

Improving Digital Inclusion in E-government Services in the European Union: a systematic literature review

Abstract

The aim of this article is to conduct a mixed-methods systematic review to identify and synthesize quantitative and qualitative findings on the factors that influence digital inclusion in the use of digital public services. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed. The sample included 76 articles. The key finding is that most enabling factors and barriers identified were socio-demographic, with age, education, digital skills, and income being the most common factors. Additionally, most recommendations for improving digital inclusion focused on educating citizens, either through information campaigns or training programs. However, there is a lack of studies analyzing initiatives to improve citizens' digital skills for using e-government services. More qualitative studies are needed for an in-depth understanding of this issue.

Keywords

Digital competence; Digital skills; Digital inclusion; E-government; Systematic Review; PRISMA; Digital public services.

1. Introduction

E-government refers to the use of information and communication technologies (ICT) for the provision of government information and services, and for promoting transparency, accountability, and citizen participation (Saylam and Yildiz, 2022). Since the late 1990s, numerous European governments have invested in the development of electronic services and digital inclusion policies (Botric and Bozic, 2021), as governments should ensure that all citizens can access and use these services (United Nations, 2020). In fact, one of the six priorities of the European Commission for 2019-2024 was the digital upskilling of EU citizens for digital transformation (European Commission et al., 2022). Digital skills are considered "a top priority of the European Policy Agenda," as highlighted in DigComp 2.2. Four key strategies and policies are identified as relevant for digital competences in DigComp 2.2: the European Skills Agenda, the Digital Education Action Plan, the Digital Compass, and the European Pillar of Social Rights Action Plan (European Commission et al., 2022).

However, these initiatives have not necessarily led to greater acceptance of these services (Ebbers et al., 2016), despite the fact that Member States' digital strategies prioritize e-inclusion and socially disadvantaged groups (Al-Muwil et al., 2019). It is important to note that these strategies address not only digital competences but also social inclusion. Thus, having the necessary digital skills enables citizens to benefit from the digital society and, consequently, avoid exclusion from it (European Commission, 2015).

E-government research in the 1990s was largely descriptive and practice-oriented until the mid-2000s, when empirical investigations began to emerge (Wirtz and Daiser, 2018). While in developed countries the main challenge is unequal access to the internet (Dodel and Aguirre, 2018), in Western societies and European countries, access to technology has reached very high

levels (Botric and Bozic, 2021). Studies published in the 2000s were heavily technology-focused (Madsen et al., 2014). Technology adoption models like UTAUT (Unified Theory of Acceptance and Use of Technology) and TAM (Technology Acceptance Model) have been applied to e-government (Rodríguez-Hevía et al., 2020). Another major focus of research has been the analysis of social and socio-demographic determinants of e-government use (e.g., Belanger and Carter, 2009; Taipale, 2013). Along these lines, some studies specifically relate the level of digital skills to the use of e-government services (van Deursen and van Dijk, 2010; Ebbers et al., 2016).

Various studies on the internet have shown that the digitization of society either leads to or reinforces mechanisms of social inequality (e.g., Ragnedda et al., 2022), which is why e-government research has also focused on digital inclusion policies (Robles et al., 2021). Additionally, other authors have assessed the impact of e-government policies (e.g., Dobrolyubova, 2021). Furthermore, it seems that there are different patterns of adoption and use across countries and regions (Yera et al., 2020), often shaped by cultural and socio-economic differences (Inkinen et al., 2018). One recurring idea in the literature is that both the concepts of the digital divide and e-inclusion are multidimensional (Camilleri, 2019). Therefore, it is important to recognize that there are success factors and barriers in e-government adoption (Jacob et al., 2019). In this regard, a large body of studies has been analysing factors that influence the relationship between citizens and e-government use (see Table 1).

Table 1. Summary of literature about e-government use and digital inclusion

Main Topics	Main Findings	Authors
E-government research	E-government research has evolved from being descriptive and technology-focused to becoming more user-centric and focused on user experience	Madsen et al. (2014) Wirtz and Daiser (2018)
Digital divide in the use of digital public services	Social exclusion influences use of digital public services. Digital inclusion is essential for e-government success	Belanger and Carter (2009) Helbig et al. (2009)
Factors affecting the use of digital public services	Trust, privacy concerns, usability, social influence, satisfaction. Social and demographic factors such as age, income, educational level	Taipale (2013) Scheerder et al. (2017) Camilleri (2019) Ejdys et al. (2019) Frohlich et al. (2020)
Digital skills and use of digital public services	Digital skills are essential components in the impact of the digital divide on e-government.	Ebbers et al. (2016) Taejun et al. (2020) Zhao et al. (2014)
Digital divide and inequality	The digital divide is multidimensional. Digital inequalities deepen the disadvantage of the most vulnerable groups	Taewoon and Sigit (2011) Ragnedda et al. (2022) Beunoyer et al. (2020)

Digital inclusion policies	Digital inclusion and digital skills policies are essential to bridge the digital divide and ensure that all citizens can benefit from e-government services.	Alruwaie et al. (2020) Van Deursen and Helsper (2015) Robles et al. (2021) Rodríguez-Hevía et al. (2022)
E-Government development indicators	There is a need for better indicators to measure the impact and public value of e-government policies.	Dobrolyubova (2021) Ma and Zheng (2017) Lněnička and Máchová (2022)

This systematic review focuses on the barriers and facilitating conditions for using e-government services, as well as proposals and suggestions from the literature to improve citizens' interaction with e-government. Therefore, this study concentrates on the service delivery aspect of e-government (Mergel et al., 2019). Given that social and digital inclusion are intertwined (Helsper and Galacz, 2009), we also focus on services that are more relevant from the perspective of the welfare state, as those at greater risk of social exclusion—who have a higher need to use these services—are less likely to engage with public digital services. Although in many cases citizens are obligated to use these services, this gap can manifest in various ways: from receiving more or better information from the government, to applying for benefits or subsidies, or in terms of the personal autonomy of certain citizens when interacting with the government online, requiring others to complete processes on their behalf. Another aspect of inequality within this gap can be seen in participation in civic or political affairs.

This systematic review also employs the PRISMA methodology, which we consider relatively new in the context of social sciences. Additionally, a gap in the literature has been identified, as little research has been conducted at the European Union (EU) level (Rodríguez et al., 2020; Yera et al., 2020), and no mixed-methods systematic reviews on factors influencing citizens' engagement with e-government services have been found. This review aims to identify both quantitative and qualitative evidence on this area of interest within the same systematic review. No existing systematic reviews have been found regarding the conditioning factors and public policies related to acquiring digital competence for interacting with e-government services. Though various aspects of e-government and the digital divide have been widely studied, research on the factors influencing citizens' engagement with digital public services remains relevant. It is also worth noting the lack of studies focusing on digital competences, which represents one of the key contributions of this study.

In the digital frameworks and initiatives concerning the digital transformation of Member States, improving citizens' digital skills is recognized as one of the key strategies. Furthermore, enhancing digital services is frequently cited as a primary objective. However, it is not as common to see digital skills highlighted as essential for the uptake of public services, despite their importance being consistently emphasized in the literature (Rodríguez-Hevía et al., 2022). Our findings reveal that both digital skills and the provision of digital public services are strategic pillars in every Member State's digital strategy. Nevertheless, there is a clear risk of digital exclusion among the population. According to the United Nations (2022), "the new face of inequality is digital." The European Commission is aware that low levels of digital skills may deepen the digital divide as more services are offered exclusively online (European Commission, 2022). Therefore, it is worth questioning whether these digital strategies could be improved to enhance citizens' engagement with e-government, and how digital competences influence this interaction.

2. Research methodology

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement, along with its associated 27-item checklist and a protocol based on PRISMA-P 2015 (Moher et al., 2015), was applied to conduct this systematic review. The PRISMA method, initially introduced by a group of experts in 2009 to establish minimum criteria for high-quality systematic reviews, has been updated in 2015 and 2021. The PRISMA 2020 statement is now widely used across scientific disciplines to enhance the transparency, clarity, and traceability of the review process. Although PRISMA originated in the field of medicine, it has successfully expanded to other research areas due to its universal applicability. Today, PRISMA is one of the most commonly used methods for conducting systematic reviews across all scientific domains, including the social sciences, and is frequently referenced in a wide range of journals and conferences (Page et al., 2021).

2.1 Objective and research questions

The objective of this mixed-methods systematic review is to identify and synthesize quantitative and qualitative findings of conditional factors of digital inclusion with a multidimensional perspective and the policies taken by governments to improve the interactions between citizens and online public services.

We addressed the following research questions:

- (1) What barriers obstruct citizens' interaction with educational, social, and healthcare e-government services? (RQ1)
- (2) What sociodemographic groups are at risk of digital vulnerability related to e-government use? (RQ2)
- (3) What enabling factors are associated when citizens interact with educational, social, and healthcare e-government services? (RQ3)
- (4) What measures have been considered by e-government policies regarding the digital competences of the citizens? (RQ4)

2.2. Eligibility criteria and selection process

Research in the social sciences frequently investigates associations between various conditions and factors (exposures) and their effects (outcomes) within specific populations. The application of a PECO framework (Population, Exposure, Comparator, Outcomes) in a systematic review—although commonly associated with clinical studies and health sciences—is considered an appropriate and effective tool for studies that require a clear delineation of populations and selection criteria for identifying and analysing exposure–outcome relationships in social contexts, as well as for enabling relevant comparisons of outcomes. The PECO framework facilitates the precise definition of the review's scope, the formulation of focused, clear, and answerable research questions, and the determination of unambiguous eligibility criteria. It also contributes to bias reduction by ensuring consistency in the inclusion and exclusion of studies. Its application is especially relevant when the formulation of PECO components takes into account the specific context and the existing knowledge regarding the effects of an exposure on an outcome at a given point in time (Methley et al., 2014). Given the reliance on the research and decision-making context, it is necessary to clarify these aspects when developing a PECO (Morgan et al., 2018).

In summary, the methodological innovation introduced of applying the PECO framework to social science research has the potential to improve the quality of systematic reviews in this field by enhancing the precision, transparency, and replicability of literature selection and analysis. The Campbell Collaboration (2021), an international research network in social sciences established in 2000 to promote evidence-based decisions and policy, also recommends the use of the PICOS framework (Population, Interventions, Comparison, Outcomes, Study Designs) in its guidelines for conducting systematic reviews, originally developed in 2014 and updated in December 2020. This framework is designed to support evidence synthesis on the effectiveness of social programmes, policies, and practices for use in decision-making processes in the areas of crime and justice, education, international development, and social welfare. By extending the use of PECO beyond its conventional domains, this paper could contribute to advancing methodological standards in evidence synthesis within information science, and to strengthening overall methodological rigour.

The selected PECO is shown below in Table 2.

Table 2. PECO framework

Participants	People over 16 years old
Exposure	Any risk factors or barriers for digital exclusion to be identified
Comparator	Any enabling factors to be identified
Outcomes	<ul style="list-style-type: none"> • Risk factors or barriers which cause digital exclusion • Enabling factors which cause digital inclusion • Public measures or proposals to promote digital inclusion

As part of the systematic review methodology, the initial queries for identifying the literature corpus across selected bibliographic databases were developed using a structured and replicable search strategy. This strategy was informed by key descriptors derived from the DigComp framework (European Commission et al., 2022) and by terminology extracted from the relevant specialised literature (see Table 1). Keywords related to e-government, digital divide, e-health, education, and social services were systematically combined using Boolean operators to enable comprehensive and targeted retrieval of relevant publications (see Appendix A).

The selected databases included Web of Science, Scopus, Educational Resources Information Center (ERIC), ProQuest, MEDLINE, PubMed, SocINDEX, and Cairn.info, chosen for their comprehensive and multidisciplinary coverage of the domains under review. The search strings were carefully adapted to the indexing protocols and search functionalities of each database, ensuring that terms were applied consistently in the title, abstract, and keyword fields. The formulation of queries followed an iterative refinement process. Initial broad searches were conducted to capture an extensive range of potentially relevant studies. These were subsequently refined through multiple iterations in order to narrow the literature corpus and increase the specificity and precision of the retrieved results. The refinement process also

involved disaggregating queries by service domain —education, health, and social services— to ensure comprehensive thematic coverage in line with the study’s objectives. Appendix B presents an example of a Scopus search query and the corresponding number of retrieved documents for each iteration.

The iterative nature of the query development reflects a robust and flexible search strategy, which is essential for achieving both breadth and rigour in systematic evidence synthesis. The review focused on studies with an empirical foundation, including case studies, surveys, questionnaires, interviews, direct observation, and focus groups. Mixed methods studies were also considered eligible, provided that the qualitative and quantitative data could be clearly extracted and analysed separately. Due to our PECO framework, it will be less likely to find randomized controlled trials (RCTs), case-control studies, quasi-experimental studies and cross-sectional studies. However, if we find them, they will be included in the review. Research that is focused on both the general population and significant sociodemographic groups will be included.

The time period of systematic reviews should be carried out with reference to a significant milestone for the studied phenomenon and not based on convenience. Research about government services shifted from a technology focus to a user-centricity focus a decade ago (Barcevičius et al., 2019). Since we are more interested about research that took a very citizen centric approach, we chose only studies published from 2010 onwards. The search date was March 2024. We selected only studies focused on the European Union, as we wanted to focus on a coherent territorial unit. Hence, we included the United Kingdom, since it was a member state of the European Union until January 2020. Also, we disregarded the first level of the digital divide on this systematic review.

In summary, the inclusion criteria for the systematic review comprised articles published in peer-reviewed journals between 2010 and March 2024, aligned with a predefined PECO framework (see Table 2), focused on studies conducted within the European Union and the United Kingdom, and written in English, French, German, Spanish, Italian, or Portuguese. The exclusion criteria were studies exclusively addressing the first level of the digital divide.

1.983 records in databases searching were founded during the search process. After duplicates removal, 932 records were screened from title and abstract, from which 83 full-text documents were retrieved. Finally, 76 papers were included during the selection process (see Figure 1). We assessed the methodological quality of the selected studies by using the Mixed Methods Appraisal Tool (MMAT).

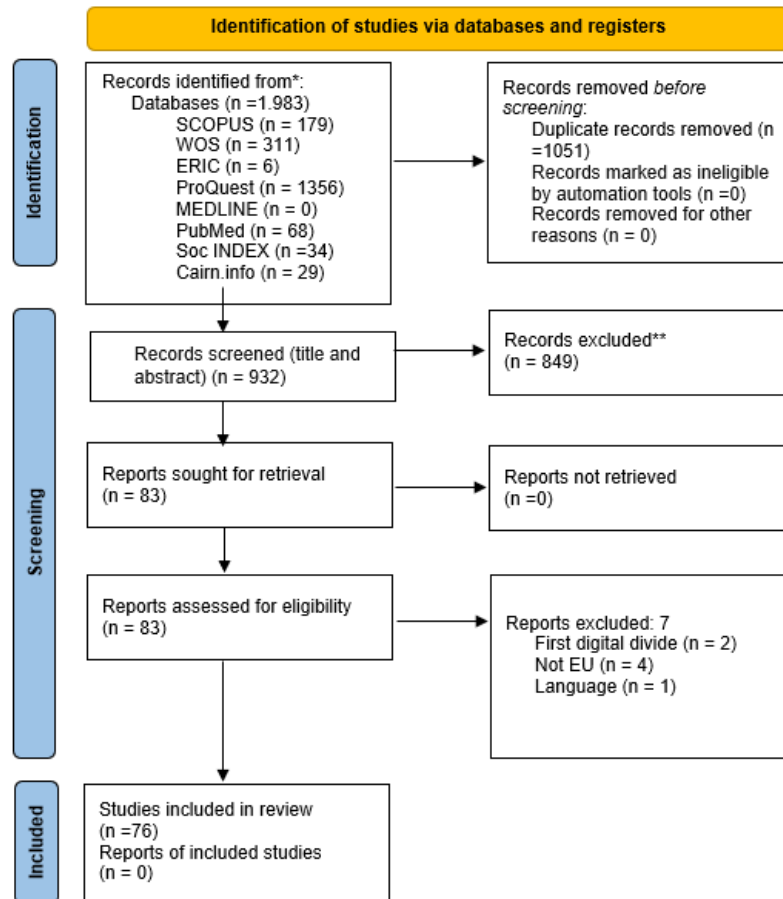


Figure 1. PRISMA Flowchart

3. Results

The highest annual publication figures for the selected articles are concentrated in a six-year period (2016–2021), with a total of 53 articles, representing 70% of the entire sample. Two peaks are observed in 2020 (15 items) and 2021 (11 items). A sharp decline is noted in 2022 and 2023, with only six articles published, and one additional article in 2024. However, it should be noted that the search was conducted in March of that last year (see Figure 2).

Serrano, Munoz & Brusca (2018)	✓			✓			✓	✓
Al-Muwil et al. (2019)		✓	✓		✓	✓	✓	
Andersen, Nielsen & Kim (2019)	✓			✓				
Barrera, Rey & Medina (2019)	✓			✓	✓		✓	
Camilleri (2019)					✓	✓	✓	
Ejdys et al. (2019)		✓				✓	✓	
Tamppuu & Masso (2019)								
Androniceanu, Kinnunen & Georgescu (2020)								
Ardielli (2020)								
De Filippi, Coscia & Cocina (2020)	✓						✓	
Martzoukou et al. (2020)					✓			
Mulet (2020)								
Pariso & Marino (2020)								✓
Pérez-Morote, Pontones-Rosa & Nuñez-Chicharro (2020)				✓	✓	✓	✓	✓
Rodríguez-Hevíá, Navío & Ruiz (2020)							✓	✓
Ruiz, González & Lucendo (2020)								
Yera et al. (2020)				✓	✓			
Boksova et al. (2021)	✓	✓		✓	✓		✓	
Botric & Bozic (2021)	✓	✓		✓			✓	
De Marco (2021)						✓	✓	
Pérez-Amaral et al. (2021)	✓	✓		✓	✓		✓	✓
Pethig, Kroenung & Noeltner, (2021)		✓						
Ragnedda, Ruii & Addeo (2021)	✓					✓	✓	
Rodríguez Müller et al. (2021)						✓	✓	✓
Robles, Torres-Alvero & Villarino (2021)						✓		✓
Cernadas et al. (2022)	✓			✓			✓	
Horobet et al (2022)						✓		✓
Mesa (2023)	✓					✓	✓	
Patergiannaki & Pollalis (2024)	✓			✓			✓	
Qualitative studies								
Didraga & Brandas (2015)							✓	✓
Mesa & Martínez-Monje (2015)								
Madsen & Kræmmergaard (2016)		✓	✓			✓		
Taylor & Packham (2016)								
Abad et al. (2017)		✓	✓		✓	✓	✓	✓
Laenens, Van den Broeck & Mariën (2018)	✓	✓	✓		✓	✓	✓	
Bugdol & Pokrzywa (2020)								
Shkarlet et al. (2020)								✓
Klich (2021)								✓
Allamann & Radu (2022)			✓				✓	
Mixed methods studies								
Aleixo, Nunes & Isaias (2012)							✓	
Choudrie, Ghinea & Songonuga (2013)	✓	✓	✓	✓	✓		✓	
Stefanou & Skouras (2015)								
Siren & Knudsen (2017)	✓	✓	✓	✓			✓	✓
Hepburn (2018)								
Kalenda & Kowaliková (2020)	✓	✓		✓	✓		✓	✓
Christie et al. (2021)	✓	✓						
Review studies								
Wright & Wadhwa (2010)								
Stroud (2012)								
Ariton-Gelan (2015)								
Mihai et al. (2016)								
Viñarás et al. (2017)		✓						
Arsenijevic, Tummers & Bosma (2020)								
Esteban-Navarro et al. (2020)								
Adamczyk & Betlej (2021)								
Olesen, Wold & Chong (2021)					✓	✓		
Kumari, Singh, Vermaa & Fetais (2022)				✓	✓	✓		✓

SD: sociodemographic factors; T: technologic factors; P: personal factors; O: operational proposals; S: strategic proposals

In short, the most represented approach was the quantitative (n=49), followed by the qualitative (n=10), the review (n=10) and the mixed-methods approach (n=7). The articles in our sample used a wide variety of research methods, though the most prevalent were the survey and the interview (see Table 4).

Table 4. Research methods and techniques used in the articles

Study design and method	Number of studies
Quantitative	49
Survey as secondary data	29
Self-made survey	18
RCT	1
Bibliometric analysis	1
Qualitative	10
Content analysis	1
Focus group	2
Interview	2
Focus group and interview	2
Observation	1
Comparative analysis	2
Review	10
Literature review	8
Systematic review and meta-analysis	1
Scoping review	1
Mixed-methods	7
Quantitative and qualitative analysis of websites	1
Survey, interview and focus group	2
Survey and interview	3
Survey and Delphi	1

Thirty-one articles (4 qualitative, 4 mixed-methods, 1 review, and 22 quantitative studies) identified risk factors in the interaction between citizens and e-government services. Forty-three studies (3 qualitative, 3 mixed-methods, 2 systematic reviews, and 35 quantitative) identified enabling factors that improve citizens' use of e-government services. Forty-eight articles (7 qualitative studies, 4 mixed-methods studies, 1 review, and 36 quantitative studies) proposed ways to enhance e-government services and increase citizen adoption.

4. Discussion

The findings of this systematic review identify several specific, actionable factors significantly impacting digital inclusion related to the adoption and use of e-government services, particularly in the educational, social, and healthcare domains, which make it possible to address the four research questions outlined above.

4.1 Barriers and groups at risk

Among the most frequently identified risk factors or set of barriers that hinder citizen interaction with e-government services (RQ1), are low levels of education, advanced age, limited digital skills, and low income. Age continues to be a critical determinant of digital exclusion, as older individuals often prefer face-to-face interactions and exhibit higher levels of concern regarding data security (Viñarás et al., 2017). They also encounter usability challenges with digital

platforms (Choudrie et al., 2013), including fears associated with the intangibility of digital documents and distrust in online systems (Abad et al., 2017), particularly in relation to the protection of personal data (Viñarás et al., 2017). A general disinterest in using ICT and e-government tools has also been reported among older adults (Siren and Knudsen, 2017). Mixed-methods studies corroborate these findings, repeatedly identifying old age as a primary barrier to digital public service adoption (Siren and Knudsen, 2017), alongside low educational and economic status (Kalenda and Kowaliková, 2020), and limited language proficiency, often associated with lower educational attainment (Choudrie et al., 2013).

Education level is also a decisive factor; individuals with no, primary, or secondary education face notable disadvantages (Garín et al., 2017; Mesa, 2023). Educational background plays a key role in user exclusion (Laenens et al., 2018), and qualitative data provide unique insights into perceptions of e-government tools, including gendered views on task distribution—for example, filing taxes being perceived as a "man's task." However, gender was not a significant determinant in the majority of the studies, and our sample yielded inconclusive results as well.

Additionally, a recurrent barrier reported across studies include low digital competence. Limited internet or digital skills (Boksova et al., 2021; Pérez-Amaral et al., 2021) emerge as significant obstacles. Qualitative studies in particular underscore how low digital skills hinder users' ability to interact effectively with e-government platforms (Madsen and Kræmmergaard, 2016; Allmann and Radu, 2022). In these studies, old age, technophobia, loss of physical contact with public service personnel, and concern over data privacy (Abad et al., 2017) frequently appear as relevant barriers, resulting from limited digital literacy.

Employment-related vulnerabilities are also reported, with certain statuses—such as retired, self-employed, unemployed, homeless, or homemaker—linked to reduced engagement with e-government services (e.g., Andersen et al., 2019; Barrera et al., 2019; Botric and Bozic, 2021; Da Silva et al., 2022). While employment is generally associated with lower levels of digital exclusion, contradictory findings emerge in the European context. In countries with comprehensive welfare systems, unemployed individuals and residents of low-income areas may exhibit higher levels of e-government use than employed persons, due to the strong link between e-services and social benefit claims (Taipale, 2013). These findings suggest that e-government use is shaped by a complex interplay of sociodemographic and contextual factors, highlighting the need for further research that accounts for national policy frameworks and cultural variables.

Furthermore, barriers identified across the reviewed literature include low internet usage (Boksova et al., 2021), lack of motivation (Berger et al., 2016), youth (Gerpott and Ahmadi, 2016), migrant status (Berger et al., 2016), language difficulties, and data security concerns (Ejdys et al., 2019). Also platform usability issues, poor service design, and lack of user motivation are cited as significant deterrents (Siren and Knudsen, 2017). Only qualitative studies highlight other certain nuanced risk factors, such as lacking a prior digital presence (e.g., no email account), or holding negative views of digital public services (Abad et al., 2017; Laenens et al., 2018; Allmann and Radu, 2022). It is noteworthy that some factors were exclusively reported in qualitative studies, suggesting the added value of diverse methodological approaches in capturing less tangible forms of digital vulnerability.

In terms of population segments at higher risk of digital vulnerability (RQ2), the review identifies older adults with low educational attainment (typically primary or secondary), limited digital proficiency, and low socioeconomic status as particularly vulnerable. Quantitative studies reinforce the central role of age, consistently identifying older individuals as most at

risk of digital exclusion (Andersen et al., 2019; Berger et al., 2016). Specific social groups such as retirees and individuals outside the labour force are disproportionately affected, especially in welfare-state contexts where e-government services are often essential for accessing social and health benefits. Language barriers and institutional distrust further compound these vulnerabilities, contributing to fears about technology and disinterest in digital public services.

In sum, the evidence reviewed in response to RQ1 and RQ2 points to a multifaceted landscape of digital barriers, strongly mediated by age, education, socioeconomic status, and subjective attitudes towards technology. These findings underscore the need for differentiated public policies and service designs that account for the heterogeneous profiles of digitally vulnerable citizens.

4.2 Enabling factors

The results of this systematic review identify a diverse range of enabling factors (RQ3) that facilitate citizens' interaction with e-government services in the areas of education, social welfare, and healthcare. These determinants vary across methodological approaches, yet several consistent themes emerge.

In the qualitative studies, the most frequently reported enabling factors include perceived ease of use, user satisfaction, high levels of digital skills, trust in e-government, motivation to use digital services, intensive use of digital media, and awareness of the benefits associated with online public services. Additionally, multi-channel access (Abad et al., 2017), service quality (Laenens et al., 2018), and a positive perception of public authorities (Madsen and Kræmmergaard, 2016) were commonly mentioned. These elements are often interrelated, with trust, usability, and service quality reinforcing citizens' willingness and capacity to engage with digital government platforms.

The mixed-methods studies emphasize similar patterns, identifying high educational attainment, youth, and employment as enabling factors (Choudrie et al., 2013; Siren and Knudsen, 2017). Some studies also link high digital skills, high household income, and residence in affluent areas to greater use of e-government services (Kalenda and Kowaliková, 2020). Although these factors reflect structural advantages, personal preferences—such as favoring personal contact—were also recognized in these studies as important to consider (e.g., Siren and Knudsen, 2017), highlighting the complexity of citizen engagement beyond technical readiness.

In the quantitative studies, enabling factors were clearly dominated by education, particularly at the university level, cited in 21 articles (e.g., Barrera et al., 2019; Zheng and Schachter, 2017). High digital skills were also consistently found to be critical determinants (Pérez-Amaral et al., 2021; Stoiciu and Popa, 2012), alongside youth (Botric and Bozic, 2021), and high income (Andersen et al., 2019; Serrano et al., 2018). Other significant variables included the number of digital devices in the household (De Marco, 2021) and prior experience with digital public services (Mesa, 2023). Additionally, several attitudinal and perceptual factors—such as trust in e-government (Robles et al., 2021), perceived usefulness (Camilleri, 2019), awareness and attractiveness of services (Patergiannaki and Pollalis, 2024), perceived ease of use (Zafiropoulos et al., 2012), and social influences (Weerakkody et al., 2012)—emerged as relevant predictors of service adoption.

In summary, the most frequently cited enabling factors are: high education level, high digital competence, youth, and high household income. These factors are often interdependent: individuals with university education tend to have higher digital skills, greater awareness of the benefits of e-services, and greater ability to interpret complex or legalistic language often present in public administration platforms. Moreover, students and employed individuals—typically younger or middle-aged—tend to have more frequent access to the Internet and digital media, enhancing their familiarity and comfort with online platforms.

However, the findings also challenge certain assumptions. Despite being considered “digital natives,” young people also face notable difficulties when navigating e-government systems due to complex language and administrative procedures (Botric and Bozic, 2021). This undermines the commonly held belief that youth automatically translates into digital competency in public sector interactions. A key insight from the review is that, beyond general digital literacy, citizens must also understand the specific logic, terminology, and procedural demands of administrative systems. Consequently, effective strategies must go beyond generic digital training to include plain language initiatives and administrative-specific education, thereby reducing the cognitive load imposed by bureaucratic complexity.

4.3 Proposals

The most frequently suggested proposals (RQ4) in both qualitative and quantitative studies included making digital platforms more user-friendly and accessible, focusing on the specific needs of citizens according to diverse sociodemographic profiles, implementing digital competences and IT training programs, and creating information campaigns to promote e-government benefits.

Firstly, a substantial body of academic literature identifies the clarity and simplicity of information on e-government platforms as key determinants for successful user interaction. A simple and intuitive interface can help users perceive the services as easy to navigate. Specifically, clear guidelines, simplified processes, and comprehensible language significantly facilitate user engagement, particularly among older adults and socioeconomically disadvantaged populations (Camilleri, 2019; Rodríguez-Hevía et al., 2020; Frohlich et al., 2020). Abad et al. (2017) suggested several measures to make digital services more user-friendly, such as limiting the number of sections, using a large legible font, and employing contrasting colours.

User-friendly platforms refer to those whose design simplifies user interaction through clear interfaces and instructions, intuitive navigation, streamlined processes, easily identifiable actions and understandable language adapted to the average user's skill level. The simplification of administrative procedures and the ability to complete complex tasks with a minimal number of clicks directly embody the essence of user-friendliness. Even a technically user-friendly interface can become unusable if the language and content are incomprehensible. Accessible platforms, on the other hand, are those that comply with specific standards such as the European Web Accessibility Directive WCAG 2.1 (W3C, 2025), ensuring equitable access to digital public services for all individuals, including those with disabilities or cognitive impairments. These aspects directly align with the European DigComp framework, particularly competencies related to technical problem-solving and civic participation through digital technologies (European Commission, 2022).

It is important to consider user experiences (e.g., Decman, 2018; Zheng and Schachter, 2017) and needs (Zafiroopoulos et al., 2012) to develop user-friendly (e.g., Barrera et al., 2019;

Rodríguez Müller et al., 2021) and accessible platforms (Stoiciu and Popa, 2012). The quantitative studies emphasized the importance of improving the quality of these platforms (Stoiciu and Popa, 2012; Zafiropoulos et al., 2012) and ensuring that quality is measured appropriately (Szopiński and Staniewski, 2017). Moreover, a multi-channel strategy is recommended (e.g., Al-Muwil et al., 2019; De Filippi et al., 2020). To enhance user-friendliness, design adjustments and the use of more colloquial language are necessary (Da Silva et al., 2022). The suggestion for age-friendly digital services that enhance platform usability was highlighted (Siren and Knudsen, 2017). Therefore, all stakeholders should be involved in designing online services to make them more citizen-centric (Cernadas et al., 2023). Furthermore, providing multiple channels of support and technical assistance to less digitally skilled citizens were also popular proposals (Barrera et al., 2019). Providing multiple channels of support and technical assistance to less digitally skilled citizens has been widely recommended in the literature (Siren and Knudsen, 2017; Barrera et al., 2019; Chipeva et al., 2018; De Marco, 2021), including through live chat options with service employees (Camilleri, 2019). A multi-channel access or preference for face-to-face contact, especially for users who experience significant barriers due to age, socioeconomic status, or educational level, is other innovative proposal (Pérez-Morote et al., 2020)

Studies utilizing technology acceptance models (UTAUT and TAM) demonstrate that perceived ease of use and usability are consistently associated with increased user satisfaction and continued usage of digital government services (Rodríguez-Hevíá et al., 2020; Pérez-Morote et al., 2020; Olesen et al., 2021). As perceived ease of use is closely related to user satisfaction, citizens are more likely to feel comfortable interacting with public services when the factors outlined above are properly optimized. Furthermore, providing incentives to encourage the use of e-services, such as discounts on paid services, has been proposed (Choudrie et al., 2013).

Secondly, there is broad consensus in the literature on the importance of ensuring that all citizens have the opportunity to access government services. This is specifically reflected in certain studies through proposals developed from a citizen-centric perspective that focus on citizens' needs (Siren & Knudsen, 2017) and recommend targeted solutions for vulnerable groups (e.g., Pérez et al., 2020). Identifying these vulnerable groups through a sociodemographic perspective was also advised (e.g., Garín et al., 2017). The quality of information provided according to real citizens' needs was highlighted as an enabling factor influencing citizen satisfaction (e.g., Laenens et al., 2018). In particular, simplifying administrative processes can make them more accessible to digitally vulnerable citizens (e.g., Abad et al., 2017).

While survey-based studies are common in e-government research, some quantitative studies acknowledge their limitations in capturing motivational and socio-cultural factors that predict e-government use (e.g., Al-Muwil et al., 2019). For instance, factors such as fear of technology or a negative perception of e-government channels were more frequently mentioned in qualitative data. Language barriers were noted in quantitative studies (Berger et al., 2016; Choudrie et al., 2013) but were primarily linked to poor language proficiency. Qualitative data revealed that difficulties understanding the legal terminology used by public authorities (Madsen and Kræmmergaard, 2016) and the complexity of bureaucratic language were significant issues for older individuals (Abad et al., 2017). Thus, it is evident that both digital skills and a certain level of "administrative literacy" (Madsen and Kræmmergaard, 2016) are necessary for effective e-government interaction.

Thirdly, while numerous proposals have been made to enhance citizen access to e-government services, only a limited number of studies focus on concrete measures and actions to improve citizens' digital skills in their interactions with these services. As highlighted by van Deursen and van Dijk (2010), and reinforced by subsequent research (Taipale, 2013; Zhao et al., 2014; Ebbers et al., 2016), citizens' digital competences profoundly affect their ability to effectively interact with e-government platforms and, hence, directly influence how citizens perceive and appreciate digital services.

However, studies that propose offering ITC training programs are exceptional and only partially addressed in the academic literature (Stoiciu and Popa, 2012; Botric and Bozic, 2021; Abad et al., 2017). The formation should specifically address individuals with low digital skills or those living in areas with poor or no internet access (Horobet et al., 2023). Training programs aimed at the elderly should involve their grandchildren to achieve better results (Choudrie et al., 2013). Regarding children's education, Kalenda and Kowaliková (2020) proposed programs to support digital skills development and the establishment of a national methodology to prevent the digital exclusion of vulnerable children. Involving third-sector organizations is advocated based on their proven capability to bridge gaps between government initiatives and citizenry, fostering trust and mitigating socio-cultural barriers (Ragnedda et al., 2022; Beaunoyer et al., 2020). More recently, greater investment in public libraries and digital help centers, as well as the introduction of data literacy into the core school curriculum, were advocated (Allmann and Radu, 2022).

Nevertheless, scholars who have examined this issue consistently identify the absence of digital skills as a risk factor associated with various sociodemographic determinants. This gap notably impacts vulnerable groups, such as elderly populations, individuals with lower educational attainment, or economically disadvantaged groups, exacerbating existing inequalities (Beaunoyer et al., 2020; Ragnedda et al., 2022). This issue is pressing, as digital vulnerability will not disappear with generational change, given the inherent socioeconomic determinants in society. Therefore, EU public policies must aim to reduce and mitigate existing social inequalities. Moreover, EU countries looking to develop more user-centric policies should prioritize the digital skills of their populations. Understanding the needs of the population, particularly among the most vulnerable groups, is crucial before designing digital public services. Conducting studies on these groups can be challenging due to accessibility issues. IT training programs should be tailored to the specific needs of these communities to be effective.

By last, a fourth group of proposals consists of studies that emphasize the importance of information campaigns to promote e-government. A multi-channel approach, launching information campaigns, and investing in support for citizens who may need assistance were recommended (Laenens et al., 2018), articulating the functionality and practical benefits of using digital public services (Pérez et al., 2020; Boksova et al., 2021). A campaign aimed at raising awareness about ongoing reforms and their concrete benefits can enhance citizens' understanding of the functionalities and advantages of using these services (Mesa, 2023; Patergiannaki and Pollalis, 2024). E-government campaigns should specifically target older adults (Choudrie et al., 2013) and focus on elements that enhance trust among citizens (Siren and Knudsen, 2017).

Increasing citizens' awareness of these services could enhance their trust and perceptions of e-government, both identified as critical enabling factors (John and Blume, 2017). In connection with this, trust in government services and concerns about data privacy represent significant psychological barriers to engagement. Multiple studies underline trust as a key predictor of citizen willingness to adopt digital public services, suggesting that perceived security and

transparency greatly influence digital interactions (Ejdys et al., 2019; Pérez-Morote et al., 2020). Since distrust is a significant barrier, public policies should provide clear information about how citizens' personal data is managed. Additionally, internet users should be informed about their protections and how they can safeguard themselves (Robles et al., 2021). These insights indicate that enhancing cybersecurity measures, improving data transparency, and clearly communicating these improvements to citizens are essential steps towards overcoming user resistance.

In summary, a combination of digital skills training, user-centered design, and trust-building measures can create a positive reinforcing cycle of engagement with e-government services. In contrast, studies that examine digital policies and their relationship with governance indicators place greater emphasis on national and bureaucratic contexts, arguing that digital transformation should serve as a tool to enhance the effectiveness and efficiency of public administration (Dobrolyubova, 2021). In this regard, it is worth noting that two proposals that emerged solely from the qualitative data included leveraging the experiences of more developed European Union countries (Didraga and Brandas, 2015; Shkarlet et al., 2020) and simplifying administrative procedures (e.g., Klich, 2021; Pariso and Marino, 2020).

5. Conclusions and limitations

This article primarily targets scholars, educators, public administrators and policymakers concerned with digital inclusion within European frameworks. Although initially appearing as a general introductory study, its true purpose is to provide a robust foundation and concrete proposals identified in academic literature, derived from robust empirical research, to guide specific digital inclusion initiatives and improving e-government usage through evidence-based interventions. Recognizing the multidimensional nature of digital inclusion, the article synthesizes evidence across several critical domains, such as digital skill development, accessibility of platforms, and social and institutional trust. Likewise, this systematic review highlights the barriers and enabling factors that influence interactions between citizens and e-government.

The predominance of quantitative studies in the selected research significantly shapes the findings. Notably, there has been a recent increase in studies focusing on e-health. Education emerges as a critical factor, essential for bridging the digital divide in e-government. Improved education correlates with better engagement in public services, empowering citizens toward favourable outcomes.

To effectively address these issues, national strategies and digital policies must prioritize the digital competencies of vulnerable groups and develop targeted strategies and communication campaigns. Most identified enabling factors and barriers are socio-demographic, underscoring the need to incorporate these variables when defining vulnerable populations. A key limitation of this study is its focus on the first level of the digital divide and its reliance on peer-reviewed publications from 2010 to 2024. Additionally, this review does not extend to a meta-analysis.

For future research, gathering more qualitative data on factors influencing e-government use would be valuable, particularly in understanding the concept of administrative literacy. While it is acknowledged that a minimum level of digital skills is necessary for interacting with these services, there is a gap in studies focused on improving these essential skills for satisfactory usage. A challenge in relying solely on usage statistics is the inability to ascertain how many users independently engage with these digital public services, as many may delegate this task to friends or family. The presence of "faux users" poses a significant challenge for EU

policymakers in evaluating e-government service utilization. In-depth qualitative research is recommended to explore the causes of digital exclusion in e-government services. Moreover, the findings of this study may be influenced by the social, economic, cultural, and technological contexts of each country. Thus, a clear avenue for future research would be to analyze specific digital inclusion initiatives across EU countries related to digital skills and service usage.

Finally, it is important to highlight a methodological recommendation found in the literature. While quantitative studies —particularly surveys— are frequently used in e-government research, this approach may limit the understanding of the complex and diverse determinants involved in interactions between government and citizens. Interestingly, some enabling elements, only appeared in mixed-methods studies, suggesting that user preferences may not be fully captured through purely quantitative or qualitative approaches. To address this limitation, some authors recommend complementing survey-based research ethnographic studies that provide deeper insights into social contexts (Berger et al., 2016). This suggestion is particularly notable, given that most studies rely on quantitative data and tend to overlook the broader social context. This finding aligns with the critique that technology-centred models are insufficient for comprehensively evaluating e-government adoption, calling instead for greater attention to the relational dynamics between citizens and public institutions (Rana et al., 2017; Olesen et al., 2021).

Additionally, investigating whether e-government information campaigns are being implemented in European countries, how they are developed, and their impact on citizens would be beneficial. Further exploration is needed into the role of institutional communication in e-government and how effective communication strategies for digital public services could enhance adoption. By not recognizing at-risk groups, access to social benefits remains limited for certain citizens. Future research should also address a third approach to the digital divide, as e-government can confer economic and social advantages to users over non-users.

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8. Appendices

Appendix A. Key descriptors

1. "e-government" OR "electronic government" OR "digital government" OR "e-governance" OR "electronic governance"
2. "digital divide" OR "digital vulnerab*" OR "digital inequalit*" OR "digital exclusion" OR "digital inclusion"
3. 1 AND 2
4. "e-health*" OR "health*"
5. "welfare services" OR "social services" OR "care services" OR "protection services" OR "support services" OR "social assistance" OR "social care" OR "assistance services" OR "e-services"
6. "education"
7. 3 AND 4
8. 3 AND 5
9. 3 AND 6

Appendix B: Search in Scopus.

1. TITLE-ABS-KEY ("e-government" OR "electronic government" OR "digital government" OR "e-governance" OR "electronic governance"): 24,391 documents found.
2. TITLE-ABS-KEY ("digital divide" OR "digital vulnerab*" OR "digital inequalit*" OR "digital exclusion" OR "digital inclusion"): 16,724 documents found.
3. Search 1 AND Search 2: 843 documents found.
4. Search 3 and PUBYEAR > 2009 AND PUBYEAR < 2025: 569 documents found.
5. Search 4 and LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Spanish") OR LIMIT-TO (LANGUAGE , "Portuguese") OR LIMIT-TO (LANGUAGE , "French") OR LIMIT-TO (LANGUAGE , "Italian"): 560 documents found.
6. TITLE-ABS-KEY ("e-health*" OR "health*"): 8,420,350 documents found
7. TITLE-ABS-KEY ("welfare services" OR "social services" OR "care services" OR "protection services" OR "support services" OR "social assistance" OR "social care" OR "assistance services" OR "e-services"): 200,507 documents found
8. TITLE-ABS-KEY ("education"): 2,958,195 documents found.
9. Search 5 and Search 6: 40 documents found.
10. Search 5 and Search 7: 52 documents found.
11. Search 5 and Search 8: 95 documents found.
12. Search 9 or Search 10 or Search 11: 179 documents found.