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From use to impact: different approaches to Spanish e-Government

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From use to impact: different approaches to Spanish e-Government

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Keywords: e-Government, Logit, Internet, Digital Divide, e-Trust.

Abstract

This paper studies the determinants of e-government use in Spain, a country highly ranked in the UN E-Government Development Index. Utilizing a logit model and recent national data (2023), the study identifies key factors influencing e-government usage, such as time and cost savings, and examines user characteristics in relation to the digital divide. Additionally, the paper aims to advance the definitions of the second and third levels of the digital divide to adapt them to current realities. The findings highlight the importance of ICT skills, trust in technology, and quality internet connectivity for effective e-government participation. Policy recommendations are provided to bridge the digital divide and improve e-government adoption among vulnerable groups, emphasizing the need for targeted support and education to enhance digital skills and trust in e-government services.

1. Introduction

E-government refers to the use of Information and Communication Technologies (ICTs) by government agencies to enhance the access to and delivery of government services and information to the public, businesses, and other government entities. It aims to improve the efficiency, transparency, and accountability of government operations, facilitating more effective and inclusive public administration (West, 2004).

The development of an ideal model of e-government envisions a scenario where citizens can access public services from anywhere, regardless of their location, and receive care and service 24/7 without relying on face-to-face interactions. This model also includes interconnected state

administration information systems tailored to each citizen as an individual, allowing citizens to interact with the government without needing to understand its organizational structure (OECD, 2003).

The importance and extent of e-government lie with citizens and the use of Information and Communication Technologies to access useful and timely data to enable them to make better decisions and interact with the government, in a feedback process to make public services more efficient by reducing operating costs and increasing the government's own revenues through citizen participation (Heeks, 2001).

The digital divide refers to the gap in access to and use of information and communication technologies (ICTs) across different socio-economic groups. While progress has been made in reducing the access divide, particularly in developed countries, there is a need to better define and address the second and third levels of the digital divide. These levels focus on differences in digital skills and the effective use of ICTs. Recent studies highlight that as the access gap narrows, disparities in skills and usage become more critical, affecting e-governance by limiting the benefits of digital public services for certain groups (Scheerder, van Deursen & van Dijk, 2017; van Deursen & van Dijk, 2014).

Building on this foundation, this paper investigates the determinants of e-government use in Spain, emphasizing the redefinition of the second and third levels of the digital divide, as access disparities have significantly diminished in developed countries in recent years (van Deursen & van Dijk, 2014). By examining ICT skills, trust in technology, and internet connectivity, the study aims to provide insights and policy recommendations to

enhance digital inclusion and e-government effectiveness (Hargittai, 2010; Scheerder, van Deursen & van Dijk, 2017).

The results of the recent United Nations (UN) E-Government Development Index (United Nations, 2022) rank 73 nations as advanced in e-government and 60 as very advanced, with the most developed economies dominating the top positions. In terms of the world's population, 50% of the world's inhabitants fall outside these top rankings or can be defined as "laggards" in e-government. Similarly, the OECD Digital Governance Indicator (OECD, 2016) is a qualitative indicator focused on the analysis and recommendations on e-government policies and digital governance. Both studies highlight the digital divide as one of the key elements for the development of e-government.

Spain in 2022 ranks 18th globally in the E-Government Development Index, and in the Open Government Data Index (OGDI), Spain achieves the highest score. At the local level, the city of Madrid leads the Local e-Government Development Index, meeting 98% of the indicators assessed (United Nations, 2022).

A quantitative approach is adopted, exploring recent national data to provide a detailed picture of the case. The data are analysed using a linear probabilistic analysis, specifically a logit model. This paper aims to study e-government from different perspectives and to distinguish which activities provide tangible benefits for users, such as saving time, saving money, or simplifying procedures (Grishchenko, 2020). It seeks to understand e-government users in Spain from the perspective of the second and third levels of the digital divide, and to identify any differences in characteristics among individuals who report experiencing this divide.

The article is structured as follows: after this introduction, section 2 presents a review of the literature on the main elements that affect and define e-governance. Section 3 describes the data and methodology used, while section 4 contains the results. Finally, section 5 includes the main conclusions of the research.

2. Literature Review.

Digital inequality is due to a combination of economic, social, educational and knowledge (services and infrastructure) factors between those who have access to ICTs and those who do not. This inequality manifests itself between groups of people and communities, and is affected by variations in income, race, age, education level, gender and place of residence. People's purchasing power is a crucial factor, as a certain level of income is required to purchase ICT devices and subscribe to broadband access and services. Income differences lead to what is known as the digital divide, whereby individuals who suffer from the digital divide are at a disadvantage compared to others, as this disadvantage prevents them from accessing employment opportunities, healthcare and other essential aspects of modern life (El-Bawab, 2020).

The digital divide affects all digital services and infrastructures, especially e-commerce, e-banking and e-government, whereby education, income, age and rurality influence the use of e-government services (Pérez-Morote, Pontones-Rosa & Núñez-Chicharro, 2020). The digital divide would also have relevance when it comes to achieving the Sustainable Development Goals (SDG) launched by the United Nations (2015). This would have particular weight in the fulfilment of SDG-9 'Build resilient infrastructure, promote sustainable industrialization and foster innovation', SDG-10 'Reduce inequalities' and SDG-11 'Make cities more inclusive, safe, resilient and sustainable'. The appropriate and efficient use of ICTs would be fundamental to achieving these goals, and a proper understanding of the digital divide and how to bridge it would be fundamental for all individuals to be able to exploit technology, leading most efficiently to the development of more coherent frameworks and policies to address these needs and reduce inequality (Stantcheva, 2022).

The importance of facilitating this access and thus the development of e-government is at the core of open governance, defined by the OECD (2016) as 'a culture of government based on innovative and sustainable public policies and practices inspired by the principles of transparency, accountability and

participation that foster democracy and inclusive growth’.

A. E-government

E-government is understood as the incorporation of ICT in the public sector to improve effectiveness and efficiency in the provision of public services to individuals and businesses (UNDESA, 2018). However, other nuances can also be included, such as the importance of using this means of state-citizen communication to provide information and services, encourage participation and manage the administration (Gil-García & Luna-Reyes, 2006). In this approach of governments to citizens through ICTs, the administration is faced with users who, for the most part, are accustomed to receiving information and products quickly via the Internet, which must become a vocation of public administrations to promote the development of processes in a fast, economic, efficient and transparent manner (OECD, 2009).

A proper e-government system is not built overnight; it follows a process that allows for the adaptation of users and the administration itself. The typical phases for the implementation of e-government always start from very simple forms of communication, consisting of a unidirectional sending of information from the state to citizens, passing through interactions on public administration platforms and reaching a transactional perspective that allows the integration of administrative services through the Internet (Alshehri & Drew, 2010).

The fundamental aim of e-government is to improve the efficiency of public services and, from there, to create a better relationship between government and citizens (Norris, 2010). The more general approach to e-government refers to the adoption of the concept of e-commerce in the delivery of public services, transferring this experience from the private sector to the public sector (MacLean & Titah, 2021). Among the factors influencing the use of e-government services, evaluations of and trust in government itself are affected by transparency, and the digital divide affects access to e-government services.

A study of 27 EU countries showed that the use of e-government services increases as countries achieve higher levels of trust in government, income, education and a younger population (Pérez-Morote, Pontones-Rosa & Núñez-Chicharro, 2020). This finding highlights the existence of a digital divide based on income and education levels. Regarding trust in government, there is a positive relationship between trust and the use of e-government services. This suggests that the higher the level of trust in government, the more likely citizens are to use e-government services. This result underlines the importance of trust in government as a key factor for the success of e-government initiatives.

On the other hand, Pérez-Morote, Pontones-Rosa and Núñez-Chicharro (2020) identified a gap between the availability and use of e-government services, suggesting that despite efforts to increase the supply of e-government services, their potential benefits have not yet been fully realised due to a lack of universal access.

In this regard, one of the most notable aspects is the positive relationship between the quality of e-government services and trust in government (Myeong, Kwon & Seo, 2014). It is essential to promote policies that increase the willingness to use ICTs, while doing transparency work to strengthen trust in government (Malodia, Dhir, Mishra & Bhatti, 2021; Myeong, Kwon & Seo, 2014; Reffat, 2003).

To generate security and maintain the quality of e-government, blockchain and artificial immune systems can be used (Elisa, Yang, Chao, Naik & Boongoen, 2023). It should not be forgotten that this is a user demand, and it must respond to the demands of citizens (Malodia et al., 2021).

Another major challenge for e-government is the establishment of a solid infrastructure and the revision of legislation are crucial steps to ensure the viability and effectiveness of e-government (Alshehri & Drew, 2010; Reffat, 2003). In addition, there are organisational barriers, including lack of support from senior management, resistance to change and a shortage of skilled staff (Alshehri & Drew, 2010).

But it is not just trust in government and infrastructure that needs to be addressed. Adoption

of e-services is influenced by socio-demographic factors such as gender, age, education and income, as well as variables related to ICT usage and frequency of use (Boksova, Boksa, Horak, Strouhal & Saroch, 2021; Garín-Muñoz, López, Pérez-Amaral, Herguera & Valarezo, 2019; Seljan, Miloloža & Pejić-Bach, 2020). However, the government's communication capacity also needs to be strengthened, with some studies highlighting a lack of awareness of digital government services; these efforts should focus on marginalised groups (Boksova et al., 2021).

B. Digital divide

The digital divide and digital literacy affect opportunities, individual experiences and incomes. The pandemic has increased the digital divide; households that cannot invest in upgrading their devices have fewer academic and employment opportunities, as well as poorer mental health (Stantcheva, 2022). The author points out that, in addition, if you have the equipment even though you are poor, but your area has worse broadband infrastructure and connectivity, you fall into the same problem. At the business level, the author points out that some sectors survive thanks to digitization and e-commerce.

But the digital divide is not homogeneous and constant and analysable from a single dimension, it addresses different aspects of digital inclusion and thus, traditionally, it can be broken down into three levels or scenarios according to the integration of ICTs in the lives of individuals (Scheerder, van Deursen & van Dijk, 2017). These levels can intensify inequalities and affect individuals' material and working conditions.

First, the digital access divide refers to disparities in the availability of technological infrastructure and devices, as well as connectivity and the quality of connectivity (Grishchenko, 2020; Lythreatis, Singh & El-Kassar, 2022).

Second, one finds the digital use divide, focusing on different levels of e-skills, including operational, navigational, social and creative skills (van Deursen & Helsper, 2015). Finally, the take-up digital divide, also known as the outcomes digital

divide, focuses on differences in the benefits and outcomes derived from ICT use (Lythreatis, Singh & El-Kassar, 2022; Scheerder, van Deursen & van Dijk, 2017). These must be clear outcomes that impact on the development not only online, but also offline of individuals (Grishchenko, 2020).

The third level is influenced by the lack of opportunities and knowledge to take advantage of the opportunities provided by technology, resulting in a growth of inequality caused by the Internet (Ilhan, Iseri & Uyar, 2020). Results for the Netherlands highlight that people with higher social status tend to derive greater benefits from internet use, which can intensify pre-existing inequalities (van Deursen & Helsper, 2015). This would be related to the third level of the digital divide, showing an impact of pre-existing socio-demographic conditions: social class, gender, race, and age, on subsequent digital inequality.

At all levels of the digital divide, socio-demographic, socio-economic, cultural and digital skills variables play a role, as do major events that can change epochal sensitivities or social preferences (Lythreatis, Singh & El-Kassar, 2022; Scheerder, van Deursen & van Dijk, 2017).

Focusing on digital skills, e-skills, the most important and defining part of the digital divide from its second level, the subject of this paper, are also key to reducing concerns about the security of personal data and conducting interactions online (Lamberti, Lopez-Sintas & Sukphan, 2023; Siddiquah & Salim, 2017). Lack of e-trust is the third most important factor in the digital divide, after e-skills and physical access (Lamberti, Lopez-Sintas & Sukphan, 2023).

For the case to be studied, the digital divides of use and exploitation that can be found in e-government in the Spanish case. This perspective has been studied by De Marco (2021), in his study he distinguishes between the second and third digital divide in the context of e-government as follows: the second digital divide focuses on the adequate use of the resources offered by the Internet, while the third digital divide focuses on the need for adequate digital skills to obtain tangible benefits from these previous uses. In e-government, the tangible benefits that would differentiate the second and third levels of the

digital divide could relate to the time savings and enhanced capabilities that result from interacting with government, the 'co-creation of value' that results from this fact (De Marco, 2021; Malodia et al., 2021).

C. Involuntary e-trust in e-government.

As previously identified, the use of e-government is also influenced by trust, not only trust in government, as seen above, but also trust on the Internet.

The e-trust defines the activities that users carry out on the Internet, if they do not trust the security of a website, they will not use it (Corritore, Kracher & Wiedenbeck). Trust in e-services is therefore influenced by their accessibility, quality, privacy, data protection and other services that satisfy the user (Peštek, Resić & Nožica, 2011). But it does not only depend on the providers, in this case the government, it also depends on the security that users use to protect themselves while surfing the Internet (Butler, 2014).

Involuntary trust arises when citizens must use e-government services, such as e-ID, due to mandatory requirements. This trust, driven by necessity rather than choice, can impact user perceptions and adoption of e-government services. While mandatory usage can increase familiarity and comfort over time, it can also lead to resistance if users feel forced to use systems they do not fully trust or understand (Reddick & Roy, 2013). To manage involuntary trust, governments should ensure e-government platforms are secure, user-friendly, and transparent. Providing clear information about security measures and offering support services can help build genuine trust and improve user acceptance (Myeong, Kwon & Seo, 2014).

D. Accessibility and connectivity.

Technology spending is a key element in understanding the dimensions of the digital divide and bridging the digital access divide. Erman, Rojko and Lesjak (2022) conclude that the higher the investment in new ICTs, the higher the investment in traditional ICTs, showing that these two forms of ICT spending are related.

All the above differences are more pronounced in the geographical dimension of cities and rural areas. Thus, Lin, Kishk and Alouini (2024) identify and quantify the existence of a digital divide between urban and rural areas in their application to IoT devices, reflecting the unequal capabilities of these devices to harvest wireless energy in different environments. This divide is a critical factor affecting the performance of IoT devices in rural areas, which has implications for the geographical differentiation mentioned above.

Furthermore, Chaoub et al. (2022) highlight that the introduction of 6G networks offers new promise for connecting remote areas, with technologies such as self-healing capabilities and smart reflective surfaces providing more resilient and efficient networks that could significantly improve the reliability and quality of internet services in rural areas, bridging the digital divide and bringing the benefits of the digital age to all, regardless of their geographical location (Hargittai, 2010). Applied to young people, they conclude that there is diversity among young people in their use of ICT and digital literacy. This diversity is driven by variables such as parental education, gender, race and income.

All previous studies highlight that people who experience greater inequality are more likely to be victims of the digital divide, less likely to be Internet users, and when they do go online, they tend not to engage in activities that enhance human capital. It also underlines that failure to bridge the digital divide leads to increased inequalities and the need to develop public policies and regulations that adequately address the problem.

While significant progress has been made in understanding and addressing the digital divide, there is still ample room for improvement, particularly regarding the second and third levels of the digital divide. Recent studies suggest that as the access divide narrows, disparities in digital skills and effective usage become more critical, impacting the overall effectiveness of e-governance (Scheerder, van Deursen & van Dijk, 2017; van Deursen & van Dijk, 2014). This paper aims to advance the definitions of these second and third levels,

providing a more nuanced understanding that reflects current realities.

This study contributes to the existing literature by identifying key factors influencing e-government usage in Spain and examining how these factors interact with the digital divide. By focusing on ICT skills, trust in technology, and Internet connectivity, a comprehensive analysis is provided that highlights the importance of these elements for effective e-government participation. Additionally, policy recommendations are proposed to bridge the digital divide and improve e-government adoption among vulnerable groups, emphasizing the need for targeted support and education to enhance digital skills and trust in e-government services.

The choice of Spain as a case study is particularly relevant given its high ranking in the UN E-Government Development Index, positioned 18th globally and 7th among EU countries. This ranking underscores Spain's advanced e-government infrastructure and practices, making it an ideal context to explore the nuances of the digital divide. The findings from this study are likely transferable to other developed countries with similar rankings, providing valuable insights and implications for global e-governance policies and strategies.

As a result of the foregoing, the following research questions are proposed in this paper:

1.- How do e-skills, e-trust, and Internet connectivity affect e-government adoption?

2.- Are sociodemographic characteristics of individuals still relevant in estimating e-government participation?

3.- How can the definitions of the second and third levels of the digital divide in e-government be advanced to better reflect current realities?

4.- What policy recommendations can be made to bridge the digital divide and improve e-government adoption among vulnerable groups?

3. Data and Methodology.

The data were collected through a survey conducted annually by the National Statistics Institute (INE). This is the Survey on Equipment and Use of Information and Communication Technologies in Households (INE, 2023a, 2023b).

This annual survey collects information on the ICT equipment of Spanish households with individuals over the age of 10, with special emphasis on those aged between 16 and 74. The data used in this study were collected from 2023 onwards. To compare the impact and new profiles that may be found. The sample is representative at national level and by gender, age and educational level (INE, 2023a).

The Survey on Equipment and Use of Information and Communication Technologies in Households follows a tri-stage model and is stratified by census sections of the Spanish territory, thus covering it in its entirety (INE, 2023b). This survey is a household survey, studying not only the adults who respond to the interview, but also the children between ten and fifteen years of age in the household. The survey is designed to interview 25,000 people, but in this case the total sample is 15,200. It is carried out using a combination of CAWI (Computer Assisted Web Interview), CATI (Computer Assisted Telephone Interview) and in exceptional cases CAPI (Computer Assisted Personal Interview).

The main statistics of the variables used are shown in table 1.

Table 1. Main statistics

Variable	Mean	Std. Dev.	Min.	Max.
Gender	.456	.498	0	1
Age	54.464	18, 183	16	100
Income	1943,14	1209,89	400	4000
Years of Education	11.329	4.376	1	20
Broadband	.838	.369	0	1
e-Trust	.582	.493	0	1
Use of ICT (medium)	.499	.500	0	1
e-Commerce	.696	.462	0	1
e-Bank	.726	.445	0	1
e-Government	.595	.490	0	1
– Information e-Government	.359	.480	0	1
– Documents e-Government	.327	.469	0	1
– Tax Return e-Government	.523	.499	0	1
– e-ID				

Source: Author's own elaboration based on INE data (INE, 2023a).

The dependent variable is a dummy variable that takes the value 1 if the individual uses e-government, zero otherwise. These variables are 'e-government - Information', 'e-government - Documents', 'e-government - Tax Return' and 'e-government - e-ID'. The first of these indicates whether the user has used e-government to access information about e-Government, databases or personal information, the second, 'e-Government - Documents', takes value 1 if the user has accessed to download a document, fill it in or file a complaint via e-government. These are the e-government usage variables that because they do not involve substantial savings in time or money compared to the others below, or are simpler, are used to define the second level gap in e-government usage.

De Marco (2021) used these variables to talk about the third level digital divide, but by having other more relevant variables in this database on the relationship of users with the administration, it is possible to separate those who use e-government in a more superficial way from those who benefit from it and thus understand the differences.

The variables used for the analysis of the third level of the digital divide using e-government are also binary, 'e-government - Tax Return', which refers to individuals who use e-government to make their tax return, thus making it faster and at no cost, with a personal benefit in terms of time and money. On the other hand, 'e-government - e-ID' indicates whether the user has an electronic certificate, CL@VE system or electronic ID (e-ID). This is a benefit to users in terms of having more tools for interacting with the administration, saving time and reducing procedures.

Socio-demographic variables such as gender, age, educational level, and household income are used as independent variables. Gender is coded as one if the individual is male at birth and zero if female. Age is recorded from the age of 16 onwards. Education level ranges from one (no formal education) to 20 years (PhD). The income variable is categorical, dividing individuals into various levels of monthly income between 400 and 4000 euros.

Additionally, variables related to e-skills are included, such as 'ICT-medium use,' which is coded

as one when the individual knows how to perform moderately complex activities like modifying computer applications. Other e-skills variables include the use of e-services like 'e-banking' and 'e-commerce,' which are binary (one if the individual uses them, zero otherwise). 'E-trust' is coded as one if the individual relies at least moderately on the internet while using it, and 'broadband' is coded as one if the individual's home internet connection is of good quality.

The study also examines reasons related to the digital divide that prevent users from using e-government. 'Not use Digital Divide (e-Gov)' and 'Not use Digital Divide (e-ID)' are coded as one if the individual does not use e-government or does not have an e-ID due to a lack of e-skills or lack of awareness (considered a digital divide), and zero otherwise. 'Not use e-Trust (e-Gov)' and 'Not use e-Trust (e-ID)' are coded as one if the individual does not use e-government or does not have an e-ID due to a lack of trust in the administration, and zero otherwise.

The methodology for e-government analysis follows the technology acceptance models (TAM) developed by Davis (1989) and the extended model by Venkatesh and Davis (2000). Since the dependent variable is dichotomous and the data are cross-sectional, linear probability, logit, or probit models are applicable (Heij, Boer, Franses, Kloek & Dijk, 2004). The logit model is used in this paper as it provides the best fit. The area under the ROC curve, recommended by Mihalovič (2016), will be used to ensure the model's estimation capacity, feasibility, and ability to discriminate results. This model uses the maximum likelihood estimator (Heij et al., 2004).

Before the quantitative analysis, a descriptive analysis will be conducted to reflect the current situation of the dependent variable. The study aims to understand the current status of e-government usage, how individuals use it, the penetration of these services, and the reasons for non-use. The descriptive analysis will explore the digital access gap to determine if individuals generally have the devices to access e-services and e-government, the simplest uses of e-government to analyse its penetration in users' lives, the usage of more

advanced services, and the reasons for the non-use of e-government services.

This study aims to identify the causes of the digital divide in e-government usage and its impact on vulnerable populations, as well as to comprehensively understand e-government users at all levels.

4. Results.

In this section, the analysis proposed in the methodology is systematically developed in different sub-sections:

A. Approach to e-government

This section analyses e-government and the uses to which it is put in Spain, looking at simple uses, more advanced uses, and the reasons why it is not used. Table 2 shows how Internet users in Spain connect to the Internet and whether they have any type of device at home, to determine whether there is any clear fault that excludes users and represents a clear digital divide in access.

Table 2. First Level of digital divide

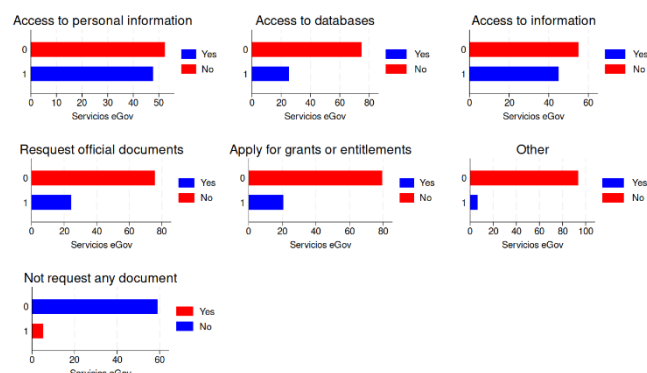
	Internet Access	Device Access	Mobile Internet
Freq.	14446	15481	13476
Percent	91.53	98.11	99.82

Source: Author's own elaboration based on INE data (INE, 2023a).

The results in table 2 show that there is no clear gap in Internet access or devices in Spain that is particularly noteworthy. A total of 98.11% of users have a device with which to connect to the Internet at home, and 91.53% have a device at home. Furthermore, 99.82% of users with a mobile phone have Internet on their own mobile phone, which would allow some users, despite not having Internet at home, to access the Internet via their smartphone.

Based on this situation of general Internet access in Spanish households and therefore susceptible to using e-services, figure 1 studies the percentage of users who participate in the simplest e-government activities, consulting information from the public administration and consulting documents.

Figure 1. Uses of e-Government



Source: Author's own elaboration based on INE data (INE, 2023a).

The first row refers to the questions on information retrieval which comprise the variable in table 1, 'e-government - Information', in this case distinguishing between retrieval of stored personal information, which has been retrieved by more than 40% of respondents, retrieval of government information itself, around 40%, and retrieval of government databases, only 20%.

Overall, as in table 1, 60% of Internet users have ever used e-government to access information.

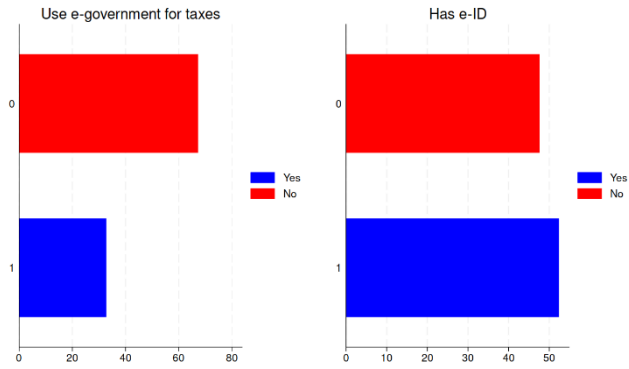
The second row represents the e-government users represented by the variable in table 1, 'e-government - Documents', who access the administration to consult: official documents, file complaints or search for subsidies and other requests, as shown in figure 1.

It can be observed that searching for documents is not so common among Spanish users, according to the values in table 1, only 35% of users use e-government for these tasks. More specifically, 20% of users claim to have consulted official documents, and the same percentage to have searched for ways to file complaints or request help.

The third row of figure 1 shows in blue and red whether individuals who have not consulted e-government information have needed to do so, and of the 65% who say they have not consulted it, 60% say they have not needed to do so but could have done so.

Then, moving on to the more specific use of e-government, figure 2 shows users who perform other more specific tasks.

Figure 2. Advanced uses of e-Government



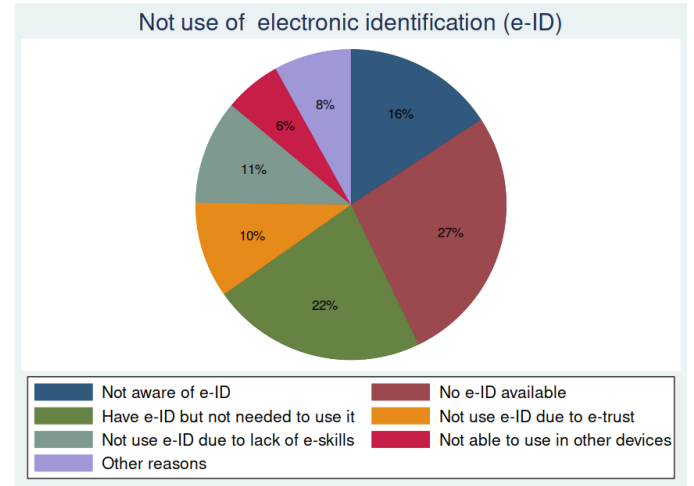
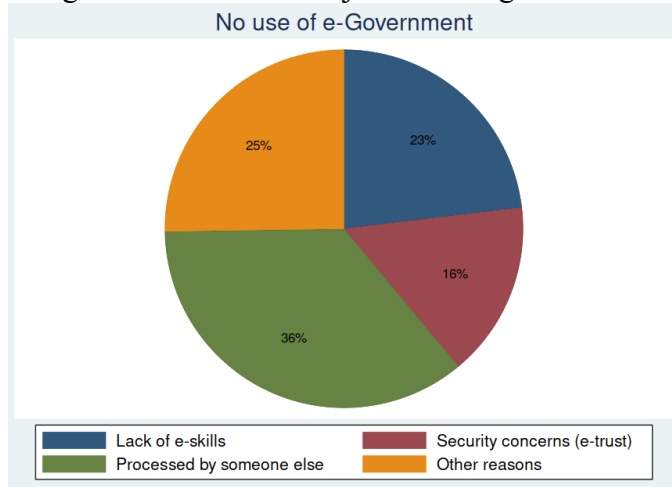
Source: Author's own elaboration based on INE data (INE, 2023a).

Figure 2 presents the uses that are available to all Spanish individuals, but are not easy to do, such as the tax return, unless you are not subject to it, ‘e-government - Tax Return’, and the ability to have electronic ID, ‘e-government - e-ID’, of any kind.

Users who claim to have filed their tax return online, as they are able to do so, are around 30%, the rest have opted for the face-to-face form or paid to have it done by a third party. More than half of those interviewed say that they have an e-ID, which is a positive indicator of the integration of e-government in Spain, as expected in accordance with UN statistics (United Nations, 2022).

However, not all users have e-IDs and not all of them use e-government, which is why the reasons why they do not use it are described in figure 3.

Figure 3. Reasons for rejection of e-government



Source: Author's own elaboration based on INE data (INE, 2023a).

The results in figure 3 distinguish the reasons for not using e-government or not having an e-ID for Spanish users. Among those who say they do not use e-government, 23% say they do not use it because they lack e-skills and 16% because they lack e-trust. Another notable finding is that 36% say that someone else does it for them.

The reasons for not having an e-ID are more diverse. Even so, 37% suffer from a direct digital divide, 16% say they do not know what the e-ID is and did not know it existed, 11% do not have the skills to use or install it, and 10% do not trust online public administration. Other interesting data include that 22% are not interested in it and 27% say they cannot have e-ID but do not explain why.

B. Second level digital divide and e-government.

This section focuses on models that study the use of e-government in a user sense, searching for information and consulting or requesting official documents. In addition, those individuals who suffer from a digital divide due to a lack of e-skills or e-trust in the use of e-government to consult official documents will be studied. Table 3 presents the estimation of e-government in what it has been contextualized as the second level of the digital divide.

Table 3. Use of e-Government

e-Government Information	e-Government Documents
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Variable	Odd-Ratio (std. error)	Odd-Ratio (std. error)
Gender	1.097** (.049)	.986 (.041)
Age	1.079*** (.007)	1.003 (.007)
Age ²	.999*** (.000)	.999*** (.000)
Income	1.000 (.000)	.9990** (.000)
Years of Education	1.104*** (.007)	1.065*** (.007)
Broadband	1.287*** (.086)	1.203*** (.085)
e-Trust	1.327*** (.062)	1.156*** (.053)
Use of ICT (medium)	2.305*** (.111)	2.022*** (.098)
e-Commerce	2.223*** (.125)	2.138*** (.137)
e-Bank	3.043*** (.164)	1.875*** (.115)
Constant	.010*** (.001)	.099*** (.018)
n	12510	12510
Pseudo R ²	0.257	0.167
AUCR	0.821	0.761

* Significant at 10%, ** significant at 5% and *** significant at 1%.

As can be seen in table 3, the results of both estimations are very similar regardless of the e-government activity carried out, with most of the variables used being significant. Both models have a sample of 12510 individuals, adequate pseudo-R² values, indicating that the model explains a reasonable percentage of the variability of the dependent variable, and an AUC greater than 0.7, indicating a useful model for predicting and classifying individuals.

Regarding the estimation model 'e-government - Information', about the socio-demographic variables, it can be observed that there is a gender gap, which discriminates against women, and a digital age gap, which discriminates against younger and older people, who are more likely not to use e-government. There is also a gap by years of education, which favours those with more education.

In this sense, the variables related to ICT equipment are also significant; good connectivity is fundamental to participate in e-government, and the variables related to the use of e-services and the possession of e-skills are also significant and

positive.

Meanwhile, the model estimating 'e-government - documents' shows very similar values for the ICT equipment variables, with good connectivity being positive and significant, and for the variables related to e-skills, e-trust and e-services, which are significant and positively related to the use of e-government. However, there is a difference within the socio-demographic variables. In this case, the gender and age variables have no influence, with only the digital divide by years of education and the digital divide by income appearing non-significant.

On the other hand, when examining the variables that attempt to estimate non-use: 'Not using digital divide (e-Gov)' and 'Not using e-Trust (e-Gov)', the estimation models are not so consistent. Table A1 shows the estimates with a sample of 639 and with goodness of fit measures that are adequate for the 'Not use' model, which refers to the lack of e-skills, and not adequate for the e-Trust model. Most of the variables in table A1 are not significant; within the socio-demographic variables, only years of education and income are significant.

The next section focuses on individuals performing or not performing more complex e-government tasks.

C. Third level digital divide and e-government.

The following models have been defined to estimate the propensity of individuals to use e-government to bridge the third level digital divide, thus gaining personal benefits online and offline. Either by saving time or money. Table 4 presents the estimates for using e-government to file tax returns and using e-government with e-ID.

Table 4. Advanced use of e-Government

	e-Government Tax Return	e-Government e-ID
Variable	Odd-Ratio (std. error)	Odd-Ratio (std. error)
Gender	1.446*** (.066)	1.123*** (.048)
Age	1.014 (.010)	1.077*** (.007)
Age ²	.999** (.000)	.999*** (.000)
Income	1.000*	1.000

	(.000)	(.000)
Years of Education	1.103*** (.008)	1.102*** (.007)
Broadband	1.232** (.099)	1.262*** (.086)
e-Trust	1.285*** (.067)	1.221*** (.056)
Use of ICT (medium)	1.409*** (.076)	2.097*** (.099)
e-Commerce	2.180*** (.164)	2.551*** (.146)
e-Bank	1.816*** (.136)	2.544*** (.142)
Constant	.018*** (.005)	.0108*** (.002)
n	10171	12510
Pseudo R ²	0.124	0.242
AUCR	0.730	0.810

* Significant at 10%, ** significant at 5% and *** significant at 1%.

The estimates in table 4 are for the dependent variables 'e-government - tax return' and 'e-government - e-ID'. The estimation of 'e-government - tax return' has a sample size of 10171, as it excludes those who are exempted, and the estimation of 'e-government - e-ID' has a sample size of 12510.

The first column, analysing 'e-government - Tax Return', has a pseudo-R² of 0.12 and an AUC greater than 0.7 means that the model is feasible at the level of classifiable. Meanwhile, the second column, which examines 'e-government - e-ID', shows goodness-of-fit measures of pseudo-R² and AUC of 0.24 and 0.81 respectively, explaining a higher percentage of variance of the dependent variable than the other estimation.

Focusing the analysis on the first column, studying the performance of the online tax return 'e-government - Tax Return', it is observed that, analysing the socio-demographic variables: there is a gender gap favouring men, who are more independent in carrying out this type of procedure. The academic gap is also repeated: people with fewer years of education are less likely to use e-government.

In the block of variables related to ICT equipment and connectivity and e-skills, all are significant at 1% and have a positive impact on the use of e-government. Thus, the use of e-banking and e-commerce is related to e-government; connectivity is also related to e-government; and having e-trust

and e-skills are also characteristics of e-government users.

On the other hand, the study of having e-ID, 'e-government - e-ID', shows that at this level of e-government study, the gender gap becomes more pronounced with men being more likely than women to have an official online ID. In turn, in this case there is also an age gap that disadvantages older and younger respondents.

In addition, common to all estimates in this sense, there is an education-related digital divide in the use of e-government, disadvantaging those with fewer opportunities to study. There is no income gap in this model. As in the 'e-government - Tax Return' estimation, for the 'e-government - e-ID', the variables related to e-services usage, e-skills, e-trust and equipment are significant and positive.

Meanwhile, examining the variables that try to estimate non-use: 'Not using Digital Divide (e-ID)' and 'Not using e-Trust (e-ID)'. Table A2 shows a very interesting estimation, the estimation of 'Not using Digital Divide (e-ID)', which analyses individuals who claim not to have an e-ID because they were not aware of its existence, has very adequate goodness of fit measures with an AUC above 0.7, most of the explanatory variables are significant and a sample of 5884 individuals.

In this sense, the people who suffer from this digital divide, according to their significant variables, are women, older, have a lower income, and fewer years of education. They also lack e-skills, do not use e-services, and do not trust technology.

While table A2, looking at 'Not use e-ID', shows only two significant variables, e-trust, which is obviously negative, and a gap by age.

5. Discussion

The results of this study offer a comprehensive view of the access and usage patterns of e-government in Spain, shedding light on the ongoing digital divides and their impact on citizen participation. Despite high levels of internet access and digital device availability in Spanish households (over 98%), significant disparities persist in the effective use of e-government services, particularly for more complex activities.

The findings align with previous research highlighting digital divides in online service usage, including governmental services. Studies by Reddick and Roy (2013) and Myeong, Kwon and Seo (2014) emphasize the role of business perceptions, trust in government, and community commitment in shaping satisfaction with and sustainable use of e-government services. Research by Scheerder, van Deursen and van Dijk (2017), and van Deursen and van Dijk (2014) further explores the determinants of Internet skills, usage, and outcomes, revealing factors influencing differential usage patterns and outcomes.

Identifying these digital divides has significant implications for equitable access to governmental services and the effectiveness of e-government initiatives in Spain. Addressing factors such as lack of digital skills and online distrust is crucial.

There is a gender and age gap that is also important to note, as well as a synergy in the individuals who regularly use the Internet (Lamberti, Lopez-Sintas & Sukphan, 2023). In bridging the third level digital divide, the need for a versed use of other e-services intensifies, indicating a propensity to use the Internet, hence, to have a higher e-trust and possibly higher e-skills because of years of education and, as noted above, also significant, of regular Internet use, similar to the findings of De Marco (2021).

Strategies like digital training and awareness campaigns can bridge these divides and enhance e-government participation.

6. Conclusions

In today's digital age, the adoption of innovative technologies is essential for daily activities. The 2020 pandemic accelerated digitalization across all sectors, but the adaptation of users has lagged behind technological advancements (Stantcheva, 2022). Public administration has progressed, but the population has not kept pace (Erman, Rojko & Lesjak, 2022).

This study presents a probability model of e-government usage in Spain, utilizing a representative database of the Spanish population (INE, 2023). Like

findings by El-Bawab (2020) and Hargittai (2010), there is a generational gap in the use of innovative technologies. Education and resources are key to coping with new digital practices and utilizing recent technologies (Erman, Rojko & Lesjak, 2022).

The results indicate that e-government access, regardless of the activity level, is dominated by similar individuals. Training and e-skills development are fundamental for participating in e-services and benefiting from digitalization (Siddiquah & Salim, 2017). E-trust also plays a crucial role; safe Internet usage increases the propensity to use e-services and enhances their effectiveness. Quality Internet connectivity is vital for e-government participation.

A notable finding is that women are more susceptible to a digital achievement gap in e-government usage, deriving fewer tangible benefits compared to men (Stantcheva, 2022). The study reveals little relevance of income or gender in e-government use, but a lack of e-skills significantly affects access. Individuals lacking e-skills tend to be less educated, distrustful of technology, and more likely to be excluded from digitalization, making them a target group for support. In contrast, gaps due to a lack of e-trust are inconclusive.

A. Answers to Research Questions

1.- How do e-skills, e-trust, and Internet connectivity affect e-government adoption?

E-skills, e-trust, and internet connectivity are significant factors in the adoption of e-government services. Higher digital skills enable users to navigate and utilize online governmental platforms effectively. Trust in online services increases the likelihood of using e-government for activities such as filing tax returns or accessing personal information. Reliable and high-speed internet access is crucial for engaging with e-government services without facing technical barriers.

Noting this efficiency that stands out in the use of e-government, these characteristics are the key to moving from a usage level of e-government use, second level, to a utilisation level, digital divide, third level, gaining benefits from this relationship.

2.- Are sociodemographic characteristics of individuals still relevant in estimating e-government participation?

Yes, sociodemographic characteristics remain relevant in estimating e-government participation. There is a gender gap favouring men in more complex e-government activities. Both younger and older individuals are less likely to use e-government services compared to middle-aged individuals. Higher educational attainment is associated with increased e-government usage. Although the income gap is not as pronounced, lower-income individuals are generally less likely to have the necessary e-skills and e-trust.

3.- How can the definitions of the second and third levels of the digital divide in e-government be advanced to better reflect current realities?

The second level digital divide should include not only access to technology but also the quality of usage, considering how effectively individuals use e-government services and focusing on digital skills and trust in technology. The third level digital divide should emphasize the outcomes of e-government usage, measuring benefits such as time and cost savings, and improved access to public services. It should also consider broader impacts on social inclusion and empowerment.

In e-government, this translates into time savings, easier procedures and less administrative work.

4.- What policy recommendations can be made to bridge the digital divide and improve e-government adoption among vulnerable groups?

Implement comprehensive digital literacy programs to enhance e-skills among vulnerable groups.

To increase e-government usage, targeted support for the elderly and other vulnerable groups is essential. This includes face-to-face and telephone helpdesks and digital mentoring programs. Improving education and e-skills from an early age and offering courses on e-government platforms can prevent future fraud and enhance digital literacy.

Develop initiatives to build trust in e-

government services, including improving security and conducting awareness campaigns.

Awareness campaigns about e-government tools and services, using both traditional and digital media, are crucial. These recommendations aim to bridge the digital divide and ensure universal e-government usage.

Ensure accessibility of e-government services, including for individuals with disabilities.

Conduct targeted outreach and support programs for groups less likely to use e-government services.

Invest in improving internet infrastructure in underserved areas to ensure reliable high-speed internet access.

B. Limitations and Future Research

This study limitations include its reliance on cross-sectional household surveys, preventing longitudinal analysis. Regional differences and the influence of rural environments or job types were not explored. Comparing these findings with data from other EU countries could provide a broader perspective.

Future research could investigate non-users of e-government services to identify vulnerable groups. Additionally, studying the administration's perspective on e-government could reveal areas for efficiency improvements. Addressing these limitations and incorporating a European comparison could offer novel insights into e-government usage.

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ANNEXES

Table A1. Not use of e-Government

Variable	Not use Digital Divide (e-Gov) Odd-Ratio (std. error)	Not use e-Trust (e-Gov) Odd-Ratio (std. error)
Gender	1.141 (.217)	1.280 (.248)
Age	.993 (.037)	1.039 (.038)
Age ²	1.000 (.000)	.999 (.000)
Income	.999* (.000)	.999** (.000)
Years of Education	.935*** (.024)	.972 (.026)
Broadband	.868 (.217)	.519*** (.125)
e-Trust	.442*** (.087)	.517*** (.107)
Use of ICT (medium)	.395*** (.082)	.915 (.205)
e-Commerce	1.042 (.244)	.964 (.242)
e-Bank	.769 (.165)	.975 (.221)
Constant	2.129 (2.187)	.733 (.729)
n	639	639
Pseudo R ²	0.198	0.057
AUCR	0.793	0.661

* Significant at 10%, ** significant at 5% and *** significant at 1%.

Table A2. Not use of e-ID

Variable	Not use Digital Divide (e- ID) Odd-Ratio (std. error)	Not use e-trust (e-ID) Odd-Ratio (std. error)
Gender	.842** (.060)	1.019 (.083)
Age	.957*** (.009)	1.050*** (.013)
Age ²	1.000*** (.000)	.999*** (.000)
Income	.999** (.000)	.999 (.000)
Years of Education	.876*** (.008)	1.001 (.011)
Broadband	.819** (.067)	1.170 (.124)
e-Trust	.770*** (.059)	.775*** (.067)
Use of ICT (medium)	.879 (.076)	1.022 (.097)
e-Commerce	.780*** (.069)	.952 (.096)
e-Bank	.781*** (.061)	1.104 (1.104)
Constant	5.024*** (1.409)	.044*** (.015)
N	5884	5884
Pseudo R ²	0.092	0.007
AUCR	0.715	0.562

* Significant at 10%, ** significant at 5% and *** significant at 1%.