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Digital Citizenship Profiles in Türkiye: A Clustering Analysis of E-Government Service Usage

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Abstract

A cluster analysis has been employed to study usage patterns of e-government services in Türkiye and to develop profiles of digital citizenship. The analysis used microdata from the Turkish Statistical Institute's 2024 Household Information Technology Usage Survey, which is a representative survey of 18,366 respondents, and contained socio-demographic data such as age, gender, education level, work status, and region (IBBS-1) as well as several behavioral variables such as accessing personal information, making appointments, transferring forms, and applying for social services. The k-means clustering algorithm was applied, and the elbow and silhouette methods suggested that a three-cluster solution best described the data. The results demonstrate that there is not a homogenous digital citizenry in Türkiye. Western provinces represent the first cluster and participants here are using a large number of e-government services with high levels of digital competence. The second cluster consists of participants from eastern provinces who have low levels of digital competence and are not utilizing e-government services. The third cluster (in the central region) represents participants who are transitioning to full digital citizenship. Therefore, future policies related to digital citizenship need to be created with a tiered and targeted approach rather than one-size-fits-all.

Keywords: Digital citizenship, e-government, cluster analysis, K-means, digital divide, Türkiye

1. Introduction

The increased pace of adoption of information and communication technologies (ICT) in the past few years (Amiri & Sangar, 2023) and their adoption by the government apparatus are causing a shift in the conventional paper-intensive communication practices among the various stakeholders and beneficiaries (Bhatia & Bhatia, 2025), thereby creating a breeding ground for a paradigm shift in the manner of engagements between the government and its citizens (Chun et al., 2010; Alkhudhiri, 2023). This has resulted in the development of a new notion called "digital citizenship," which encompasses not just the accessibility as well as usage capability of the online government services by citizens but also their engagement with the online governance environment (Jæger, 2021).

Despite the expansion of e-government infrastructures worldwide, there are still existing gaps between the different groups regarding their access and usage of e-government infrastructures, so the realization of digital citizenship is influenced (Cui et al., 2025). It has been discovered that gender, age, education level, employment status, and the developmental status of the region where individuals reside are significant variables affecting people's usage of e-government services (Botrić & Božić, 2021; Pontones-Rosa et al., 2023; Oztaskin, Iyit & Alkan, 2024). For example, empirical research has shown that younger, more educated, and urban citizens tend to be more receptive to the use of e-government services, largely because they possess better IT skills (Opacic et al., 2023; Dodel, 2024). These findings illustrate the existing socio-demographic and regional discrepancies, which reveal that digital citizenship encompasses not only technological issues but also socio-political phenomena related to inclusion and exclusion in digital society (Kozaman Aygün & İnal Çekiç, 2025).

In light of these findings, current studies emphasize that technology adoption models are inadequate for understanding digital citizenship and that user-centered segmentation models such as clustering should be used. Segmentation techniques such as clustering offer a robust methodological framework for revealing latent user profiles based on socio-demographic characteristics and usage behaviors; this perspective is increasingly advocated in e-government research (Shin et al., 2024; Bach et al., 2025). For example, Rodríguez-Heví, Navío-Marco and Ruíz-Gómez (2020) found that digital skills, population density, and socio-demographic variables are significant factors in the adoption of e-government services in the context

of European Union countries; while, Tokovska et al. (2023) revealed that even in countries with relatively high infrastructure access, individuals' education levels and digital literacy skills are determining factors in the adoption of e-government services. These findings emphasize that access is a necessary but not sufficient technological component for the development of digital citizenship, and that the simultaneous development of cognitive and social skills is crucial for the formation of a sustainable and accessible digital citizenship (Van Dijk, 2020).

In the Turkish context, the importance of digital citizenship is particularly evident in the rapid growth of the national e-Government Portal (e-Government Gateway), launched in 2008 and one of the most advanced and comprehensive platforms of its kind globally. As of 2024, more than 66 million citizens (approximately 80% of the population) actively use the portal to access 8,309 services offered by 1,080 institutions, ranging from taxation and healthcare to education, social assistance, and judicial information (Presidency of the Republic of Türkiye Digital Transformation Office, 2025). While this effective and widespread use demonstrates the central importance of the portal in the daily lives of citizens, previous studies in Türkiye have either focused on the adoption of e-government services (Sebetci, 2015; Özen, Çam, Pourmousa, 2017; Akgül, 2018; Arslan & Gurer, 2025) or examined the e-government infrastructure from a technological and legal perspective (Çeliksoy & Canga, 2024; Atar, Güler & Usta, 2025). Studies that investigate and analyze the heterogeneous structure of users and the socio-demographic dynamics shaping digital citizenship practices have been relatively limited.

This study aimed to address this gap by examining socio-demographic characteristics such as gender, age, education level, employment status, and regional location (IBBS-1), as well as behavioral indicators related to e-government service use, such as access to information, form downloading, appointment scheduling, account management, tax verification, document requests, social assistance applications, and reported application usage and technical difficulties. A clustering approach was used to identify and analyze digital citizenship profiles in Türkiye. The purpose of using clustering techniques is to provide a more detailed and user-centered approach to how citizens interact with e-government infrastructures.

This research has three contributions. First, by adopting a data-driven segmentation approach to analyze the diverse ways in which citizens interact with the e-Government Portal in Türkiye and moving past existing perspectives centered on adoption models and associated factors, there is an open research gap regarding the heterogeneous nature of this user interaction within the Turkish e-Government Portal context. Second, this research provides an analytical framework that allows for a more detailed analysis of citizen behavior in an e-Government context through clustering techniques, e.g., K-Means clustering with a large scale national dataset. Finally, by demonstrating the relationship between digital inequities and patterns of service use, this research provides recommendations for decision-makers interested in addressing the digital divide in Türkiye. In Chapter 2 the literature and theoretical orientation are provided. In Chapter 3 details of the dataset, variables and clustering methodology are presented. In Chapter 4 the results of the analysis are presented and in Chapter 5 implications are discussed in terms of the findings. In Chapter 6 the study's contributions and limitations are summarized and future research directions are suggested.

2. Theoretical Background And Literature Review

2.1. Digital Citizenship: Conceptual Framework and Evolution

Digital citizenship has been discussed in various frameworks in the literature, and past studies have examined it in broader contexts, from simple ideas like access to technology or digital literacy to the ethical, social, and environmental dimensions of digital participation. Mossberger, Tolbert, and McNeal (2007) define digital citizenship as the ability to participate in online transactions within society, and stresses that technologies have changed citizens' methods of participation in society, access to information, and engagement with political issues. This perspective has expanded over time, going beyond basic skills to include cognitive-analytical and participatory-social skills (Choi, Glassman & Cristol, 2017). Digital citizenship emphasizes equality, transparency, accountability, and social participation by enabling citizens to benefit from e-government services through ICT in the digital age (Asimakopoulos et al., 2025).

Hintz, Dençik, and Wahl-Jorgensen (2018), emphasize that digital citizenship is an active and political struggle that goes beyond simple issues like access and digital literacy, arguing that this has led to the emergence of data justice, critique of power mechanisms, defense of digital rights, and citizen resistance against commercialized platforms. This demonstrates that the debate on digital citizenship has evolved in response to rapid technological and societal changes in recent years.

2.2. E-Government Adoption and Usage Patterns

The extensive literature on e-government adoption is predominantly based on technology acceptance models, particularly the Technology Acceptance Model (TAM) and the Unified Theory of Technology Acceptance and Use (UTAUT). These models examine perceived usefulness, perceived ease of use, user attitude, and behavioral intention as the most important variables of e-government service adoption (Özen, Çam, Pourmousa, 2017; Akgül, 2018; Arslan & Gurer, 2025).

However, more recent studies highlight that adoption is not only related to individual perceptions and attitudes towards technology, but is also shaped by socio-demographic variables such as gender, age, education, income, and regional inequalities, as well as structural constraints such as digital literacy, trust in government, and infrastructure inequalities (Pérez-Morote, Pontones-Rosa & Núñez-Chicharro, 2020; Rodríguez-Hevíá, Navío-Marco, and Ruíz-Gómez, 2020; Botrić & Božić, 2021; Oztaskin, Iyit & Alkan, 2024). As a result, for a successful e-government implementation, not only initial adoption but also examining digital gaps and inequalities in the use of public services, continuous use, service diversification and user satisfaction need to be examined.

In this context, while approaches focusing on adoption and usage intention are effective in explaining whether citizens accept e-government services, they fall short in revealing how different user groups experience and interact with these services. To address this gap, recent studies have highlighted user-centric segmentation methods—specifically profiling and clustering—that allow users to visualize heterogeneous behavioral patterns. This topic will be discussed in more detail in Section 2.4.

2.3. Socio-Demographic Determinants of Digital Divides

Socio-demographic factors such as gender, age, education level, and employment status play a significant role in shaping digital citizenship and e-government adoption patterns (Gupta, 2020; Gounopoulos et al., 2020). When gender is examined, studies have consistently shown that women have lower levels of e-government usage compared to men. This can be explained by factors such as digital skills, cultural norms, and inequality of access (Antonio & Tuffley, 2014; Ariansyah et al., 2023; Djatmiko, Sinaga, & Pawirosumarto, 2025). When age is examined, younger individuals more easily adopt and actively use e-government systems and services, while older individuals have difficulty adapting to the system due to a lack of digital literacy and insufficient understanding of the benefits of e-government (Sung & Lee, 2025). Furthermore, when education level is considered, it has been found that more educated individuals are significantly more likely to access and effectively use e-government services, thanks to their technological skills, digital literacy, and technological awareness (AlHadid et al., 2022; Mesa, 2023). Furthermore, citizens in rural areas face geographical inequalities due to limited digital infrastructure, slower internet connections, and less digital literacy. These urban-rural differences lead to significant disparities in access to digital services and, in general, in digitalization (Omweri, 2024; Nwonye, Nkan & Akpan, 2025).

In conclusion, regional inequality is evident in almost all areas in Türkiye. In terms of industry and digital development, western regions are more advanced than eastern regions, and the widening gap between them significantly affects digital access and e-government use. Limited digital infrastructure, lower income and education levels, and weaker institutional capacity in less developed regions like the east negatively impact citizens' use of e-government and participation in digital governance (Alkan & Ünver, 2021; Özcan Alp & Baycan, 2024; Atar, Güler, & Usta, 2025). Therefore, analyses at the NUTS-1 (IBBS-1) level highlight that the digital divide has not only individual but also spatial dimensions, making regional inequalities a key obstacle to achieving inclusive digital citizenship.

2.4. Clustering Approaches in E-Government Research

The use of clustering techniques in e-government research represents an analytical approach that goes beyond traditional adoption models and places the user at the center (Shin et al., 2024; Bach et al., 2025). Cluster analysis allows for the identification of highly similar individuals into predefined categories, enabling the creation of meaningful user groups based on usage behaviors (Rakha & El Kontar, 2019; Liu & Su, 2025). In this context, clustering methods make visible the diversity in the use of digital public services by men and women and produce applicable outputs for policy design (Sarı, 2025).

Recent studies show that clustering approaches have successfully revealed e-government user profiles in different national contexts. For instance, Moraliyska (2024) revealed that there is a deep digital divide in the use of e-government services in European Union countries, and that many countries lag far behind the best-performing countries in all digital areas. Shin et al. (2024) revealed that cluster-based analyses of digital participation tools show that digital tool sets with different functions in the e-government ecosystem differentiate the levels of citizen participation in problem identification, negotiation, and decision-making processes. These findings indicate that e-government services should be segmented not only based on access but also on functional usage patterns. Leogrande et al. (2022), through clustering analyses based on e-government indicators, reveal a significant digital divide between countries; Western European countries are concentrated in clusters with high e-government values, while Eastern European countries are in clusters exhibiting low e-government performance.

2.5. Research Gap

Three significant research gaps in this study are identified by the literature review. First off, there aren't many cluster-based studies in Türkiye that look at the diversity of e-government users; instead, most research focuses on adoption rates. Second, a review of current research in Türkiye reveals that the relationship between socio-demographic characteristics and e-government usage behaviors is not adequately addressed because these studies concentrate on adoption and behavior analysis. However, factors like age, educational level, work status, and regional variations not only influence service accessibility but also have a direct impact on the reasons and degree to which people utilize these services.

A thorough grasp of digital citizenship is seriously hampered by ignoring this aspect. Thirdly, it is impossible to directly contribute to the creation of digital citizenship policies because the majority of current research in Türkiye concentrates on a small amount of data and a particular area, failing to generate generalizable findings. In particular, big data-driven analyses that show which user groups use which services frequently or the difficulties they encounter when doing so are desperately needed from the perspective of policymakers.

In order to fill these gaps, this study uses cluster analysis on a sizable dataset that represents every region of Türkiye to uncover digital citizenship profiles. It is evident that digital citizenship in Türkiye does not have a consistent structure when sociodemographic traits and e-government usage patterns are assessed jointly. In this regard, the study produces tangible results that will open the door for the creation of more inclusive and focused policies in addition to making an original contribution to the literature.

3. Data And Methodology

3.1. Data Set

The dataset used in this study was collected by the Turkish Statistical Institute (TÜİK) in 2024 from 18,366 individuals as part of the Household Information Technology Usage Survey. This survey, conducted nationwide, is one of the most comprehensive national resources measuring the access levels of individuals and households to information and communication technologies, their internet, e-commerce, digital service, and e-government service usage habits, and the problems they encounter.

The research was designed to be representative of Türkiye by including individuals aged 18-74, allowing for generalizable results when applied nationwide. Since the survey includes detailed behavioral indicators regarding the use of e-government services, as well as socio-demographic characteristics at the individual and household levels, it offers a suitable framework for analyzing digital citizenship profiles.

3.2. Variables

The variables used in the study were considered in two main groups:

- (i) Socio-demographic variables and
- (ii) behavioral variables related to the use of e-government services.

3.2.1. Socio-Demographic Variables

In order to reflect the structural characteristics of individuals in determining digital citizenship profiles, the following socio-demographic variables were included in the analysis:

- Gender
- Age group
- Education level
- Employment status
- Regional location (NUTS-1 level)

These variables are considered in the literature as the main determinants of the digital divide and are among the factors that directly affect access to and usage intensity of e-government services.

3.2.2. E-Government Service Usage Variables

To measure digital citizenship practices, the following indicators reflecting the transactions individuals perform through the e-Government Portal have been used:

- Access to personal information
- Access to information belonging to public institutions
- Downloading forms and documents
- Making appointments
- Receiving official digital notifications
- Digital tax return processing
- Requests for official documents and certificates
- Applications for social assistance and support
- Difficulty in use
- Experiencing technical problems

These variables are important in revealing whether individuals use e-government services only for passive information retrieval or for purposes requiring more advanced transactions and interactions.

3.3. Methodology: Clustering Analysis

This study uses clustering analysis to reveal digital citizenship profiles. Clustering analysis is an exploratory data analysis method that allows revealing hidden structures within data by grouping individuals with similar characteristics under the same groups without predefined classes (Özyüksel Çiftçioğlu & Naser, 2022).

In this study, the k-means algorithm was chosen because of its ability to cluster numerical data without requiring supervision. K-means was preferred because of its computationally efficient performance in large samples, the interpretability of its results, and its widespread use in e-government literature. The k-means algorithm groups individuals according to their distance from cluster centers and represents each cluster

with the average of the observations belonging to that cluster. This approach produces strong results, especially in the analysis of quantitative variables such as the frequency and intensity of e-government service use (Khumngoen & Sinthupinyo, 2023).

The following steps were followed in the analysis process:

- Since the majority of variables consist of binary (yes/no) or limited categorical responses derived from official survey data, no extreme values were detected.

- The Elbow (WCSS) and Silhouette analyses were used together to determine the number of clusters. The Elbow method revealed that exceeding three clusters resulted in only marginal improvements in WCSS values. While the Silhouette analysis showed that the highest value was obtained with a six-cluster solution, the three-cluster solution also had a highly competitive Silhouette score. In the context of social sciences, considering that a higher number of clusters would limit interpretability and policy-making, the Elbow and Silhouette results were evaluated together, and it was concluded that the three-cluster solution best represents the data structure.

Cluster analysis was performed at the individual level, and the socio-demographic profiles of the resulting clusters were interpreted using sample weights to represent the Turkish population.

4. FINDINGS

This study applied K-means clustering analysis to reveal the differing profiles regarding the use of digital public services at the individual level across Türkiye. The analysis identified three distinct clusters that differ in terms of digital citizenship behaviors and socio-demographic characteristics. Cluster interpretations were made by considering age, gender, education level, employment status, regional distribution (WEST-CENTRAL-EAST), and usage patterns of e-Government services together. Since the variables were coded as binary (Yes=1, No=2), lower mean values indicate more intensive use of the relevant service.

4.1. Distribution of Digital Citizenship Clusters within the Sample

The distribution of digital citizenship profiles within the sample, obtained from the K-means clustering analysis, is presented in Figure 1.

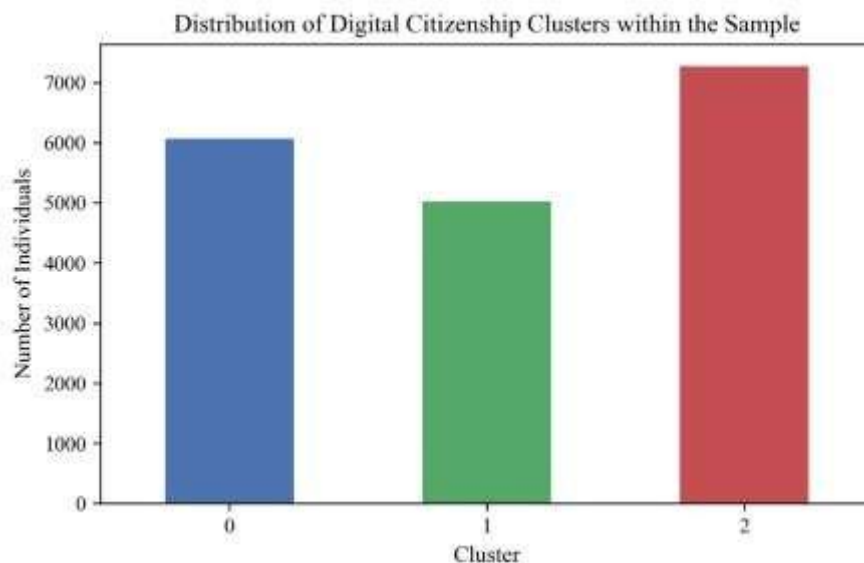


Figure 1. Distribution of Digital Citizenship Clusters within the Sample

Examining Figure 1, it can be seen that Cluster 2 constitutes the largest part of the sample. This cluster represents approximately 39.6% of the total sample with 7,274 individuals. Cluster 0 constitutes 33.0% of the sample with 6,067 individuals, and Cluster 1 constitutes 27.4% with 5,025 individuals. This distribution indicates the existence of distinctly different profiles in terms of individuals' digital behaviors, rather than a homogeneous structure regarding the use of digital public services across Türkiye.

4.2. Cluster-Based Profiles of e-Government Service Usage

This subsection examines the intensity of e-Government service usage among digital citizenship clusters on a service-by-service basis. For this purpose, the average values of the variables related to e-government services determined within the scope of the study were calculated for each cluster and shown on a heat map to more clearly demonstrate the differences between the clusters. In the collected dataset, the variables were coded in binary form (Yes = 1, No = 2), and an average value close to 1 indicates more intensive use of the service, while a value close to 2 indicates a lower level of use.

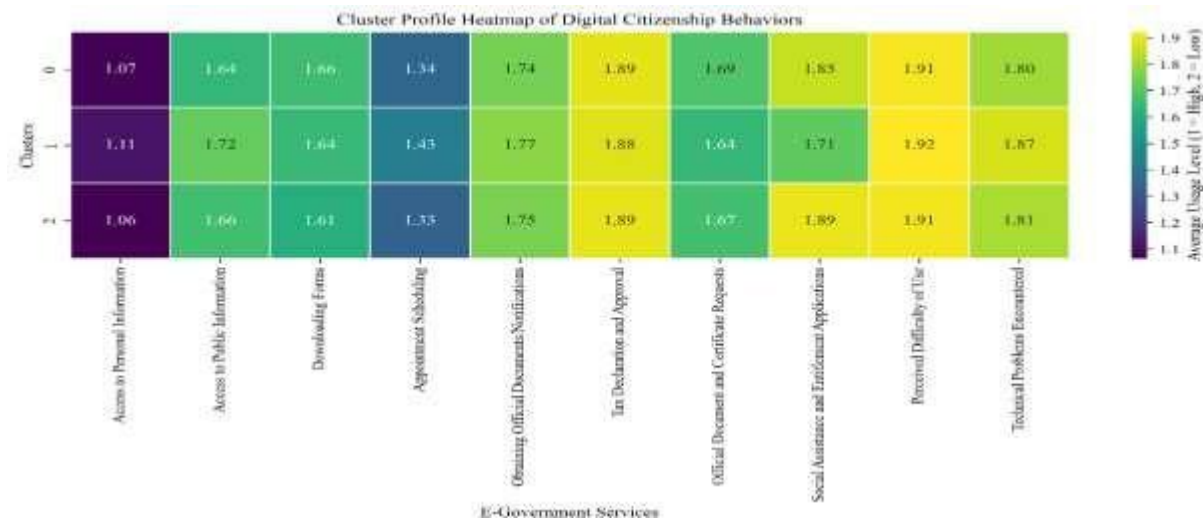


Figure 2. Cluster Profile Heatmap of e-Government Service Usage

Figure 2 shows significant differences in the usage levels of e-government services among the clusters. Cluster 0 has lower average values for services such as access to personal information, appointment scheduling and access to public information, cluster 1 has lower average values for services such as access to personal information, appointment scheduling, and downloading for form and cluster 2 has lower average values for services such as access to personal information, appointment scheduling, and downloading form. All three clusters have the highest averages for services such as perceived difficulty of use and tax declaration and approval.

Cluster 1 was found to have a relatively high average in most services overall compared to the other clusters, and it was observed to differ more from the other clusters in areas such as access to public information, appointment scheduling, social assistance and entitlement applications, and technical problems encountered.

Additionally, access to personal information and appointment scheduling services were found to have the lowest averages across all clusters, while perceived difficulty of use and tax declaration and approval had the highest averages.

4.3. Socio-Demographic Distribution of Digital Citizenship Clusters by Education Level

This section examines the distribution of clusters representing digital citizenship profiles according to education level and age. The dataset originally consisted of eight categories representing individuals' education levels: no schooling, primary school, secondary school, high school, associate degree, bachelor's degree, master's degree, and doctorate. However, to provide a more meaningful and comparable analysis, the education level variable was reclassified into three categories: no schooling, primary school, and secondary school as low education level, high school and associate degree as medium education level and bachelor's, master's, and doctorate as high education level.

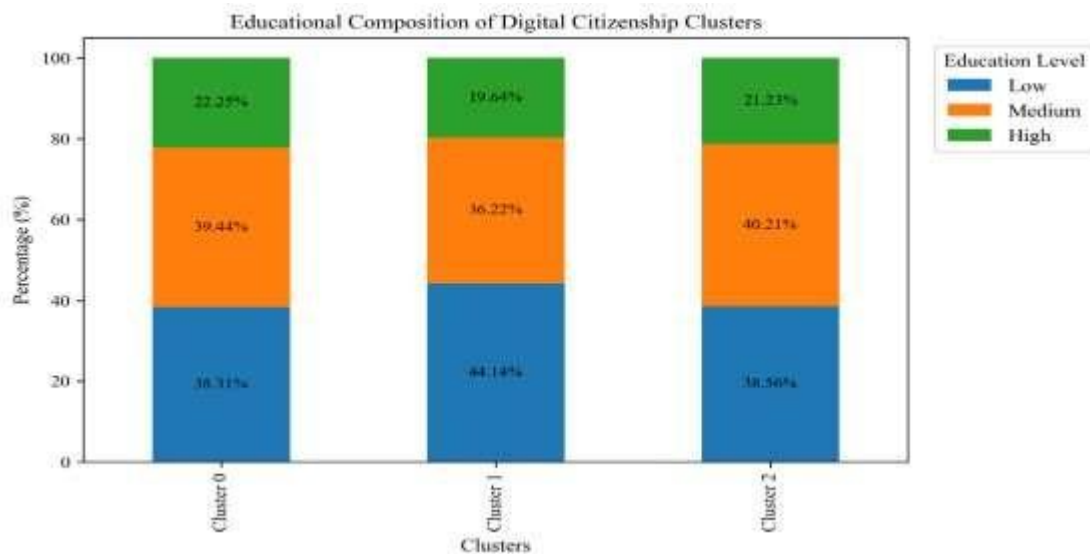


Figure 3. Educational composition of digital citizenship clusters

The percentage distribution of digital citizenship clusters according to education levels is presented in Figure 3. The findings indicate that individuals with higher education (bachelor's, master's, doctorate) have the lowest proportion across all three clusters. The proportion of the higher education group was calculated as 22.25% in Cluster 0, 19.64% in Cluster 1, and 21.23% in Cluster 2. The similar proportions of the higher education group in all clusters indicate that this group exhibits a balanced distribution in terms of digital citizenship profiles. While the middle education level has the highest proportion in Clusters 0 and 2, the low education level has the highest proportion in Cluster 1. This finding is due to the fact that 4.42% of individuals with no schooling in Cluster 1.

To more comprehensively reveal the socio-demographic characteristics of digital citizenship clusters, age distributions and mean age values were calculated in the continuation of the study. Cluster-based analyses show that although the mean ages are similar among the clusters, some differences are also present. As seen in Figure 4, cluster 2 has the highest mean age with 39.55, while cluster 1 has the lowest mean age with 36.37. Furthermore, similar values were obtained in the standard deviation calculation for all three clusters (Cluster 0: SD = 13.61; Cluster 1: SD = 13.01; Cluster 2: SD = 13.73). This indicates that there is a comparable age distribution within each digital citizenship profile.

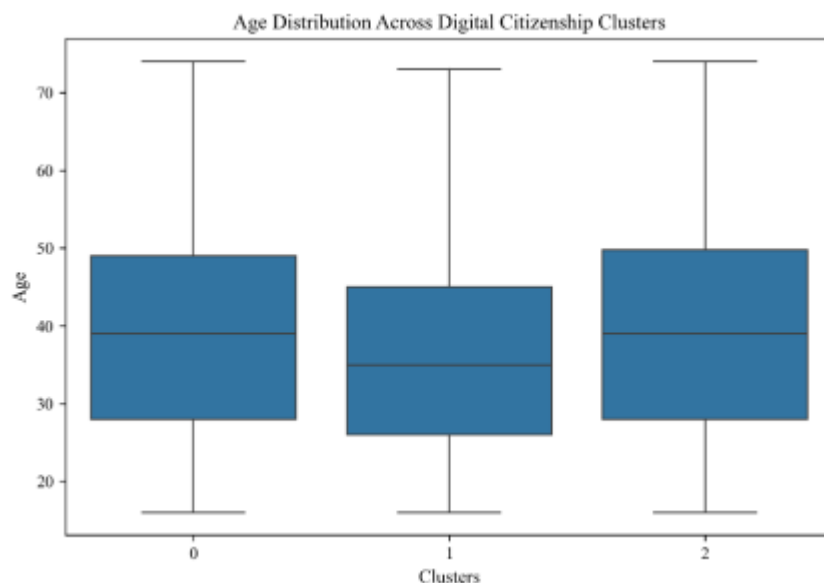


Figure 4. Age distribution according to digital citizenship clusters.

5. Discussion

This study demonstrates that digital citizenship in Türkiye does not exhibit a homogeneous appearance. Socio-demographic variables, regional inequalities, and the ways in which e-government services are utilized show that digital citizenship profiles do not have a uniform structure. The K-means clustering method was applied to analyze the data within the scope of the research, and three distinct digital citizenship profiles were identified. These findings empirically substantiate the distinction between "access, use, and sufficiency," frequently mentioned in the e-government literature.

This section discusses the findings by comparing them with national and international literature, and evaluates the implications of these results for digital citizenship, the digital divide, and policies.

5.1. High Digital Competence and Inclusive Use: Advanced Digital Citizens Concentrated in Western Regions (Cluster 2)

Individuals in Cluster 2 demonstrated that they utilize a wide variety of e-government services, not solely for accessing personal information. Relatively high usage levels (appointment scheduling, form downloading, accessing public information, and requesting official documents and certificates) indicate that this group perceives e-government services as a holistic governance system.

This finding, as Van Dijk (2020) and Choi et al. (2017) also demonstrated in their work, highlights the need to consider cognitive and structural competency dimensions and emphasizes that digital citizenship is not solely about "technology use." Also, studies of Rodríguez-Heví et al. (2020) and Tokovska et al. (2023) suggested that regions with higher levels of education and regional development use e-government services more deeply. This study found that citizens in Cluster 2 have a higher level of education compared to other clusters, and therefore, it is consistent with the results of the aforementioned studies. At the same time, the fact that the citizens in this cluster are generally concentrated in provinces located in western Türkiye shows that digital citizenship is affected by spatial inequality. These findings are consistent with the work of Alkan & Ünver (2021) and Özcan Alp & Baycan (2024), who emphasize that regional development

inequalities are reflected in the digital divide. In this context, it can be explained that individuals in cluster 2 can adopt digital transformation programs and policies quickly and early.

5.2. Users Confined to Basic Services and with Low Digital Capacity: Vulnerable Digital Citizens Concentrated in Eastern Regions (Cluster 1)

Cluster 1 consists of individuals who use e-government services less frequently than other clusters, such as accessing personal and public information, scheduling appointments, and receiving official documents or notifications, but who make more social assistance and rights claims. The reason this cluster is better off experiencing technical problems than other clusters may be due to their less frequent use of most services. This situation reveals that the digital divide has dimensions not only of access but also of quality of use and digital competence. The findings directly coincide with the conclusion highlighted by AlHadid et al. (2022) and Mesa (2023) that education level is a factor in e-government use. While Sung & Lee (2025), AlHadid et al. (2022), Botrić & Božić (2021), and Dodel (2024) suggest that younger individuals use e-government services more intensively, the findings of this study contradict this literature. Accordingly, it was found that Cluster 1, which has a lower average age (Cluster 2: 39.55, Cluster 1: 36.37 and Cluster 0: 38.93) compared to other clusters, uses e-government services at a more limited level.

The presence of this cluster in the Eastern regions shows that the digital citizenship in Türkiye is not just a problem of the individual, but also a matter of structural and regional inequalities as well. The result here shows that just simply providing the many institutions with access to e-government service will not be sufficient for success; it will require digital literacy training, ICT use skills development, support for users, and development of capacity building policies at the regional level. Therefore, these findings correspond with the conclusion made by Van Dijk (2020) that access alone is not enough and that digital literacy and education are key components.

5.3. Selective and Need-Based Use: Transitional Digital Citizens Concentrated in Middle Regions (Cluster 0)

Digital citizenship location is represented by Cluster 0. In this instance, those in the digital profile of Cluster 0 fall in between Cluster 1 and Cluster 2, but they still show more resemblance to Cluster 2 (age and level of education) than Cluster 1. The presence of Participants between Clusters 1 and 2 also illustrates the transition that takes place between the two clusters.

This profile largely aligns with the findings of Özcan Alp and Baycan (2024) and Atar, Güler, and Usta (2025), which highlight the access and usage-based digital divide reflecting the development gap between western and eastern regions of Türkiye. In this group, considering the usage levels of most services, it is shown that this cluster's digital skills have exceeded a certain threshold, but they are not fully integrated into advanced digital citizenship practices as much as Cluster 2.

This cluster is important because it demonstrates that, by emphasizing appropriate policy interventions (user experience improvements, service integration, guidance mechanisms) in the realization of digital citizenship and the widespread adoption of digitalization, this group can evolve towards a full digital citizenship profile. This finding supports approaches that address digital citizenship based on processes rather than fixed categories.

5.4. General Assessment and Contribution to the Literature

Overall, this study reveals that digital citizenship in Türkiye is not uniform, is affected by socio-demographic and regional inequalities, and that e-government use varies in terms of quality rather than quantity.

The findings corroborate the existing literature on the digital divide, while also expanding upon it in terms of spatial inequality stemming from Türkiye's regional structure. Specifically, inequalities in access to digital devices and digital literacy, highlighted in the literature, are also identified within the context of the e-government and digital citizenship debate, thus providing a strong regional perspective.

In this context, the study contributes directly not only to the academic literature but also to the development of targeted digital citizenship policies.

6. Conclusion And Limitations

6.1. Conclusion

This study examines the use of e-government services and demonstrates that digital citizenship profiles in Türkiye are not homogeneous, but are directly linked to socio-demographic characteristics and regional development levels. K-means clustering analysis was performed on microdata from the Turkish Statistical Institute's 2024 Household Information Technology Usage Survey. This dataset provided an opportunity to analyze not only whether individuals use e-government services, but also which services they use and whether they encounter technical difficulties while using them.

There are twelve NUTS-1 regions in Türkiye where three groups of digital citizens were identified. Group one consists of western provinces with older, more educated citizens as compared to the other two groups. This group uses e-government services extensively and with high digital competence. Group two consists of eastern provinces with younger and less-educated citizens than either of the other two groups. Most people in group two have limited use of e-government services and lower digital competency than members

in either of the other two groups. Group three is made up of central provinces that show greater digital citizen activity than group two but also represent an intermediate stage of development regarding the transition to digital citizenship.

These findings demonstrate that the widespread adoption of e-government infrastructure is necessary for the development of digital citizenship, but not sufficient on its own. Digital citizenship is shaped not only by technological access but also by structural factors such as education level, employment status, regional development, and digital skills. In this respect, the study supports approaches that consider digital citizenship as a socio-technical and spatial phenomenon rather than individual preferences.

Another important contribution of the study is that it offers a user-centered analysis based on actual usage behaviors, going beyond the adoption and intention-based models that are predominantly focused on in the e-government literature in the Turkish context. Thanks to the clustering approach, the heterogeneous structure of digital citizenship practices, hidden under average values, has been made visible, and targetable user profiles have been revealed for policymakers.

In this context, the results indicate that digital citizenship policies should not be designed with a "one-size-fits-all" approach, but rather in a layered and target-oriented manner that takes into account the needs, capacities, and experiences of different user groups.

6.2. Limitations and Directions for Future Research

While the findings of this study offer significant contributions, they also have some limitations. Firstly, the analyses are based on a cross-sectional dataset. This limitation prevents the examination of changes in digital citizenship profiles over time, how individuals' behaviors change, and how they transition from one cluster to another. In this context, future studies could examine how profiles have changed and which profiles have progressed more positively by analyzing repeated cross-sectional data from 2004 to the present. Secondly, the dataset used in this study consists only of binary (yes/no) indicators, and the absence of multi-option indicators such as usage duration, usage frequency, and user satisfaction prevents a detailed analysis. Future studies could enrich these profiles by conducting detailed analyses using multi-category or scale-based tools.

Thirdly, the k-means method, which is successful in clustering large-scale and numerical data, was used in this study. However, in this clustering method, the number of clusters is determined by the researcher and the variables are fixed to the measurement level. Therefore, in future studies, alternative methods such as hierarchical clustering, model-based clustering based on the statistical distribution of the data, or fuzzy clustering, which allows an individual to partially belong to more than one cluster, can be used without the need to predetermine the number of clusters.

In conclusion, this study only attempts to determine digital citizenship profiles through the use of e-government services. However, digital citizenship is a much broader concept encompassing internet use, smartphone and computer ownership, digital literacy, digital rights, and data privacy awareness. Therefore, future studies could examine it using a multidimensional framework by including these dimensions.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s)

AUTHOR CONTRIBUTIONS

First author contributed to the data analysis, clustering application, and interpretation of findings. Second author was responsible for writing the introduction and literature review sections. Third author contributed to the acquisition of the dataset and the overall review and evaluation of the article. All authors have read and approved the final version of the article.

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