THE RELATIONSHIP BETWEEN E-GOVERNMENT AND THE DIGITALIZATION OPPORTUNITIES OFFERED BY THE ICT SECTOR: AN ANALYSIS AT THE LEVEL OF THE MEMBER COUNTRIES OF THE EUROPEAN UNION AND THE EEA

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Abstract
The research presented in this article had as objectives carrying out a review of the specialized literature in the field of E-government and the opportunities of digitization from the perspective of the IC&T sector, the study of the relations between E-governance (expressed as activities via websites) and the evolution of the IC&T sector and analysis of the obtained results, verification of the confirmation of the formulated hypotheses and contextualization

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of the results by referring to other results obtained in the specialized literature. To highlight the relationship between E-government and the digitalization opportunities offered by the evolution of the IC&T sector, correlation analyzes were carried out using the secondary data made available by the Eurostat databases. Three research hypotheses were formulated and the first research hypothesis, the one regarding a strong positive relationship between E-governance and the number of enterprises active in IC&T, is validated in the case of most European countries. The other two research hypotheses, regarding a strong positive relationship between E-governance and the number of enterprises active in IC&T and also a positive and close relationship between E-governance and the share of IC&T staff in total employees, have been confirmed only in the case of fewer European countries.
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1. INTRODUCTION

E-government is the use of information and communication technologies (ICTs) to improve the efficiency, effectiveness, transparency and accountability of public services. E-government can enhance the quality of life of citizens, reduce administrative costs, increase public participation and trust, and foster innovation and collaboration. E-government is not only about delivering services online, but also about transforming the way governments operate and interact with their stakeholders.

Taking into account the current state of research on the relationship between E-government and the opportunities of digitization from the perspective of the ICT sector, the research carried out had the following objectives:

- carrying out a review of the specialized literature in the field of E-government and the opportunities of digitization from the perspective of the IC&T sector;
- the study of the relations between E-governance (expressed as activities via websites) and the evolution of the IC&T sector (from the perspective of the number of enterprises active in IC&T, the share of the IC&T sector in GDP and the share of IC&T personnel in the total number of employees);
- an analysis of the obtained results, verification of the confirmation of the formulated hypotheses and contextualization of the results by referring to other results obtained in the specialized literature.

The major transformation in digitalization is radically altering systems and organisations (Abuljadail et al, 2023), acting as the primary drivers of innovation (Bartolomé et al, 2022) and advocating for inclusive and sustainable development (Elmassah et al, 2022). E-governance is the term used to describe the incorporation of digitalization tools in public services involving businesses, citizens, and governmental entities with the intention of minimising bureaucracy (Lo et al, 2022) and maximising process simplification, service quality, institutional efficiency, transparency, and democracy (Inakefe et al, 2023). Electronic

governance systems are being adopted more often as a result of the widespread use of information and communication technologies (Cho et al, 2022), ICT being regarded as an essential aspect of today's society (Bacca-Acosta et al, 2023). The broad adoption of e-governance is expected to be driven by the emerging digital economy (Sharma et al, 2022). Even under disruptive circumstances when the majority of activity should be swiftly transferred online, e-governance advances progressively rather than in a dramatic revolutionary manner (Gavriluta et al, 2022).

The current research status-quo proves that the ICT overlapping has become a vital component in the complex public-private partnership. By testing various scenarios that can provide a significant e-productivity increase (Iordache et al, 2023), digital opportunities prove their indispensability in a world where, affected by the SarsCov 2 virus pandemic worldwide lockdown, virtual communication saved private companies and public institutions from economic collapse. And even in this complicated context, the responsibility of e-governance revolves around ensuring a sustainable equilibrium of public-private collaboration, as studies (Zeebaree et al, 2023) reveal that the implementation of 6G can be considered as being forced by the adrenaline of accessing a communication speed above the digital capabilities of some regions and even nations, causing gaps deepening instead of building bridges of digital information exchange. Aware of digital inequalities (Dodel, 2024) and of negative correlation between internet use and e-government indicators (Horobet et al, 2023), countries have begun to reevaluate their Digital Economy and Society Index ranking (Dumitrache, 2023) in order to identify the directions that can be followed for stepping up to a higher cross-country level of digitization, bridging the gap (Patergiannaki & Pollalis, 2023) between e-Government institution offerings, private companies and citizen requirements in terms of e-government information quality (EGIQ) (Mensah & Mwakapesa, 2023).

As the impact of IC&T opportunities empowers a presumed GDP growth, as a targeted general purpose, data cyber security preservation (Elisa et all, 2023), considering the aforementioned challenges, remains a fundamental pillar in the reliable use of public services by private companies and citizens.

Taking into account the previous publications and the results obtained in the previous studies, the research aimed to validate the following hypotheses:

H.1. There is a strong positive relationship between E-governance and the number of enterprises active in IC&T.

H.2. There is a positive and strong relationship between E-governance and the share of the IC&T sector in GDP.

H.3. There is a positive and close relationship between E-governance and the share of IC&T staff in total employees.

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2. LITERATURE REVIEW

E-government simplifies interactions within the government, with citizens and with businesses (Bonson et al, 2015), changing the way individuals engage with bureaucratic procedures (Özmen, 2023). Electronic governance uses smart devices to digitally deliver a range of government services to citizens (Cho et al, 2022). Illustrative activities include the online issuance of personal documents, tax payments, license acquisition and learning platforms, among various others. (Inakefe et al, 2023). When it comes to e-governance, the development of smart cities creates a naturally favourable environment (Abuljadail get al, 2023), digital literacy, cost of technological innovation and sustainability are three of the main drivers for improvement identified by Kuzior et al. (2023). Bokhari and collaborators concluded in their paper that e-governance brings positive transformations in the lives of individuals, corporations, governments, and institutions, benefiting them collectively (2022).

According to the World Development Report the use of technology has proven to have the ability to boost earnings and reduce poverty (Inakefe et al, 2023). ICT can be a dependable indication of economic dynamism in European states (Bacca-Acosta et al, 2023), the risk of divergence and polarisation (Caravella et al, 2023) being introduced by the disparity in the distribution of digital abilities across regions. Information and Communication Technologies (ICTs) are undergoing a profound transformation (Gavriluta et al, 2022), reshaping the societal, occupational, and communicative dimensions of individuals' lives. It has been ascertained as a catalyst, fostering citizen engagement within the decision-making process (Myeong et al, 2023). An effective e-governance service is dependable on the skills and level of digital literacy of the workers and users (Opacic et al, 2023).

ICT is essential for fueling significant sectors of the economy, exerting a transformative impact on innovation and operational efficiency (Sahoo et al, 2022) across various domains, e-governance being one of them. Building confidence in e-government portals requires the implementation of strict data security and protection procedures. Moreover, the connection between innovations and smart city success (Kuzior et al, 2023) is influenced by electronic government.

One of the many benefits of e-governance (Bokhari et al, 2022) is that it might potentially reduce fraud facilitated by online transaction tracking system (Myeong et al, 2023). Other benefits include enhanced communication, increased public engagement in governance processes, reduced overall costs, and higher-quality governance. According to Lyulyov et al. (2024), EU countries should persist to advance the digital transformation in a variety of areas, stressing that its benefits are crucial catalysts toward accomplishing the Sustainable Development Goals.

Thus, nations are witnessing a fulminant evolution of the ICT sector, in the current post-COVID19 period, with clear and concrete opportunities that the openness to digitization offers to E-Government, in such a manner that the digitization of the public sector became an irreversible process (Doran et al, 2023).

From pre-school to early stages of employment the development of digital skills it has become so natural that the return to precursor ICT seems an unrealizable and undesirable hypothesis. A return path to non-digitalization is unfeasible because there are no nations that do not have at least a primary form of digitalization, and that have not already established ways to empower the security of inter- and intra-institutional data exchange. Although some countries are ranked on diametrically opposite levels of digitization degree development, the path to follow was drawn by the need for free trade, free movement and free information.

The interaction impact between companies or citizens with different access to data security and data privacy and with different experiences on the trust in using public services irreversibly changes the reporting to the e-government collaboration modality in terms of ICT requirements. Each step of upgrading the e-government development index (EGDI) through Electronic Identification(eID), eDelivery, eNotify, eSeal, ePayment, e-licensing and National Government Portal (Ivic, 2023) also requires the education of individual ICT skills (Lustrilanang, 2023) in terms of data security as cyberattacks erodes public trust in government (Matzkin et all, 2023).

The concrete identification of the type, degree and purpose of use of the e-government components sets, at an alert pace, specific directions for the development of the ICT sector, for example the need for the validation of documents has determined the expansion of the categories of request and use of digital signatures verification by institutions with the legal right to confirm the authenticity of the electronic signature stamp at the correct date and time, by the right holder of the signature.

At the same time, the opportunity to digitally sign and confirm documents comes in addition to the need to own two or more different devices, digitally advanced at the current level of using online public services, with unlimited and unconditional internet access in real time, for the two-step authentication requirement to confirm the authenticity of the signatory.

Thereby, it is found that the development of e-government and the ICT sector is a constant process of bidirectional development. Although the ICT sector offers a wide range of digitally interconnected possibilities, the milestones that companies and citizens meet in the daily development of the public-private partnership generate new challenges that overload IT systems and devices in the alignment of competencies, still in the early stages of formation . The burden of aligning with high-performance digital devices in the context of protecting data security is materialized in major changes in IT techniques, the hiring of IT specialists, the education of current employees and more recently the setting of high

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standards for the recruitment of new employees, which changes also the school programs of pre-university and university education systems, for the acquisition of digital skills during the years of study for a quick integration in the field of work.

A good level of online versatile platforms knowledge and usage, correlated with education and employment status (Mesa, 2023) opens up opportunities of digitization to handle information exchange, processes, databases, mobile and web-based applications (Phalake et all, 2023).

As an irreversible process, the attainment of a high level of digitization, competes for the generation of device-dependent automatisms to the detriment of the natural development of human abilities behavior mutations (Negricea et al, 2015) the rights to be forgotten and habeas data being a transcendental issue (Rojas et all, 2023).

The development of the ICT sector shows both the opportunities to increase GDP per capita, but also projects in real time the vulnerabilities of public and private institutions. Data can be uploaded and transferred between institutions faster, but they can also be de-secured just as quickly. Access to information of interest in real time generates a fierce need to secure the channels through which the data circulates. A data breach that allows the retrieval of data taken from a system without the knowledge or authorization of the system's owner, generates major trust issues in the use of e-public services and seriously halts the development of e-government.

In terms of digital future readiness (Sagarik, 2023), conceptual framework must be outlined. The interaction with public authorities for the least last 12 months must be analyzed, in order to policy focus in this matter. The relationship between E-government (activities via websites) and the share of ICT&T personnel must be put under the magnifying glass, in order to be able to identify the real disparities between the national digitization plan, the current skills of the employees, the institutional digitization capacity, the unconditional and unlimited access to the Internet, as well as the access to own two different online authentication mechanisms in order to sign and certify the authenticity of holding the right to log in and make changes in documents and online certifications.

Moreover, studies on public opinion reveal that citizens do not hold the government accountable for Internet disruptions (Strauch, 2023), the evolution of ICT presupposing the education regarding the limits seen in the operating systems and the setting of real expectations regarding the capacities of public institutions to economically support the equal technological advance at the level of the entire budgetary apparatus.

Transcendence to e-governance, in the aforementioned context, is no longer an optional subject. Awareness has become widespread. The focus is on the identification of the current ranking of national digitization, the barriers that limit the institutional digital development, the plans for post-COVID 19 economic recoveries by starting transnational digital cooperation strategies.

Although digitization is highly desirable, e-government is also held responsible for the security of national borders, for the protection of material and immaterial assets of citizens and national companies. The steps taken at the governmental level must be done under the auspices of maintaining a sustainable equilibrium and high protection from cyber disruptions with trans-generational impact, by real and rational legislative apparatus.

3. RESEARCH METHOLODOGY

In order to highlight the relationship between E-government and the digitalization opportunities offered by the evolution of the IC&T sector, correlation analyzes were carried out using the secondary data made available by the Eurostat databases. Thus, the following Eurostat databases were used as secondary data sources:

- E-government activities of individuals via websites (ISOC_CIEGI_AC), Internet use: interaction with public authorities (last 12 months), data extracted on 03/08/2023 16:41:24 from [ESTAT]
- Population of active enterprises in t – number, Information and Communication Technology – Total, Business demography by legal form (NACE Rev. 2, BD_9AC_L_FORM_R2__custom_7096209), data extracted on 05/08/2023 16:57:51 from [ESTAT],
- Percentage of the ICT sector in GDP (ISOC_BDE15AG), data extracted on 03/08/2023 18:15:34 from [ESTAT],
- Percentage of the ICT personnel in total employment (ISOC_BDE15AP) - data extracted on 05/08/2023 16:41:10 from [ESTAT].

The data available for the period 2012-2022 for the member countries of the European Union and the EEA area were selected. As a methodological peculiarity, for the years and countries for which data were not available, the average of the data of the mentioned interval for each country was estimated.

For the analysis of the correlation between the chosen variables, the Pearso correlation coefficient and Colton's rules of correlation interpretation were used for two essential elements (Leech et al., 2014; Pirnau et al., 2019). In checking the validity of the formulated hypotheses, the following ranges of the Pearson coefficient were taken into account:

• very weak to non-existent relationship if a correlation coefficient value between -0.25 and 0.25 is obtained.

• weak relationship for values between 0.25 and 0.50 or -0.50 and -0.25.

• moderate relationship for values between 0.50 and 0.75 or -0.75 and -0.50,

• strong relationship for values between 0.75 and 1 or -1 and -0.75.

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4. RESEARCH RESULTS

The analysis of the relationship between digitalization opportunities and E-government in public institutions took into account the following types of opportunities: the number of enterprises active in IC&T (information and communication technology); share of the ICT&T sector in GDP; the share of IC&T personnel in the total number of employees; The analysis for each type of opportunity targeted the member countries of the European Union and member countries of the EEA (European Economic Area).

The analysis of the correlation between E-government (activities via websites) and the number of enterprises active in ICT (information and communication technology) is presented in Table 1.

TABLE 1. CORRELATION BETWEEN E-GOVERNANCE (ACTIVITIES VIA WEBSITES) AND THE NUMBER OF ENTERPRISES ACTIVE IN ICT IN THE MEMBER COUNTRIES OF THE EUROPEAN UNION AND THE EEA

No.	Country	Correlation coefficient value
1.	Belgium	0,917
2.	Bulgaria	0,527
3.	Czechia	0,937
4.	Denmark	0,919
5.	Germany	0,515
6.	Estonia	0,659
7.	Ireland	0,927
8.	Greece	0,810
9.	Spain	0,902
10.	France	0,738
11.	Croatia	0,572
12.	Italy	0,872
13.	Cyprus	0,908
14.	Latvia	0,930
15.	Lithuania	0,996
16.	Luxembourg	-0,032
17.	Hungary	0,885
18.	Malta	0,859
19.	Netherlands	0,830
20.	Austria	0,896
21.	Poland	0,987
22.	Portugal	0,355
23.	Romania	0,719
24.	Slovenia	0,503
25.	Slovakia	0,744
26.	Finland	0,852
27.	Sweden	0,742
28.	Iceland	0,872
29.	Norway	0,873
30.	Switzerland	0,643
31.	United Kingdom	0,757

Source: own processing of information from the EUROSTAT databases

The analysis of the correlation between E-governance (activities via websites) and the number of companies active in IC&T (information and communication technology) revealed the following elements:

• a group of countries in which the link between E-government (activities via websites) and the number of enterprises active in IC&T (information and communication technology) is a positive and strong one is a very close and positive one. This group includes Belgium, Czech Republic, Denmark, Spain, Poland.

• A second group of countries where the relationship between E-government (activities via websites) and the number of enterprises active in IC&T (information and communication technology) is close/relatively close and positive. This group includes countries such as Greece, France, Croatia, Cyprus, Switzerland.

• Countries with weak or negative correlation (such as Luxembourg).

Romania therefore belongs to the group of European countries where there is a strong correlation between the real productivity of labor per person and the nominal unitary cost of labor based on persons E-governance (activities via websites) and the number of enterprises active in IC&T (information technology and communications).

The second element considered as a digitization opportunity is represented by the share of the ICT&T sector in GDP. The correlation between E-governance (activities via websites) and the share of the ICT&T sector in GDP in the member countries of the European Union and the EEA is presented in the following table.

TABLE 2. THE CORRELATION BETWEEN E-GOVERNMENT (ACTIVITIES VIA WEBSITES) AND THE SHARE OF THE ICT SECTOR IN GDP IN THE MEMBER COUNTRIES OF THE EUROPEAN UNION AND THE EEA

No.	Country	Correlation coefficient value
1.	Belgium	0,595
2.	Bulgaria	0,774
3.	Czechia	0,847
4.	Denmark	0,084
5.	Germany	0,880
6.	Estonia	0,507
7.	Ireland	-
8.	Greece	0,622
9.	Spain	-0,161
10.	France	0,582
11.	Croatia	0,711
12.	Italy	0,386
13.	Cyprus	-
14.	Latvia	0,860
15.	Lithuania	0,961
16.	Luxembourg	-
17.	Hungary	0,509
18.	Malta	0,842
19.	Netherlands	0,000

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20.	Austria	0,965
21.	Poland	0,975
22.	Portugal	-
23.	Romania	0,747
24.	Slovenia	0,852
25.	Slovakia	0,643
26.	Finland	0,786
27.	Sweden	0,201
28.	Iceland	0,399
29.	Norway	0,777
30.	Switzerland	-
31.	United Kingdom	0,413

Source: own processing of information from the EUROSTAT databases

Regarding the correlation between E-governance (activities via websites) and the share of the ICT&T sector in GDP in the member countries of the European Union and the EEA, the data presented in the previous table show the existence of distinct groups of countries:

• A first group in which the link between E-governance (activities via websites) and the share of the ICT&T sector in GDP is strong and positive. This group includes a number of countries such as the Czech Republic, Germany, Lithuania, Austria;

• The second group of countries, (Greece, France, Hungary) where there is a relationship between E-government (activities via websites) and the share of the ICT&T sector in GDP, but it is not as intense as in the case of the first group.

• The third group of countries, where there is a positive but weak relationship between E-government (activities via websites) and the share of the IC&T sector in GDP (Sweden, Italy).

• The last group, characterized by a more or less intense negative correlation between E-government (activities via websites) and the share of the ICT&T sector in GDP, which includes countries such as Spain.

Another element taken into account in the relationship between the opportunities of digitization and governance is represented by the share of IC&T personnel in the total number of employees. Data on this correlation for European Union and EEA member countries are presented in the following table.

TABLE 3. CORRELATION BETWEEN E-GOVERNANCE (ACTIVITIES VIA WEBSITES) AND THE SHARE OF IC&T PERSONNEL IN THE TOTAL NUMBER OF EMPLOYEES IN THE MEMBER COUNTRIES OF THE EUROPEAN UNION AND THE EEA

No.	Country	Correlation coefficient value
1.	Belgium	0,740
2.	Bulgaria	0,647
3.	Czechia	0,956
4.	Denmark	-0,079
5.	Germany	0,838
6.	Estonia	0,595
7.	Ireland	-

8.	Greece	0,912
9.	Spain	0,937
10.	France	0,569
11.	Croatia	0,728
12.	Italy	0,188
13.	Cyprus	-
14.	Latvia	0,923
15.	Lithuania	0,982
16.	Luxembourg	-
17.	Hungary	0,683
18.	Malta	0,827
19.	Netherlands	-
20.	Austria	0,973
21.	Poland	0,966
22.	Portugal	-
23.	Romania	0,708
24.	Slovenia	0,738
25.	Slovakia	0,447
26.	Finland	0,745
27.	Sweden	0,321
28.	Iceland	-
29.	Norway	0,850
30.	Switzerland	-0,103
31.	United Kingdom	0,217

Source: own processing of information from the EUROSTAT databases

The states in which the strongest positive relationship between E-government (activities via websites) and the share of ICT&T personnel in the total number of employees among the member countries of the European Union and the EEA are registered are the Czech Republic, Spain, Greece, Latvia, Lithuania, Austria, Poland. The countries where the correlation between E-government (activities via websites) and the share of IC&T personnel in the total number of employees is positive but weak or negative are Denmark, Italy or Sweden.

From the data presented in the previous table, it can be noted that in most European countries, with very few exceptions, mentioned previously, there is a strong or relatively strong correlation between E-governance (activities via websites) and the share of IC&T personnel in the total number of employees. Romania is among the countries where the relationship between E-governance (activities via websites) and the proportion of ICT&T personnel in the total number of employees is relatively strong (along with countries such as Croatia, France or Finland).

The status of the validation of the three hypotheses of the research in the case of each member country of the European Union or EEA is presented in Table 4.

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TABLE 4. VALIDATION OF RESEARCH HYPOTHESES

No.	Country	H1	H2	H3
1.	Belgium	✓		
2.	Bulgaria		✓	
3.	Czechia	✓	✓	✓
4.	Denmark	✓		
5.	Germany		✓	✓
6.	Estonia			
7.	Ireland	✓		
8.	Greece	✓		✓
9.	Spain	✓		✓
10.	France			
11.	Croatia			
12.	Italy	✓		
13.	Cyprus	✓		
14.	Latvia	✓	✓	✓
15.	Lithuania	✓	✓	✓
16.	Luxembourg			
17.	Hungary	✓		
18.	Malta	✓	✓	✓
19.	Netherlands	✓		
20.	Austria	✓	✓	✓
21.	Poland	✓	✓	✓
22.	Portugal			
23.	Romania			
24.	Slovenia		✓	
25.	Slovakia			
26.	Finland	✓	✓	
27.	Sweden			
28.	Iceland	✓		
29.	Norway	✓	✓	✓
30.	Switzerland			
31.	United Kingdom	✓		

Source: authors' research

The first hypothesis, the one regarding a strong positive relationship between E-governance and the number of enterprises active in IC&T, is validated in the case of most European countries except Bulgaria, Germany, Estonia, France, Croatia, Luxembourg, Portugal, Romania, Slovenia, Slovakia, Sweden, Switzerland. The other two research hypotheses are confirmed in the case of more or less European Union and EEA countries. The second research hypothesis, regarding a positive and strong relationship between E-governance and the share of the IC&T sector in GDP, is validated in the case of Bulgaria, Czechia, Germany, Latvia, Latvia, Malta, Austria, Poland, Slovenia, Finland and Norway. The third hypothesis, regarding a positive and close relationship between E-governance and the share of IC&T staff in total employees is confirmed in the case Czechia, Germany, Greece, Spain, Latvia, Lithuania, Malta, Austria, Poland, Norway.

5. CONCLUSIONS

The research carried out started from the main approaches previously presented in the specialized literature with the main objective being the study of the relations between E-governance (expressed as activities via websites) and the evolution of the IC&T sector. To carry out the research, the EUROSTAT databases were used regarding: E-government activities of individuals via websites; population of active enterprises in t - number, Information and Communication Technology - total, business demography by legal form; percentage of the ICT sector in GDP; percentage of ICT personnel in total employment.

From a methodological point of view, by means of the correlation analysis, the validation of three research hypotheses was sought in the case of all the member countries of the European Union and the EEA. The first research hypothesis, the one regarding a strong positive relationship between E-governance and the number of enterprises active in IC&T, is validated in the case of most European countries. The second research hypothesis (the one regarding a strong positive relationship between E-governance and the number of enterprises active in IC&T) is validated only for a few European countries (Bulgaria, Czechia, Germany, Latvia, Latvia, Malta, Austria, Poland, Slovenia, Finland and Norway). The third research hypothesis, regarding a positive and close relationship between E-governance and the share of IC&T staff in total employees is also confirmed for a small number of European countries (Czechia, Germany, Greece, Spain , Latvia, Lithuania, Malta, Austria, Poland, Norway).

Considering the results obtained in this research, in the future we intend to increase the number of variables taken into account that have influence on E-Government and to expand the analysis from the country level to the regional level. We are also considering the opportunity to carry out some qualitative analyzes to complement the quantitative ones presented in this article.

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