Revista ARACÊ
ISSN: 2358-2472

ASPECTS OF SOFTWARE PRODUCT QUALITY IN THE USE OF E-GOV: AN ANALYSIS BASED ON THE PERSPECTIVES OF OLDER PEOPLE IN A CITY IN BRAZIL

https://doi.org/10.56238/arev7n3-023

Submitted on: 02/05/2025 **Publication date:** 03/05/2025

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ABSTRACT

In a context marked by the acceleration of aging, according to studies of demographic transition in the world and Brazil, in addition to the growing availability of e-Gov services, the objective of this study arose to identify, in the opinion of the elderly, the relative importance of the quality characteristics of the product as motivating factors for the use of e-Gov. The study followed a qualitative approach, based on in-depth interviews with elderly people in a location in Brazil. Among the results, the current relevance of the feeling of security as a key motivating factor for the elderly to use e-Gov services stands out.

Keywords: e-Gov. Elderly Person. Social inclusion. Digital Gap. Digital Citizenship.

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ISSN: 2358-2472

INTRODUCTION

Demographic Transition Studies provided a deeper understanding of aging in the world and Brazil (VASCONCELOS and GOMES, 2012; CAMARANO and MARINHO, 2014; COSTANZI and ANSILIERO, 2014; MARTINS, 2019). Variations between mortality and fertility rates have accelerated aging due to advances in medicine and hygiene. In addition, factors such as family planning and urbanization are noted in the contribution to the phenomenon (MORTE-NADAL and ESTEBAN-NAVARRO, 2022).

In Brazil, the following stand out: significant changes in the Brazilian population pyramid, influenced by migratory movements, the growing participation of women in the labor market and by public policies related to health and social security, influencing the economy, urban infrastructure, and public policies, and it is important not to consider the elderly as unproductive or inactive even though there is heterogeneity in people's capacities, regardless of age (FALEIROS, 2023). Internationally, for the UN, as in Brazil, elderly people are defined as those aged 60 years or older (BRAZIL, 2003; UNITED NATIONS, 2020), even though the Brazilian social security system adopts the international guidelines of developed countries aged 65 years for this definition. This research adopts the Brazilian legal framework of 60 years or older to define an elderly person.

On the other hand, COVID-19 has exacerbated the challenges faced by this audience, particularly those related to the digital world and the use of e-Gov services, causing a digital disparity and consequent exclusion, demanding attention to inclusive approaches, to facilitate their engagement in government services (SEIFERT, COTTON and XIE, 2021).

Although beneficial, the use of e-Gov presents risks of creating a digital divide, affecting the social inclusion of older people in the global information society. This phenomenon, known as the "digital divide" is an area of study that has been developing since the 2000s. It is important to understand the relationship between technology and social equity (KOSLOSKI; MOURA; GOMES, 2024). The authors highlight the multidisciplinary nature of the issue, establishing a framework of concepts and impact factors influencing the use of e-Gov by older people that contribute to the digital divide as (LAMPEÃO et al., 2023) deal with changes in government organizations. From its results, it is possible to observe factors of various classes.

Among them, this work addresses the technological related to the quality of the software product such as usability, portability, performance, reliability, and security. Such

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ISSN: 2358-2472

factors are well defined by the software product quality model presented by the SQUARE standard (ISO/IEC, 2010). In this scenario, e-Gov services are united by a common characteristic: they are solutions for government services implemented through software products (MEDINA; MARCISZACK; GROPPO, 2018) and, therefore, subject to the concepts of the software quality area (BOURQUE; FAIRLEY, 2014).

In this discussion, the work of Charlton (2004), was originally developed for people with disabilities (PWDs), but the concept of including the participation of the interest group was adopted in this study. The adoption aimed to promote more active participation of older people in the research by collecting their own opinions and perspectives on quality features of the software product in the use of e-Gov services. As the main objective, this study seeks to identify the relative importance attributed by the elderly themselves and related to the quality characteristics of the software product that motivate or demotivate them in the use of e-Gov services.

METHODOLOGY

The research question was based on the PCC strategy – Population (elderly people), Concept (quality characteristics), and Context (use of e-Gov) (SILVA, PRATES, MALTA, 2021). It was established as "What are the relative importance of software product quality features for older people when using e-government services?"

We opted for a qualitative approach, to deepen the knowledge of a social or human problem, an exploratory to investigate a problem without much previous knowledge and apply, it to expand theoretical knowledge that can later be used in areas such as software engineering and public policies (CRESWELL; CRESWELL, 2014; GIL, 2008).

The procedural approach was field research with data collected through in-depth interviews as suggested by Minayo, Deslandes, and Gomes (2011). The literature review was systematized through an MSL – Systematic Literature Mapping, widely discussed in Kosloski, Moura, and Gomes (2024), and the results presented were based on Content Analysis as per Bardin, Burrell, and Morgan (1979), already applied in topics involving the use of e-Gov such as Damiam and Merlo (2013).

A total of 34 interviews were conducted with elderly people aged 60 and over, distributed by age groups in years: 60 to 64, 65 to 69, 70 to 74, 75 to 79, and 80 and over years of age. The sample was of convenience with the use of the snowball technique (BOCKORNI; GOMES, 2021). During the interviews, each characteristic was explained

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ISSN: 2358-2472

and exemplified so that the elderly people could express their opinions about the importance of the characteristics, which, in turn, were treated in pairs. At the end of the event, the resulting order of importance was repeated, to validate the interviewer's understanding, in addition to confirming it with the interviewee. This procedure was adopted to validate the order of importance of the characteristics addressed. Even so, in some of the interviews, it was not possible to establish a ranking of priorities of quality characteristics. These interviews were excluded from the sample (5 interviews), constituting a use of 85% of the data collected (29/34 interviews). For the ranking, a specific scale was developed (Chart 1), inspired by the SAATY scale used in the AHP method (SAATY, 2004).

The method itself consisted of collecting the statements of each interviewee, analyzing them, and obtaining the intended ranking from the lowest to the highest importance attributed to the quality characteristic, using the scale created (Chart 1).

Chart 1: Scoring scale used in the ranking of quality characteristics

Name	Definitions	Stitches	Examples of situations
No Importance	Irrelevant, without any value to the decision to use the service	0	Whether or not the service has this characteristic for me is the same thing. If it existed, I wouldn't even notice.
Little importance	The importance is recognized but with minimal impact.	1	It's interesting, but I wouldn't stop using it if it didn't exist. It's a kind of ornament.
Intermediary (1-3)	It has some importance, but it is not essential	2	It's more than just an embellishment, but it still wouldn't bother me if it was missing."
Moderate importance	It is beneficial, but not indispensable.	3	I like that. If not, I will miss it, but I can still use the app
Intermediate (3-5)	There is a significant amount, but not enough to be a "priority".	4	It's useful, something that helps, but I don't need it to the point of being important. When I don't know, I ask for help to use it.
Important	Significant weight. If absent, it discourages the interviewee and influences the decision to use the product	5	If I don't have that, it starts to bother me, and I can think about using another solution, or depending on someone's help.
Intermediate (5-7)	The trait exceeds the Important level but does not yet reach Very Important.	6	It is almost at a very high level of importance, but it is not yet indispensable." Usually with external help, I can do it.
Very important	If it is not present, the feeling is one of frustration. It is something with a strong impact on product adherence.	7	If I don't have it, I'll probably stop using it. It's fundamental for me." If I don't have external help (do it together) I can't do it
Intermediate (7-9)	Practically indispensable, leaving a small gap before classifying it as mandatory.	8	It's almost indispensable, but maybe there's some way around it if it doesn't exist. I think it's hard for me to do it without someone's help.

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Extremely important.	Its absence compromises the interviewee's interest in using the product. The apex of relevance.	9	Without that, I don't use it at all. I don't use it without first asking someone more experienced.

Source: Adapted from SAATY (2004)

After the ranking, the order of importance of the quality characteristics attributed by the interviewee is obtained. Then, according to this order of importance, importance points were awarded according to this order as follows: 1 point for the least important characteristic (first place), 3 points for the second most important, 5 points for the third most important, and so on, until the most important characteristic (last place in the list of importance) receiving 9 points. In the end, the points of the order of importance of the characteristics were added to obtain an overall ranking representing the opinion of all respondents in a consolidated manner.

The audios of the interviews were recorded, and the ICFs – Informed Consent Forms were explained, signed, and stored for future references, as established by the project approved by the CEP ethics committee under registration number CAAE: 63881622.0.0000.5540. The transcriptions were automated using the Media Podium software (V.1.0.6, for IOS), and the transcriptions were imported into MAXQDA (V. 2024, for IOS), where the content analysis was carried out. The content analysis followed the procedures established by its creators, with the creation of a coding structure used in floating reading. The coding structure was formed by the terms associated with the quality of the software product such as usability, portability, performance, reliability, and security. Therefore, the statements were analyzed to obtain for each interviewee the order of importance according to their own opinion. The scale of Chart 1 was applied to these statements to finally obtain the desired ranking for the quality characteristics of the product.

THEORETICAL FRAMEWORK

The theoretical framework used in this work was built from the results obtained by Kosloski, Moura, and Gomes (2024) when carrying out a systematic mapping of literature presented in a consolidated way in the concept map of Figure 1. It observes a central concept, known as the digital gap, with classes of aspects with impact the use of e-gov services by elderly people.

Among them, the technological ones, comprised of issues related to ICT infrastructure such as connectivity, and availability of equipment for access to services, in addition to those related to software quality, the social/demographic ones such as age,

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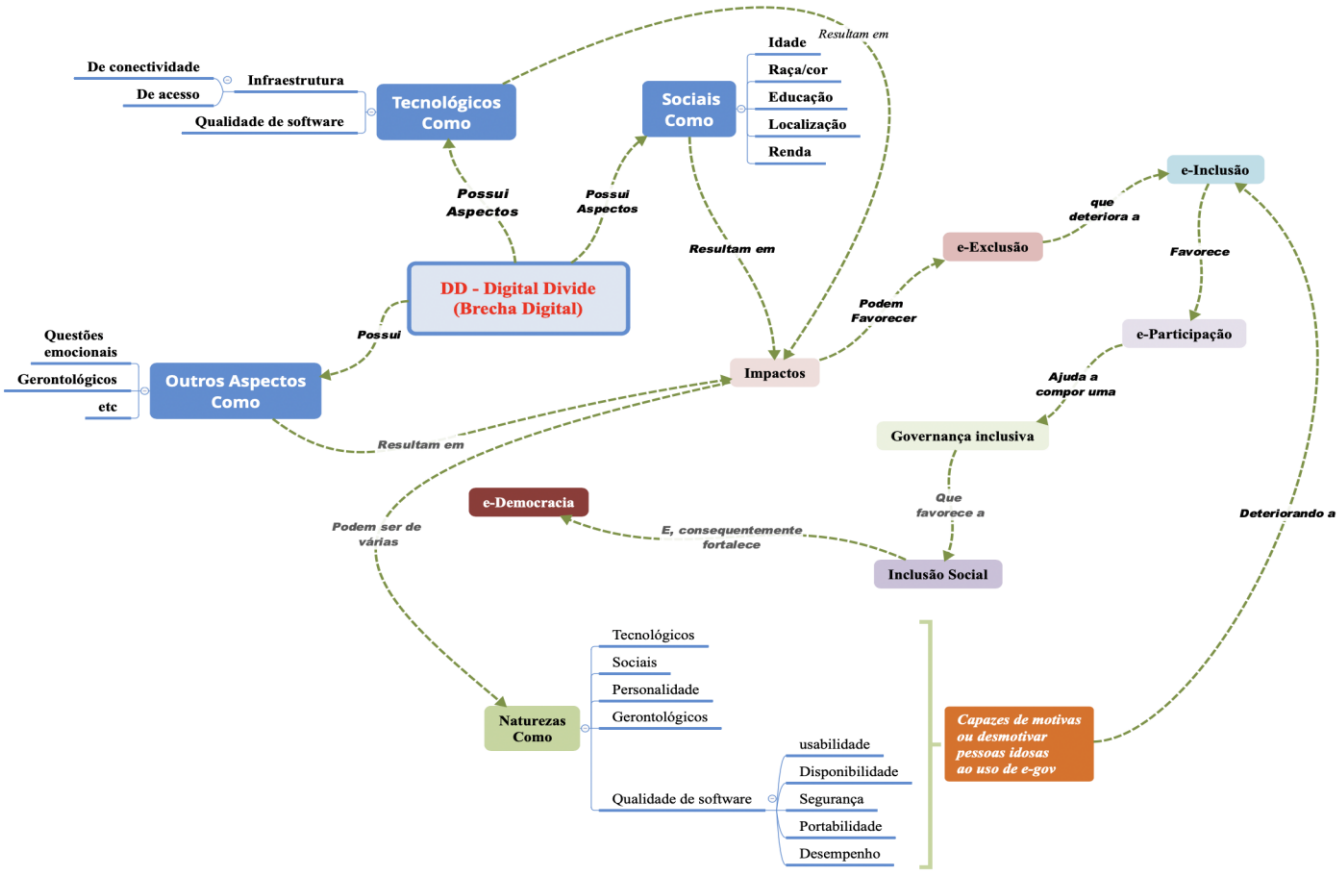
ISSN: 2358-2472

race-color, education, location (urban/rural) and income. In other factors, emotional factors such as irritation, fear, and insecurity come into play (VENKATESH; SYKES; VENKATRAMAN, 2014).

Figure 1. Concepts and impact factors for older people



Source: Kosloski, Moura and Gomes (2024)

Gerontological factors are related to aspects of the aging process (CZAJA; LEE, 2007) as age causes additional challenges to the use of new technologies, especially related to health, functional capacity (HEPBURN, 2018), and structural ageism (FALEIROS, 2023). In the presence of cognitive and physical declines, services with friendlier and more accessible interfaces become essential, especially due to the importance of technology as a mediator of social interaction for the elderly (SEIFERT; COTTEN; XIE, 2021; SÁNCHEZ VALLE; LLORENTE BARROSO, 2023). In the software area, these aspects are addressed by the quality of software in interface friendliness and accessibility (Figure 2), including reliability in which the software product needs to work free of defects to avoid confusing elderly people during the use of e-Gov services. Considering these issues is important to outline inclusive strategies for the use of e-Gov by older people

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ISSN: 2358-2472

aiming at active and participatory aging (HARVEY; HASTINGS; CHOWDHURY, 2023).

On the other hand, issues of race/color are treated as important barriers to access to digital technologies (GARCIA-GARCIA; GIL-GARCIA, 2018). For education, individuals with higher educational levels may have an easier understanding when using e-Gov services more effectively (PÉREZ-AMARAL et al., 2021). The issue of rural locations with deficient ICT infrastructures and connectivity when compared to urban areas is addressed by Al-Muwil et al. (2019) and income and employment influence access to and effectiveness of e-Gov use, as higher income and previous work experience tend to facilitate this use (DODEL; AGUIRRE, 2018).

Finally, emotional issues are discussed by Santahanamery and Ramayah (2015) involving the aversion of elderly people to the use of internet resources, by depriving them of personal contact, and by Grigoryeva, Shubinskiy, and Mayorova (2014) when discussing the need to provide older people with a better sense of usefulness of e-Gov services. More recently, Holgersson and Sã (2020) include personality characteristics such as extroversion, neuroticism, and conscientiousness as important factors in motivating the use of e-Gov services.

So, the digital inclusion of older people is not only limited to access to technology but also to the ability to use it effectively, which is also influenced by factors such as digital literacy and trust in technology (DEATH-NADAL; ESTEBAN-NAVARRO, 2022; DICK; MACADAR; PEREIRA, 2023). Thus, it is imperative to combat the digital divide, one of the roots of the problem related to digital inclusion which, more recently, has been argued to influence the achievement of digital citizenship for the group of elderly people (NUNES; LEHFELD, 2019).

The focus of this work was on technological issues involving the quality of the software product as addressed by the SQUARE standards (ISO/IEC, 2010). Quality is a complex concept and can be understood as how much the system, component, or process satisfies the needs and expectations of the users of the software products (GALIN, 2004). Quality can be viewed from distinct points of view, or quality foci, as defined by the standard (Figure 2) and containing an intrinsic relationship between them. The quality in use, that is, the user's perception of the quality of the software product to its used product, depends on the quality of the software product itself, which, in turn, is influenced by the quality of the process that generated it.

This work does not aim to deal with the quality of the process, something very

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technical and associated with software development processes, nor the quality in use, as it does not intend to deepen the evaluation of user satisfaction when using e-Gov services, but rather on the focus on the quality of the software product described by quality characteristics, due to its importance, both by influencing the quality in use, and by being influenced by the quality of its production process. Thus, understanding the opinions of the elderly when prioritizing the importance of the quality characteristics analyzed became important, motivating this research.

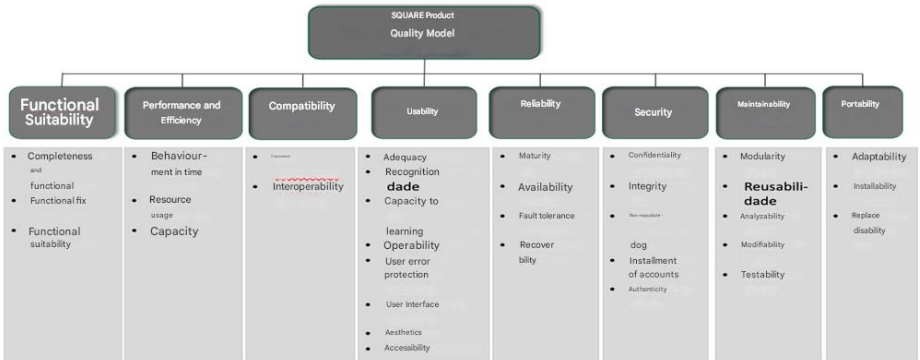
Going deeper, the product quality model can be seen in Figure 3. In it, eight quality characteristics for the software product are presented: functional adequacy; performance and efficiency; compatibility; usability, reliability; safety; maintainability, and portability.

According to the standard, maintainability and compatibility are technical non-functional characteristics, important for software developers because they deal with the ease of making modifications to products, keeping them updated according to the needs of their users (maintainability), and with interactions between different software (Compatibility). Functional fit addresses the functionalities of the software, whether they are adequate, complete, and functioning properly. These characteristics were excluded from the scope of analysis of this work due to their highly technical biases and because the literature focuses on characteristics with greater impact on the use of e-Gov (KOSLOSKI; MOURA; GOMES, 2024).

Figure 2: Relationships between focuses and software quality

Source: Adapted from ISO/IEC, 2010

Figure 3: Product Quality Model



Source: Adapted from ISO/IEC, 2010

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ISSN: 2358-2472

Detailing the influences of these characteristics are:

- **Usability:** Greater usability of e-Gov service applications is important in motivating older people's intention to use e-Gov services (MOUSAVI; PIMENIDIS; JAHANKHANI, 2008). Its subcharacteristics are important for the elderly, such as accessibility, studied by (BECKER et al., 2008) and, more recently, by (HOLGERSSON; SÃ, 2020). In (ABAD-ALCALÁ et al., 2017) the ease of learning how to use e-Gov applications and the application's ability to help the user not to make mistakes (learning capacity and protection against user errors, respectively by the standard) are considered. Skalska (2012) addresses the complexity of navigating through the application as a demotivating factor for the use of e-Gov.
- **Portability**: ways to provide e-Gov services via multichannel (WEB, mobile telephony, digital TV, etc.) have been studied to motivate older people to use the various possibilities of access to them (HOLGERSSON; SÃ, 2020), also addressed by the standard in the subcharacteristics of software adaptability.
- **Performance**: In addition to the questions of *Time Out*[4], issues related to slow access speed can cause demotivating feelings for elderly people in the use of e-Gov services, such as anxieties or irritability (GUPTA; BHASKAR; SINGH, 2017). The standard addresses this aspect through the performance sub characteristics known as behavior over time.
- **Reliability:** In a qualitative study with focus groups involving elderly people, trust in the electronic government service comes up against aspects related to the occurrence of errors, making elderly people prefer face-to-face contact or printing proof of the service performed, to trust it (ABAD-ALCALÁ et al., 2017). In another quantitative study using structural equation systems with data collected by *Surveys*, it was concluded that the quality in terms of service stability and response time contribute to the increase in reliability and, consequently, the intention to use e-Gov services (KHAN et al., 2012).
- **Safety**: It is an important aspect to alleviate feelings of fear and anxiety of older people in services involving payments, in addition to aspects about data privacy (HARVEY, HASTINGS, and CHOWDHURY, 2021). Concerns about cybercrime

[4] An event in a system, process, or operation that is interrupted due to excessive wait time for a response, which may require restarting the activity running on the software system.

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are highlighted by these authors in confirmation of older studies of Grigoryeva, Shubinskiy, and Mayorova (2014).

Although necessary for access security, Alfalah, Choudrie, and Spencer (2017) address the issue of memorizing large amounts of passwords when browsing through different services. In this sense, the *Single sign-on*, used by Brazil for digital identification, in INSS services such as Proof of Life, available on the Brazilian e-Gov portal (www.gov.br), is used to minimize this problem, without deteriorating access security (BRAZIL, 2023).

RESULTS

Chart 2 presents the score table obtained by ranking the interviews:

Table 2: General ranking of the importance of product quality characteristics

Features	First.	2nd.	30.	4th.	5th.	Grand Totals
Usability	19x1	7x3	3x5	0x7	0x9	55 photos
Partial totals	19	21	15	0	0	
Portability	5x1	15x3	4x5	1x7	3x9	104 photos
Partial totals	5	45	20	7	27	
Performance	3x1	7x3	18x5	0x7	0x9	114 photos
Partial totals	3	21	90	0	0	
Reliability	0x1	0x3	4x5	20x7	0x9	160 photos
Partial totals	0	0	20	140	0	
Safety	0x1	0x3	7x5	20x7	21x9	364 photos
Partial totals	0	0	35	140	189	

Source: Authorship (2025)

In this table, the importance of quality characteristics is scored, after having been ranked. The score is given by the number and times that a quality characteristic appears in a given position (first place of importance - least importance, and so on until the highest importance - fifth place).

For these positions, 3, 5, 7, and 9 points of importance were assigned, respectively. So, according to the opinion of the interviewees, usability, for example, appears in the ranking 19 times in first place (less important), receiving 19 points for this fact (19x1). She also appears 7 times in second place, receiving 7x3 = 21 points; 3 times in third place receiving 3x5 = 15 points. Usability appears neither in fourth nor fifth place, receiving zero (0) points for it. In the end, usability receives the sum of the points: 19 + 21 + 15 + 0 + 0 = 55 points of importance. Analogously, the other characteristics were scored to arrive at the general results of Chart 3.

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In general, at present, safety almost always remains the most important characteristic in the opinion of the elderly, except for some special situations shown in Chart 5. In addition, it can also be seen that the difference in importance between portability and performance was not as great as the others, which may mean an indication of uncertainty on the part of the interviewees, even if the concepts have been explained and exemplified during the interviews, as well as validated as to their orders of importance attributed by the interviewee during the event.

Table 3: General ranking of quality characteristics (opinion of the elderly)

Characteristic	Importance Issues	Order of importance
Usability	55	1st (less important)
Portability	104	2nd
Performance	114	3rd
Reliability	160	4th
Safety	364	5th (most important)

Source: own authorship (2025)

DISCUSSION

In the results, a difference in points of importance between application security and usability is perceived (364-55=309 points). For this reason, we started to segregate population subgroups within the interview sample with the reapplication of the method and consequent reassessment for the cohorts of age groups, sex, level of education, and family income, as shown in Chart 5. In addition, the order of characteristics obtained by the complete sample called the general cohort, was also chosen as the baseline for comparisons. In this Table, the orders of importance of quality characteristics of all the scored cohorts were consolidated.

The literature addresses software quality characteristics as factors capable of causing impacts, motivating or not the use of e-Gov services, and influencing the digital inclusion of older people, as addressed by Kosloski, Moura, and Gomes (2024) in his work (Figure 1). However, the studies found and presented so far have not set out to include the opinion of older people to specifically rank the relative importance of the quality characteristics of software products.

In Chart 4, some subgroups did not have representatives and, for this reason, they are not included in the chart as those related to Education: Incomplete high school, incomplete superior, and incomplete graduate studies. For all the others, the ranking of

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importance of characteristics and quality of the software product was redone.

Usability having a lower relative importance than the other characteristics studied in the literature is surprising. In this sense. Its strength of importance was weakened by the family arrangement, as statements about "asking for help" from family members are common when there are difficulties related to this characteristic, according to the statements of the interviewees. In the case of living alone, as there are some representatives, they also ask for help from someone they trust, reinforcing the literature on the importance of social interaction. Regarding security, the concern is strengthened by the current context of cyber scams, a subject also addressed by the recovered literature and, therefore, currently assumes a preponderant role because it can be translated into fear of using services that can cause you to give up using them.

Table 4: Consolidation of orders of importance by cohorts

Cohort	Interviews (Qty)	Order importance					Comparisons
		1st	2nd	Third	4th	5th	
General - all	**29**	**U**	**P**	**D**	**C**	**S**	**Benchmark for comparisons**
60-64 years old	6	U	P	D	C	S	Same order overall cohort
65-69 years	9	P	U	D	C	S	Inversion between 1st. and 2nd. Places
70-74 years	8	U	D	P	C	S	Inversion between 2nd. and 3rd. Places
75-69 years	4	U	P	D	C	S	Same order overall cohort
80-84 years old	2	U	P	D	X	S	Tie: usability and portability. Unrated reliability[5].
Sex Fem.	23	U	P	D	C	S	Same order overall cohort
Male sex.	6	U	D	C	P	S	Inversion between 2nd. Third. and 4th. Places
Education: incomplete elementary school	6	U	P	D	C	S	Same order overall cohort
Education: complete elementary school	5	U	C	P	D	S	Inversion between 2nd. Third. and 4th. Places
Education: Complete high school	14	U	D	P	C	S	Inversion between 2nd. and 3rd. Places
Instruction: complete superior	3	U	P	D	C	S	Tie between portability and performance
Instruction: complete graduate degree	3	U	D	C	P	S	Inversion between 2nd. and 3rd. Places
Income <= 1 MW	4	P	U	D	C	S	Inversion 1st and 2nd. Places
Income 1<SM<=2	2	P	U	C	D	S	Inversion 1st and 2nd. Places
Income 2<SM<=3	8	U	P	D	C	S	Same order overall cohort
Income 3<SM<=5	4	U	D	P	C	S	Inversion 2nd. and 3rd. Places
Income	5	U	D	P	C	S	Inversion between 2nd. and 3rd. Places

[5] It was not possible to establish an order considering the reliability for the cohort.

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5<MW<=10							
Reda >10 SM	3	U	P	D	C	S	Tie: portability and performance

Legend: SM – Minimum Wage; U-Usability; P-Portability; D-Performance; C-reliability; S-Security; Amounts: 1st. 2nd. Third. 4th. 5th. Places (ascending order of importance).
Source: Authorship (2025)

In addition, according to the statements of the interviewees, reliability and security are two characteristics that work associated. Elderly people feel safe in using e-Gov services when they work properly without defects and generate the expected results, as they are transformed into feelings of trust, which influence safety, which once again confirms studies retrieved from the researched literature.

Thus, the family arrangement variable becomes critical for understanding what motivates or does not motivate the elderly in the use of e-Gov resources. Family and social life are important as a source of solving doubts of the elderly when using e-Gov services. In this sense, delving into this issue may be a future path of research on this topic.

For the age groups, there is an agreement in the ranking of importance with the baseline of comparison (general cohort), but an inversion of priorities for the groups between 65 and 74 years old, in which usability gains more preponderance over portability and where performance makes a difference in the decision to use electronic government services. The issue deserves further study in future studies, increasing the sample of interviews, one of the internal weaknesses identified in this study. On gender, there is an inversion of priorities between the female and male public. The evidence suggests a greater concern with portability for the female public but also deserves further study on this issue to enable analyses involving not only the gender variable but also its combined relationship with other variables such as family income and level of education.

Therefore, analyses combining variables are important, as shown by the results for the male audience. For them, portability plays a more important role than for women, but it is also observed that they belong to higher family income brackets. And, finally, something expected was the tiebreaker for the public with lower family incomes to give less importance to portability, as they generally cannot have various types of equipment available to access e-Gov services.

CONCLUSION

As established in the objective that motivated this research, increasing order of importance was obtained according to the opinions of the elderly people, heard in

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interviews under the validity of a project approved by the CEP Ethics Committee.

The general order of increasing importance is made up of usability, portability, performance, reliability, and security. This order is important for directing technological and government efforts. The importance is shown in actions related to e-government, to motivate this population group to use e-Gov, which, in turn, constitutes one of the effects of digital transformation in the world and Brazil, even knowing the decline in capabilities over aging over time.

This is because digital transformation emerged with the advancement of Information and Communication Technologies (ICTs), changing the economy and society. This progress has highlighted the need to democratize access to these technologies, giving rise to concepts of digital inclusion (MATOS; CHAGAS, 2017) and fostering e-Democracy based on the active and protagonist participation of older people. The effort consists of combating the digital divide that reflects and widens social inequalities.

In this sense, digital inclusion acts as a tool to promote social inclusion, by offering access to education, work, and citizenship, to allow individuals to actively participate in the current digital environment characteristic of the information society, giving rise to the concept of digital citizenship. Digital citizenship, in turn, adds ethical participation and the full exercise of rights and duties in the online world (NUNES; LEHFELD, 2019), and, therefore, the relationship between the provision of e-Gov services and structural inequities is important. The study of these aspects must be deepened in defense of the threats to the rights of older people. Based on the results obtained, it is proposed to add to the conceptual map of Figure 1 the interconnections between the concepts of e-Democracy and Digital Citizenship, as both are anchored in the use of digital technologies to expand political participation and strengthen civic involvement (COREZOLA; CÔRTES, 2021).

ACKNOWLEDGMENTS

The authors thank the elderly people interviewed for their time and willingness to participate, with resilience and enthusiasm, believing that this important e-Gov tool can be increasingly the target of improvements, to motivate them to use it and to achieve their respective digital citizenships, in the current information society currently reigning in Brazil and the world. In particular, the authors would like to thank the DPI/BCE/UnB for their financial support, through call for proposals No. 001/2025 DPI/BCE/UnB.

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