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IN E-GOVERNMENT WE TRUST? CORRELATING FACTORS OF E-GOVERNMENT USE IN THE WESTERN BALKAN AND EU COUNTRIES

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Abstract

The e-Government form of governing is thought to enable transparency, efficiency and develop user-centered public services delivery. Usage of e-Government services is seen as one of the prerequisites for full participation in society. However, the success of e-Government is contingent on a combination of factors that determine people's willingness to use e-Government services. Previous research finds trust in government to be one of the key predictors of e-Government use. In this study we test the relationship of trust in government and e-Government usage, also including factors of digital inclusion. We focus on European Union countries and the less studied Western Balkan (WB) countries in the attempt to give an overview of the whole European region. For this purpose, we employ comparable secondary data from reliable datasets following standardized methodology for the EU and the WB countries. We performed a correlation and regression analysis to first test the trust in government and e-Government usage relationship and control the effects by adding two factors of digital inclusion and GDP per capita. The findings problematize and develop the relationship of trust in government, digital inclusion, and e-Government usage.

Keywords: *e-Government use, trust in government, digital inclusion, Western Balkans, European Union*

Introduction

Advancing digitalization of the public sector and increased use of technology among citizens has redefined forms of citizen participation and changed the government-citizen interaction (Jaeger, 2021; Liva et al., 2020). The overall process of introducing information and communication technology (ICT) in the public sector and the availability of public digital services established the concept of e-Government. Many scholars have noted that e-Government should provide a wider framework for social inclusion, encourage civic participation, and improve the communication between citizens and governments (Lee & Huang, 2014; Abu-Shanab, 2015; Romero et al., 2022). In the same line, the OECD issued a recommendation aimed at bringing governments close to the citizens and businesses through the implementation of digital government, i.e. "the use of digital technologies as an integrated part of governments' modernization strategies, to create public value" (OECD, 2014). Enabling access to digital public services and participation through e-Government constitutes the UN sustainable development goals (UN General Assembly, 2015) as part of the efforts for reducing inequalities and promoting social inclusion.

The UN E-Government Development Index shows that Europe is the most advanced region in the world in this regard (UN EGDI website, 2023). At the same time there are countries in Europe, including the Western Balkans (WB) that score lower. The commitment of the European Union (EU) towards ensuring that everyone can contribute to and utilize the benefits of the digital world, is operationalized through active policy measures present in the Digital Agenda for Europe 2020-2030 aimed at improving the level of digital skills, infrastructure and the availability of electronic public services for all (Ratcliff et al., 2023; EC website, 2023). Aiming to support the digital transition of the whole European region, in 2018 the EU launched the Digital Agenda for the WB to encourage research and innovation and to strengthen digital infrastructure, digital economy and society (EC press release, 2018). As prospective EU member countries, the WB countries, Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia expressed commitment to implementation of the action items envisaged in the digital agenda.

However, to be successful, the offer of public digital services should meet users' demands (Van Dijk, 2020). The best indicator of successful and effective e-Government is the willingness of citizens to use the services. Usage is the whole purpose of introducing technology and performing the process of digital transformation in the public sector. Previous research finds that adoption and

use of new technologies or innovations in the public sector depend on the combination of socio-economic, demographic, intrinsic, cognitive factors and extrinsic or more technical factors (Kumar et al., 2007; Taipale, 2013; Nam, 2014; Venkatesh et al., 2014; Sharma, 2015; Rallis et al., 2019). Some of the studies find trust in government to be one of the most prominent determinants of e-government use (Carter & Belanger, 2005; Alzahrani et al., 2016; Mensah et al., 2020, Hooda et al., 2022). Other studies focus more on digital access and inclusion factors that would enable effective and equal use of digital public services such as digital skills or digital infrastructure (van Dijk, 2020; van Deursen & van Dijk, 2009; Khan et al., 2010; Alshehri & Drew, 2010; Rodríguez-Hevía et al., 2020).

Prior research has explored the role of trust in government in relation to e-Government use as dependent on intrinsic variables and individual perceptions of digital service characteristics (Rehman et al., 2023; Li, 2021; Cheng-Min, 2019; Alshehri et al., 2014). This article tends to expand the focus and explores the relationship between trust in government, factors of digital inclusion, and e-Government use in the EU and WB countries. While most of the previous research focuses on case studies or individual contexts (Kanaan et al., 2023; Mensah, 2020; Ranaweera, 2016), this paper attempts to give a broader analysis on a country level. Furthermore, there is a lack of digital government research in the WB, especially written in English. A recent dissertation (Alexopoulou, 2022) compared digital inclusion in European countries but did not include the WB countries. To fill in the gap, the purpose of this study is to 1) investigate the direct relationship of trust in government and e-Government use on a country level for EU and WB countries; and 2) examine the influence of other digital inclusion factors on the trust in government and e-Government use relationship. For that aim, we performed a correlation matrix, simple and multiple linear regression analysis by employing comparable secondary data from reliable datasets for the EU and WB countries. Furthermore, we discuss and problematize the results.

The next section of the article introduces the theoretical framework and previous research laying the ground for the selections of key variables and the hypotheses. Afterwards, the methodology section motivates the selection of databases and operationalization of concepts to variables. Furthermore, the paper describes how the correlation matrix and linear regressions were conducted. The results section presents and reflects upon the results from the simple and linear regression analysis. Finally, we discuss the results by re-visiting the hypotheses and give examples of specific countries to practically illustrate the findings. The paper ends with reference to the limitations of the study and suggestions for further research.

Theoretical background and motivation of hypotheses

A broadly acknowledged framework to understand digital inclusion is presented by van Dijk (2005; 2020). The framework consists of four levels - motivation attitude, physical access, skills access, and usage. It implies that people need to be motivated/have positive attitudes to use technology, have physical access to technology e.g. broadband and digital devices, have the digital skills to use the digital devices and services, and lastly to actually use technology, the internet and digital services. Digital inclusion has also been connected to trust in government, especially in relation to usage of e-Government services (Chohan&Hu, 2022; Morte Nadal&Esteban Navarro, 2022; Refat et al., 2023). Our framework to understand e-Government usage, through factors of digital inclusion and trust in government is thus framed as:

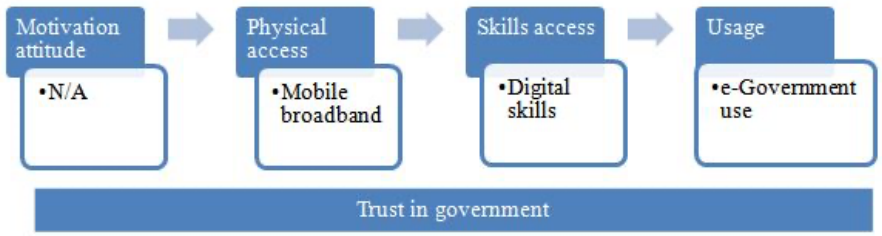


Figure 1. Own adapted version of the sequential model of digital media access (van Dijk, 2020, p. 33)

The outcome, usage, is here conceptualized as e-Government use. Skills access is conceptualized as at least basic digital skills. Physical access is conceptualized as access to mobile broadband. The first level motivation attitude is not added due to lack of observations and variables in the dataset. However, it could be argued that trust in government is a motivational attitude. Yet, we place it outside the digital inclusion sequential levels as we argue that it cannot be placed as a first step in this sequential model.

GDP per capita is added, in the correlation matrix and regression analysis, as it correlates to e-Government development and is able to regress parts of the economic differences between the observed countries. Further motivation, description and explanation of the factors presented above, including GDP per capita, and the two hypotheses is found in the following section.

Conceptualization of e-Government and e-Government usage

Information technology has become one of the core elements of electronic government and should figure prominently in future governance (Nunes et al., 2017). These developments are aligned with the good governance principles which strengthened collaboration and interaction between citizens and

governments that encourages horizontal and decentralized governance. In addition, a few definitions of the concept of e-government are presented:

Table 1: Definitions of e-Government

e-Government definition	Authors
e-Government is the application of information technologies to provide higher standards of innovation in the administration of government operations and systems.	Capistrano (2020), Mouna et al. (2020)
e-Government is a strategic tool to enhance maximum participation of citizens in the political and social development of a country through effective participation, consultation, and empowerment process.	Lee & Huang (2014), Abu-Shanab (2015)
e-Government also known as electronic government is a tool to offer online government related services to the citizens and has a significant impact on the individual attitude towards the usage of e-Government services.	Zahid & Haji Din (2019), Mensah, Zeng & Luo (2020)

A common feature of the elements defining e-Government is the progress of government towards enhanced citizens' participation, innovations in the public sector, improved relationship between service providers and users contributing to better overall social development. Another important aspect is the interaction of the technical and social elements, in other words there cannot be an e-Government without citizens in the role of users and vice versa, innovations are there to enable faster, better and optimal service delivery. The technical and social elements are the two sides of a coin in the process of digital

transformation and the path of enabling a functional e-Government. e-Government usage thus refers to citizens' use of digital governmental services.

The importance of trust for e-Government usage

Trust in government is a frequent variable in e-Government research being the base of the relationship between citizens and governments. Bélanger (2002) points out that citizens' confidence in both the government and the enabling technologies impact citizens' intention to use state e-government services. Previous research finds that higher levels of trust in government correlate with higher e-Government services uptake (Belanger & Carter 2008; Tolbert & Mossberger, 2006). Other scholars support this claim by indicating that trust in government has implications for e-Government use since citizens will have confidence only if they perceive government as working for their ultimate interest (Mensah et al., 2020; Horsburgh et al., 2011; Fjeldstad, 2004; Yang & Holzer, 2006). Moreover, as a rising socio-cognitive factor, scholars considered introducing trust in government as an external variable to existing models as in the cases of the Unified Theory of Acceptance and Use of Technology UTAUT model (Venkatesh et al., 2003 extended by Li, 2021); and the Unified Model of Electronic Government Adoption UMEGA (Dwivedi et al., 2017 extended by Mensah et al., 2020). Those satisfied with the services and those who find the government more transparent are more likely to use e-Government services.

Therefore, we propose our first hypothesis:

H1: *Higher levels of trust in government is positively associated with a higher share of e-Government users.*

The importance of mobile broadband and digital skills for e-Government usage

As seen in the model by Van Dijk (2020), physical access such as mobile broadband, and skills access operationalized through digital skills precede levels of actual usage of digital services. The need of physical access (van Deursen & Van Dijk; 2019; Hilbert, 2016; Humphry, 2014) and digital skills (Chetty et al., 2018; Gonzales, 2016; Janssen et al., 2013) for the usage of technology, the internet, and digital services is supported by previous research as well. The access to mobile broadband and the extension of e-Government services to mobile platforms is expected to increase the reach of e-Government services (OECD, 2011). The culmination of digital inclusion is in how users utilize the internet, whether for entertainment, commercial purposes, or deeper engagements such as social, political, and economic activities online. These engagements are often influenced by the resources, skills, and knowledge users have (Helsper, 2012). With our study focusing on the EU and the WB, each at different stages of digital transformation, we emphasize mobile broadband and digital skills as pivotal independent variables.

The importance of GDP per capita for e-Government usage

Another important variable included in country level analyses is the GDP per capita, used as a measurement of the general economic development of countries. GDP per capita is a popular metric for the average prosperity and well-being of a country that takes into account population size allowing easy comparisons between countries with different sizes (Brock & Rathburn, 2023). Despite the efforts and commitment in the European context for an inclusive process of digital transformation, there is still a trend of online services improving unevenly across Europe (European e-Government report, 2016). Moreover, transition economies lag behind developed economies (Szabo and Chiriac, 2016). On a similar note, countries with higher GDP per capita tend to be faster adopters of new technology. Economic prosperity, besides being directly related to adoption of innovations, is also closely linked to the technological preparedness of the country, the infrastructure, and the ability to provide conditions to access and absorb information and information technology (ibid). Furthermore, employing GDP per capita as an independent variable will also regress parts of the economical differences of the countries included in the study, except being an important factor for e-Government development and usage.

Considering the variables and relationships between concepts identified in previous research we propose the second hypothesis:

H2: *Higher levels of trust in government is positively associated with higher share of e-Government users when controlling for mobile broadband, digital skills, and GDP per capita.*

Methodology

The databases for acquiring secondary data for the variables employed in the study were carefully selected on the basis of employing a unified, standardized methodology that allows comparison across countries. According to the OECD (2017), the most comprehensive source currently available for internationally comparable data on trust in government is the Gallup World Poll. Therefore, the data for the variable Trust in government was obtained from the Gallup World Poll, 2022.

In terms of the variables e-Government users, Mobile broadband and Digital skills, we have utilized data from the Digital Economy and Society Index (DESI), 2022. The DESI measures the progress towards a digital economy and society and monitors Europe's overall digital performance while keeping track of the digital competitiveness of the countries (EC website, 2022). The DESI for EU member countries formally exists from 2014, while the first WB DESI Report provides DESI calculations for 2021 and 2022 (RCC website, 2023).

The first WB DESI Report was developed under the Regional Cooperation Council (RCC) umbrella based on the EU DESI 2022 methodology that allows comparison along various digital indicators with the EU DESI (RCC website, 2023). Panel data analysis is not possible since data for WB only exists since 2021/2022.

The data for the variable GDP per capita was acquired from the World Development Indicators (WDI) database of the World Bank. The WDI presents the most current and accurate global development data compiled from officially recognized international sources (World Bank website, 2023).

Our dataset consists of 33 observations of which are 27 EU countries and 6 WB countries. In addition, we present the variables with their exact definitions from the source databases.

Table 2. Definitions of variables in source databases

Dependent variable			
e-Government users	Individuals aged 16-74 who used the internet, in the last 12 months, for interaction with public authorities on websites or on mobile applications.	0%-100%	(EU DESI, 2022 and WB DESI, 2022 Report)
Independent variables			
Trust in government	Survey question for a sample of 1000 citizens per country: Do you have confidence in national government? Yes/No	0%-100%	(Gallup World Poll, 2022)
Mobile broadband	Number of mobile data subscriptions per 100 people, breakdown percentage of individuals aged 16-74	0%-100%	(EU DESI, 2022 and WB DESI, 2022 Report)
Digital skills	Individuals with 'basic' or 'above basic' digital skills in each of the following five dimensions: information, and data literacy, communication and collaboration, problem solving, digital content creation and safety, breakdown	0%-100%	(EU DESI, 2022 and WB DESI, 2022 Report)

	percentage of individuals aged 16-74		
GDP per capita	Gross domestic product in USD divided by the population of the country.	0< (USD)	(World Bank, 2022)

With the data available, we first performed a correlation analysis (Table 3) to assess the initial relationship of our selected variables, Trust in government, Digital skills, Mobile broadband, GDP per capita, and e-Government users.

Table 3. Correlation Matrix using Pearson's R

	e-Government users	**Trust in government**	**Digital skills**	**Mobile Broadband**	**GDP per capita**
e-Government users	N/A				
Trust in government	0.508**	N/A			
Digital skills	0.851***	0.539**	N/A		
Mobile broadband	0.674***	0.645***	0.724***	N/A	
GDP per capita	0.619***	0.669***	0.663***	0.652***	N/A

Correlation (2-tailed) significant at <0.05 *, <0.01**, <0.001***.

The correlation matrix shows a significant positive correlation between all variables, including between the selected independent variables and the dependent variable. In terms of physical access, we first considered both fixed broadband and mobile broadband. However, since fixed broadband displayed a weak positive correlation that was not significant (r (33) = .191, $p > .05$), we opted for only including mobile broadband. Furthermore, due to the number of observations (33), fewer independent variables will make the regression tests more reliable as too many independent variables in relation to observation can skew the p-value and make it harder to detect significant results. VIF test for detecting multicollinearity is presented in the results section. The correlation analysis was made using the free statistical software Jamovi (Version 2.4, 2023).

Hypotheses testing

Simple and multiple linear regression using OLS (ordinary least squares) estimates are performed to test the hypotheses. The simple linear regression tests hypothesis 1 - the relation of the dependent variable e-Government usage (Y) and the independent variable Trust in government (X_1). In the equation below, β_0 meaning the value of Y when X is zero. β_1 is the coefficient or slope of the regression line, meaning the change of Y for a one unit change in X. Lastly, u is the error term or residual which captures unobserved factors affecting Y but which are not included in the regression model.

$$\gamma \equiv \beta_0 + \beta_1 \times_1 + u$$

The multiple linear regression tests hypothesis 2 and thus controls for the variables Digital skills (X_2), Mobile connectivity (X_3), and GDP per capita (X_4). The equation thus becomes as follows:

$$\gamma \equiv \beta_0 + \beta_1 \times_1 + \beta_2 \times_2 + \beta_3 \times_3 + \beta_4 \times_4 + u$$

GDP per capita is transformed to the logarithm of GDP, after visualization of the variables, to linearize the relation of GDP per capita and e-Government users. This is a common method in previous research (cf. from the field of e-Government Zhao et al., 2022; Martins et al., 2018).

The significant level is put at 0.05 (*), but 0.01 (**) and 0.001 (***) are also highlighted. Because of the low number of observations (33), finding significant p-values will be more difficult. Removing one or two control variables could make it easier. However, from a theoretical perspective, the included variables are interesting to control for.

Descriptive statistics and visualizations were inspected before conducting the regressions. Furthermore, the assumptions for linear regression were tested for both the simple and multiple linear regression. Several diagnostic tests and visualizations were utilized to assess the assumptions for linear regression - linearity, zero conditional mean, homoscedasticity, normality, and multicollinearity for the multiple linear regressions. Specifically, scatterplots of each independent variable against the dependent variable were developed, residuals versus fitted values were plotted, White test and Breusch-Pagan test was completed, Variance Inflation Factor (VIF) tests were conducted, Q-Q plot (Quantile-Quantile plot) were assessed, partial regression plots were examined, and the Shapiro-Wilk test was conducted. The tests and visualizations provided support to conclude that the assumptions for linear regression are met.

Outliers were assessed visually by plotting all variables in scatterplots, boxplots with whiskers, and histograms. Additionally, the Jackknife studentized test and Cook's distance test were conducted. The visualizations of single variables identified observation 33 (Bosnia and Herzegovina) has potential outliers. The diagnostic tests for the simple linear regression identified observations 24

(Romania), and 31 (Kosovo) as potential outliers. The tests for the multiple linear regression identified 24 (Romania) and 28 (Montenegro) as potential outliers. The Western Balkan countries, Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, Kosovo, and Albania, have in general lower values compared to other countries. Removing the potential outliers separately for the simple and multiple linear regression and re-running the tests does not show any major nor significant differences.

The visualizations and tests were done using R Statistical Software (v.4.3.1 2023-06-16 ucrt). Used R packages include ggplot2 (Wickham, 2016), car (Fox & Weisberg, 2019), and lmtest (Zeileis & Hothorn, 2002).

Results

This section presents the results from the hypothesis testing.

Table 4. Simple linear regression (OLS estimates)

	Estimate	Std. Error	T value	P value
(Intercept)	34.0020	9.7932	3.472	0.00154**
Trust in government	0.6803	0.2073	3.281	0.00256**

Intercept and coefficient significant at <0.05 *, <0.01**, <0.001***.
Residual standard error: 20.18 on 31 degrees of freedom. Multiple R-squared: 0.2578, Adjusted R-squared: 0.2338. F-statistic: 10.77 on 1 and 31 DF, p-value: 0.00256.

The simple linear regression shows that one unit increase in Trust in government equals a 0.68 increase in e-Government users. This means that 1% increase in the share of a population trusting the government equals a 0.68% increase in the share of e-Government users. The p-value shows that the results for both variables are significant at 0.01(**) level, meaning that the results are likely not due to chance.

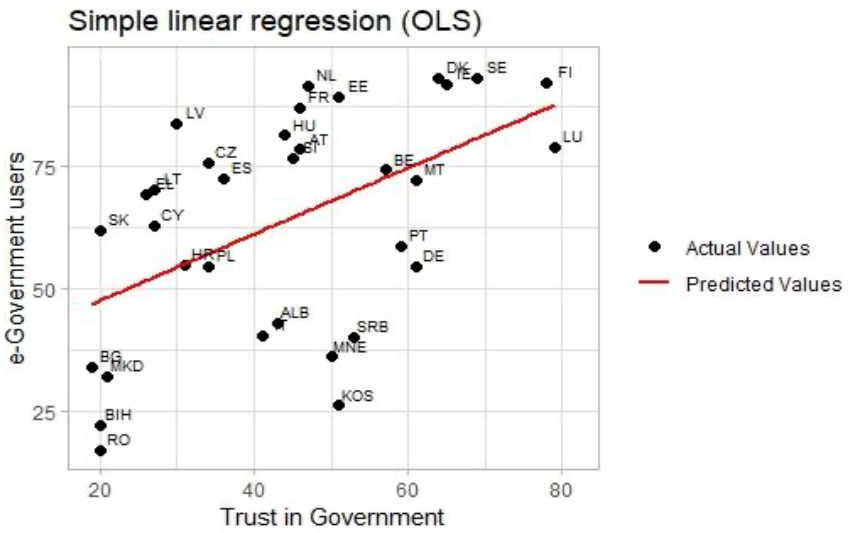


Figure 2. Scatter plot visualization of the simple linear regression

The predicted regression line shows that the share of e-Government users increases together with higher levels of Trust in government. However, the data points are scattered and not especially close to the predicted regression line. Notably, Bosnia and Herzegovina, Romania and Kosovo are far from the predicted regression line. Furthermore, WB countries (but also, Romania and Bulgaria) have a lower share of e-Government users. The predicted relationship of Trust in government and e-Government users does not sufficiently capture the actual values of the countries in our sample. The scatter plot and the moderate correlation coefficient (see correlation matrix) suggests that there are omitted variables, meaning that other variables need to be included to better understand the relationship between Trust in Government and e-Government users. The 1% increase in Trust in government equaling a 0.68% increase in e-Government users is thus subject to further investigation.

Table 5. Multiple linear regression (OLS estimates)

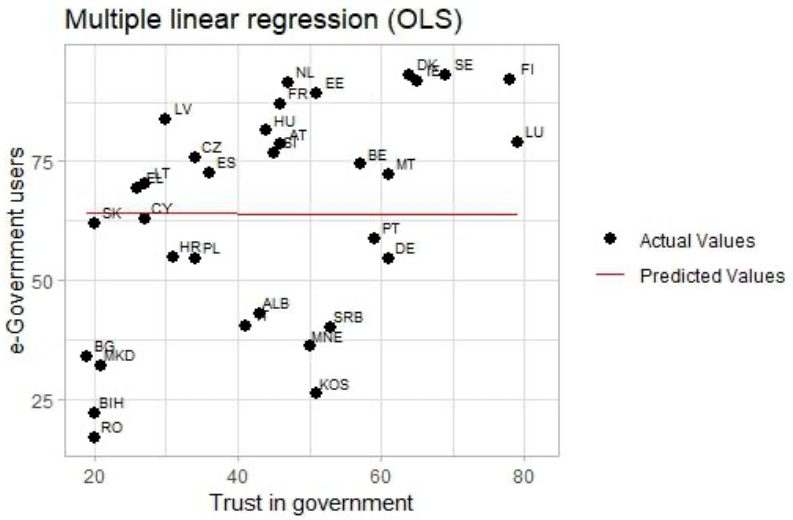
	Estimate	Std. Error	T value	P value	VIF
(Intercept)	-26.50964	28.50723	-0.930	0.36036	N/A
Trust in government	-0.00663	0.17059	-0.039	0.96927	1.81661
Digital skills	0.99340	0.28141	3.530	0.00146 **	3.33148

Mobile broadband	0.17429	0.44266	0.394	0.69676	2.71046
GDP per capita	7.33188	5.09867	1.438	0.16152	3.32873

Intercept and coefficients significant at <0.05 *, <0.01**, <0.001***.
Residual standard error: 12.32 on 28 degrees of freedom. Multiple R-squared: 0.7502, Adjusted R-squared: 0.7145. F-statistic: 21.02 on 4 and 28 DF, p-value: 4.247e-08. VIF values are not larger than 3.3 below the recommended threshold of 5 (Kennedy, 2003) indicating that multicollinearity should not be an issue.

The multiple linear regression tests the relationship between Trust in government and e-Government users while controlling for other variables deemed important in previous research. When the effects of Digital skills, Mobile broadband, and GDP per capita are set to zero, the relationship between Trust in government and e-Government users changes. The relationship is barely existent, which is shown by the very weak negative coefficient value of Trust in government at -0.013. However, the coefficient is not significant, meaning that the coefficient results are not probable. Instead, the regression shows that the share of e-Government users increases together with higher levels of Digital skills. The significant coefficient of Digital skills (0.99340) means that 1% increase in the share of a population with Digital skills equals a 0.99% increase in the share of e-Government users. The coefficient for Mobile broadband is weak and not significant. The coefficient for (logarithm of) GDP per capita suggests that a 1% increase in GDP per capita equals a 7% increase in share of e-Government users, the coefficient is however not significant.

To assess the relationship of the variables, and the multiple linear regression model, further tests were conducted. While not presented here, all control variables showed a significant positive relationship with e-Government usage



in a simple regression. Mobile broadband and Trust in government are the only variables also showing a significant intercept in a simple linear regression. Furthermore, when Trust in government is controlled one on one with the control variables, the coefficient of trust decreases and the significance disappears. Instead, the control variable (Digital skills, Mobile broadband, or GDP per capita) shows a significant positive relationship. If removing either Mobile broadband or GDP per capita from the multiple linear regression presented above, the coefficient of Digital skills is slightly increased, and the significance of the coefficients and intercept remain the same.

Figure 3. Scatter plot visualization of the multiple linear regression

The scatter plot shows the predicted relationship of Trust in government and e-Government users when the values of the control variables are held at their means. The non-significant predicted regression line shows an almost flat line, as could be predicted from the weak coefficient of Trust in government. Furthermore, the data points are not aligned with the predicted regression line.

Discussion

This article is guided by two hypotheses. The simple linear regression of e-Government use (Y) and Trust in Government (X_1) provided a significant coefficient for Trust in Government at 0.68 and a significant intercept at 34. The coefficient and intercept values mean that when the effects of Trust in Government are removed, the share of e-Government users is 34%, and for each 1% increase in Trust in Government, the share of e-Government users increase with 0.68%. The results show that the share of e-Government users increases together with higher levels of Trust in government. We can thus find support for H1: *Higher levels of Trust in government is positively associated with higher share of e-Government users.* However, the scattered data points around the regression line in the scatter plot, the R^2 value of 0.25, and the moderate correlation of 0.508, indicate there are omitted variables that need to be included in the study to be able to better assess the relationship.

The multiple linear regression further investigated the relationship by adding the control variables Digital skills (X_2), Mobile broadband (X_3), and (logarithm of) GDP per capita (X_4). The regression results showed the effects of the control variables absorbed those previously found between Trust in government and e-Government use. The coefficient value for Trust in government became close to zero and even negative -0.013. However, the coefficient value was not significant, meaning that we cannot be confident about the coefficient value. In this case, we could not find support for H2: *Higher levels of trust in government is positively associated with higher share of e-Government users when controlling for mobile broadband, digital skills, and GDP per capita.* Instead,

the multiple regression results showed that the share of e-Government users increases along with a higher proportion of the population having digital skills.

These findings have several implications. Previous studies incorporating trust as a variable amongst other intrinsic variables and individuals' perceptions (Kumar et al., 2007; Taipale, 2013; Nam, 2014; Venkatesh et al., 2014; Sharma, 2015; Rallis et al., 2019) when studying e-Government usage, show that trust has a significant and positive relationship with e-Government usage. These studies are often based on technology acceptance models such as the UTAUT and UMEGA models (Mensah et al., 2020; Li, 2021). These studies also often include other factors to measure trust such as trust in technology and perceived risks, while we focus solely on trust in government. When we instead focus on trust in government and control for digital inclusion variables based on van Dijks (2020) model, the positive relationship between trust and e-Government usage is not found. This could indicate that factors of digital inclusion such as digital skills might be more important for predicting the share of e-Government users. Furthermore, that delimiting trust to trust in government changes the relationship. However, this is not necessarily the case. Due to the low number of observations (33) in relation to four independent variables, the strength of the multiple linear regression is weakened. Furthermore, the coefficient value of Trust in government is not significant indicating that we cannot be confident about its value. Thus, the simple linear regression should not directly be dismissed by the multiple linear regression, as the simple linear regression does not suffer from the same issue of few observations in relation to four independent variables. Yet, as shown in the results, if the control variables are included in a multiple linear regression one by one, together with Trust in government and e-Government users, the significant coefficient of Trust in government decreases and the significance disappears. Thus, once again, pointing at similar results as the multiple linear regression with all three control variables together.

The results from multiple linear regression also suggest that the prediction of e-Government users has moved beyond the stage of physical access such as mobile broadband in van Dijk's (2020) model of successive levels. Furthermore, physical access such as fixed broadband, which was excluded in the regression analysis due to being extremely scattered when plotted in a scatter plot with e-Government users, and due to not being correlated to e-Government users, become an even weaker predictor, being replaced by mobile broadband. Instead, the third level, digital skills, seems to better predict the share of e-Government users at a country level in EU and WB.

To better support our findings, we have selected pairs of countries from the WB and the EU to look into the relationship between Trust in government and e-Government while considering the effects of control variables.

Table 6. Variable values for selected countries included in the study

Country	WB/EU	e-Gov users (%)	Trust in government (%)	Digital skills (%)	Mobile broadband (%)	GDP per capita (USD)
France	EU	87.09	46.00	61.96	87.61	40,963
Serbia	WB	40.00	53.00	41.00	96.00	9,393
Slovenia	EU	76.79	45.00	49.67	87.27	29,457
Kosovo	WB	26.00	51.00	28.00	78.00	5,351
Romania	EU	16.72	20.00	27.82	82.41	15,892
Bosnia and Herzegovina	WB	22.00	20.00	35.00	63.00	7,585
Greece	EU	69.50	26.00	52.48	76.46	20,732
Montenegro	WB	36.00	50.00	47.00	91.00	9,893

Observing the main relationship of our interest, Trust in government and the share of e-Government users, we notice that in the example of France, Trust in government is at 46%, while share of e-Government users is at 87.09%. We have opposed the case of France to Serbia, as a country with higher level of trust in government at 53% and fewer than half share of e-Government users at 40%. France surpasses Serbia in the scores for digital skills and GDP per capita, while Serbia stands at a higher level of mobile broadband 96% compared to France 87.61%.

In the cases of Slovenia and Kosovo, trust in government of 51% in Kosovo surpasses the 46% of trust in government in Slovenia. However, the e-Government use in Slovenia of 76.79%, is almost three times higher than in Kosovo, at the level of 26%. Looking at the other variables for this case, Slovenia's scores for digital skills, mobile broadband and GDP per capita surpasses those of Kosovo.

Another pair of countries to observe is Bosnia and Herzegovina and Romania. At 20% both have the same level of trust in government with e-Government use of 22% in Bosnia and Herzegovina and 16.72% in Romania with digital skills levels of 35% in Bosnia and Herzegovina and 27.82% in Romania. The GDP per capita of Romania, 16,892 USD, on the other hand is almost double that of Bosnia and Herzegovina at 7,585 USD.

Finally, in the cases of Greece and Montenegro, the score of trust in government in Montenegro of 50% is almost twice that of trust in government in Greece at 26%. Still, the percentage of e-Government users in Greece is 69.50% and 30% in Montenegro. Looking at the other variables, Greece surpasses Montenegro in the level of digital skills and GDP per capita, while Montenegro stands at a higher level of Mobile broadband, standing at 91.00% in comparison to Greece at 76.46%. The remaining examples for the other countries are also an interesting subject of further analysis. What is noticeable in the given examples is the pattern of positive relationship between the level of digital skills and the share of e-Government users.

Limitations, further research and conclusions

To better understand the relationship of trust in government, factors of digital inclusion, and e-Government usage, further studies are needed both at the country level and the individual level. Performing regression analysis on a country level in the case of investigating variables as Trust in government may neglect specific contextual country features such as the stage of digital transformation, the level of awareness and motivation for public digital services, political culture or specific ongoing political developments. Especially in relation to the WB countries, where there is both a lack of previous studies on e-Government and data on the same topic. As has been stated, the availability of comparable data acquired on a basis of standardized methodology for all countries in the WB and the EU only allowed analysis for the year 2021/2022, as comparable data for WB countries exists since the year 2021/2022.

Collecting more data and conducting more studies about e-Government in the WB countries would enable analysis of specific WB countries with a higher number of observations in the data set, making the statistical tests more robust. This would also enable further conceptualization and measurement of concepts of interest, such as trust and factors of digital inclusion. In addition, it would enable indicator performance comparisons between WB countries and other EU countries. Finally, it would set the basis for longitudinal studies that follow the trends over longer periods of time which may provide more precise findings on the effects of different factors on e-Government use.

Furthermore, in-depth observations and more studies of cognitive factors related to e-Government use, such as motivation, trust in technology, awareness, quality of information, easiness of use, etc., together with factors of digital inclusion would be valuable to better understand the relationship of trust in government and e-Government usage. The country level analysis may guide policymakers in taking into consideration significant variables from countries at the similar level of digital progress, while conducting analysis on an individual level could contribute to closely addressing users' needs in the given local environment.

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Annex 1

Links to data and databases:

Indicator	Source	Link to source:
e-Government users (EU countries)	EU DESI, 2022	https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts/desi-indicators?indicator=desi_4a1&breakdown=ind_total&period=desi_2023&unit=pc_ind_ilt12&country=AT,BE,BG,HR,CY,CZ,DK,EE,EU,FI,FR,DE,EL,HU,IE,IT,LV,LT,LU,MT,NL,PL,PT,RO,SK,SI,ES,SE
e-Government users (WB countries)	WB DESI, 2022	https://www.rcc.int/pubs/159/western-balkans-digital-economy-society-index-wb-desi-2022-report
Trust in government	Gallup World Poll, 2022	https://news.gallup.com/opinion/gallup/507950/confidence-governments-lowest.aspx
Mobile broadband	EU DESI, 2022	https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts/desi-indicators?indicator=desi_2b1&breakdown=ind_total&period=desi_2023&unit=pc_ind&country=AT,BE,BG,HR,CY,CZ,DK,EE,EU,FI,FR,DE,EL,HU,IE,IT,LV,LT,LU,MT,NL,PL,PT,RO,SK,SI,ES,SE
Mobile broadband (WB countries)	WB DESI, 2022	https://www.rcc.int/pubs/159/western-balkans-digital-economy-society-index-wb-desi-2022-report
Digital skills	EU DESI, 2022	https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts/desi-indicators?indicator=desi_1a2&breakdown=ind_total&period=desi_2023&unit=pc_ind&country=AT,BE,BG,HR,CY,CZ,DK,EE,EU,FI,FR,DE,EL,HU,IE,

		IT,LV,LT,LU,MT,NL,PL,PT,RO,SK,SI, ES,SE
Digital skills (WB countries)	WB DESI, 2022	https://www.rcc.int/pubs/159/western-balkans-digital-economy-society-index-wb-desi-2022-report
GDP per capita	World Bank, 2022	https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD