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DIGITAL ECOSYSTEM OF THE STATE AS A DRIVER OF PROFESSIONALIZATION OF PUBLIC SERVICE: THE EXPERIENCE OF UKRAINE AND EU COUNTRIES

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ABSTRACT

In the context of the public administration transformation in Ukraine, digital public services are becoming a determining factor in increasing the transparency, efficiency and professionalism of the public service, providing new formats of interaction between the state and citizens, optimizing management processes, contributing to the formation of modern competencies of civil servants and creating conditions for the transition to a service- oriented model of the state. The need for research is due to the fact that existing scientific approaches consider digitalization mainly as a tool for increasing management efficiency, not sufficiently taking into account its systemic impact on the professionalization of the public service. In the context of active digital transformation in Ukraine, a comprehensive analysis of the relationship between the development of digital services, the level of digital competencies and the institutional capacity of the public service is relevant. The purpose of the article is to explore the potential and effectiveness of digital public services as a tool for increasing the professionalism of the public service, to determine their impact on the competence, effectiveness and openness of the public service, and to outline promising ways of their improvement. The study uses systemic, institutional and structural-functional approaches, as well as analysis, synthesis, comparison, content analysis of official digital platforms, analysis of statistical data and monitoring of digital governance practices. As a result of the study, it was established that digital public services are a system-forming factor in the professionalization of the public service of Ukraine. It is proven that the introduction of digital tools, digital ethics and digital communications forms new competencies of civil servants, expands the range of managerial roles and increases the need for digital literacy, data management, cybersecurity and electronic systems. A comparison of the level of digital skills of citizens and e - government development indicators revealed interdependence: a higher level of competence of the population ensures a faster implementation of digital services, and electronic services themselves stimulate further growth of digital literacy of society and public service employees. The analysis of public investment in digitalization has shown that the effectiveness of the digital services development depends not only on the amount of funding, but also on the ability of the state to integrate digital solutions into personnel policy, educational programs and the management system. The article demonstrates that digital public services are not just automation tools, but a fundamental mechanism for the professionalization of the public service. Their implementation contributes to the renewal of the competencies of officials, improvement of management, improvement of the quality of public services and the formation of a service- oriented model of the state. This

ensures sustainable progress in reforming Ukraine's public service and its compliance with European standards.

Keywords: *Digital Services; Digital Ecosystem Of The State; Digital Ethics; Digital Communications; Public Service; Administrative Services; Professionalization; Digital Competencies; E-Government; ICT Sector; Digitalization; Innovation; Digital Transformation; Service- Oriented State.*

1. INTRODUCTION

Modern transformation processes covering public administration around the world define digitalization as a key factor in increasing the efficiency, transparency and effectiveness of the functioning of the public service. In these conditions, digital services of the state become not only a technical tool for modernization, but also a system-forming element of the professionalization of the public service. Ukraine, being in conditions of large-scale challenges and at the same time demonstrating high rates of digital transformation, has formed a unique model of the state's digital ecosystem, at the center of which is the development of service- oriented public administration.

Within the framework of this study, digital state services are understood as electronic platforms, information systems and digital tools that ensure the provision of administrative services, data management and support for management decisions in the public sector. The subject of the study is their impact on the processes of professionalization of the public service of Ukraine, in particular on the formation of competencies, changing functional roles and increasing the efficiency of civil servants. At the same time, the study does not cover the technical aspects of software development, nor does it provide for a detailed analysis of individual industry information systems outside the context of their impact on personnel and management processes.

Digital state services allow us to rethink the functions of a civil servant and the interaction of the state with citizens, shifting the emphasis from procedural administration to effective service provision, data management and operational decision-making. Thanks to digital tools, public servants are able to work in a more dynamic, transparent and technologically supported environment, which requires new skills, digital competence and a culture of using modern technologies. Thus, digitalization becomes a driver for the formation of new standards of professional activity of public servants.

The study is based on the assumption that the level of development of digital services correlates with the level of digital competencies of both civil servants and citizens, which allows us to assess their relationship at the macro level.

At the same time, the effectiveness of the state's digital transformation depends on a number of factors: the development of the level of the ICT sector and innovations in the country, the digital literacy of citizens, the readiness of public servants to implement new tools, as well as the strategic coherence of the digitalization policy. In this regard, the study of state digital services as a tool for ensuring the professionalization of the public service acquires particular importance. It is necessary to find out how digital solutions affect the quality of work of civil servants, what factors determine the effectiveness of digital transformation, and how the development of digital services interacts with the level of digital competencies of the population and the institutional capacity of government bodies.

2. LITERATURE REVIEW

Digital transformation of public administration is one of the key areas of modern interdisciplinary research, integrating approaches of public administration, public policy, information systems and institutional economics. The conceptual foundations of modern digital governance were formed within the framework of the digital-era theory governance, which justifies the transition from fragmented models of e-government to integrated platform solutions [17; 27]. In this paradigm, digital services are considered as a system-forming element of the institutional transformation of the state.

The further development of digital governance is reflected in the works of Gil-García and Pardo [19], Gil-García and al. [18], which emphasize the need to integrate governance reforms and digital tools. The ecosystem approach to digital governance proposed by Dawes and al. [14] and Janssen and al. [22], involves the formation of network interaction between government agencies, businesses and citizens based on data and platforms.

The institutional dimension of digitalization is revealed through the concept of public value, according to which digital reforms are assessed from

the standpoint of transparency, legitimacy and public trust [12]. Systemic barriers to digital reforms are associated with organizational inertia and insufficient level of digital competencies [21; 40].

A separate area of research is devoted to the professionalization of public service in the context of digital transformation. Changing the competency profile of a civil servant involves the development of digital literacy, analytical skills and a culture of working with data [1; 8]. The relationship between digital skills and civic participation is also confirmed in the work of Asimakopoulos and [9].

Available scientific research demonstrates a rapid growth of scientific interest in the issues of digital governance and institutional modernization [25; 34] . International comparative indices [20; 29] emphasize the importance of human capital and institutional capacity in ensuring the digital maturity of the state.

The domestic scientific community focuses significant attention on the development of national digital platforms [11; 23; 35], as well as on the transformation of management processes in the context of European integration [16; 24]. Despite a significant body of research, there remains a scientific gap in the comprehensive analysis of the impact of digital ecosystems on the professionalization of the public service.

The need for this study is due to the fact that existing scientific approaches mainly consider digitalization either as a tool for increasing the efficiency of public administration or as a component of institutional reforms, ignoring its systemic impact on the transformation of the human resource potential of the public service. At the same time, the modern conditions of the functioning of the state, in particular in Ukraine, are characterized by the simultaneous implementation of large-scale digital solutions and the need to improve the quality of managerial personnel, which creates new challenges for their professional training and development. The lack of comprehensive studies that combine the analysis of digital services, the level of digital competencies and the institutional capacity of the public service limits the possibilities of forming an effective digital governance policy. That is why it is relevant to conduct a study aimed at identifying the relationships between the development of digital services of the state and the processes of professionalization of the public service, as well as substantiating the directions of their further integration.

3. METHODOLOGY

The methodological basis of the study is systemic, institutional and managerial approaches, which allow for a comprehensive consideration of digital public services as a tool for modernization and professionalization of public service. The theoretical basis is modern concepts of digital governance, e-democracy, public management, service-oriented state and professional development of civil servants.

The following methods were used in the research process, anmely: analysis and synthesis - to summarize information on the development of digital services and their impact on public service; comparison - to compare Ukrainian services with international digital governance practices; systemic analysis – to consider digital services as a component of a single digital ecosystem of public administration; structural-functional method – to assess the functions of digital tools in the processes of professionalization of civil servants; content analysis of official government portals, digital services, strategic documents and open data; review of statistical data on the use of digital services by citizens and civil servants; monitoring of practices of leading government platforms and initiatives.

To assess the impact of government digital services on the professionalization of public service, it is advisable to rely on a number of internationally recognized indicators. This study uses three key indicators: GII 2025, Government Effectiveness and Government Online Service Index. Each of them allows for a comprehensive measurement of the development of the state's digital ecosystem, the potential for innovation, and the digitalization level of public administration. Global Innovation Index (GII) is one of the world's leading indicators that assesses a country's innovation potential and the economy's ability to generate digital solutions. Government Effectiveness assesses the quality of public administration, the professionalism of the public service, and the government's ability to formulate and implement effective policies. Digital transformation is impossible without effective public administration. Government Online Service Index (GOSI) directly measures the development level of digital government services. GOSI is a direct indicator of how developed a country's digital ecosystem is.

This study examines the countries of the European Union and Ukraine. This approach is driven by the need for a comparative analysis of the development of digital government services and their impact on the professionalization of public service. Analysis of EU countries allows for the formation of a broad comparative base, the possibility of constructing

comparative ratings, and an analytical basis for objective conclusions.

4. RESULTS

At the center of modern digital transformation is the state's digital ecosystem - a complex of technologies, services, platforms, procedures and institutions that ensure the provision of public services in a convenient, transparent and effective format. It is the state's digital ecosystem that is the core around which the interaction of citizens, businesses and state bodies is built. Lin and Yaakop [25] analyze trends, main directions and researchers in the field of digital governance and note that this area is key for effective, transparent and open government services. Digital state services are electronic tools and platforms created by the state to automate, optimize, and make public service work more transparent. In Ukraine, their development is systematically handled by the Ministry of Digital Transformation of Ukraine [28], which coordinates the digitalization of public services, including services for citizens and civil servants.

Redziuk and Darmostu [35] prove that successful digital services of the state are based on a single platform with an integrated architecture (in Ukraine this is the portal "Diya"). Chumakova and Pasichnyuk [11] conduct a comprehensive analysis of the development of digital public services and note that the central digital platform in Ukraine is the "Diya" portal, and for the further development of state digital services, modernization of the civil service is necessary.

Korvat [23] analyzes how e-government is moving towards a digital governance ecosystem and notes that a digital ecosystem is not just electronic services, but an integrated environment for interaction between public service, technology and users to achieve sustainable development.

That is, the digital ecosystem of the state is a complex interconnected infrastructure of digital services of the state, technologies, tools, users, which is aimed at effective management, transparent interaction of the government with citizens and business and reduces bureaucracy. Medvedenko [26], analyzing international experience, demonstrates how digital systems strengthen the connection between the state, citizens and business.

Therefore, the development of the state's digital ecosystem requires a harmonious combination of three key components: a powerful ICT sector and innovative infrastructure, a high level of digital skills of citizens, and professional digital competence of civil servants. The interaction of these three elements creates conditions for the stable development of the state's digital services, improving the quality of public administration, and forming a modern service state (Fig. 1).

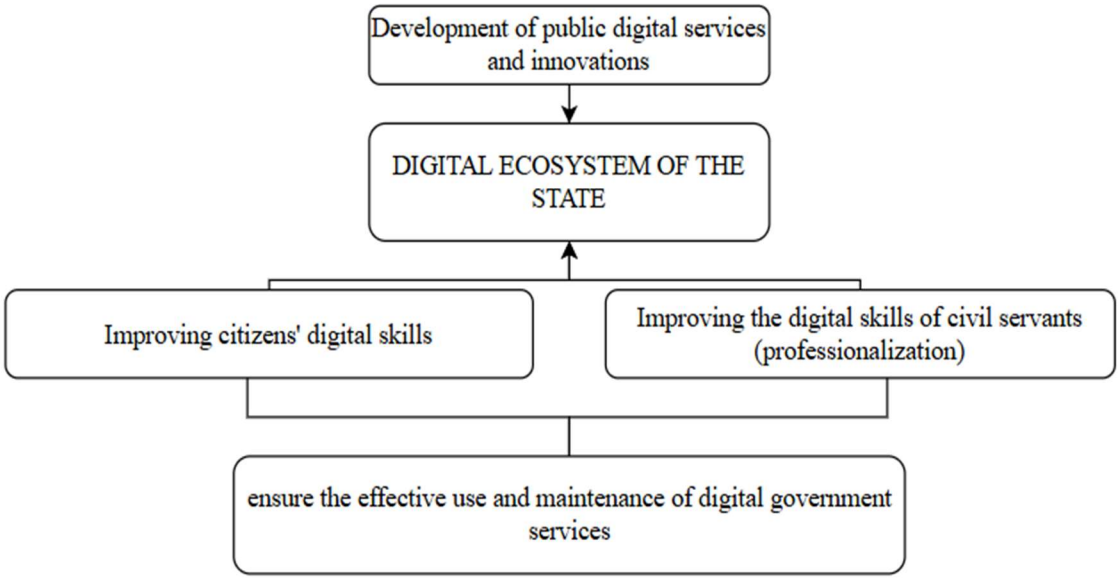

Figure 1: Diagram of the interconnection of the constituent elements of the state's digital ecosystem
Source: compiled by the authors based on their own research

Digitalization of the state is impossible without the simultaneous development of these three interrelated elements.

The development of the ICT sector and technological innovations directly affects the digitalization of public service and digital governance. Wirata et. al. [42] argue that ICT innovation is a key factor enhancing the quality, productivity and transparency of public services in different countries. Haug et. al. [21] show that digital technologies lead to transformational changes in the public sector. That is, the creation of modern digital government services requires a solid technological foundation, without which the state will not be able to create, maintain and scale high-quality digital services, namely:

- modernization of digital infrastructure (internet, data centers, cyber defense);
- development of IT companies, technology startups, innovation hubs;
- stimulating investments in digital solutions;
- introduction of innovations: artificial intelligence, cloud services, Big Data etc.

For a comprehensive assessment of the digital capacity of states and determining Ukraine's place among the countries of the European Union, it is advisable to analyze international indices that reflect the innovation level of the state, its managerial efficiency, and the development of state online services. Comparison of GII 2025 indicators, Government Effectiveness and Government Online Service The Index allows us to trace the relationship between innovation potential, the quality of public administration, and the effectiveness of public digital services. Based on these data, we can assess the strengths and weaknesses of each country's digital ecosystem, identify characteristic models of digitalization, and outline Ukraine's position in the European space, which is important given its course for EU integration (Fig. 2).

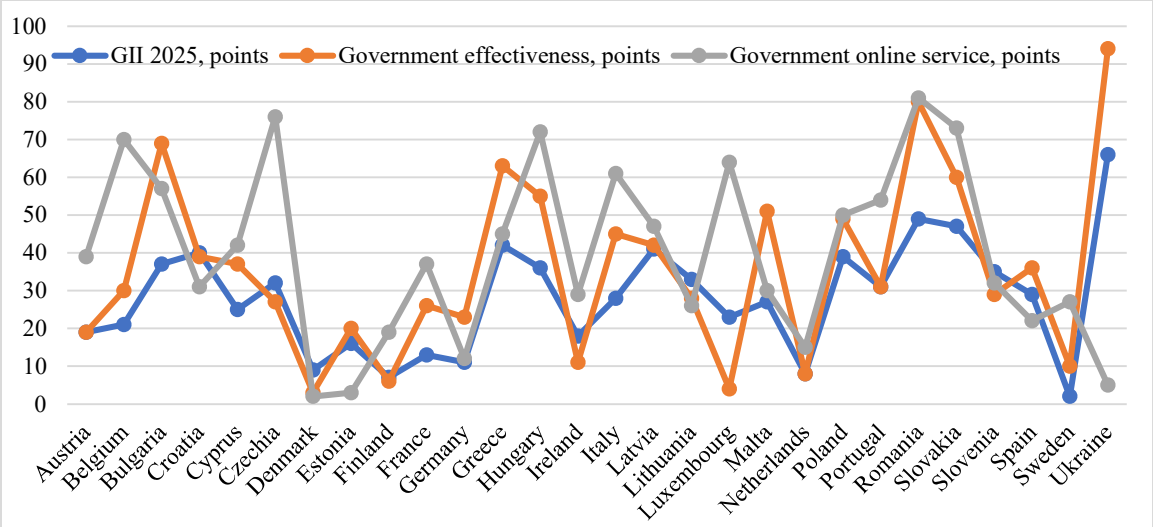

Figure 2: Comparative indicators of innovation, government efficiency and development of digital services in the EU countries and Ukraine (GII 2025, Government Effectiveness, Government Online Service Index)
Source: compiled by the authors based on [20]

Data analysis allows us to clearly identify three groups of countries in terms of the level of digital governance, public administration efficiency, and the development of public online services.

The most successful countries include Denmark, Sweden, Finland, Netherlands, Germany, Estonia and France, which consistently demonstrate high values in all three indicators. Estonia stands out in particular, combining strong positions in the GII and Government Effectiveness with almost the highest level of development of government online services. These countries form a group of leaders whose experience is a model of integrated, mature and technologically advanced institutional models, which indicates a systemic state policy of digitalization and the formation of a service-oriented state.

The middle level is characterized by the second, larger group, which includes Austria, Belgium, Ireland, Czechia, Portugal, Spain, Slovenia, Cyprus, Lithuania, Latvia, Croatia, Italy, Luxembourg, Malta and Poland. These countries demonstrate acceptable but uneven results: some have strong positions in innovation, but weaker in digital public services; others - the opposite. High innovation potential is not always accompanied by developed online services. This indicates that a strong ICT sector in itself does

not guarantee the digital maturity of public services and requires coordinated management decisions.

The group of countries with relatively weaker positions includes Greece, Hungary, Bulgaria, Romania and Slovakia, which have traditionally lower levels of Government Effectiveness or significant gaps in the development of digital government services. Their position in the rankings indicates systemic difficulties with institutional capacity, digital infrastructure, or the quality of management processes.

Ukraine occupies an intermediate but specific position: at the level of Government Effectiveness is closer to the group of outsider countries, but its Government indicator. Online Service is one of the highest among all the countries considered. This forms a unique profile of the country, where low institutional efficiency is compensated by a very high level of digitalization of public services and confirms that the Ukrainian digital transformation is moving "from services to systems", Digital services are developing more dynamically than the general level of the state management system.

Thus, Ukraine tends to the third group in terms of institutional quality, but at the same time is among the leaders in the field of e-governance, which emphasizes the asymmetric nature of its development and significant potential for leveling these indicators in the future.

The data demonstrate three key patterns:

1. Sustainable digital ecosystem is only possible if there is a balance between innovation, institutional capacity, and accessibility of public online services.
2. The Nordic countries are a model of balanced digital development.
3. Ukraine has a unique advantage in the field of digital government services, but needs to strengthen its management efficiency and innovation potential to reach the level of digital resilience of EU countries.

As part of the digital transformation of public administration in Ukraine, a broad ecosystem of state digital services has been formed, covering key areas of interaction between citizens, businesses, and public authorities. These platforms provide access to administrative services, educational tools, business opportunities, transparent state processes, and support innovation and the country's recovery. The formation of such a digital infrastructure is critically important for increasing state efficiency, strengthening public trust, modernizing public service, and building a modern service- oriented state (Table 1).

Table 1. Elements of the digital ecosystem of the state of Ukraine and their functionalities

Digital service/platform	Brief description, meaning and capabilities	Official website
Action	The main ecosystem of the digital state of Ukraine, where more than 130 state electronic services are collected. Digital documents (ID card, passport, etc.) and online services (certificates, registrations, payments, business processes) are available. This is the main tool for interaction between a citizen and an entrepreneur with the state in a digital format	https://diia.gov.ua [7]
Diia.Business	Part of the "Diya" ecosystem - a platform to support entrepreneurs: tools for doing business, consultations, services for registering sole proprietors and automating business processes	https://business.diia.gov.ua [2]
Diia.Education	Educational platform with online courses and trainings that improve users' digital literacy, professional and business skills	https://education.diia.gov.ua [5]
Diia.City	Legal and tax regime for IT companies, which creates favorable conditions for innovation, development of technological business and attraction of investments in the IT industry	https://diia.city [3]
Diia.Digital Hromada	Platform for digital transformation of local communities, tools for local governance, transparency, communication with citizens and optimization of administrative processes	https://hromada.gov.ua [4]
Diia.Engine	A technical tool for creating digital state services and integrating data between state bodies, accelerating the implementation of digital services	https://thedigital.gov.ua/projects [6]
Mria	State educational mobile application to help young people choose a profession, develop skills, and adapt to the labor market	https://mriia.app [38]

CDTO Campus	Chief Digital Transformation Specialist Training Platform (Chief Digital Transformation Officers) for implementing digital solutions in government agencies	https://cdto.campus [10]
PlanDiia	A conceptual platform that unites all digital services and integrates them for citizens and civil servants into a single system	https://plan2.diia.gov.ua [39]
Prozorro.Sale	Online ecosystem of electronic auctions for transparent sale and lease of state and municipal property, increasing the efficiency of asset management	https://prozorro.sale [32]
Digital Restoration EcoSystem for Accountable Management (DREAM)	The State Digital Ecosystem for Recovery and Public Investment Management is a "single window" for planning, controlling and monitoring the implementation of reconstruction, modernization and financing projects in Ukraine in real time. The platform provides transparency, access to data, and monitoring all stages from planning to completion works	https://dream.gov.ua [33]

Source: compiled by the authors

Table 1 demonstrates the scale and interconnectedness of the state's digital ecosystem: from electronic documents and business tools to platforms for transparency, education, national recovery, and digital transformation of public service.

For the transformation of the public service, it is important to consider that digitalization is becoming not only a technical tool, but also a fundamental factor in strengthening citizens' trust in the state, expanding their participation in governance, and forming a new model of state-society interaction. The integration of digital services into the activities of the public service significantly affects the speed of decision-making, the transparency of procedures, and the efficiency of state institutions.

Petkun et. al. [31] prove that digital services contribute to meeting the needs of citizens in real time, significantly increase the quality and accessibility of services, and create a basis for improving the efficiency of government bodies. Redziuk and Darmostuk [35] argue that digital platforms significantly increase the accessibility, simplicity and transparency of public services and contribute to the reduction of bureaucratic barriers. Asimakopoulos et. al. [9] argue that digital technologies allow for increased citizen participation in governance processes, enhance transparency and trust in public service.

However, the implementation of digital state services cannot be effective without being combined with the development of digital literacy, digital ethics, digital communications, infrastructure, and policies that support innovation.

The state's digital services will not be effective if people do not know how to use them, the more citizens confidently use digital services, the more efficiently the state's digital ecosystem works. A. Abdul Kareem and Oladimeji [1] investigated the role of digital literacy and citizen trust in the adoption and use of e-government services, relying on a technological adoption model applied to a specific e-service (electronic submission of documents). The study showed that digital literacy and digital ethics significantly enhances the positive impact of citizen trust on the perception of the usefulness and ease of use of digital government services, which in turn contributes to their more active use. Anzar [8] proves that the level of digital literacy directly affects citizens' activity in using e-government services and their participation in digital governance; countries that implement targeted digital communication and related skills training programs experience higher citizen participation in digital governance processes.

That is, digital public services are directly related to the level of digital skills of citizens, since the ability to use online services is determined not only by the availability of technological infrastructure, but also by the competences of the population. Analysis of data on the development of online services and the level of digital skills in the countries of the European Union and Ukraine allows us to assess how much the state's digital ecosystem meets the needs of citizens and whether it ensures the effective functioning of public services through the involvement of the population in digital services (Fig. 3).

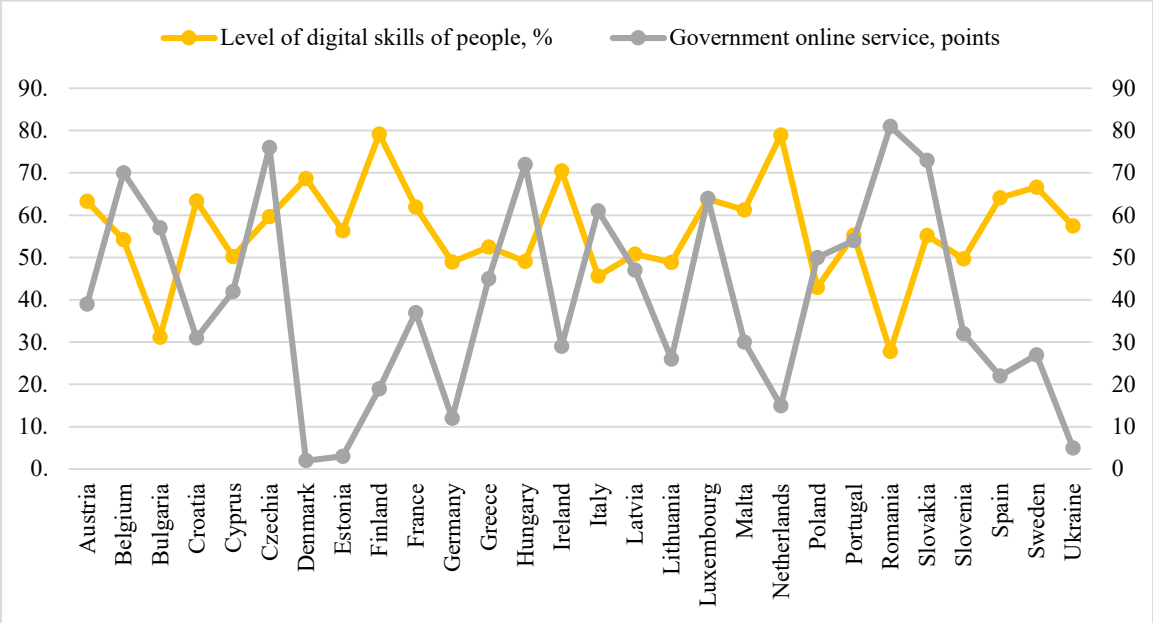

Figure 3: Comparative indicators of the development of public online services and the level of digital skills of the population in the EU countries and Ukraine

Source: compiled by the authors based on [13; 15; 30; 40]

The analysis shows that countries with the most developed digital government services do not always demonstrate the highest level of digital skills of the population. Thus, Denmark and Estonia occupy leading positions in the Government indicator Online Service, which indicates a high level of accessibility and functionality of public services online, while their indicators of digital skills of citizens are quite high, but not record-breaking, which emphasizes the effective organization of digital platforms even with an average level of digital competences of users. Finland and the Netherlands demonstrate a high level of digital skills of the population, which contributes to the active use of government services, although the positions of these countries in the Government index Online Service are not absolute leaders, which indicates that the availability of services and citizens' willingness to use them do not always develop synchronously.

Countries with a medium level of online public services implementation, such as the Czech Republic, Italy, Poland and Portugal, are characterized by balanced results, with the development of online services matching or slightly ahead of the level of digital skills of the population. This means that in these countries there is a moderate integration of digital services into the daily lives of citizens, but the potential for more active involvement of the population remains.

Of particular interest is the case of Ukraine and Romania, where there is a significant asymmetry between the level of online services and the digital skills of citizens. In Ukraine, the Government Index Online Service occupies one of the highest positions among all the countries studied, which demonstrates the active development of the state's digital ecosystem, while the level of digital skills of citizens remains moderate. This indicates the need for a targeted increase in the digital competences of the population to maximize the potential of digital state services and increase the efficiency of public service. In Romania, a different situation is observed, including: the low level of development of public online services is accompanied by a low level of digital skills of citizens, which limits the effectiveness of using these services in everyday life and emphasizes the importance of a comprehensive approach to digitalization.

Overall, the comparison of indicators demonstrates that the synergy between the development of online services and citizens' digital competences is a key factor in increasing public engagement and professionalizing public service. States that simultaneously develop service infrastructure and citizens' digital literacy form the most effective and sustainable digital ecosystems.

Improving citizens' digital skills should include a set of measures aimed at developing knowledge, skills and conscious behavior in the digital environment. First, it is important to teach the basics of digital literacy, which provides a basic understanding of the principles of computer systems,

the Internet and modern digital tools, which creates a foundation for more effective use of digital resources in everyday life and interaction with government services.

The development of digital government services cannot be assessed solely by the availability of technical platforms; the active use of these services by citizens is equally important.

Fig. 4 illustrates the level of public engagement in e-government activities through websites in EU countries and Ukraine, reflecting the effectiveness of digital interaction between the state and citizens. A high level of participation indicates a developed culture of using online services, a sufficient level of digital skills of the population and trust in electronic platforms, while low indicators indicate the need to increase digital literacy and overcome barriers to access to government services.

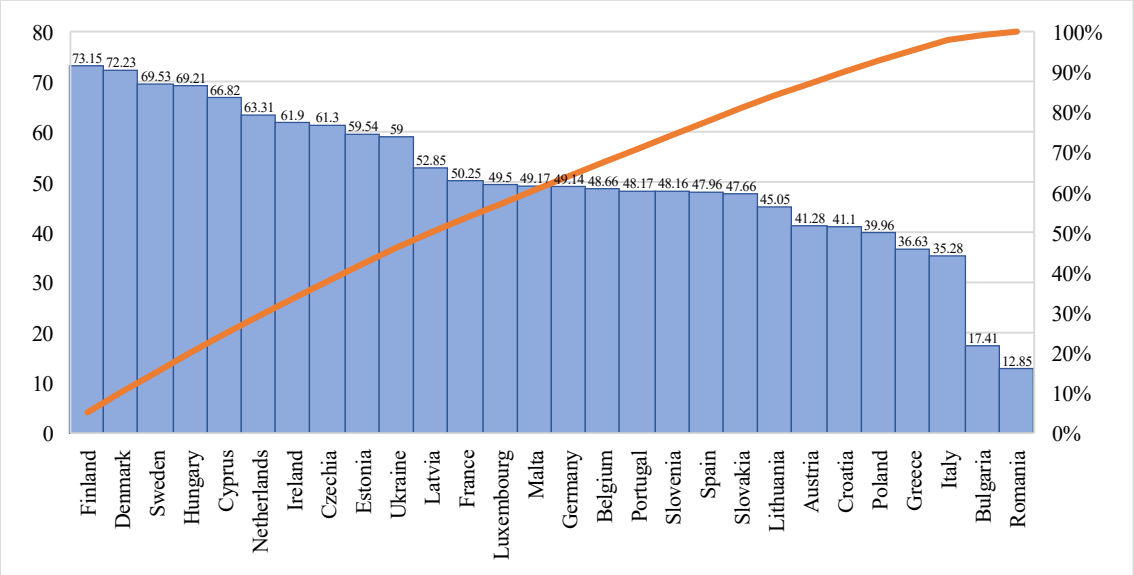

Figure 4: E-government activities of individuals via websites, %

Source: compiled by the authors based on [13; 30]

The leaders are Finland, Denmark and Sweden, where over 70% of the population participate in e-government activities, which indicates a high integration of online services into the daily lives of citizens and an established culture of digital interaction with the state. Significant indicators are also observed in countries such as Hungary, Cyprus, the Netherlands and Ireland, where over 60% of citizens use e- government services, which indicates a successful synergy between the availability of online services and the digital skills of the population.

The middle group of countries, including the Czech Republic, Estonia, Ukraine, Latvia and France, demonstrate moderate levels of citizen participation, in the range of 50-60%, indicating some progress in digitalization, but there are still barriers to full population engagement, which may be related to insufficient digital literacy or limited access to online platforms.

The disparity is especially noticeable in countries such as Poland, Greece, Italy, Bulgaria and Romania, where population activity rates do not exceed 20-40%.

Ukraine, with a rate of about 59%, is in an intermediate position, indicating significant potential for growth.

The quality of public services directly depends on the competence of those who create and administer them. Therefore, it is especially important to increase the digital competences (professionalization) of public servants through:

- training in working with registers, electronic systems and analytical tools;
- understanding the principles of cybersecurity and personal data protection;
- ability to work with digital document management;
- development of digital management skills, communications, and service approach.

Competent civil servants are a key condition for the effective operation of the state's digital ecosystem.

The level of public investment in research and innovation projects is a key indicator of the country's strategic capacity to develop digital technologies,

modernize public administration, and implement effective digital services. In the context of digital transformation, state spending on R&D determines the ability to create new technological solutions, improve the quality of digital services, and professionalize public service, in particular by developing digital competencies of employees and implementing modern tools for communication with citizens (Fig. 5).

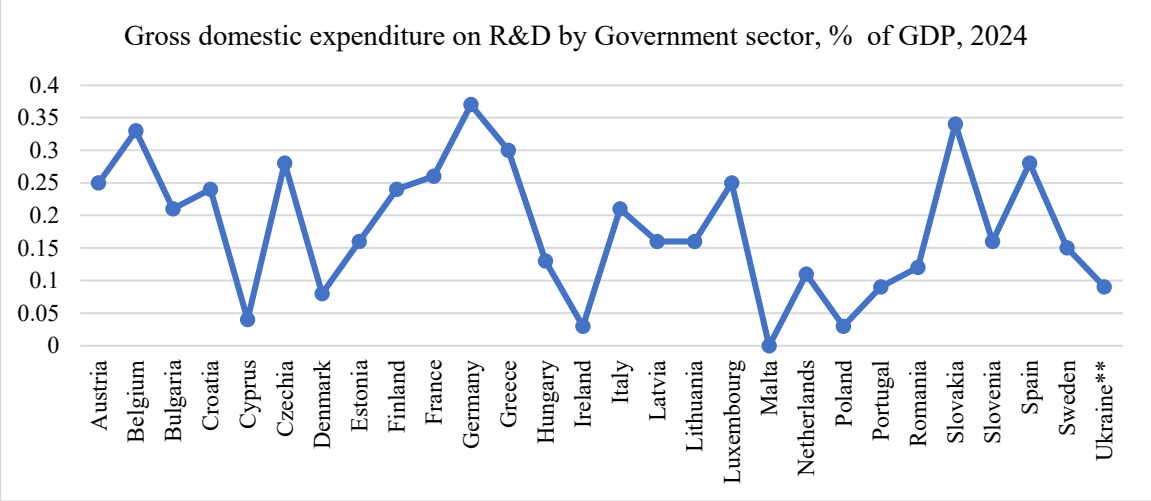

Figure 5: State research and development costs Public sector R & D work, % of GDP, 2024
Source: compiled by the authors based on [13]
*** In the absence of reporting to Eurostat, data for Ukraine reflect the funding of the Ministry of Digital Transformation in terms of e-government, innovative technologies and the work of the Innovation Development Fund [37]*

The comparison results indicate significant differentiation of public spending on R&D between EU countries, which affects the overall depth of digital transformation, innovative activity, and the ability of public institutions to develop modern digital services.

The leaders in terms of public investment in R&D are Germany (0.37%), Belgium (0.33%), Slovakia (0.34%) and Greece (0.30%). However, a deeper comparative analysis shows different results of these investments. In the case of Germany and Belgium, high spending on research and development correlates with a developed digital infrastructure, sustainable use of digital government services and the growth of digital competences of citizens. This indicates the effective integration of innovations into the activities of the public sector, as well as the systemic professionalization of the public service, including the development of skills for working with data, modern electronic tools and digital communications. In contrast, Greece and Slovakia, despite high funding indicators, demonstrate significantly lower levels of digital services, digital skills and the use of e-overnment. This discrepancy indicates the inefficient use of public investments or their dispersion between projects that do not provide a quick practical effect for citizens. In these countries, innovation spending is not transformed into improving the digital interaction of the state with citizens, which is a consequence of weak coordination of digitalization policies, insufficient professional training of public servants, or the absence of a holistic modernization strategy.

Countries with an average level of funding (0.15-0.28%) – France, Austria, Czech Republic, Spain, Finland, Slovenia, Lithuania – also demonstrate a sufficient level of digital development, but their progress is more gradual. They have stable but less aggressive models of innovation policy in the public sector. This affects the pace of updating digital platforms, the development of omnichannel public communications and the possibilities of integrating new services into the public ecosystem.

The countries with the lowest indicators – Cyprus (0.04%), Ireland (0.03%), Poland (0.03%), Romania (0.12%), Bulgaria (0.21%) – demonstrate lower positions in the use of digital government services and in the development of digital competence of the population. Limited investments in the public sector of innovation complicate the modernization of IT infrastructure and the formation of modern approaches to public administration and communications. This creates a vicious circle, namely: low digital skills of the population restrain

the demand for complex digital services, and insufficient quality of services, in turn, does not motivate citizens to improve their competences.

Ukraine, with an indicator of about 0.09%, formally belongs to the countries with a low level of public R&D investments in the public sector, but it has significant specifics. In 2024, these funds were directed to financing key areas of the Ministry of Digital Transformation of Ukraine: e-government, development of special innovative technologies, support for the Innovation Development Fund and digital security projects. Despite the war conditions, Ukraine demonstrates a higher level of use of digital services (58-59%) than some EU countries with similar or even higher R&D expenditures, which confirms the effectiveness of the national digital policy and the quality of public communications.

Limited investments slow down the professionalization of the public service, as the creation of high-tech services requires broader training of digital personnel, the introduction of new competency models, and a steady renewal of infrastructure.

Overall, public spending on R&D is a key factor in the development of digital government services, increasing citizens' digital competence, and modernizing public administration. It provides the basis for:

– creation of modern technologies;

– increasing the efficiency of government services;

– transition to a professional digital public service;

– development of high-quality public communications;

– formation of an innovative environment.

On the other hand, a high level of R&D funding does not guarantee the development of digital services if it is not complemented by:

– effective strategic management;

– professionalization of public servants;

– development of digital communications and user engagement;

– a clear digital policy focused on the needs of citizens.

Overall, the analysis confirms that the active participation of citizens in e - government directly depends on the level of digital literacy and the availability of online services, which is a key aspect of the professionalization of public service and the development of a service- oriented state.

The level of digital competence of citizens, both users and civil servants as service providers, is a determining factor in the effective development of digital government services. In countries where the population has high digital skills, there is intensive use of online platforms, which stimulates the state to further modernize services, expand functionality and implement new digital solutions. At the same time, the study shows that there is also a reverse effect: when the state actively implements advanced digital services, citizens are forced to increase their own digital competences in order to fully use such services or provide them (Fig. 6).

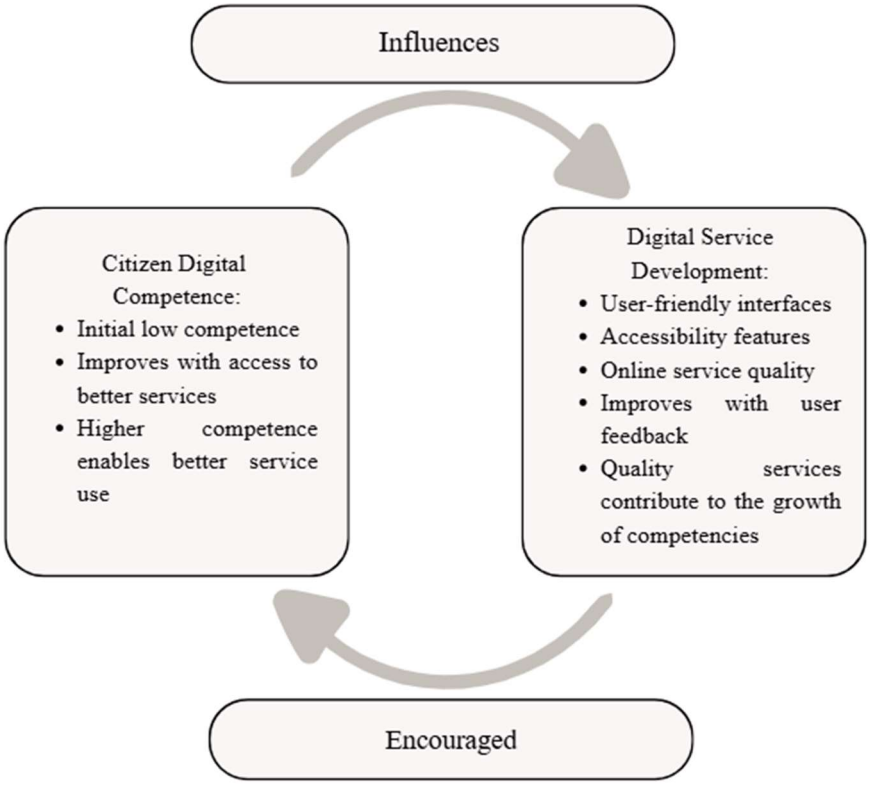

Figure 6: Cyclical mutual influence of the digital competence of the population, including civil servants, and the quality of the state's digital services
Source: compiled by the authors based on their own research

Fig. 6 illustrates the interdependence between citizens' digital competence and the development of digital services and shows a two-way cycle of influences:

- Digital competence determines how effectively citizens are able to use digital public services. Initially, the level of skills may be low, but it increases with access to high-quality and easy-to-use online services. As competence increases, citizens can use digital services more actively and more widely;
- The development of digital services includes improving interfaces, increasing accessibility, taking into account user experience and feedback. The better and more convenient services are, the more they motivate citizens to develop their own digital skills.

Thus, the diagram demonstrates a closed loop: digital skills → effective use of public services → development of public services → further growth of digital skills. This process is both mutual and self-reinforcing.

5. DISCUSSION

The results obtained expand the scientific discussion on the system-forming role of digital government services in the transformation of public administration and confirm their transition from an instrumental to a structural level of influence. In line with the digital-era concept governance [17] and subsequent interpretations of the digital state (Meijer, 2018), the results of the study demonstrate that digital services not only modernize administrative procedures, but also change the very logic of public administration – from process-oriented to service- oriented, from hierarchical to platform -integrated.

In this context, the ecosystem approach to digital governance [27; 35], which allows interpreting digital services as elements of an interconnected network of actors, data and platforms, acquires special importance. The results obtained confirm that the effectiveness of digital transformation is determined not by isolated technological solutions, but by the level of coordination between institutions, data standardization and the presence of a strategic center for digital policy. Thus, the digital ecosystem

of the state appears as a new form of institutional organization of the public sector.

The position that there is no direct linear relationship between the volume of public funding and the level of digital maturity is debatable, but confirmed within the framework of the study. The comparative analysis of Ukraine and the EU countries correlates with the conclusions of international organizations [13; 29] regarding the determining role of institutional capacity, managerial coordination and human capital. This allows us to formulate a thesis about an asymmetric model of digital development, in which individual areas of digital services can develop at a faster pace compared to the overall quality of public administration.

Of particular note is the established mutual relationship between the digital skills of the population and the development of digital services. The results obtained confirm the cyclical model of digital transformation: increasing digital literacy of citizens stimulates the demand for online services, which, in turn, leads to further improvement of the service infrastructure. This conclusion is consistent with the approaches to the analysis of digital trust and civic participation [1; 9] and allows us to interpret digitalization as a process of joint evolution of the state and society, rather than a unilateral introduction of technologies.

At the same time, the results of the study also deepen the discussion on the professionalization of the public service. The digital ecosystem of the state forms a new competency profile of a public servant, which includes digital literacy, the ability to work with large data sets and strategic management of digital changes. This conclusion is consistent with the results of systematic reviews of digital changes in the public sector [21; 41].

The Ukrainian experience of digital transformation demonstrates the possibility of forming a competitive digital ecosystem even under resource and security constraints. This allows expanding the theoretical understanding of digital governance, supplementing it with the thesis of institutional flexibility as a factor of accelerated digital modernization. At the same time, the results of the study indicate that the further development of digital services requires the institutionalization of a systemic approach to the development of digital competencies of civil servants, the implementation of data standards governance and the formation of a culture of evidence-based management.

The theoretical contribution of the study is the conceptualization of the state's digital ecosystem as an integrated institutional environment that simultaneously functions as a tool for modernization and a mechanism for professionalizing the public service. Unlike traditional approaches that consider digital services mainly through the prism of efficiency or convenience, the proposed approach emphasizes their transformative impact on management practices, institutional architecture, and human capital of the public sector.

The practical implications of the results obtained are the need to integrate digital transformation policies with human resource management policies in the public sector. The professionalization of the public service should be considered as a structural component of the state's digital strategy, and not as a concomitant element of administrative reform. Only if the technological, institutional and competence dimensions of digitalization are synchronized is it possible to form a sustainable digital ecosystem.

In summary, it is worth noting that the results of the study confirm that digital state services act as a strategic mechanism for the institutional transformation of public administration. They form a new model of interaction between the state and citizens, change the professional structure of the public service and create a basis for strengthening trust in state institutions. Thus, the digital ecosystem of the state can be considered a key driver of long-term modernization of the public sector in Ukraine and the European Union countries.

6. CONCLUSIONS

The study allowed for a comprehensive assessment of the role of state digital services in the formation of a modern public service and to identify key factors that influence the effectiveness of digital transformation. Analysis of indicators of EU countries and Ukraine demonstrated that the development of state digital services is a multidimensional process that combines investments in innovation, the level of digital skills of the population, the professionalization of public service and the quality of public administration.

The comparison results showed that countries with high state investments in R&D and a strong ICT sector have significantly higher rates of digitalization of public administration, as well as a higher level of digital skills of citizens. At the same time, examples of individual countries have shown that significant financial investments do not guarantee automatic success - without effective management, proper staffing and a coordinated digital policy, high costs may not be converted into an increase in the quality of state digital services.

Ukraine, despite relatively lower investment in R&D, demonstrates a high level of development of digital services and significant progress in the implementation of innovative solutions. This indicates the effectiveness of the national digitalization strategy, as well as the ability of the state to quickly and flexibly adapt to challenges, ensuring the rapid implementation of digital services. At the same time, it emphasizes the importance of increasing funding for the development of innovations in order not to lose the high pace of digital modernization.

It has been established that citizens' digital skills are one of the key determinants of the effective use of online services, but there is also a reverse effect: high-quality government digital services stimulate the population to increase their level of digital competence. Such interdependence forms a positive cycle of development - increasing accessibility of services increases the demand for digital skills, and increasing digital literacy stimulates further modernization of services.

It has been proven that the development of digital services is a tool for professionalizing public service. The use of electronic tools requires civil servants to have new competencies - data management, digital communication, cybersecurity, and innovation. This creates the basis for the formation of a modern state personnel model focused on efficiency, openness, and effectiveness.

Thus, digital state services are not only a technological solution, but also a strategic resource for the development of public administration, as:

- improve the quality and accessibility of public services;
- strengthen transparency and trust in the state;
- form a new culture of interaction between government and society;
- contribute to the professionalization of public service;
- strengthen innovation potential and economic development.

The scientific contribution of the study is the development of a theoretical and methodological approach to understanding the state's digital services as an integrated tool for professionalizing the public service, combining technological, competency, and institutional dimensions. Unlike existing research, the work substantiates the systemic relationship between the level of development of digital services, the digital competencies of the population, and the institutional capacity of the public service, and also proves the presence of a two-way effect of their interaction.

Thus, digital state services are a critically important element of a modern state, and their further development will determine the effectiveness of public administration, the country's competitiveness, and the quality of life of citizens.

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