extensive body of scholarly work. Recent structured reviews provide evidence of the growing complexity and multidimensional nature of this field, as shown by analyses of digitally induced change in the public sector that identify the main drivers, implementation processes, and transformation outcomes (Haug, et al, 2023). The relationship between public administration digitalization and government effectiveness in EU countries has been comprehensively assessed, revealing governance improvements associated with advanced digital systems (Androniceanu, et al, 2023). At the same time, the interconnections between digitalization, accounting, and accountability in public services have been systematized, with clear research gaps outlined for future studies (Agostino, et al, 2022).

A growing number of studies have examined the transformative influence of disruptive technologies on governance structures, including the impact of digital public infrastructure on public value creation in India (Desai & Manoharan, 2024). The COVID-19 pandemic has been widely recognized as a catalyst for accelerating digital transformation in public service delivery, reshaping operational models and adoption rates (Gabryelczyk, 2020; Agostino, et al, 2021). Broader policy and innovation perspectives have been explored to assess how digital transformation affects organizational performance and competitiveness (Peng & Tao, 2022). Other works focus on the role of smart technologies and artificial intelligence in generating public value (Criado & Gil-Garcia, 2019) and critically assess AI governance challenges in democratic settings, highlighting both opportunities and ethical risks (Medaglia, et al, 2023; Kuziemski & Misuraca, 2020).

Significant empirical foundations are also provided by international organizations. Comparative analyses of global e-government trends and development frameworks have been offered (United Nations, 2022), benchmarking methodologies for digital government maturity have been established (OECD, 2020), and targeted studies on digital transformation in Central Asia have been conducted (World Bank, 2021). The global statistical landscape is supplemented by ICT infrastructure and readiness data (ITU, 2023).

In the post-Soviet research space, notable contributions include comprehensive theoretical and practical models for e-government implementation in Russian-speaking countries (Sidorova, 2018), in-depth analyses of mechanisms of digital state governance and implementation constraints (Kosorukov, 2020), and integrated studies that combine theoretical frameworks with applied recommendations for advancing digital transformation (Dobrolyubova, et al, 2019). Broader perspectives on public management digitalization (Kostina, et al, 2022) and data-centric approaches grounded in semantic interoperability principles (Akatkin & Yasinovskaya, 2018) have further enriched the literature.

In Kazakhstan, academic coverage is comparatively limited, although early assessments documented initial e-government initiatives, implementation challenges, and foundational policy frameworks. Subsequent developments have included the adoption of the Digital Kazakhstan Concept and formalized rules for digital transformation, providing a structured approach to nationwide implementation (Ministry of Digital Development, Innovation and Aerospace Industry, 2022). The literature shows several clear trends: intensification of systematic reviews and meta-analyses, emphasis on regional comparative approaches to capture contextual differences, and increasing integration of global best practices into national digital governance systems. Within this context, Kazakhstan's adoption of the "State Program of Electronic Government Formation for 2005-2007" marked its entry into the international digitalization movement, emphasizing alignment with global standards in meeting citizen needs (Kudaikulova, 2007).

Research materials and methods. Both qualitative and quantitative methods can be used to study the digitalization of public administration and its primary challenges. For this study, qualitative analysis is the most suitable approach for several reasons. First, qualitative research is designed to explain complex phenomena. Context is central because analysis occurs within specific social settings. Moreover, qualitative research emphasizes interpretation. While objectivity is the goal of any inquiry, qualitative designs also consider subjective dimensions that may influence research outcomes. This analysis seeks to provide additional insight into the opportunities, challenges, and risks associated with this phenomenon. Because this study employs a qualitative methodology, document content analysis is the most appropriate method for data collection and analysis. This approach enables a comprehensive examination of diverse textual materials, regardless of their origin, format, or institutional source. Document analysis supports a systematic review of policy documents, government reports, academic publications, and official statements that together illuminate the evolution and current state of public administration digitalization.

As noted above, given the relative novelty of digitalization in public administration, the academic literature devoted specifically to this topic remains limited, particularly with respect to comprehensive case studies of developments in Kazakhstan. This limitation reflects a broader challenge for researchers who examine rapidly evolving technological and administrative phenomena, in which policy implementation often outpaces academic analysis and theory development.

However, substantial empirical material is available through international reports and comparative studies published by prominent organizations. The Organisation for Economic Co-operation and Development has produced extensive documentation on digital government strategies and implementation across member and partner countries (OECD, 2020). The World Bank has published comprehensive reports on digital transformation in developing countries, including specific analyses of Central Asian states (World Bank, 2021). The United Nations Department of Economic and Social Affairs regularly releases the UN E-Government Survey, which provides detailed country-by-country assessments of e-government development worldwide

(United Nations, 2022). Additionally, the International Telecommunication Union offers valuable data on ICT infrastructure and digital readiness indicators (ITU, 2023).

While these international reports provide valuable comparative perspectives and standardized metrics for assessing digitalization progress, they often overlook critical internal factors that play crucial roles in realizing and implementing digitalization initiatives within specific national contexts. Such factors may include cultural attitudes toward technology adoption, bureaucratic resistance to change, specific legal and regulatory frameworks, resource allocation mechanisms, and local capacity constraints. Despite these limitations, international reports generally maintain strong reputations for methodological rigor and analytical objectivity, making them reliable sources for comparative analysis.

To supplement international sources, this study incorporates analysis of national policy documents, government strategies, and official publications from Kazakhstan's relevant ministries and agencies. The Digital Kazakhstan Program provides an essential framework for understanding national digitalization priorities (Ministry of Digital Development, Innovation and Aerospace Industry, 2022), while various e-government implementation reports and statistical data from the Agency for Strategic Planning and Reforms offer crucial primary sources for analyzing the specific trajectory of digitalization in Kazakhstan.

The qualitative content analysis methodology used in this research follows systematic text analysis procedures, including the identification of key themes, patterns, and conceptual categories that emerge from the documentary evidence. This approach supports both descriptive analysis of digitalization developments and interpretive analysis of the underlying factors that influence implementation success or create challenges. The analysis process involves multiple iterations of document review, coding of significant concepts, and synthesis of findings across diverse source types and time periods.

The qualitative content analysis is grounded in systematic text examination, which involves not only reading but also identifying topics, features, and patterns aligned with the study's main objectives. A qualitative inductive reading of reports will be conducted in conjunction with existing journal articles, newspaper publications, books, and official documents. Inductive reading means that the nomenclature will be developed during the process of content analysis. Based on the results of the final literature review, specific concepts and categories will be formulated to guide and enhance subsequent stages of content analysis.

Results. After more than a quarter century of active development in the digitalization of public administration, countries worldwide that have reached the fourth stage of e-government development still cannot clearly determine whether they have entered the fifth stage. The evolution of this phenomenon does not conform strictly to predefined boundaries but instead progresses by seeking new avenues of development in response to the prevailing needs and demands of society.

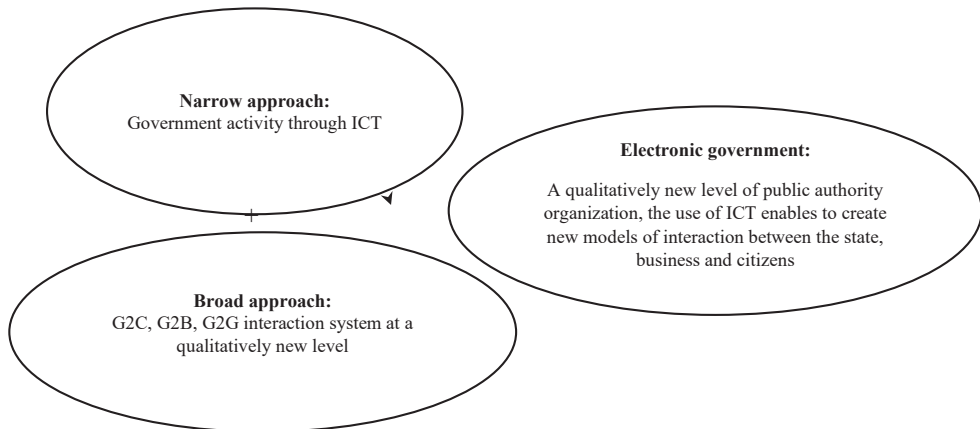


Figure 1. Approaches to the definition of e-government

*Compiled on the basis of data from Sidorova's source

The concepts outlined above are widely discussed in the existing literature; however, discrepancies remain in their definitions. In this regard, the present study briefly examines the main concepts, provides precise definitions, identifies the relationships among them, and establishes a general nomenclature for the target audience. It is logical to begin with the definition of e-government, as it served as the catalyst for the digitalization of public administration. In a narrow sense, e-government refers to government activities supported by modern information and communication technology (ICT) tools across all areas, specifically government-to-government (G2G), government-to-business (G2B), and government-to-citizen (G2C) interactions. In a broader sense, e-government is a specialized system of interaction based on these models, operating at a qualitatively new level and enabling a high degree of public participation in public administration processes.

Within this distinction between narrow and broad approaches lies a premise for their separability and the notion that e-government in its complete form emerges only when these approaches are combined. This analysis demonstrates that such an interpretation can lead to misrepresentation, as even under a narrow implementation approach it is possible to identify the presence of e-government at its initial stage, and potentially up to the fourth stage, according to the referenced model.

This study proposes refining and supplementing the existing framework of definitions and approaches to the concept of e-government as presented in Table 1.

Table 1. Approaches to the definition of the e-government*

Electronic government	
Narrow approach	Broad approach
Government activity through ICT, G2G, G2B, and G2C models. Development stages 1-4	Qualitatively, it is a new level of public authority organization, in the development stage 5. Emergence and active development of B2G, C2G models

*Compiled by the authors

Based on the author's interpretation of e-government, a broad approach is proposed that involves not only expanding the concept but also incorporating additional e-government models. In practice, this stage is already being implemented in Kazakhstan, as demonstrated by the Sergek System, which enables businesses to provide public sector services for road safety control. In other words, the B2G model is being applied. This direction could be further developed within the C2G model by creating a portal for uploading videos containing evidence of traffic violations, thereby establishing a precedent for crowdsourcing from drivers equipped with dashboard cameras.

The analysis indicates that e-government is a communicative infrastructure encompassing all models of interaction between actors at any stage of its development. A classic definition was provided by the scholar Kosorukov (Kosorukov, 2020): "an electronic government implies a situation in which the executive, legislative, and judicial branches of government, including federal and regional governments, conduct their interdepartmental operations electronically, interact with the external environment, and effectively use networked information systems to achieve higher quality in the provision of state and municipal services." The main goals of creating an electronic government include:

1. strengthening the transparency of public authorities' work;
2. simplifying and standardizing bureaucratic procedures and daily practices of public administration;
3. providing online access to documents and acts of public authorities for citizens and organizations, in accordance with the applicable access level;
4. enabling electronic document management among public authorities, citizens, and state bodies (Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan, 2022).

Along with the development of e-government, it has become increasingly evident that the state is the largest custodian of information across all data domains. In this context, two terms naturally emerge that require precise definition: open government and big government data. Influenced by advances in ICT during the 1990s, citizens in many countries began to demand greater disclosure of information on government activities, which led to a heightened emphasis on transparency, particularly as new technologies made such disclosure possible. As a result, the concept of open data, more precisely referred to as open government data, gained prominence. Its primary objective is to place publicly significant materials generated in the course of government operations into the public domain, enabling citizens, businesses, and public organizations to use them for their own purposes. The term was first formally introduced in 1993 as part of an initiative that marked a milestone in the informatization of public administration, aimed at strengthening partnerships in the creation of an open government (Pravitel'stvo Respubliki Kazakhstan, 2022).

Accordingly, as the primary holder and custodian of big data generated in the course of performing its functions, the state has adopted a model of providing open access to this information with the possibility of its reuse. This principle is referred

to as “open government.” The primary objectives of an open government are to establish a transparent and accountable state, empower citizens in the governance process, strengthen the fight against corruption, and leverage new technologies to improve the efficiency of public administration.

The combined outcome of these developments is the digitalization of public administration. According to some authors, the origins of this concept are linked to the active promotion of the “digital economy” idea. Based on an analysis of recent research, three stages in the development of digitalization have been identified (Table 2).

Table 2. Stages of digitalization development*

Stage	Name	Features
Stage 1	Automation	Implementation of IT solutions that repeat existing processes
Stage 2	Digitalization	Improving existing processes by introducing IT and data analysis for decision making
Stage 3	Digital transformation	Reducing transaction costs through platforms, the emergence of new products and services

*Compiled on the basis of data from Kostina’s source

According to the analysis, one of the most comprehensive definitions of public administration digitalization is as follows: “the digital transformation of public administration involves creating a single state digital space in which, when providing public services and exercising their powers, digital twins of state bodies and civil officers interact, with the ability to connect to this information space economic entities, non-profit organizations, residents of the country, and their associations” (Kostina, et al, 2022).

Kazakhstan was no exception. Although it joined the process of digitalizing public administration almost a decade later than some countries, it nevertheless took an active role. Having entered the process later, the country managed to make up for the initial gap in a relatively short time, and today it holds strong positions in various international rankings that assess states by this indicator. It is important to briefly outline how this process began in Kazakhstan. In 2004, the first government-sponsored program for the formation of an “electronic government” in the Republic of Kazakhstan was adopted, covering the period from 2005 to 2007. This was followed by the development and implementation of the “Program for Reducing the Digital Divide” from 2007 to 2009. Following the statement by the First President of the Republic of Kazakhstan in his address to the people on March 1, 2006, regarding a new format of interaction between citizens and the government through the “electronic government,” the e-government portal e-gov.kz was launched. The stages of e-government development in the country are presented in Table 3 below.

Table 3. Stages of e-government implementation in Kazakhstan*

Stage	Name	Features
Stage 1 2005-2006	Information	Creation of backbone databases, websites of state bodies
Stage 2 2006-2007	Interactive	Creation of pilot projects on e-licensing, e-taxes, e-statistics, etc.
Stage 3 2007-2008	Transactional	Creation of a payment gateway and calculation with the budget online.
Stage 4 2010 – further	Transformational	Predominance of electronic services over paper ones, formation of the information society

*Compiled on the basis of data from (Kudaikulova, 2007)

Today, Kazakhstan is entering the fourth stage of e-government development, with up to 90 percent of public services provided electronically, and the process of opening a limited liability partnership taking as little as 15 minutes. In this context, the digitalization of public administration has accelerated since the introduction of electronic invoices. An electronic warehouse and accompanying notes for electronic goods are being implemented. In other words, the digital transformation of the entire economy is underway, driven by the digitalization of public administration.

Building on the identified stages of digitalization and the narrow and broad approaches to e-government, it becomes evident that these frameworks operate in parallel rather than as isolated sequences. To capture this interdependence more effectively, an integrated analytical model is proposed. This model connects the three stages of digitalization — automation, digitalization, and digital transformation — with the spectrum of interaction models (G2G, G2B, G2C, B2G, and C2G) and the progressive expansion of openness and citizen participation. Such an approach makes it possible to map a country's progress across multiple dimensions, revealing areas of both advancement and stagnation simultaneously (Fig. 2).

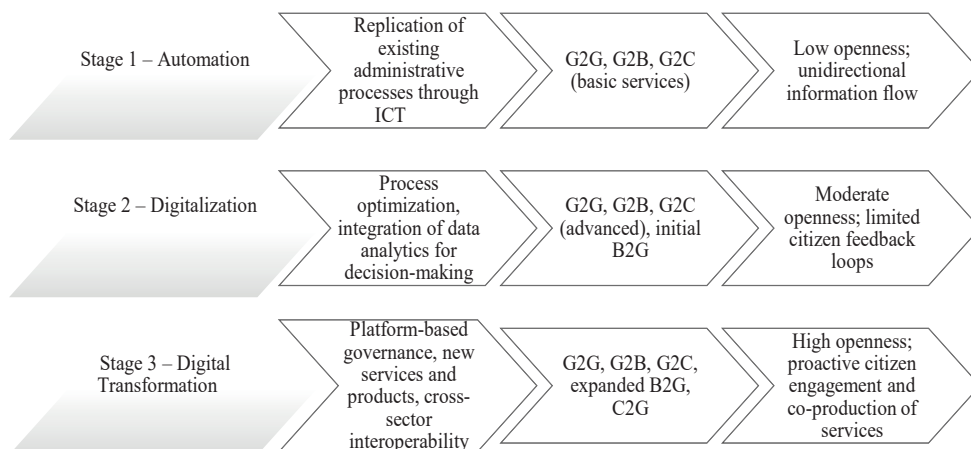


Figure 2. Integrated Stage-Model-Openness Framework for Public Administration Digitalization

*Compiled by the authors

When Kazakhstan's progress is mapped against the Integrated Stage–Model–Openness Framework, the resulting profile reveals an uneven distribution of advancement across the three dimensions. Certain advanced interaction models, such as B2G solutions for traffic safety monitoring and emerging C2G initiatives in crowdsourced reporting, have been implemented ahead of the full institutional and infrastructural readiness typically associated with Stage 3. At the same time, several Stage 2 characteristics remain, including fragmented data exchange between government systems, limited integration of open data into decision-making processes, and insufficient institutional mechanisms for sustained citizen engagement.

The practical value of the framework lies in its capacity to guide policymakers in prioritizing interventions by dimension rather than by stage alone. For example, it can be used to determine that advancing interoperability standards and expanding data literacy programs may generate greater system-wide benefits than introducing new service platforms in isolation. Similarly, it can identify where targeted investment in citizen engagement mechanisms could accelerate the shift toward more participatory governance, even if certain technological elements remain at earlier stages. This multidimensional perspective supports adaptive policy planning, enabling countries to advance along different trajectories that reflect their institutional capacities, resource availability, and strategic objectives, while maintaining alignment between the technological, institutional, and participatory components of digital transformation.

Discussion. The analysis of the development of digitalization in public administration reveals several critical considerations that require thorough examination and practical interpretation. The progression through different stages of e-government development demonstrates both significant achievements and ongoing challenges in the field of digital transformation. In the case of Kazakhstan, the rapid transition from basic information provision in 2005–2006 to comprehensive transformational services by 2010 illustrates the potential for accelerated progress under favorable policy frameworks and strong institutional commitment. At the same time, it underscores systemic issues that continue to constrain the sustainability of these results (Androniceanu & Georgescu, 2023; Agostino, Saliterer, & Steccolini, 2022). These challenges include disparities in digital readiness between regions, inconsistent integration of international best practices into the national framework, limited human resource capacity in digital governance, and vulnerabilities in cybersecurity and infrastructure resilience that are only partially addressed by existing initiatives (Gabryelczyk, 2020).

The conceptual framework presented in this study suggests that the traditional understanding of e-government should be broadened to include emerging models of interaction. The proposed distinction between narrow and broad approaches to defining e-government addresses a significant gap in the current literature, where the complexity of modern digital governance often goes beyond conventional categorizations (Criado & Gil-Garcia, 2019). The inclusion of Business-to-Government (B2G) and Citizen-to-Government (C2G) models reflects an evolution

beyond the traditional Government-to-Citizen (G2C), Government-to-Business (G2B), and Government-to-Government (G2G) paradigms, offering practical opportunities to enhance public–private cooperation and promote participatory governance mechanisms. However, the effective integration of these models into national systems requires the establishment of interoperable data exchange standards, regulatory reforms, and targeted incentives to encourage engagement from both the private sector and citizens (Medaglia, Gil-Garcia, & Pardo, 2023; Kuziemski & Misuraca, 2020).

The Kazakhstan case study shows that the three-stage model of digitalization — automation, digitalization, and digital transformation — functions as a flexible framework rather than a rigid sequence, since elements from different stages may be implemented in parallel depending on national capacities, institutional adaptability, and strategic priorities (Peng & Tao, 2022). This non-linearity requires adaptive policy planning that supports iterative development instead of strict sequencing. In addition, the focus on open government and big data governance reflects a paradigm shift in the relationship between citizens and the state, where transparency and citizen engagement are positioned as core objectives that shape the design of digital government programs rather than as secondary outcomes (Agostino, Arnaboldi, & Lema, 2021). In this context, strengthening mechanisms for open data utilization is warranted by evidence that greater data availability correlates with higher public trust and more informed policy-making; expanding the range of datasets released to the public fosters new business models and civic technology initiatives; and improving data literacy among citizens and civil servants ensures that open data can be effectively applied in practice.

International comparative analysis shows significant variation in digitalization approaches across countries and regions (Androniceanu & Georgescu, 2023). While Kazakhstan has achieved notable progress in global rankings, maintaining and improving this position will require sustained investment in infrastructure modernization to support high-volume digital services without performance degradation, the enhancement of digital competencies in the public sector to address persistent skill gaps that hinder innovation, and the establishment of a more robust organizational change management framework to ensure that new technologies are embedded into daily administrative practice. The long-term effectiveness of digitalization depends on integrating digital technologies into public administration as part of a broader socio-technical transformation that reshapes organizational culture, public service delivery models, and citizen expectations (Gabryelczyk, 2020; Criado & Gil-Garcia, 2019). To ensure that this transformation produces tangible governance improvements, it is necessary to align digital strategies with measurable service quality outcomes, strengthen monitoring and evaluation systems to identify inefficiencies early, and integrate feedback mechanisms that inform iterative policy refinement.

Evidence suggests that the most effective trajectory for Kazakhstan is to leverage its achievements in e-government development to address existing institutional

and infrastructural weaknesses while promoting inclusive, transparent, and citizen-oriented digital governance (Medaglia, Gil-Garcia, & Pardo, 2023). This approach is supported by the observed link between inclusivity in digital governance and higher citizen satisfaction, and it would not only consolidate past progress but also enhance resilience and adaptability in the face of technological, social, and geopolitical uncertainties.

Conclusion. The analysis demonstrates that the digitalization of public administration is a multidimensional socio-technical transformation in which technological innovation, institutional adaptation, and societal engagement function as mutually reinforcing components. The case of Kazakhstan, from the initial informatization phase in 2005 to the current stage of advanced e-government implementation, confirms that rapid progress in developing countries is achievable when coherent policy frameworks, dedicated institutional structures, and sustained political commitment are in place. The expansion from traditional G2C, G2B, and G2G interaction models to the inclusion of B2G and C2G formats reflects an emerging paradigm in which public administration operates as a communicative infrastructure that promotes diversified participation and collaborative governance.

The research also identifies systemic barriers that undermine the long-term sustainability of digital transformation. These include uneven regional digital readiness, incomplete integration of global best practices into the national governance framework, shortages in human resource capacity for digital governance, and persistent gaps in data interoperability and cybersecurity resilience. The non-linear nature of transformation, where elements of different stages coexist, further emphasizes the need for adaptive governance models that support iterative improvement rather than rigid sequencing.

Based on these findings, it is recommended that Kazakhstan's future digital transformation strategies prioritize three interlinked objectives: (1) integrating technological and institutional reforms to ensure that infrastructure modernization is accompanied by organizational change; (2) strengthening open data frameworks by increasing the volume and diversity of publicly available datasets, improving data literacy among citizens and officials, and ensuring interoperability across government platforms; and (3) enhancing citizen engagement mechanisms so that participation becomes a core driver of governance innovation rather than a supplementary function. Targeted investment in high-capacity infrastructure, advanced cybersecurity systems, and comprehensive professional development programs for public servants should be coordinated with the establishment of uniform national data exchange standards.

Furthermore, given Kazakhstan's stable yet plateauing position in international e-government rankings, greater analytical attention should be directed toward aligning global measurement methodologies with national development priorities. This will help ensure that progress in rankings reflects substantive improvements in service quality, transparency, and public trust.

From a research perspective, the study highlights the importance of longitudinal, cross-sectoral analyses to assess the sustainability and real-world impact of

digitalization initiatives. Such studies should combine quantitative performance indicators, such as service delivery efficiency and user satisfaction, with qualitative assessments of institutional change and civic engagement dynamics. Comparative regional research within Central Asia, combined with selected global benchmarks, can offer further insights into the contextual factors that shape the success of digital transformation strategies. This integrated analytical approach will capture the full complexity of public administration digitalization and provide a foundation for evidence-based policymaking in the next stages of development.

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