Perceptions and Attitudes of Spanish "Digital Seniors" Towards E-Government

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ABSTRACT

A typology of user was explored as to behaviour and perception of e-government through a telephone survey involving 405 internet users between 60 and 79 years of age. Ten different groups were identified by means of dimensionality reduction techniques followed by a cluster analysis. The main conclusion is that there is no consistent pattern, although among the groups which do use e-government they have less concerns than the rest and see less need for modifications to be applied to adapt the websites to the needs of seniors. Within this older age group, two types are clearly identified: those who feel uncomfortable, which explains their avoidance of e-government, and to a lesser degree those whose lack of contact with public administration may be due to a lack of interest for such services. It appears that a senior-friendly offering together with learning opportunities would increase interest for this channel.

KEYWORDS

Ageing, Cluster Analysis, Elder, Electronic Government, Internet Users, Profiles, Public Administration, Senior-Friendly, Typology

INTRODUCTION

E-Government implies the implementation of ICT in the different services of public administration. It is not purely a website, but the integration of transparency, responsibility and citizen participation in the evaluation of the performance of the government (Bayona & Morales, 2017). The development of e-Government has allowed diverse digital interactions (Siren & Knudsen, 2017), enabling citizens and companies fast and efficient access to public services (Molnár et al., 2017) and to democratic processes and government policies (Liikanen, 2003). Iannaccia, et al. (2019) state that the mature models of e-Government have had relatively stable trajectories which are marked by radical changes directed at the complete transformation of electronic government and are unpredictable.

E-Government is an opportunity for all, though particularly for seniors, who show a growing interest (Molnár et al., 2017), are reasonably satisfied with the provided services, and display a positive attitude towards their use (Yap et al., 2017). However, on exploring the factors which influence the adoption and maturity of e-Government, it is seen that, although for different reasons, the presence of both old and young age groups has a negative effect (Budding et al., 2018).

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Many seniors experience difficulties, specifically, technical barriers, both economic and social which respond to individual and structural matters (Baker et al., 2017). However, although it is considered that people more familiar with ICT are able to pick up e-Government innovations more rapidly than seniors (Chirara, 2018), e-Government cannot exclude this social group, who could view their citizen rights as being restricted. (Abad-Alcalá, 2016; Abad-Alcalá et al., 2017; Burholt et al., 2019; Viñarás-Abad et al., 2017). An adequate digitalisation of governmental services guarantees the functionality of the services and the autonomy of the citizens, which is particularly important in the case of seniors, who consider 'autonomous life' means wellbeing and quality of life (Siren & Knudsen, 2017). The minimal use of computers and ICT by seniors at the beginning of the century reflected the lack of perceived importance to them (Selwyn et al., 2003). In general, various research has indicated the positive psycho-social impact which the use of ICT has on seniors (Abad-Alcalá et al., 2017; Shapira et al., 2007; Viñarás-Abad et al., 2017). As for seniors who have never had contact with ICT, the use of these technologies brings them confidence, independence and social commitment (Baker et al., 2017). The Internet provides multiple possibilities for an active and autonomous old age (Llorente-Barroso et al., 2015; Slegers et al., 2007), which favours citizen empowerment of this age group (Llorente et al., 2018; Sánchez-Valle et al., 2017; Slegers et al., 2007). However, seniors do not take full advantage of the Internet nor use it as frequently nor as easily as do younger generations (Chadwick-Dias et al., 2007), fundamentally, due to complex web designs where navigation and use are not particularly intuitive (Llorente-Barroso & Sáez-Díez-Rebanal, 2019), and distrust performing online procedures (Viñarás-Abad et al., 2017). Consequently, to encourage a higher use of online services, it would be advisable to adapt the interface to a senior-friendly design (Llorente-Barroso & Sáez-Díez-Rebanal, 2019; Lunn et al., 2009; National Institute on Aging, 2009; University of Maryland, 2001; Web Accessibility Initiative, 2010) which incorporates a social value related to their specific needs (Yap et al., 2017).

In addition, ageing has a negative impact on the performance of online searches which is affected by the ergonomic quality of the website (Chevalier et al., 2013). A simplified page layout, strategic use of colour (Affonso-De-Lara et al., 2016) and the incorporation of indicators to aid navigation and use (Chevalier et al., 2013) are aspects which could improve navigation. The variable of perceived ease of use and usefulness, in which the TAM (Technology Acceptance Model) model is based (Bagozzi et al., 1992), determines the sentiments and behaviour of seniors towards e-commerce (Gopal & Murale, 2018; Smith, 2008) and are applicable to the design of e-Government sites. More specifically, Molnár (2015) proposes the IGUAN guide for the design of e-Government systems adapted to the needs of advanced age users: their proposal, based on the recommendations of Czaja and Lee (2007), includes a series of special requirements and a catalogue of criteria which contribute to the design and development of a senior-friendly e-Government (Molnár, 2015).

In addition, a higher level of education tends to be connected to a higher acceptance of e-Government by seniors (Phang et al., 2006). Similarly, seniors display an increased level of online confidence according to their perception of the expertise of the source, the depth of information and an appropriate design (Hong, 2006; Nwanekezi et al., 2016). Confidence in the Internet and the government as a provider of electronic services are key factors in the willingness to use e-Government, regardless of the age of the public (Mpinganjira, 2015). Furthermore, older age users of technology with lower incomes are less tolerant to risk than younger age users and those with high incomes (Czaja et al., 2006). Bélanger and Carter (2008) point out that institutional confidence and confidence in the Internet, as well as perceived risk, are essential elements in the use of e-Government. Citizens must believe that mechanisms which guarantee the secure and private transmission of their data exists. Furthermore, they stress the importance of assurance seals, such as those which are used in e-commerce to foster this confidence. In general, concerns regarding security and the lack of confidence in the information and the procedures on e-Government has a negative effect on the satisfaction of citizens and, precisely, the success of e-Government adoption depends on the confidence of the citizens and their will to use it (Alzahrani et al., 2018). In addition, one of the major concerns of the users of

e-Government is the maintenance of privacy which counters a willingness to reveal the necessary personal information to complete procedures and transactions online (Dinev et al., 2008).

One of the greatest challenges in Spain, is that public administration be digital by 2020, and that citizens and businesses prefer to use its online services due to it being smoother, more comprehensive and intuitive (Ministerio de Economía, 2015). However, the reality is that there is no commitment, nor co-ordination, nor collaboration within the different levels of the Spanish administration to introduce a truly national framework of interoperability which guarantees an effective e-Government (García-González, 2016). Furthermore, only 26.7% of Spanish citizens between the ages of 65 and 74 have interacted with public administration via the Internet for personal reasons in the last year (Instituto Nacional de Estadística, 2019), and such online actions are not even considered by the over 75s.

Optimum use of e-Government and other actions which involve ICT make it necessary to educate seniors in digital competencies which are more and more specific (Abad-Alcalá, 2014; Turner et al., 2007; Williamson & Asla, 2009; Xie & Bugg, 2009) and to adapt ICT to fit better with the lives of older adults (Selwyn, 2004). Digital literacy allows groups which are at risk of social exclusion crucial access to information, thereby assisting their empowerment and social integration (Bernal-Meneses et al., 2019). In that regard, it has been demonstrated that the participation of citizens in technology training programmes has a positive association on the use of e-Government, most markedly, in the case of seniors or people with disabilities (Lee & Porumbescu, 2019). Consequently, it is essential to develop prospective research which contributes to identifying and predicting the needs of seniors in the future (Ala-Mutka et al., 2008), anticipating that such requirements will continue to change and that states have the obligation to take responsibility, considering the Internet as a vital tool to improve the services provided by organisations in the public sector (Näsi et al., 2012).

METHOD

Most Internet users above 60 years of age are not a homogenous group. Their behaviour on the Web reflects different types of users (Vulpe & Crǎciun, 2020). This research aims to identify a typology of Internet users as per their preferences and behaviour with e-Government.

In addition to this goal, the following specific objectives are established (SO):

SO1. Identify profiles of users and non-users of e-Government within this age group.
SO2. Explore the differences between users and non-users of e-Government.
SO3. Discover the modifications which administrations need to perform to bring these services to the over 60s.

In order to achieve these objectives a quantitative methodology has been used. The instrument used to gather the data is a survey, as this is the most suitable methodological tool to discover a phenomenon, directly asking individuals who are the object of the study, with the objective of studying the existing relations between the variables (Corbetta, 2007).

The telephone survey was carried out with 405 people above the age of 60, both men and women as users of the Internet. The CATI (computer-assisted telephone) system was used, applying a semi-structured questionnaire with an average duration of 12 minutes. The questionnaire was designed on the basis of a subject literature review, a similar questionnaire administered by the National Institute of Statistics (Instituto Nacional de Estadística, 2019) and the principal conclusions obtained from four focus groups, conducted by the research team with participants above the age of 60, from diverse social classes and educational attainment who discussed subjects related to the Internet and e-Government. It took place between February 4 – 12, 2019 in Spain with a random and finite sample at a confidence level of 95%, and a sampling error of PQ= 0,50: 4,9% (PQ=0,75: 4,2% y PQ=0,90: 2,9%).

The sample design is proportionate to the population according to Autonomous Community, gender and age. The geographical regions most represented in the sample are the most densely

populated in Spain. Regarding the profile of those surveyed, 58.8% were men and 41.2% women. The distribution of the participants according to age is the following: 60-64 (30.9%), 65-69 (24.7%), 70-74 (36.3%) and 75-79 (8.1%).

Data Analysis

As stated above, the main goal of the paper is to study the preferences of seniors and their behavior in relation with e-Government. Since there is no variable that explicitly gathers the information of other users into a single, measurable concept of this approach to online resource we will identify the groups by means of unsupervised learning methods, more precisely, cluster analysis (Kaufmann & Rousseeuw, 1990; Kotsiantis et al., 2007). In contrast to supervised learning, unsupervised learning occurs when instances are not labelled so that the algorithms used permit unknown but useful classes of elements to be discovered (Kotsiantis et al., 2006; Kotsiantis et al., 2007).

The justification for the use of this methodology can be found in the work of authors such as Adikari et al. (2021) who propose a machine learning approach that can be used to transform social media data into actionable insights. Adikari et al. (2021) address an evidence-based study that uses machine learning algorithms to generate actionable insights of strategic value from a data-driven paradigm. These outcomes provide fresh perspectives and new thinking that advances social media as an emergent information asset for end-to-end open innovation and incremental value co-creation.

Kar and Dwivedi (2020) aim to bridge the gap in existing methodologies and provide a direction for future research and theory building, while Singh et al. (2020) use the categorization of construct group and clustering based on the expected potential of usage. As far as future research with algorithms is concerned, researchers are looking to use intelligent bio-inspired algorithms such as swarm intelligence (SI), which, although they have emerged in the areas of engineering and pure science, have great potential for the social sciences, specifically, as methods of analysis for the management of information systems or strategic decision-making at a business or institutional level (Chakraborty & Kar, 2017; Kar, 2016).

In the current research, two analyses were carried out, one for those who use online public administration and another one for those who do not. All the statistical techniques described below were carried out using R 4.0.1 under the front end RStudio 1.2.5001. In order to perform clustering methods, there are, mainly, three steps to consider, namely, computing the dissimilarity matrix, performing the actual clustering method on that matrix, and validating the results (James et al., 2013). Those steps lead to the choice of several *hyperparameters,* in other words, the choice of several decisions that should be taken by the analyst that affect the outcome of the study. All the following are choices:

- Distance: What distance is used to create the dissimilarity matrix.
- Clustering method: What method will be used to perform the clustering and, what parameters specific to that method.
- Number of clusters: How many clusters should there be. If we create as many groups as observations, the result is trivially perfect, but the descriptive value of the study is minimal, as there are no groups. Conversely, if we reduce the number of groups too much, we might obtain an insightful group with individuals which do not truly match the description of that group. Since there is no *a priori* knowledge on how many groups there should be, various outcomes must be considered to establish which one provides a better trade-off between description and result.
- Validation measures: Since we are dealing with unsupervised learning, there is no reference variable to compare our results and evaluate their performance. Therefore, other quality measures are used and the choice of whether to place more importance on one than another, is extremely significant (Santana, 1991).

For all the choices above, several possibilities were tested for both cluster analyses, and the best combination was the same both times. Several other combinations led to similar results (although not

so precisely) which is also a great indicator of the robustness of the performed clustering; after all, if several methods achieve similar results, it is natural to conclude that an actual underlying reality is being described.

As for the dissimilarity matrix, several distances were considered[1], however, ultimately the best results were achieved through the KODAMA algorithm[2] using k-Nearest Neighbors with k=5 (Cacciatore et al., 2017).

Afterwards, K-means clustering was selected as the best option to carry out the study with five clusters because it is a simple and fast method and in addition it solves the matter of results' optimization. The selection of the clustering algorithm and the optimal number of clusters was performed based on internal measures and stability measures. The internal measures have two purposes, firstly, to check that within each group the observations are sufficiently similar to each other, and secondly, to check if the groups are adequately separated. More precisely, the silhouette width computes the distance between each point and points in other clusters, connectivity measures to what extent each observation and its neighbors are in the same cluster, and the Dunn index is a ratio of the distance between each cluster and how big they are. Stability measures check the consistency and the robustness of the results, that is, whether observations are classified in the same groups even if one variable is removed. More specifically, APN measures the average proportion of observations not placed in the same cluster using the full data and removing one column. AD measures the average distance between observations placed in the same situations. ADM measures the average distance between cluster centres for observations placed in the same cluster. Both internal and stability measures were implemented using clValid (Brock et al., 2008). K-means was the choice with an optimal trade-off among all measures for both clusters conducted in this study.

Finally, the variables that played the most prominent role in identifying the differences between the groups were extracted and ranked. Additionally, bidimensional plots of the clustering were included, providing a graphical representation of *how accurate* the clusters are.

RESULTS

Before presenting the results of the cluster analysis, a description of the stated level of use and confidence in e-Government is herewith provided. Of those surveyed, 57% use the Internet for administrative procedures (medical appointments, tax returns, etc.). A total of 66.2% feel safe making purchases or performing procedures on the Internet, while 15.8% claim that they only sometimes feel safe and 18% never.

The level of confidence in the websites of public administration is - low (21.7%), or average (48.9%), while the percentage falls to 24.9% among those who consider it high or very high (5.2%).

In regard to their perceived ability to perform purchases and procedures online, 78% consider themselves to have a low or average profile: 24.9% low and 53.1 average, 17.8% believe they possess a high profile and only 4.2% classify themselves as very high (Table 1).

Results of the Cluster Analysis

On applying the cluster analysis to all survey participants, be them users or non-users of online procedures, 10 groups were identified as per the responses which were provided to the two types of question. The first define the navigating style of the older people and display the obstacles and motivators which limit or encourage their use of e-Government:

- The fear of making a mistake when performing online procedures
- The confidence generated by receiving a completed procedure confirmation
- The perception of excessive and repeated requests for data
- The fear of providing personal data

Table 1. Perception of security and confidence levels in public administration and ability to perform procedures online

Security of performing procedures or shopping online		Confidence in public administration		Ability to perform procedures or shop online	
Yes	66.2%	Low	21.7%	Low	24.9%
Sometimes	15.8%	Average	48.9%	Average	53.1%
No	18%	High	24.2%	High	17.8%
-	-	Very High	5.2%	Very High	4.2%

Source: Own elaboration

- The perception of greater confidence in company websites such as Amazon, compared to administration
- The impact of previous negative experiences of access codes, whether due to problems experienced or an excessive complexity
- The lack of security in performing procedures or a perception of not having actioned them correctly
- The perception that the website design is excessively complicated and the language excessively technical
- The impact of negative previous experiences of performing online procedures

The second refer to actions by administration which facilitate a more frequent use of this service:

- Unify passwords and have one access code only
- Simplify the web content and design
- Provide a version adapted to the needs of seniors
- Include a virtual help assistant while performing procedures
- Receive additional training
- Receive confirmation of completed procedures

Typology Of Seniors as Users Of Public Administration

Cluster analysis, together with the previous dimensionality reduction step described in the methodology, was applied firstly to the subjects that perform procedures with public administration. Here the choice of hyperparameters with an optimal trade-off between internal and stability measures is with k-means clustering using 5 groups as shown in Fig. 1.

Figure 1. Graphic representation of the clusters of users of e-Government
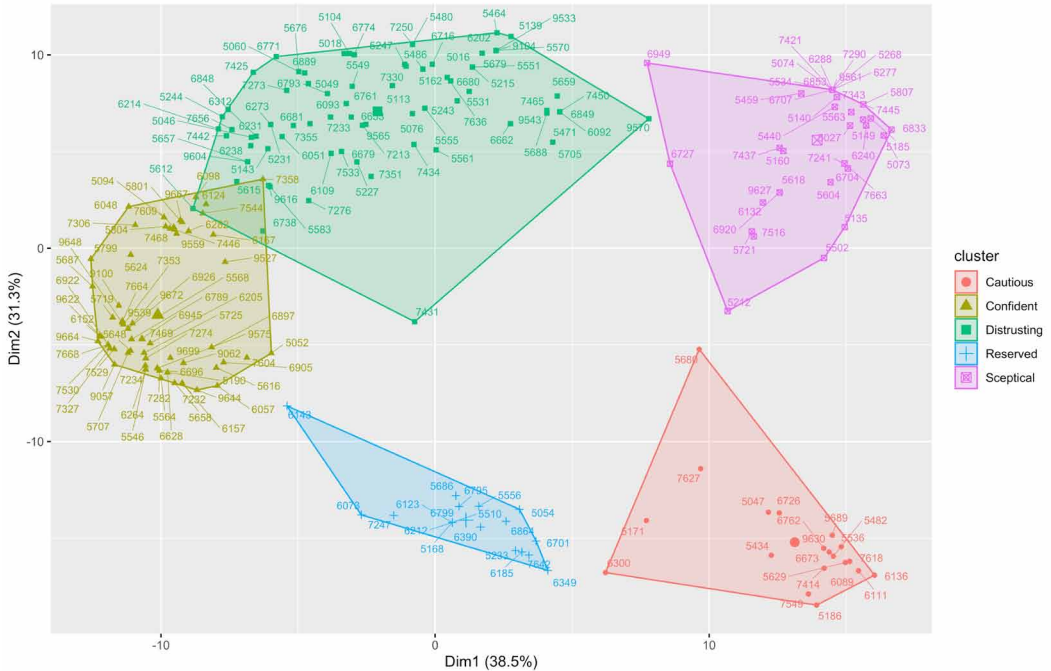
Source: Own elaboration with R.

In tables 2 and 3 the responses which best represent each of the groups can be observed. This does not mean to say that all subjects in the same group responded in the same way, but that the responses were quite similar and, at the same time, in all cases sufficiently different to those of the other groups to be able to differentiate them. As a result, the following typology of users was established:

- Distrusting: This largest cluster consists of 84 subjects whose main obstacle to using e-Government more, is the fear of providing personal data and the difficulties in remembering passwords. They consider the proposed measures to encourage e-Government use quite interesting.
- Confident: This is composed of 67 subjects and is the second largest group. It is characterised by displaying no obstacles in e-Government use and a belief that it is fairly important that web content and design be simpler., In addition, the possibility of a simplified version for seniors to encourage online procedures is valued.
- Sceptical: The third cluster, which consists of 40 people, reflects obstacles in all aspects and that e-commerce websites do not inspire more confidence than those of administration. They display great interest in administration implementing the measures covered in the survey as an incentive to using this channel.
- Cautious: The fourth group which is composed of 21 seniors, displays all the indicated obstacles, apart from the need to receive a confirmation on performing electronic procedures. As per the previous cluster, the proposed modifications to encourage the use of e-Government is of great interest.
- Reserved: The fifth group which consists of 19 people, is only concerned about having to reveal personal data. The presented actions for a greater use of e-Government are considered most interesting.

Table 2. Navigation style of e-Government users

	Afraid of making a mistake	Would feel more confident if received a procedure completion confirmation	Excessive and repeated requests for personal data	Fear of providing personal data	More confidence in private company websites	Experienced problems with codes. Need to be simplified	Excessive number of passwords make it difficult to manage and remember	N
Distrusting	No	No	Yes	Yes	No	No	Yes	84
Confident	No	No	No	No	No	No	No	67
Sceptical	Yes	Yes	Yes	Yes	No	Yes	Yes	40
Cautious	Yes	No	Yes	Yes	Yes	Yes	Yes	21
Reserved	No	No	No	Yes	No	No	No	19

Source: Own elaboration

Table 3. Requests by e-Government users to facilitate the use of online procedures

	Would like passwords to be unified	Would like a simplified design and content	Would like a simplified design for seniors	Would like a virtual assistant while completing procedures.	Would like more training	N
Distrusting	Yes	Quite interesting	Quite interesting	Quite interesting	Quite interesting	84
Confident	No	Quite interesting	Quite interesting	Not interesting	Not interesting	67
Sceptical	Yes	Very interesting	Very interesting	Very interesting	Very interesting	40
Cautious	Yes	Very interesting	Very interesting	Very interesting	Very interesting	21
Reserved	No	Very interesting	Very interesting	Very interesting	Very interesting	19

Source: Own elaboration

In figure 2 the responses which were key in classifying the groups can be observed. In the case of e-Government users, it is their perception of the modifications which could be made to make the websites more senior-friendly.

**Figure 2. Importance of provided responses for group classification used by e-Government**
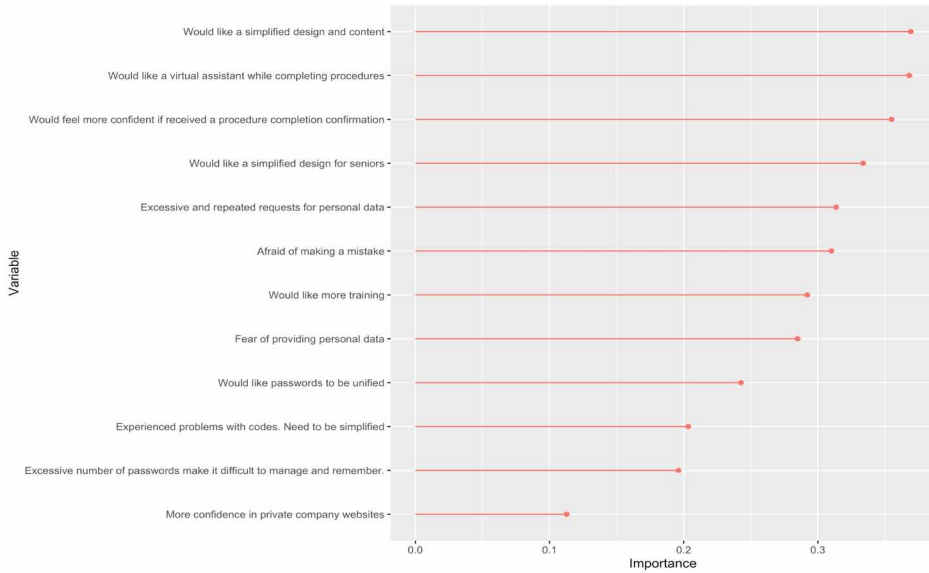
Source: Own elaboration with R

Typology of Non-Users of Public Administration

Once again, the different choices of hyperparameters when carrying out the cluster analysis to subjects that do not perform procedures with public administration, achieve an optimal trade-off between internal and stability measures when performing k-means with 5 clusters as in Fig 3.

Figure 3. Graphic representation of clusters of non-users of e-Government
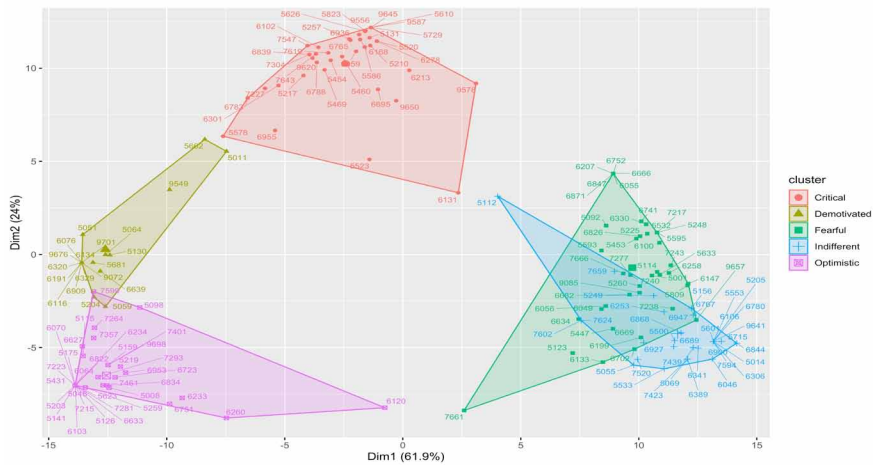
Source: Own elaboration with R

As per the responses to the previous questions (tables 4 & 5), the following taxonomy of non-user can be observed:

- Fearful:This is the most numerous profile, made up of 43 individuals. All of the obstacles are claimed. They are very insecure and cautious when it comes to e-Government and this prevents them using it. They are very interested in the websites being adapted for different cohorts such as seniors, receiving confirmation of completed procedures, and obtaining more information regarding administration as they consider themselves abandoned. Additionally, they are quite interested in the websites being simplified, and having a telephone help line for clarifying doubts when performing online procedures.
- Critical: The second cluster in terms of number of subjects consists of 40 individuals. The difference between the previous group is that they do not perform online procedures with administration, more for their lack of skills than for a lack of ease of use. However, they are quite interested in the incorporation of the modifications proposed in the survey in order to make the procedures with administration easier.
- Optimistic:This cluster is made up of 37 individual who display none of the obstacles with regards to electronic administration, and display a high level of interest in the inclusion of the proposed solutions provided in the survery to increase the use of e-Government among seniors.
- Indifferent: As per the second group, this cluster consists of 34 individuals who experience all of the presented obstacles and do not consider the proposed modification interesting for encouraging the use of e-Government.
- Demotivated: This is the least numerous cluster, made up of 20 individuals who have previously attempted to perform online procedure but unsuccessfully. They express no other obstacles in using e-Government and would be most interested in improvements to administration websites to encourage use.

Table 4. Navigation style of non-users of e-Government

|	Afraid of making a mistake	Unconfident of correct completion of the procedure	Excessively complicated websites and technical language	Fear of providing personal data	Unsuccessful previous attempts	N
Fearful	Yes	Yes	Yes	Yes	Yes	43
Critical	Yes	Yes	No	Yes	Yes	40
Optimistic	No	No	No	No	No	37
Indifferent	Yes	Yes	Yes	Yes	Yes	34
Demotivated	No	No	No	No	Yes	20

Source: Own elaboration

In figure 4 it can be observed, as in the case of users of e-Government the questions key in establishing the variations between groups are those concerning the modifications which administration could apply.

Table 5. Requests of non-users of e-Government to facilitate the use of online procedures

	Would like more simplified and easier to understand websites	Should be adapted to seniors	Would like the option of simultaneous phone or written assistance	Would feel more confident if received a completed procedure confirmation	Would like more information	N
Fearful	Quite interesting	Very interesting	Quite interesting	Very interesting	Very interesting	43
Critical	Quite interesting	Quite interesting	Quite interesting	Quite interesting	Quite interesting	40
Optimistic	Very interesting	Very interesting	Very interesting	Very interesting	Very interesting	37
Indifferent	Not interesting	Not interesting	Not interesting	Not interesting	Not interesting	34
Demotivated	Very interesting	Very interesting	Very interesting	Very interesting	Very interesting	20

Source: Own elaboration

Figure 4. Importance of provided responses for group classification of non-users of e-Government
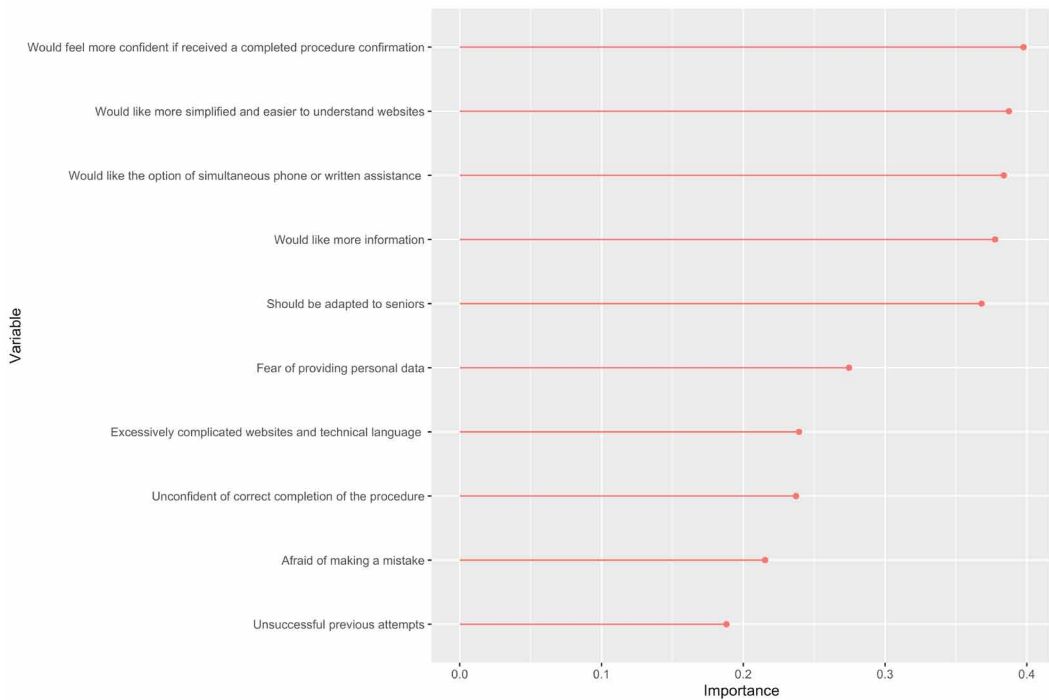
Source: Own elaboration with R

CONCLUSIONS

Seniors are not extensive users of e-Government, evidence of this, is the fact that only just over half have performed some kind of procedure (57%). This may be related to not all feeling confident about digital purchases or procedures (66.2% claim to feel confident) with the majority (70.6%) claiming to have a low to average ability to manage purchases and procedures online.

These results are confirmed after performing a taxonomy of user of e-Government over 60 years of age (SO1 & SO2). There is no consistent pattern, although it is observed that the two groups with the highest number of individuals (cluster 1 & 2) have less insecurities in performing online procedures than the other groups, and consequently consider it less important for modifications to be made to the websites.

On the contrary, the third and fourth clusters consider the application of modifications to administration websites most interesting, in line with a navigation profile which displays caution in performing procedures online. The fifth group only expresses a concern with providing personal data, yet considers the presented simplified version most interesting, in addition to the possibility of receiving assistance from administration with related online procedures.

Regarding seniors who do not perform online procedures, two clear types are identified. Those who do not feel confident, a sentiment which explains their avoidance of digital procedures, and a much smaller number of individuals (cluster 8) who express none of the questioned obstacles, therefore, their behaviour may be due to other reasons such as a lack of interest for this particular channel. About the third specific objective (SO3) which is related to modifications to encourage e-Government use, all of the groups consider the presented actions quite interesting or interesting, except for cluster 9 which does not believe they are important and coincide with the profile which displays the most obstacles. It might be precisely these obstacles which prevent seniors from even considering the possibility of using e-Government, although adapting the system to their specific needs would be a great help.

On comparing the groups of individuals of users with non-users of public administration, it is found that those who are non-users of e-Government do not always display more obstacles than those who are users. The explanation may lie in the individual capacity to deal with these limitations or that the advantages of performing online procedures outweigh the perceived disadvantages in the process.

What appears clear is that based on the displayed attitude towards e-Government, the attitude and behaviour on the Internet of seniors can be predicted, highlighting different profile types and proposing personalised actions to encourage their use of e-Government. According to those surveyed, modifications referring to the simplification of the design and the content could be a stimulus to motivate them to perform online procedures.

DISCUSSION

The dizzying rhythm of the digitalisation of developed societies has led to the implementation of beneficial modifications in administration, although, not always have the needs of seniors been considered, leaving them excluded from using such services. In order to deploy a successful model of e-Government a development in accordance with a complete circle process is necessary, supported by the feedback of citizens, and the responsibility of governments (Bataineh & Abu-Shanab, 2016). To achieve that, the ageing of these societies, in addition to economic efforts to maintain a state of wellbeing, requires a commitment from public and socio-economic players with the public at risk (Jia et al., 2015; Llorente-Barroso et al., 2018). Consequently, to deal with ageing on a global scale, requires an integrated focus which considers the underlying social factors (Tomaz-De-Lima, 2018), and one which breaks the negative stereotypes surrounding ageing (Makita et al., 2021). In this respect, ICT emerges as an instrument of social integration for the most disadvantaged groups (Bernal-Meneses et al., 2019).

Specifically, in the case of some seniors, ICT may help them to overcome certain psycho-physical limitations related with mobility (Agudo-Prado et al., 2012; Miranda-De-Larra, 2004). Consequently, it is essential to design and implement measures which help seniors isolated at home to benefit from electronic services (Ma & Zheng, 2017). In this sense, e-Government can play a key role in bridging the digital generation divide (Viñarás et al., 2017).

The development of e-Government can help to empower seniors, by giving them a greater control over their lives (Silva & Martínez, 2004), increasing their confidence and their ability to have an impact on the taking of government and socio-economic stakeholder decisions (Rowlands, 1997; Zimmerman, 1990).

Online administrative procedures ease everyday bureaucratic procedures for seniors (Llorente-Barroso et al., 2015; Llorente-Barroso et al., 2018; Sánchez-Valle et al., 2017).

In order that seniors use e-Government, it is necessary to respond to their needs, addressing modifications to website designs (Llorente-Barroso et al., 2018) by simplifying the form and content (Abad-Alcalá et al., 2017), and by alleviating technological stress (Hawthorn 2000). An interface improvement would help the perception of use and ease of use with the senior user, and in turn, their motivation and experience satisfaction when performing online procedures (Molnár, 2015). However, digital literacy with seniors is essential to foster their digital inclusion (Abad-Alcalá et al., 2017) and alleviate the digital divide (Lee & Porumbescu, 2019). In this sense, initiatives which involve seniors with experience helping other seniors learn, may be interesting (Woodward et al., 2013).

Compared to previous research that characterizes seniors as a homogenous group in relation to e-Government and has focused on their difficulties in accessing its services (Abad-Alcalá et al., 2017; Chadwick-Dias et al., 2007; Turner et al., 2007; Viñarás-Abad et al., 2017; Williamson & Asla, 2009; Xie & Bugg, 2009), proposing digital literacy as the way to achieve digital inclusion (Abad-Alcalá, 2014; Abad-Alcalá, 2016; Llorente-Barroso et al., 2021), this article makes clear the heterogenous makeup of this group and suggests a classification that would permit the design of differentiated e-Government strategies for each cluster.

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ENDNOTES

[1]   Euclidean, Chevyshev, Manhattan, Minkowski, Canberra and Mahalanobis distances were tried using the base and philentropy package (HG 2018) as well as PCA, KODAMA, ISOMAP and Shannon nonlinear mapping for dimensionality reduction. The best dissimilarity matrix was selected using the Hopkins statistic (using the cluster-end package).

[2]   The KODAMA algorithm is a novel learning algorithm for unsupervised feature extraction and is specifically designed for analysing noisy and high-dimensional datasets. KODAMA works in a similar fashion to algorithms such as t-SNE, Shannon Nonlinear Mapping or ISOMAP, reducing the dimensionality of the dataset in a nonlinear way so that meaningful groups are identified.

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