TELOS: Revista de Estudios Interdisciplinarios en Ciencias Sociales
ISSN 1317-0570 / ISSN (e) 2343-5763
Vol. 26(1): 35-51. Enero-Abril 2024

IMPACT OF DIGITAL PUBLIC SERVICES ON GOVERNANCE EFFICIENCY

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RECIBIDO: 19/10/2023 / **ACEPTADO**: 11/12/2023 / **PUBLICADO**: 15/01/2024

How to cite: Krasnykov, Y., Ninyuk, I., Storozhenko, L., Marukhlenko, O., Kruhlov, V. (2024). Impact of digital public services on governance efficiency. *Telos: Revista de Estudios Interdisciplinarios en Ciencias Sociales, 26*(1), 35-51. www.doi.org/10.36390/telos261.04

ABSTRACT

The impact of electronic services for citizens on the efficiency of public administration extends beyond simply digitizing bureaucratic processes. It has a positive effect on various aspects of management, ultimately increasing value for both society and the state. The purpose of the article is to quantify the degree of influence that electronic services have on several factors characterizing the public administration efficiency, utilizing the following methods: correlation analysis, factor analysis, multivariate regression, and radar method. The study found a relationship between the development level of electronic services (measured by the E-Government Index) and various indicators of public administration efficiency. The findings showed that e-government can account for approximately 57.1% variation in these indicators, but it is important to take into consideration the significant value of the standard estimation error. The study's novelty lies in its comprehensive approach to examining the various aspects of public

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administration efficiency regarding the development of electronic services for the population, as well as their quantitative characteristics. Further research areas will be aimed at an in-depth investigation of e-governance's impact on sustainable development and international efficiency indicators.

Keywords: E-services; e-government; public administration efficiency; e-democracy; netocracy; netocratic public administration; information society.

Impacto de los servicios digitales para los ciudadanos en la eficiencia de la administración pública

RESUMEN

El impacto de los servicios electrónicos para los ciudadanos en la eficiencia de la administración pública va más allá de la simple digitalización de los procesos burocráticos. Tiene un efecto positivo en varios aspectos de la gestión y, en última instancia, aumenta el valor tanto para la sociedad como para el Estado. El propósito del artículo es cuantificar el grado de influencia que los servicios electrónicos tienen sobre diversos factores que caracterizan la eficiencia de la administración pública, utilizando los siguientes métodos: análisis de correlación, análisis factorial, regresión multivariada y método radar. El estudio encontró una relación entre el nivel de desarrollo de los servicios electrónicos (medido por el Índice de Gobierno Electrónico) y varios indicadores de eficiencia de la administración pública. Los hallazgos mostraron que el gobierno electrónico puede representar aproximadamente un 57,1% de variación en estos indicadores, pero es conveniente tener en cuenta el valor significativo del error de estimación estándar. La novedad del estudio reside en su enfoque integral al examinar los distintos aspectos de la eficiencia de la administración pública en lo que respecta al desarrollo de servicios electrónicos para la población, así como sus características cuantitativas. Otras áreas de investigación estarán dirigidas a una investigación en profundidad del impacto de la gobernanza electrónica en el desarrollo sostenible y los indicadores internacionales de eficiencia.

Palabras Clave: servicios electrónicos; gobierno electrónico; eficiencia de la administración pública; democracia electrónica; netocracia; administración pública netocrática; sociedad de la información.

Introduction

In the midst of swift technological advancements and the intensification of digital transformation, the significance of electronic services in enhancing public administration's efficiency for citizens is progressively escalating. Developing e-services for citizens, also called e-government services, has transformed how governments interact with citizens (Lindgren et al., 2019). Digital platforms for providing such services have become an important source of information for citizens through the implementation of various operations and an unprecedented way of interacting with government bodies.

The influence of electronic services for citizens on the efficacy of public administration entails a fundamental shift in the dynamics thereof, facilitating the democratization of service accessibility, increasing public administration transparency, and encouraging citizen

engagement in administrative participation (Sydorenko, 2021). The introduction of the latest technologies in the field of public administration can contribute to the optimization of government activities, enhance the efficiency of service delivery, and expand the opportunities for citizens to participate in the decision-making process formed by their communities (Almaiah & Nasereddin, 2020; Ali & Anwar, 2021; Alruwaie et al., 2020). The concept of public administration, which is based on the idea of using Internet technologies to engage more citizens in decision-making and policy formation, is defined in modern scientific literature as "netocracy" (Storozhenko, 2023). The netocratic public administration is designed to transform the relationship between the government and citizens into more transparent and effective ones, which is achieved by creating special electronic platforms as well as encouraging citizens to use them actively.

The subsequent introduction of electronic governance into the management process worldwide and the enhancement of the mechanisms for providing services to citizens with its use necessitates an examination of the relationship between electronic services and public administration efficiency (Balisany et al., 2022; Addo & Senyo, 2021). Determining the degree of influence of electronic services on various aspects of public administration efficiency will allow obtaining valuable information that will facilitate the adoption of complex management decisions and contribute to transparent and balanced management (Andersen et al., 2023; Ullah et al., 2021; Ju et al., 2019).

This article addresses a complex relationship between electronic services for citizens and various aspects that can characterize public administration efficiency. The purpose of the study is to quantify the degree of influence of electronic services for citizens on a number of facets, evaluating the efficacy of governmental bodies at a state level. To attain this goal, the study addressed the following objectives:

- to conduct a thorough study as regards the correlation evaluation between the level of electronic services advancement and indicators of public administration efficiency, based on the evaluation data across 193 countries worldwide;
- to determine the key factors affecting the efficiency of public administration;
- to evaluate the influence of digital services provided to citizens on the governmental administration efficiency;
- to characterize the relationship between the development of electronic services for citizens and indicators of public administration efficiency for an individual country using the example of Ukraine.

Literature Review

The subject of the influence of e-services and e-government development on different aspects of public administration remains pertinent in numerous investigations. The perspective of generating public worth via implementing digital solutions for public service delivery is frequently applied to this effect for evaluation purposes. For instance, Twizeyimana and Andersson (2019) define the public value of e-governance as the citizens' expectations of this type of governance. Societal value is important for the successful implementation of e-government, so measuring what societal value e-government should bring is an urgent scholarly issue. Moreover, Ma and Zheng (2019) examine the effectiveness of e-government from the supply side and citizens' acceptance of e-services from the demand side. Drawing upon the example of 32 European countries, the scientists concluded that supply and demand are partially

coordinated, as most of citizens interviewed in the work positively characterize the introduction of electronic government. Criado and Gil-Garcia (2019) probed into the aspects of social value creation using modern smart technologies and strategic solutions. The researchers conclude that new technologies have significant potential to jointly improve public services and create public value. MacLean and Titah (2022) examine the different directions of the impact of e-government on the creation of public value: drawing on the theory of social value, scientists classify certain effects according to the role for which the value is created and based on the nature thereof.

Chen and Aklikokou (2021) pay special attention to such a measure of public administration efficiency as ways to reduce the level of corruption. Scholars are examining the impact of e-governance advancement on this phenomenon: their study contains data from 191 countries and draws upon a two-stage cluster analysis. Further, Sriyakul et al. (2022) elaborate on the possibilities of e-government in terms of how it can affect the reduction in corruption across government departments. The objective of e-governance, ascertained by the researchers, is to enhance the welfare of the general public and management efficiency, so their study contains data on the relationship between the level of corruption, e-governance, economic growth, and good governance in the example of countries such as Malaysia, Thailand, Singapore, and the Philippines.

Abdulkareem et al. (2022) conducted a study that explored the influence of e-government on citizens' e-participation in democratic processes. The findings highlight the potential of e-government to address deficits in public trust, specifically through its role as a mediator between high-quality governance and electronic participation among citizens.

According to Bakon et al. (2020), the advancement of e-government in emerging economies positively enhances service provision efficiency and quality. The scholars noted that e-government promotes citizen participation in decision-making processes, reducing corruption and augmenting transparency and accountability within governmental institutions. Further, scientists' attention was focused on the challenges associated with implementing electronic government systems in emerging economies due to their pronounced inferior performance compared to developed countries.

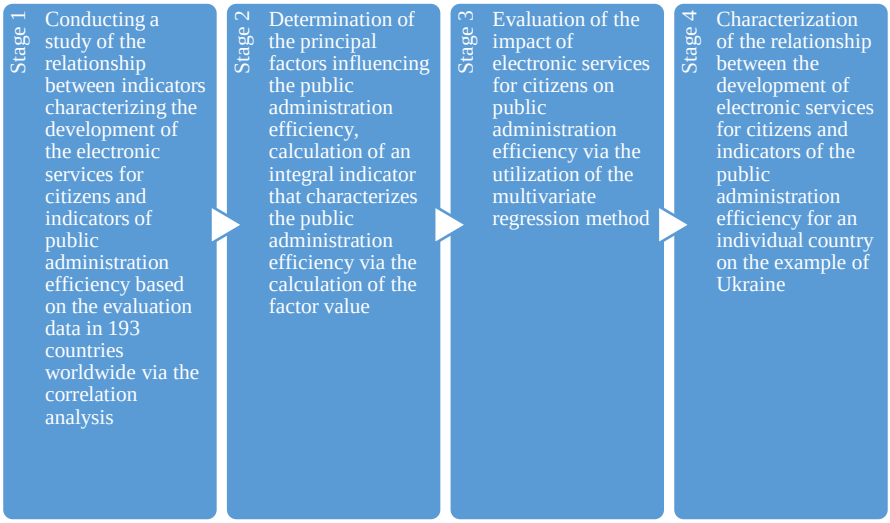
In several investigations conducted by Ukrainian scholars, the issue of implementing e-governance has also been revisited. For instance, Mokhova (2020) reveals the basics of the formation, implementation, and development process of e-government. The researcher noted that the ultimate goal of electronic government is to preserve the integrity of the public administration system. In the work of Melnychuk (2020), it is stated that the effectiveness of e-governance largely depends on citizens' perception of electronic services. Using the example of Ukraine, the scientist addresses the barriers to introducing electronic government and the factors of its insufficient efficiency. Shcherbyna (2022) clarifies the essence of the "electronic services" concept and highlights the procedure for their provision. The researcher emphasized that at the current stage, the state's functions necessitate the transformation from exclusively executive to service-oriented ones.

Methods

Research procedure

The research procedure involves dividing the study into four interconnected stages, as presented in Figure 1 below.

Figure 1.
Research procedure.



In the first stage, with the use of correlation analysis, it was proved that there is a significant relationship between the indicators of the effectiveness of the state administration (Ranking of happiness (Helliwell et al., 2022), Global State of Democracy Indices (Rights, Rule of Law) (International IDEA, 2022), Ease of Doing Business (The World Bank, 2023), Corruption Perceptions Index (Transparency International, 2023), Global Innovation Index, World Competitiveness Ranking IMD, 2022)) and indicators of the level of development of electronic services for citizens (E-Government Index 2022, E-Participation Index 2022, Online Service Index 2022, Human Capital Index 2022, Telecommunication Infrastructure Index 2022 (United Nations, 2022)). No significant relationship was found between the level of development of electronic services and such indicators of public administration efficiency as Representation, Participation, and Open Budget Index, and therefore they were excluded from further analysis. For a convenient interpretation of the analysis results, a rectangular matrix was built, where the indicators of the efficiency of public administration were on the left, and the indicators of the level of development of electronic services were on the top. Correlation values were found at the intersection of the corresponding periods and columns.

At the second stage, using factor analysis, factor loadings were determined for public administration efficiency indicators. The high values revealed in the analysis for all the indicators left in the study after the correlation analysis made it possible to prove their essential role in ensuring the efficiency of the state administration. In addition, based on the factor analysis results using Formula 1, the value of the factor "Democracy and development" was determined, which is an integral indicator calculated for the variables participating in the factor analysis.

The analysis carried out at the third stage using the multivariate regression method made it possible to determine the impact of the level of development of electronic government

on the identified factor "Democracy and development". Also, the regression analysis made it possible to confirm the significance of the model through the F-statistics and p-value and to determine what percentage of the variation in the dependent variable (the "Democracy and Development" factor) is explained by the independent one (the level of e-government development).

At the fourth stage, the positioning of Ukraine was carried out regarding the level of development of electronic services and the efficiency of public administration. For this, the radar method (Formula 2) was applied, which made it possible to compare the area of radars for Ukraine with the area of the "ideal" radar, in which all indicators have the maximum value. The percentage of the area of radars for Ukraine from "ideal" radars indicates the level of development of the studied categories.

Sample

Evaluation and impact measurement of the electronic services for citizens on the public administration efficiency necessitates the determination of quantitative criteria for the electronic services development, on the one hand, and indicators of the public administration efficiency, on the other. To that end, several assessments were used, which are a comprehensive reflection of the investigated aspects and their interpretation. The E-Government Index (United Nations, 2022) and its four sub-indices were defined as a criterion that determines the level of development of electronic services. To reveal the efficacy markers in public administration, the study hypothesizes that such efficiency is influenced by indicators related to citizens' satisfaction with the standard of living and democracy, ease of doing business, perception of corruption, budget efficiency, innovative development, competitiveness, in particular: Ranking of happiness (Helliwell et al., 2022), Global State of Democracy Indices (Representation, Rights, Rule of Law, Participation) (International IDEA, 2022), Ease of Doing Business (The World Bank, 2023), Corruption Perceptions Index (Transparency International, 2023), Open Budget Index (International Budget Partnership, 2021), Global Innovation Index, World Competitiveness Ranking (IMD, 2022).

The sample of countries for the study included 193 world countries for which data on the E-Government Index (United Nations, 2022) is available. Ukraine was considered separately as an example of the successful implementation of electronic government in an emerging economy.

Methods

The principal methods applied in the research were correlation analysis, factor analysis, and multivariate regression. While utilizing the correlation analysis method, it was confirmed that the determined indicators of public administration efficiency are interrelated with the level of electronic services development. Drawing upon the factor analysis, it was established that all the studied variables, which were used as indicators of the effectiveness of public administration, have high factor loads, thus reflecting a homogeneous concept or phenomenon, namely public administration efficiency. The value of the identified factor was calculated for its further use as an integral indicator. The formula for calculating the Democracy and Development factor is given below (1).

Factor 1 "Democracy and development" = $\sum Variable_n \times Factor\ load_n$ (1)

By applying the multivariate regression method, the influence of the level of development of electronic government on the factor "Democracy and development" was determined. The application of this method made it possible to confirm the significance of the built model and to determine how much the independent variable can explain the variations in the dependent.

The characteristics of the development level of electronic services and the public administration efficiency in the example of Ukraine were presented utilizing the radar method, which made it possible to calculate the integral indicator of the public administration efficiency in Ukraine. While applying the said method, the formula for calculating the area of the polygon was used:

$$S = \frac{1}{2} \times \left(\left(\sum_{i=1}^{n} X_i \times Y_{i+1} \right) - \left(\sum_{i=1}^{n} X_{i+1} \times Y_i \right) \right) \quad (2)$$

Where S is the area of the polygon, n is the sequence of coordinates of neighboring vertices, X and Y are the Cartesian coordinates of the vertices, and i = 1.

Limitations of the study

One of the study's limitations is the lack of data for individual countries. Also, in the absence of data for 2022, the latest available data (for 2020 or 2021) were used.

Results

Analysis of the interrelationship between the level of development of electronic services for citizens and indicators of public administration efficiency

It is advisable to check the hypothetical presence of the electronic services' influence on public administration efficiency using methods of mathematical analysis, primarily correlation analysis. This will help establish whether there is a relationship between the studied categories. The analysis of the relationship between the development of electronic services for citizens and indicators of public administration efficiency was carried out using the correlation analysis method. The results of the calculation are presented in Table 1.

Table 1.

Results of correlation analysis

Indicator	E-Government Index 2022	E-Participation Index 2022	Online Service Index 2022	Human Capital Index 2022	Telecommunication Infrastructure Index 2022
Ranking of happiness 2019-2021	0.863889	0,529219	0.583594	0.850921	0.787534
Representation 2022	0.360032	0.126100	0.132701	0.471406	0.352669
Rights 2022	0.597391	0.199965	0.210880	0.676771	0.667977

Rule of Law 2022	0.577618	0.218946	0.211517	0.635408	0.651896
Participation 2022	0.311108	0.105452	0.102370	0.400014	0.321680
Ease of Doing Business 2020	0.684187	0.511085	0.499362	0.585265	0.650149
Corruption Perceptions Index 2022	0.652154	0.313532	0.299068	0.644779	0.729032
Transparency (Open Budget Index) 2021	0.326712	0.268207	0.273580	0.366961	0.215252
Global Innovation Index 2022	0.702948	0.542084	0.530250	0.543425	0.692014
World Competitiveness Ranking, 2022	0.621959	0.431543	0.472948	0.484718	0.605959

Several public administration efficiency indicators display a moderate to substantial correlation with the degree of advancement in electronic services, as illustrated by the table through the integral indicator E-Government Index (United Nations, 2022) and its four sub-indices. The sub-indices were used in order to identify whether there is a connection between the performance indicators of public administration and certain aspects of electronic services. Focusing attention on indicators with a high degree of mutual connection, it is worth noting the following pairs of indicators:

1) Ranking of happiness has a high strength of connection (0.863889) with the general indicator of the E-Government Index (United Nations, 2022), as well as with its sub-indices, such as the Human Capital Index (0.850921) and the Telecommunication Infrastructure Index (0.787534). That said, the general standard of living of the population is related to the level of development of e-government through indicators of education, access and opportunities of using the Internet.

2) Corruption Perceptions Index has a strong correlation (0.729032) with the Telecommunication Infrastructure sub-index. This correlation can presumably be elucidated by the increased accessibility and empowerment of citizens to influence governmental decision-making through the use of internet technologies.

3) The Global Innovation Index (WIPO, 2022) is strongly related (0.702948) to the E-Government Index (United Nations, 2022), which can be accounted by the fact that the proper level of e-government development depends on the innovative development of the country overall, as it involves the use of the latest technologies, appropriate cybersecurity systems, new approaches to providing services, etc.

The average strength of the connection with the level of development of electronic services (integral indicator and/or its sub-indices) is demonstrated by such indicators of the efficiency of the public administration as Rights, Rule of Law, Ease of Doing Business, World Competitiveness Ranking (IMD, 2022). Weak strength of connection with individual indicators of the efficiency of public administration was noted only for a few sub-indices. Given the above, it is possible to confirm the hypothesis regarding the existence of a significant relationship between the performance indicators of the public administration and the citizens' electronic services

development in general. For further study, it is expedient to exclude such indicators with which the electronic services development indicators did not demonstrate a significant connection.

Determination of the main factors affecting the public administration efficiency

To verify the research hypothesis regarding the potential factors that impact public administration efficiency, a factor analysis was conducted on several comprehensive evaluations quantitatively reflecting these indicators. The outcomes of the said factor analysis are presented in Table 3.

Table 2.
Factor loads

Indicator	Factor 1
Ranking of happiness 2019-2021	-0.806617
Rights 2022	-0.819131
Rule of Law 2022	-0.898099
Ease of Doing Business 2020	-0.749170
Corruption Perceptions Index 2022	-0.946277
Global Innovation Index 2022	-0.892238
World Competitiveness Ranking, 2022	-0.872307
Total variance	5.141891
Proportion of total variance=ï	0.734556

While conducting factor analysis, a single factor was acquired. All indicators it contains have high factor loads. Considering its indicators, this factor can be defined as "Democracy and development". The factor accounts for approximately 73.45% of the variation.

From an economic perspective, the factor analysis findings may reveal that all indicators signify a uniform concept or phenomenon, namely development levels and government efficacy as measured by democracy. All the indicators show substantial or exceptionally high factor loadings, justifying their retention for further examination and underscoring their crucial role in fostering efficient public administration. These findings corroborate the proposed research hypothesis.

Evaluation of the influence of digital services for the population on the governmental management efficiency

The factor analysis enables the computation of a discerned factor's value through the application of formula (1), which presupposes summing up the products of each variable in accordance with its respective factor load. This yields an integral indicator that can be further examined using multivariate regression techniques to evaluate how electronic services for citizens impact public administration efficacy. The efficiency of public administration, expressed through the value of the "Democracy and development" factor, was a dependent variable, and

the level of electronic services, expressed through the E-Government Index (United Nations, 2022), was an independent variable. The results are presented in Table 3 as follows:

Table 3.
Results of the analysis using the multivariate regression method

	BETA	Stan.error BETA	B	Stan.error B	t(190)	p-value
Free index			-2.27676	0.057838	-39.3644	0.000000
E-Government Index 2022	-0.755418	0.047412	-0.92394	0.057989	-15.9332	0.000000

The correlation coefficient R indicates the strength and direction of the relationship between the dependent and independent variables. In the current study, R is 0.75541812, which indicates the presence of a fairly strong positive relationship. The determination coefficient R2 indicates the proportion of variation in the dependent variable that is accounted for by the independent variable. R2 equals 0.57065653, meaning the independent variable accounts for approximately 57.07% of the variation in the dependent variable. F-statistics ($F(1,191) = 253.87$) and p-value ($p<0.00000$) define the significance and relevance of the model. In this light, the given regression model is statistically relevant, and at least one independent variable significantly affects the dependent variable.

BETA regression coefficients reflect how the dependent variable changes when the independent variable changes by one. For the E-Government Index, BETA amounts to -0.755418, so a decrease in the level of e-government development by one unit is associated with a decrease in "Democracy and Development" by 0.755418.

The results of the regression analysis show that the level of development of e-government influences the factor "Democracy and development". The model is statistically relevant and can account for about 57.1% of the variation in the dependent variable. This attests, among other factors, to the existence and growing significance of netocratic processes in public administration. However, it is worth noting that the presence of a significant standard error of estimate (0.80351) may indicate the presence of other variables or uncertainties impacting the Democracy and Development factor.

Position of Ukraine

Examining the influence of digital citizen services on the efficiency of governmental administration in distinct nations can be visualized using the radar method, during which axes are built in the polar coordinate system, the number of which corresponds to the number of indicators. Accordingly, on each axis, a point whose distance to the center of the radar is equal to the value of the corresponding indicator is determined. Figures 2 and 3 depict an illustration of the radar construction process intended for Ukraine. Figure 2 contains a radar for visualizing the level of development of electronic services; Figure 3 presents a radar with indicators of public administration efficiency.

Figure 2.
Radar for visualization of electronic services development

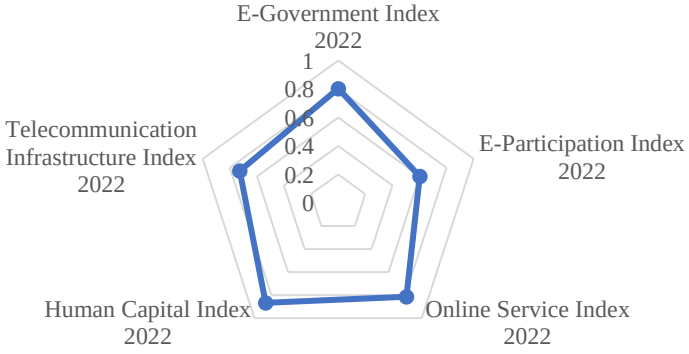
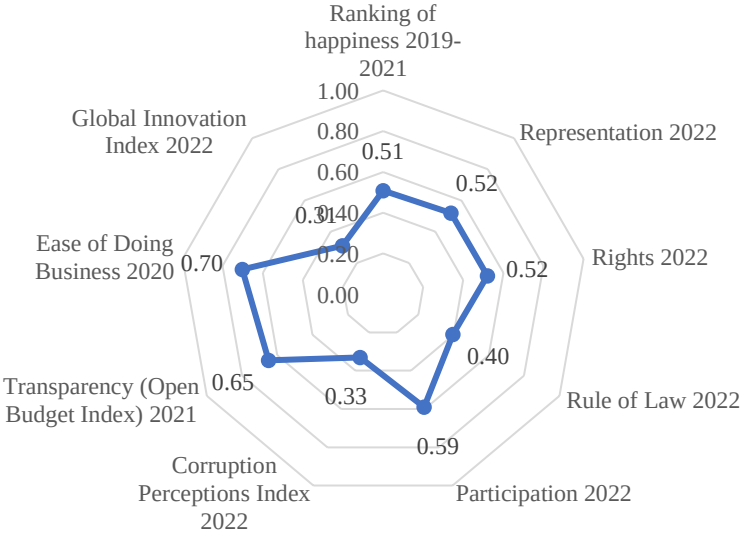


Figure 3.
Radar with public administration performance indicators



Note: the actual values of the scores for each indicator can be measured from 1 to 10 (Ranking of happiness), from 1 to 100 (Ease of Doing Business, Corruption Perceptions Index, Open Budget Index, Global Innovation Index, World Competitiveness Ranking) and from 0 to 1 (E-Government Index with sub-indicators, Representation, Rights, Rule of Law, Participation). The degree of each indicator achievement was determined by dividing the indicator by 10 or 100

(indicators measured from 0 to 1 remained unchanged) for the said indicators to be compared and displayed on the radar.

Drawing on the fact that the main indicator in Figure 2 is the E-Government Index, which comprises 0.8 for Ukraine, it can be assumed that electronic services for citizens in the country are developed by approximately 80% of the maximum possible level. The radar in Figure 3 cannot be described so unambiguously, as it does not contain one index with a number of sub-indicators but independent indicators. That being said, to determine the effectiveness of public administration in Ukraine, it is expedient to ascertain the radar's coverage area that generates the designated metrics and compare it with the area of an "ideal" radar, i.e. one in which all indicators are equal to 1. Using the formula for calculating the area of a polygon (2), it was found that the area of the "ideal" radar is equal to 2.892544 units, and radar for Ukraine accounts for 0.587861 units. Accordingly, the area of the radar for Ukraine is 20.32% of the area of the "ideal" polygon. Hence, the efficiency of public administration in Ukraine is approximately 1/5 of the maximum possible level. Drawing upon the preceding findings of the analysis, it can be noted that 57.1% of the variations in the efficiency of public administration can be accounted for by the changes in the level of development of electronic services, with a probability of about 75%. Therefore, the Ukrainian government must enhance its efforts towards fostering a netocratic vector in public administration, which can positively impact the effectiveness of public administration overall.

Discussion

The article examines and quantitatively substantiates the relationship between the development of electronic services for citizens and the effectiveness of public administration. The degree of influence of electronic services for citizens on such efficiency is determined. This appears to be the case in the course of the study, various facets of public administration effectiveness were investigated, which makes the work complex and augments its scholarly value (Gaisynuik, 2022).

In contrast to the author's article, in many works, an in-depth, but limited to one aspect of effectiveness, analysis of the impact of e-government is carried out. Ma and Zheng (2019) study the relationship between e-government effectiveness and citizen satisfaction. The researchers found that national e-government performance indicators are positively related to citizen satisfaction, but the values of the relationships differ between the three identified main e-government functions. The performance-satisfaction relationship is deeper in e-services compared to e-participation and e-information (Ma & Zheng, 2019). In the context of the author's research, the relationship between citizen satisfaction and the level of development of e-government can be traced through the analysis of correlations between the E-Government Index (United Nations, 2022) and its sub-indicators with the ratings containing the Ranking of happiness. Such an analysis allows to confirm the presence of a significant connection between the development of electronic services and the satisfaction of citizens, but an even deeper connection was found between the Human Capital Index and satisfaction.

Research conducted by Chen and Aklikokou (2021) established a correlation between the progress of e-government and the efficacy of government operations. Moreover, scholars have ascertained that the advancement of electronic governance is instrumental in

enhancing oversight against corruption. Identical findings were obtained in the study conducted by Sriyakul et al. (2022), which established that e-governance exhibits an inverse correlation with corruption; in other words, it mitigates it while simultaneously enhancing government efficacy and streamlining service delivery to citizens. The above results can be confirmed by the author's findings, particularly the discovery of a positive relationship (0.65) between the development of electronic government and the Corruption Perception Index.

The findings of the research conducted by Abdulkareem et al. (2022), which utilized a survey technique to sample proficient e-government users, suggest an absence of correlation between the quality of e-government and e-participation. However, trust in e-government mediates these relationships. Accordingly, transparency in public service managers' activities contributes to increasing public trust in electronic government. In this light, the research of scientists and the author's work have discovered the absence of a significant relationship between the development of e-government and e-participation (correlation is 0.31). It is worth noting that studies differ in their conclusions regarding the role of transparency. Thus, scientists emphasize the mediating role of transparency, while the author's research did not identify a significant connection between transparency and the development of e-government. This may be due to the fact that the papers used different approaches to assessing transparency. Likewise, MacLean and Titah (2022) argue that often, the key impacts of e-government for creating public value are, among other things, enhanced trust and communication for citizens, which is facilitated by increased transparency. Therefore, the issue of identifying the quantitative relationship between transparency and e-government requires additional in-depth analysis.

Twizeyimana and Andersson (2019) found that the development of e-government has the effect of improving the level of service provision for citizens, expanding the possibilities of open government, increasing ethics and professionalism, increasing trust in government, and improving welfare and social value. Among the scientific community, there exists a dearth of literature exploring the advancement of e-governance in developing nations, coupled with a paucity of cross-national comparative studies. It is worth noting that the current study partially fills the niche of such works, as 193 world economies participate therein, including those that are developing. A deeper inquiry into the indicators for each country would also make for the lack of comparative studies at the national level, but the limitations of the scope of work allowed the analysis to be carried out on the sole example of Ukraine.

Criado and Gil-Garcia (2019) maintain that the advancement of intelligent governance profoundly influences public services and the delivery of public benefits. Unlike the author's study, the above scholars' research focuses on examining how smart technologies and tactics contribute to this transformation. Conversely, the analysis presented in the author's paper solely draws from empirical evidence derived from electronic government implementation outcomes.

Bakon et al. (2020) found that only 15% of e-government systems in developing countries were successful. For instance, scientists draw comparisons between the mean values of the Electronic Government Development Index of African countries (0.34) and European countries (0.77). The digital divide and cultural aspects are considered to be the principal reasons for the insufficient efficiency of e-government in developing countries. From this perspective, turning to the analysis carried out in the author's article, it should be noted that the case of Ukraine will prove beneficial in implementing electronic governance in developing nations. This is since

the country has achieved high results in this direction because its E-Government Index is equal to 0.8.

Considering the achievements of Ukrainian scientists, it is expedient to distinguish the key effects of introducing of electronic government in Ukraine. According to Mokhova (2020), electronic government's main impact is forming a transparent and inclusive knowledge-driven community, which stimulates productivity, job creation, economic growth, improvement of living standards, and promotes sustainable development. The latter indicator was not researched in the author's article; however, it is relevant in modern conditions and may indicate the effectiveness of public administration. Thus, investigating the correlation and influence between e-government progress indicators and sustainable development metrics may constitute a crucial avenue for future inquiry.

Shcherbyna (2022) concludes that under the influence of the development of electronic government, entrepreneurial, public, and scientific activities develop much more effectively, and the social activity of citizens and international relations increase. The author of the current article did not conduct a quantitative analysis of the final indicator, leaving room for future exploration into how the development of electronic government may impact international governmental effectiveness.

Melnychuk (2020) cites the factors that slow down the development of e-government in Ukraine: the first group of factors concerns technical and regulatory measures for the implementation of e-government, and the second - characterizes the attitude of citizens toward the introduction of e-government. In the current article, by creating a petal chart, it is also possible to identify indicators that may hinder the progress of e-government due to their low values. It is worthy of note that the lowest values are characterized by indicators of perception of corruption, the power of the law, and innovation.

Based on the results of the discussion, it can be noted that the main value and practical significance of the study lies in the identification of a number of relationships between indicators and the determination of the impact of indicators of the development of electronic government on the indicators of the effectiveness of public administration. At the same time, the connections between each individual indicator of the development of electronic government and each of the indicators of the efficiency of the state government were separately analyzed, which allows us to identify which factors are most dependent on each other. Also, the general impact of the development of electronic government on the efficiency of public administration was analyzed, which made it possible to outline the key trend and confirm the study's main hypothesis.

Conclusions

The development of e-government and electronic services for citizens is not only a way of minimizing bureaucratic procedures and optimizing routine processes. It is an important channel for the interaction of citizens with public administration bodies, broadens their reach to public amenities, and facilitates diverse transactions. It is expedient to examine the specific aspects of public administration effectiveness that are affected by the electronic government development for informed management decision-making.

The analysis conducted conclusively demonstrates a notable correlation between the degree of advancement in electronic services and diverse facets of public administration's efficacy. This is conveyed through the elucidation of a correlation between the E-Government

Index (United Nations, 2022) and many indicators characterizing the standard of living and satisfaction of the population, ensuring human rights, the strength of the law enforcement, ease of doing business, perception of corruption, innovativeness, and overall competitiveness. Furthermore, it was found that the level of development of e-government can account for more than 57% of the variation in public administration efficiency indicators, but the significant value of the standard error of the estimate should be taken into consideration. The revealed connections bear witness to the existence and indispensable role of netocratic mechanisms in countries' governance.

The scientific novelty of the study lies in its comprehensive examination of the impact that electronic services for citizens have on administration's efficiency and quantitative characteristics. The findings obtained from this study are valuable to government officials, as they provide insight into the impact of electronic government development and can be used to enhance public administration effectiveness.

Interest conflict declarations

The authors does not have any interest conflict.

Authors contribution

Author	Concept	Data curation	Analysis/ Software	Research/ Methodology	Project/ sources	Supervision/ Validation	Initial write	Final editon
YK	X	X		X	X	X	X	X
IN	X		X	X			X	X
LS	X	X	X	X			X	
OM	X			X	X		X	
VK	X	X		X	X			X

Financing

Not applicable.

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