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E-Government Maturity and Citizen Use across the European Union: The Role of Socio-Economic Development

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***Abstract*:** Digitalisation has left its mark on virtually every aspect of how states and societies function, and the adoption of digital tools in public administration has contributed to the creation of a new form of public service delivery known as e-government. This new form has significantly improved the quality and accessibility of public administration services and increased citizen engagement. Therefore, it is important to identify the factors that may influence the success of e-governance initiatives. The aim of this paper is to investigate whether correlations exist between the maturity and quality of e-government, citizens' use of digital public administration services, and the level of socio-economic development in European Union countries. The analyses used data on 27 EU countries from the Eurostat database and the reports *The eGovernment Benchmark 2026* and *Human Development Report 2025*. We formulated and tested three research hypotheses using Spearman's correlation coefficient. The results indicate no significant correlation between socio-economic development and the maturity and quality of e-government, a limited correlation between socio-economic development and citizens' use of e-government services, and a limited correlation between the maturity and quality of e-government and its use. They also confirm significant variation amongst European Union Member States in terms of the digitalisation of public administration and its use. This article contributes to the literature on e-government by combining three levels of analysis: macroeconomic (level of socio-economic development), supply-side (maturity and quality of e-government) and demand-side (reflected by citizens' actual use of services).

Keywords: e-government; socio-economic development; digital services of public administration; digital administration.

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Introduction

The development of information and communication technologies (ICT) observed in recent decades has influenced all aspects of human life, creating the so-called 'digital economy' and transforming previously established patterns of production and consumption (Vinh, 2026). The situation was no different in the field of public administration, where the implementation of ICT solutions has brought about significant changes in the way public services are designed, delivered and evaluated (Khalid & Lavilles, 2019; Valaskova *et al.*, 2025), enabling a significant improvement in their quality and accessibility (Abu-Shanab & Shehabat, 2018; Al-Hussainan *et al.*, 2022) and streamlining the operations of the administrative apparatus (Androniceanu, 2025). Turner *et al.* (2022) state explicitly that, in public administration, ICT use has been the most significant innovation of the last four decades. This has given rise to e-government, which represents a new face of administration (Choi & Chandler, 2020; Staniulienė & Lavickaitė, 2022). In this concept, the Internet and other modern tools are intended to support better governance, respond more effectively to citizens' needs (Serra *et al*., 2015) and facilitate their access to information and communication. (Berlilana *et al.*, 2017), whilst also enabling the integration of functions across different levels of administration (Nam *et al.*, 2022). Hashim (2024) emphasises that the aim of e-government is to gradually transform the way public authorities operate, rather than merely to computerise government offices.

The origins of e-government initiatives date back to the 1990s; since then, the concept has developed and accelerated significantly with advances in modern technologies. It is generally accepted that this concept originated in the USA in 1993 (Almamy, 2022), when the Clinton administration began transforming the public sector by utilising information and communication technologies in government operations and services (Lee *et al.*, 2018). Initially, under the so-called e-gov 1.0, the aim was one-way communication involving the publication of data and documents online. Under the next generation, known as e-gov 2.0, two-way communication was enabled, thereby increasing the level of citizen participation. Technological developments in recent years have enabled the transition to the next generation, known as e-gov 3.0, which utilises solutions such as artificial intelligence (AI), the Internet of Things (IoT) and big data analytics, allowing for the personalisation of two-way communication and the tailoring of services to citizens' needs (Adnan *et al.*, 2022). E-government has therefore evolved from a simple office automation system focused on the efficient execution of administrative tasks using ICT (Nam *et al.*, 2022) into a complex system supporting intelligent decision-making, organisational reintegration and the transformation of the governance model (Zou *et al.*, 2023) that enables the realisation of e-democracy, including citizen participation (Kim & Kim, 2021).

In the European Union, emphasis has been placed on the use of the Internet and modern technologies for several decades, and one of the first initiatives in this area was eEurope 2002 – a programme approved by the Member States in 2000, which

highlighted the benefits of applying ICT in public administration (Domenichiello, 2015). In the years that followed, further programs and strategic documents were adopted, setting out objectives and measures for using the Internet and modern technologies to provide public services (Androniceanu & Streimikiene, 2026). Since 2012, the European Commission has regularly published comparative reports on e-government in European countries (Pérez-Morote *et al.*, 2020). Many international organisations have also developed and publish indicators measuring the quality and maturity of e-government, as well as the level of use of digital public services (Santos *et al.*, 2025). One of the most widely used is the EGDI index developed by the UN, which takes three dimensions into account: the online services index, the telecommunications infrastructure index and the human capital index (Nookhao & Kiattisin, 2023). This ranking shows a steady increase in e-government digital maturity (Ma, 2026), likely because governments worldwide are investing significant resources in new technologies. Malodia *et al.* (2021), citing earlier studies, indicate that a country's economic situation directly influences its information and communications technology (ICT) infrastructure, which in turn determines the scope of e-government initiatives. The authors of the Global Information Technology Report also highlighted the existence of a link between GDP per capita and an economy's readiness to utilise ICT (Ojha & Pandey, 2017).

It is widely emphasised in the literature that many e-government implementations have failed to attract the interest and acceptance of citizens (Adeel *et al.*, 2023; Nookhao & Kiattisin, 2023; Silvestro *et al.*, 2024), as they failed to meet users' expectations (Adnan *et al.*, 2022).) E-government projects fail if the target audience does not use them; therefore, actual success is determined primarily by citizens' attitudes and behaviours (Alryalat, 2024; Burhanudddin *et al.*, 2019), rather than by a country's position in maturity rankings (Nookhao & Kiattisin, 2023). In this context, Verastegui *et al.* (2023), analysing data on Mexico, observed significant discrepancies between citizens' use of e-government (only around 31-36 percent, depending on the study) and the level of e-government development measured according to UN standards.

The aim of this article is to investigate whether relationships exist between the maturity and quality of e-government, citizens' use of digital public services, and the level of socio-economic development in European Union countries. E-government in the EU has been the subject of numerous studies; however, authors have focused on aspects such as the relationship between the intensity of digitalisation, institutional quality and the implementation of e-government services (Lobonț *et al.*, 2025), the impact of the intensification of the digitalisation of public services on the growth of government efficiency in European Union Member States (Doran *et al.*, 2023), an analysis of digital skills and network infrastructure in European Union countries (Obelovska *et al.*, 2025), and an easy-to-implement tool for assessing the digital divide between and within countries (Bruno *et al.*, 2023). Crăciun *et al.* (2025) conducted the most closely related research; however, they limited their analysis to 10 countries and focused primarily on Romania's results. Our proposed approach

still represents a research gap, which this article aims to help fill. Testing three hypotheses supports this objective.
H1: There is a relationship between the maturity and quality of e-government and citizens' use of its services.
H2: There is a relationship between socio-economic development and the maturity and quality of e-government.
H3: There is a relationship between socio-economic development and citizens' use of services provided by e-government.

1. Literature review

E-government involves the use of information and communication technologies (primarily the Internet and mobile technologies) by public administration bodies to transform their relationships with citizens (G2C), businesses (G2B) and other government institutions (G2G) (Lupu & Lazăr, 2015; Sarrayrih & Sriram, 2015; Ahmad *et al.*, 2021; Gijón *et al.*, 2025) by providing cost-effective and efficient services, information and knowledge (Gasova & Stofkova, 2017). Put simply, it constitutes a system of electronic communication between public administration, citizens and businesses (Mahmoodi & Nojedeh, 2016). E-government is also defined as the use by public authorities of information and communication technologies (ICT) in conjunction with organisational changes, aimed at streamlining the structures and functioning of public administration (Twizeyimana & Andersson, 2019). It can also be characterised as an administration that efficiently carries out official tasks in relations between administrative bodies and public institutions, or for the benefit of citizens, through the digitisation of administrative processes using information technology (Lee *et al.*, 2018). Abu-Shanab and Shehabat (2018) and Tissayakorn (2025) describe e-government as using ICT and the Internet to improve the delivery of digital services to citizens, streamline traditional services and the functioning of public administration, and increase citizens' participation in public life. Similarly, Afieroho *et al.* (2023) highlight the use of ICT to streamline public authorities' activities and enhance efficiency by engaging citizens in governance processes.
The overarching aim of e-government is to enable public authorities to deliver services to citizens and decision-makers efficiently and cost-effectively (Al-Besher & Kumar, 2022). E-government can also serve purposes such as: ensuring transparency, streamlining service delivery, increasing public participation, transforming public administration structures (Verastegui *et al.*, 2023), improving the quality of interactions and partnerships with users and businesses (Alryalat, 2024), and enhancing convenience in dealings with administrative bodies (Tissayakorn, 2025).
E-government encompasses a wide range of functionalities and applications, and different countries and authorities may exhibit varying levels of implementation. Consequently, it has become essential to assess the maturity level of e-government, taking into account the extent to which information technology is utilised to deliver

services electronically. The literature offers several models for this assessment (Pérez-Morote *et al.*, 2020; Kim & Kim, 2021), though the most widely used is the United Nations model. According to this model, there are four stages of e-government maturity (Khalid & Lavilles, 2019; Sabani *et al.*, 2023):

- emergence – access to basic, static information concerning the functioning of public authorities (institutions), principles of governance and legal regulations;
- enhancement – the ability to download documents and forms, one-way or simple two-way communication, and the ability to submit feedback (e.g. complaints) electronically;
- transaction – advanced two-way communication, the ability to submit forms and applications electronically and to carry out financial transactions;
- connection – integrated services, the so-called 'one-stop shop' model enabling comprehensive customer service and immediate access to all public services, interactive tools and applications.

The maturity of e-government and the extent to which it is adopted depend on many factors, some of which lie with the state and others with citizens. Factors influencing the functioning of e-government include, among others, the political, social, economic, industrial and technological environment, political leadership, policy vision and goals, strategic priorities, key contractors and stakeholders, service recipients, allocation of human, financial and technological resources, inter-institutional cooperation, level of IT development, feedback, personal data protection and security (Kim & Kim, 2021), digital exclusion, economic growth and political stability (Malodia *et al.*, 2021), and the capacity of public institutions to share knowledge and cooperate effectively (Boutaleb & Tamnine, 2026). Samuel et al. (2020) conducted an in-depth analysis of the factors influencing e-government uptake. They divided these factors into internal (citizens' characteristics and the quality of services provided) and external (the characteristics of the institution providing e-government services). They classified organisational characteristics, implementation and management strategy, and leadership as external factors. Among the internal factors, they identified citizens' demographic characteristics, culture and social influence, digital literacy, attitudes and beliefs, trust, and civic engagement. The second group of internal factors relates to service quality. Service quality can be defined as the difference between expectations and actual service experiences (Le *et al.*, 2026). When assessing the quality of e-services, users typically focus on characteristics such as operational efficiency, privacy, order fulfilment and system availability (Belanche Gracia & Casaló Ariño, 2015; Kowalik, 2020). Li and Shang (2020) argue that eight elements determine e-government service quality: system quality, reliability, security, availability, information quality, service capabilities, interactivity, and responsiveness. The first four elements relate to technical aspects, whilst the next four relate to service functions. AlHussainan *et al.* (2022) examined factors influencing the quality of e-government services in Kuwait and found that, for citizens, the functionality of the e-government portal—

enabling them to complete all necessary transactions and processes—is crucial, while trust, ease of use, and citizen support are also important.

Citizen satisfaction with e-services (Dinu *et al.*, 2026) and the quality of e-government services (Nam *et al.*, 2024; Le *et al.*, 2026) are among the key factors influencing citizens' willingness to use digital government services. Citizens' willingness to use these services, however, is one of the most important conditions for the success of e-government services (Almamy, 2022; Santos *et al.*, 2025) and, as Almamy (2022), there is no single factor motivating the use of e-government. Maktub *et al.* (2025) analysed the factors influencing users' decisions to use e-government services in Indonesia and found that these include the potential of the administration, expected usefulness, quality of information, quality of services, self-efficacy in using a computer, trust in the authorities, perceived risk and user attitude. Sabani *et al.* (2023) also attempted to identify the key factors influencing Indonesian citizens' decisions about using e-government. They expected the most influential factors to be expected usefulness, expected effort, system quality, and perceived transparency. Factors of moderate importance include social influence, facilitating conditions, perceived security, information quality, and incentives from the authorities; among the factors examined, competence in information and communication technologies (ICT) was the least significant. Pérez-Morote *et al.* (2020), on the other hand, found that citizens' use of e-government is most strongly influenced by: their assessment of the supply of these services, citizens' trust in the authorities, and the digital divide determined by income and education. Nookhao and Kiattisin (2023), in turn, based on a survey of Thai citizens, indicated that the willingness to use was influenced by factors such as: the quality of information, the quality of the system, the quality of services, citizen satisfaction, perceived usefulness, self-efficacy in using a computer, and trust in the government, with trust in the government having the strongest influence. Trust in the government and in ICT technologies themselves is frequently cited in the literature as a key factor influencing the uptake of e-government and citizens' willingness to use its services (Pérez-Morote *et al.*, 2020; Gijón *et al.*, 2025). To build this trust, authorities should focus on transparency, clear service-delivery standards, quality and reliability, accountability, responsiveness, and the security and protection of personal data (Ndzabela *et al.*, 2025).

The implementation of e-government undoubtedly brings a range of benefits, as the literature has well documented. The use of modern technologies is intended to ensure the more efficient functioning of the administration, to facilitate citizens' access to public services and information, and to strengthen the accountability of the authorities to the public (Sarrayrih & Sriram, 2015) and to create opportunities for cooperation within democratic processes (Mahmoodi & Nojedeh, 2016), including within the context of local democracy (Tejedo-Romero *et al.*, 2022). E-government contributes to more effective cooperation between the administration and the public, helps to address the problems of administrative inefficiency and corruption, enables the involvement of stakeholders in public policy-making and social development (Afieroho *et al.*, 2023), provides stakeholders with higher-quality public services and

information (Zou *et al.*, 2023), enhances the transparency of public decision-making, and facilitates the exchange of information between government institutions (Sabani *et al.*, 2023), helps to bridge the digital divide, deepen democratisation, increase business competitiveness and improve economic performance (Krishna & MP, 2021), and achieve sustainable development goals (Doran *et al.*, 2023; Valaskova *et al.*, 2025), saves time and reduces costs (Amanbek *et al.*, 2020), builds citizens' trust in the authorities and strengthens adherence to the rule of law (Oztaskin *et al.*, 2024), can also serve as a key mechanism for crisis management (Nookhao & Kiattisin, 2023; Li & Wang, 2026), and can contribute to improving the quality of regulation and political stability, and even to reducing violence and terrorism (Zou *et al.*, 2023). Much of the literature focuses on e-government's role in preventing corruption; however, findings remain inconclusive (Lee *et al.*, 2018; Zou *et al.*, 2023; Dang *et al.*, 2025).

Krishna and MP (2021) note that, despite its numerous benefits, e-government development also entails risks and challenges, particularly cyber threats related to information security. These may disrupt service continuity and breach privacy and data security, and consequently erode public trust in e-government (Al-Besher & Kumar, 2022; Rambau *et al.*, 2026). Some researchers highlight another risk of e-government: its use for surveillance and social control (Turner *et al.*, 2022; Zou *et al.*, 2023). Furthermore, the challenges associated with the implementation of e-government include the phenomenon of digital exclusion, including insufficient ICT skills amongst both citizens and public administration staff, inequalities in internet access and a lack of adequate ICT infrastructure (Al-Hussainan *et al.*, 2022; Valaskova *et al.*, 2025), as well as a lack of user trust, which limits the effective adoption of digital solutions in public administration (Ndzabela *et al.*, 2025).

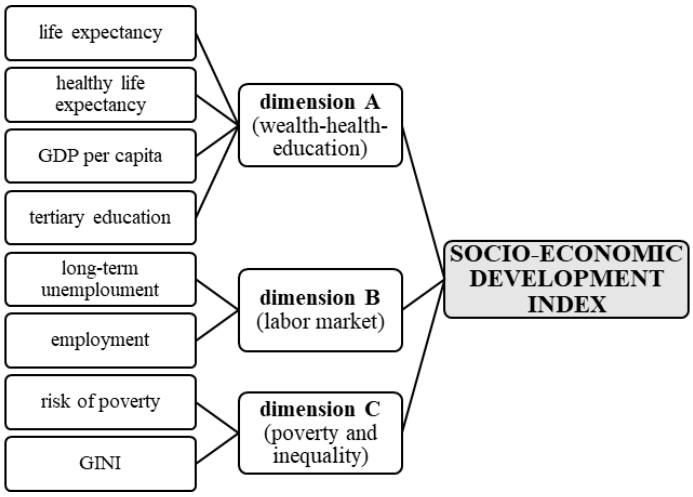
2. Research methodology

The analysis covered data on 27 European Union countries, describing e-government maturity and quality, the extent to which citizens use digital public administration services, and the level of socio-economic development. The data comes from the Eurostat database and the reports The eGovernment Benchmark 2026 and Human Development Report 2025, and the vast majority relates to 2025. In a few cases, due to a lack of more recent data, data for 2024 was analysed, whilst the data on the Human Development Index (HDI) relates to 2023. Data describing the maturity and quality of e-government come from The eGovernment Benchmark 2026 and include an assessment of maturity (the percentage of administrative procedures that can be completed electronically) for services aimed at citizens in areas such as Health, Moving, Justice, Transport, Career, Family and Studying. The second area of assessment comprises quality indicators relating to: pre-filled forms, transparency of service delivery, transparency of personal data, transparency of service design, user support and mobile-friendliness. Both maturity and quality indicators are scored on a scale of 0-100, where a higher score indicates a better performance by the country in question. Data describing citizens' use of e-government services are sourced from

the Eurostat database and relate to activities such as: accessing public databases or registers, accessing personal information, interacting with public authorities, making appointments or bookings, requesting official documents or certificates, claiming benefits or entitlements, using public authorities' websites or apps, and obtaining information about services, benefits, entitlements, laws and opening hours; downloading or printing official forms; submitting tax returns; and using eID to access services provided by public authorities or public services in the last 12 months. These figures indicate the percentage of citizens who carried out specific e-government-related activities ment. The level of socio-economic development was measured in three ways: using a proprietary composite indicator, the construction of which is described below; the Human Development Index; and unidimensionally, focusing on economic development as represented by GDP per capita (in Purchasing Power Standard – PPS terms). To test the research hypotheses, statistical analyses and tests were carried out using Jamovi. We examined relationships between variables using Spearman's rho test, as the Shapiro-Wilk test indicated non-normality in some variables.

The concept behind our proprietary synthetic socio-economic development index was based, to some extent, on the Human Development Index, as it also accounts for economic, health, and educational factors and is therefore a multidimensional construct. However, our index has been constructed from eight components, which differ slightly from those used in the HDI: life expectancy, healthy life expectancy, GDP per capita (PPS), the Gini coefficient, the risk of poverty after social transfers (poverty), the long-term unemployment rate, the total employment rate and the level of tertiary educational attainment (education). We obtained all data from the Eurostat database. When constructing the index, we deliberately excluded aspects related to digital skills levels and expenditure on research and development, as we assumed these might be too closely linked to the level of e-government development. Due to the different units of measurement for the variables used, z-score standardisation was applied. To examine the structure of the relationships between the variables, Principal Component Analysis (PCA) was used, which supported identifying three dimensions (sub-indices). These dimensions represent relatively distinct aspects of socio-economic development, as confirmed by their very low correlations. We assigned equal weight to these dimensions, creating a composite index of multidimensional socio-economic development. Figure 1 shows the index structure.

Figure 1. Structure of the socio-economic development index



Source: Authors' contribution.

Table 1, on the other hand, presents the designations assigned to the individual variables analysed later in this paper.

Table 1. Characteristics of the variables

Variable	Designation	Variable	Designation
Health	MAT_1	Obtaining information about services, benefits, entitlements, laws, opening hours	USE_3
Moving	MAT_2	Downloading or printing official forms	USE_4
Justice	MAT_3	Accessing public databases or registers	USE_5
Transport	MAT_4	Accessing personal information	USE_6
Career	MAT_5	Making an appointment or reservation	USE_7
Family	MAT_6	Request official documents or certificates	USE_8
Studying	MAT _7	Request benefits or entitlements	USE_9
Pre-filled forms	QAL_1	Using eID to access services provided by public authorities or public services	USE_10
Transparency of Service Delivery	QAL_2	Submitting tax declaration	USE_11
Transparency of Personal Data	QAL_3	GDP per capita (PPS)	GDP
Transparency of Service Design	QAL_4	Subindex A (wealth-health-education)	SUB_A

Variable	Designation	Variable	Designation
User Support	QAL_5	Subindex B (labor market)	SUB_B
Mobile Friendliness	QAL_6	Subindex C (poverty and inequality)	SUB_C
Using websites or app of public authorities	USE_1	Socio-economic development index	INDEX
Interaction with public authorities	USE_2	Human Development Index	HDI

Source: Authors' contribution.

3. Research results and discussions

European Union countries differ significantly in terms of the maturity, quality, and use of e-government. Table 2 presents basic descriptive statistics relating to these aspects.

Table 2. Descriptive statistics

Variable	Min	Max	Median	Mean	SD
MAT_1	52.00	95.60	74.40	72.14	12.0884
MAT_2	55.20	96.60	81.80	80.93	10.2175
MAT_3	43.80	94.30	68.40	68.60	13.5291
MAT_4	40.70	91.50	73.20	72.70	13.1007
MAT_5	35.90	95.00	81.00	79.00	13.5472
MAT_6	41.10	95.30	79.20	75.76	14.6197
MAT_7	43.00	96.80	78.40	75.82	13.6564
QAL_1	20.20	97.20	80.30	75.93	18.0750
QAL_2	20.40	100.00	61.70	60.81	19.1619
QAL_3	34.20	100.00	77.00	76.13	16.7914
QAL_4	19.40	100.00	75.00	71.80	24.4519
QAL_5	63.50	100.00	92.90	90.01	10.0040
QAL_6	89.80	100.00	97.80	97.36	2.3502
USE_1	24.12	97.99	76.54	75.27	17.2640
USE_2	16.53	91.35	66.02	64.45	17.4976
USE_3	12.18	72.23	47.16	47.88	15.1358
USE_4	12.29	69.48	35.46	38.33	14.2370
USE_5	0.96	52.78	24.99	26.54	14.1635
USE_6	7.63	87.40	52.01	51.34	20.3735
USE_7	12.82	74.40	42.01	39.63	15.9334
USE_8	4.91	57.84	19.54	21.79	12.0259
USE_9	1.91	37.61	20.91	18.77	8.7403
USE_10	4.67	95.09	50.32	51.73	26.2179
USE_11	0.36	84.88	39.41	40.41	25.0609
GDP	28332.00	99621.30	38557.00	43301.18	17115.1080
HDI	0.845	0.962	0.915	0.915	0.0325

Source: Authors' contribution.

The data presented in the table confirm very significant variation amongst EU countries. In terms of maturity, the greatest differences are found in MAT_5 (Career), and the smallest in MAT_2 (Moving). MAT_2 is also the dimension in which citizens can carry out the largest proportion of their business via digital services. However, e-government has the most room for improvement in the MAT_3 (Justice) dimension. It is also worth noting that no country offered the possibility of dealing with all matters digitally in any dimension. The situation is slightly different in the area defined as 'quality', where only QAL_1 (Pre-filled forms) did not receive the highest score. Among EU countries, Malta is the clear leader, achieving the maximum score in all dimensions except the aforementioned QAL_1. It should be emphasised, however, that in most dimensions several countries achieved the maximum score – QAL_4 (Transparency of Service Design) and QAL_5 (User Support) performed best in this respect. QAL_4 also shows the greatest disparity, with a minimum score of just 19.4 (for Cyprus). QAL_1 (Pre-filled forms) and QAL_2 (Transparency of Service Delivery) recorded slightly higher minimum scores, although QAL_2 has the lowest mean and median; therefore, EU countries have the most room for improvement in this area. By far the best-performing dimension, however, is QAL_6 (Mobile Friendliness), in which EU countries have already achieved near-perfect scores; a very good result (over 90) was also recorded for QAL_5 (User Support).

E-government use also varies considerably. In the leading country (Denmark), almost 98 percent of citizens use e-government services in some way (USE_1), whilst in the country performing the worst (Romania), the figure is just under 25 percent. Similar discrepancies are evident for other, more specific e-government activities. Of particular note is USE_10 (using eID to access services provided by public authorities or public services), where the difference is over 90 percentage points; it is slightly lower for USE_6 (accessing personal information) and USE_11 (submitting tax returns). By far the least popular activity among EU citizens is 'requesting benefits or entitlements' (USE_9), followed closely by 'accessing public databases or registers' (USE_5). At the same time, 'accessing public databases or registers' is, alongside USE_11 (submitting tax returns), the activity that achieved the lowest (below 1 percent) individual score (in both cases, the country in question was Croatia).

The data obtained clearly indicate that there is currently no such thing as a uniform level of digitalisation across the European Union's public administration. Therefore, the average figures for the EU as a whole, as reported in the public domain, may be misleading because they do not accurately reflect the situation.

Verifying the hypotheses set out at the outset required statistical analysis. Tables 3 and 4 present the results of Spearman's correlation coefficient, which examines the relationship between e-government maturity and quality and service use.

Table 3. Correlation between e-government maturity and the use of its services

	MAT_1	MAT_2	MAT_3	MAT_4	MAT_5	MAT_6	MAT_7
USE_1	0.431*	0.286	0.517**	0.654***	0.447*	0.398*	0.701***
USE_2	0.466*	0.330	0.513**	0.618***	0.475*	0.436*	0.628***
USE_3	0.230	0.120	0.313	0.412*	0.269	0.258	0.443*
USE_4	0.192	0.148	0.321	0.406*	0.250	0.119	0.502**
USE_5	0.202	0.060	0.365	0.387*	0.211	0.214	0.281
USE_6	0.602***	0.401*	0.518**	0.596**	0.468*	0.521**	0.637***
USE_7	0.333	0.125	0.278	0.656***	0.346	0.345	0.583**
USE_8	0.368	0.220	0.342	0.463*	0.192	0.176	0.459*
USE_9	0.101	0.321	0.471*	0.339	0.327	0.347	0.447*
USE_10	0.335	0.281	0.534**	0.474*	0.488*	0.408*	0.566**
USE_11	0.342	0.360	0.446*	0.429*	0.390*	0.473*	0.516**
* p < .05, ** p < .01, *** p < .001							

Source: Authors' contribution.

The analyses carried out indicate an ambiguous relationship between the maturity of e-government services in the specified dimensions and citizens' use of these services. In areas such as MAT_4 (Transport) and MAT_7 (Studying), there are statistically significant relationships with virtually all activities included in the study, although the effect is moderate to strong. This suggests that increasing maturity may produce the greatest rise in citizens' interest in these two areas. Conversely, in areas such as MAT_1 (Health) and MAT_2 (Moving), statistically significant correlations were observed for only a small number of activities: USE_1 (using websites or apps of public authorities) and USE_6 (accessing personal information) in the case of the Health area, and USE_6 alone in the Moving area. Activities relating to 'Accessing personal information' (USE_6) were also the only ones that showed a statistically significant, moderate correlation in each area studied. Correlations were also observed in most areas for activities such as: USE_1 (Using websites or apps of public authorities), USE_2 (Interaction with public authorities), USE_10 (Using eID to access services provided by public authorities or public services) and USE_11 (Submitting tax returns); that is, for activities defined very broadly (USE_1 and USE_2) and those representing a higher level of e-government development (USE_10 and USE_11). In contrast, 'Accessing public databases or registers' (USE_5) shows a statistically significant correlation exclusively with the 'Transport' sector (MAT_4).

The results do not allow unequivocal confirmation of the first research hypothesis; however, given correlations in most areas, one can cautiously assume that such a correlation exists. It must be emphasised, however, that there is considerable variation between the individual areas and activities analysed.

Table 4. Correlation between the quality of e-government and the use of its services

	QAL_1	QAL_2	QAL_3	QAL_4	QAL_5	QAL_6
USE_1	0.401*	0.361	0.441*	0.438*	0.431*	0.474*
USE_2	0.329	0.378	0.425*	0.348	0.407*	0.399*
USE_3	0.072	0.192	0.281	0.243	0.252	0.340
USE_4	0.270	0.036	0.114	0.305	0.390*	0.483*
USE_5	0.270	-0.061	0.141	0.311	0.309	0.154
USE_6	0.600***	0.363	0.466*	0.298	0.429*	0.291
USE_7	0.455*	0.284	0.237	0.407*	0.402*	0.186
USE_8	0.495**	0.190	0.200	0.180	0.329	0.270
USE_9	0.429*	-0.029	0.154	0.375	0.362	0.353
USE_10	0.489**	0.237	0.304	0.336	0.381	0.217
USE_11	0.469*	0.212	0.381	0.280	0.232	0.331
* p < .05, ** p < .01, *** p < .001						

Source: Authors' contribution.

The analyses revealed statistically significant correlations only for some of the dimensions examined. The QAL_1 area (Pre-filled forms) is by far the most strongly correlated (with the highest number of activities); increasing the amount of information the e-government system automatically fills in may increase the proportion of citizens carrying out most surveyed activities digitally. Furthermore, this is the only area that correlates significantly with activities associated with a higher level of e-government advancement, such as submitting tax returns or using eID. Conversely, QAL_2 (Transparency of Service Delivery) is the only dimension that does not correlate significantly with any activity, suggesting that improvements (or deterioration) in it will not significantly affect the number of people using e-government. At the same time, USE_3 (obtaining information about services, benefits, entitlements, laws, opening hours) and USE_5 (accessing public databases or registers) show no correlation with any quality dimension, indicating that citizens carry out these activities regardless of e-government quality.

The results do not fully confirm the first research hypothesis on quality and, as with maturity, point to significant variation between individual areas.

The second aspect of interest in this study is the relationship between the level of socio-economic development and e-government maturity and quality. This, too, was analysed using Spearman's rank correlation coefficient, and the results are presented in Table 5.

Table 5. Correlation between socio-economic development and the maturity and quality of e-government

	GDP	SUB_A	SUB_B	SUB_C	INDEX	HDI
MAT_1	0.126	-0.093	0.115	-0.116	-0.021	0.035
MAT_2	0.079	-0.002	-0.044	-0.112	-0.101	0.089
MAT_3	0.023	-0.067	-0.026	-0.192	-0.116	-0.010
MAT_4	0.368	0.188	0.204	-0.021	0.238	0.349
MAT_5	0.300	0.084	0.232	0.119	0.239	0.285
MAT_6	0.188	0.043	0.264	-0.098	0.137	0.151
MAT_7	0.473*	0.226	0.150	0.099	0.273	0.481*
QAL_1	0.043	0.264	-0.045	-0.214	-0.060	0.193
QAL_2	0.093	-0.127	0.373	-0.032	0.214	0.095
QAL_3	0.267	0.013	0.266	-0.051	0.144	0.166
QAL_4	0.265	0.057	0.140	0.201	0.251	0.221
QAL_5	0.253	0.065	0.196	-0.042	0.181	0.179
QAL_6	0.521**	0.334	0.281	0.326	0.495*	0.526**
* p < .05, ** p < .01, *** p < .001						

Source: Authors' contribution.

The results obtained indicate no correlation between socio-economic development and the maturity and quality of e-government, regardless of how this development is measured (whether as GDP per capita, the Human Development Index and the author's socio-economic development index, or its component dimensions), which does not allow for the positive verification of the second of the research hypotheses put forward. In terms of maturity, the only statistically significant relationship was observed for the MAT_7 (Studying) dimension and development measured by GDP per capita. In contrast, in the area of quality, only QAL_6 (Mobile Friendliness) shows a correlation with socio-economic development, regardless of how it is measured. However, all statistically significant correlations are characterised by moderate strength. Surprisingly, for all three sub-indices, we observed negative correlations in some cases; however, in each instance, they were not statistically significant, so these results must be treated with extreme caution and do not allow far-reaching conclusions.

The final aspect examined is the relationship between the level of socio-economic development and citizens' use of e-government services. Once again, Spearman's linear correlation coefficient was used, and the results are presented in Table 6.

Table 6. Correlation between socio-economic development and the use of e-government

	GDP	SUB_A	SUB_B	SUB_C	INDEX	HDI
USE_1	0.596**	0.394*	0.273	0.226	0.461*	0.631***
USE_2	0.487*	0.220	0.322	0.222	0.411*	0.489**
USE_3	0.497**	0.258	0.522**	0.372	0.583**	0.513**
USE_4	0.600**	0.608**	0.045	0.202	0.422*	0.652***
USE_5	0.241	0.234	0.209	0.208	0.305	0.316
USE_6	0.244	0.138	0.067	-0.063	0.061	0.296
USE_7	0.396*	0.259	-0.037	0.020	0.166	0.475*
USE_8	0.259	0.453*	-0.266	-0.126	0.032	0.311
USE_9	0.350	0.470*	-0.051	-0.131	0.083	0.432*
USE_10	0.319	0.360	0.102	-0.118	0.161	0.413*
USE_11	0.416*	0.291	0.299	0.063	0.303	0.475*
* p < .05, ** p < .01, *** p < .001						

Source: Authors' contribution.

The results indicate that the level of socio-economic development correlates significantly only with some e-government activities, although discrepancies remain depending on the indicator used. The HDI shows the strongest and most numerous correlations, although even in this case the correlations are moderate or strong (there are no very strong correlations). This suggests that socio-economic development may, at best, be one determinant of e-government success. USE_5 (accessing public databases or registers), USE_6 (accessing personal information) and USE_8 (requesting official documents or certificates) do not show any significant correlation with any of the development indicators (although USE_8 correlates with sub-index A), whereas USE_10 (using eID to access services provided by public authorities or public services) correlates exclusively with the HDI indicator. As with maturity and quality, the correlation with some sub-indices is negative, although again it is neither statistically significant nor strongly correlated; therefore, no far-reaching conclusions should be drawn. An interesting situation arises with USE_8 (request official documents or certificates) and USE_9 (request benefits or entitlements), as the statistically significant relationship for sub-index A does not translate into significance for the composite indicator.

The results allow cautious acceptance of the third research hypothesis, provided the relationship between socio-economic development and the use of e-government does not apply to all types of digitally carried-out activities. The method used to measure this development is also significant in this context.

4. Conclusions

There is no doubt that the digitalisation of public administration offers the opportunity for a radical transformation of the services it provides, enhancing their quality and accessibility for citizens. However, the funds allocated for this purpose are not always invested effectively, as they do not lead to increased citizens' use of new tools. Therefore, from the state's perspective, it is crucial to identify the relationship between the maturity and quality of e-government services and citizens' actual interest in them. In turn, identifying the relationship between these aspects and the level of socio-economic development allows for better targeting of policies – particularly international ones, such as those of the European Union – as well as for forecasting future development opportunities for e-government.

The results indicate significant variation among European Union member states in e-government. Alongside the absolute leaders, where almost all citizens use the digital solutions offered by public administration, some countries still face widespread adoption of e-government as a major challenge. The situation is similar in terms of the accessibility and quality of e-government services. These wide disparities show that the European Union still has much work to do on convergence and raising the standard of the least digitally advanced countries.

The statistical analyses revealed limited correlations between socio-economic development, the maturity and quality of e-government, and the extent to which citizens use these services. The first hypothesis, concerning a relationship between the availability and quality of e-government and its use, was partially confirmed, although the correlation with availability appears somewhat clearer. However, the hypothesis concerning the relationship between the level of socio-economic development and the availability and quality of e-government was not confirmed. The third hypothesis, concerning the relationship between socio-economic development and the use of e-government, was, like the first hypothesis, only partially confirmed. The results allow us to draw several important conclusions. Firstly, one should not automatically assume that an increase in the level of socio-economic development will translate into e-government development, or that e-government development will automatically lead to socio-economic growth. Indeed, the most advanced e-government systems are usually found in countries with a high level of socio-economic development – a fact stemming, for example, from the ability to allocate significant resources to this end – yet it appears that, in the context of highly developed countries (which include all European Union member states), this relationship has a weaker impact. Second, to increase e-government uptake, it is necessary to identify users' needs and focus first and foremost on the areas with the greatest interdependence. The results of our research indicate that these are pre-filled forms and user support – issues largely related to ease of use. Third, if the European Union wishes to lead in implementing e-government, it must address its own diversity. It should therefore endeavour to adapt the solutions of leading countries to those performing less well in this regard, whilst ensuring that local conditions and capabilities are taken into account.

The authors recognize that the research has limitations. Statistical analyses based on only 27 observations have certain weaknesses; however, the decision to focus exclusively on European Union countries was deliberate. This allowed us to examine the situation within the Community and highlight significant disparities between countries, demonstrating that there is still a long way to go towards convergence. Another limitation may be the discretionary nature of the components of the socio-economic development index, although in this particular case the results do not differ radically from those obtained using the Human Development Index. Despite these limitations, this article contributes to the e-government literature by combining three levels of analysis: macroeconomic (level of socio-economic development), supply-side (maturity and quality of e-government), and demand-side (reflected in citizens' actual use of services).

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Not the case.

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