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**PhD. Thesis**

## The Digital Transformation in the Public Sector: The case of the Greek Local Government


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# ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ

**ΣΧΟΛΗ ΟΙΚΟΝΟΜΙΚΩΝ, ΕΠΙΧΕΙΡΗΜΑΤΙΚΩΝ ΚΑΙ ΔΙΕΘΝΩΝ ΣΠΟΥΔΩΝ**

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## Ο Ψηφιακός Μετασχηματισμός στο Δημόσιο Τομέα: Η περίπτωση της Ελληνικής Τοπικής Αυτοδιοίκησης

**Ζωή Πατεργιαννάκη**

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# Abstract

The European Union has prioritized e-Government and digital transformation development, and several international organizations, including the United Nations and the European Commission, have proposed methods for measuring them. However, Greece has received inconsistent results in reports evaluating its digital readiness. This study examines how the e-Government strategies and goals proposed by the European Commission from 2006 to 2020 were implemented in Greece. The findings indicate that Greece differentiated from the proposed strategy and followed a different digital transformation framework. The study continues with an analysis of e-Government development and adoption at the municipal level due to their significant impact on people's day-to-day life and their exclusion from benchmarking or ranking reports on digital transformation. A literature review is conducted on the development of e-Government in Greek municipalities, and the quality of 50 municipal e-Government portals is evaluated using three distinct perspectives: supply side (e-Government Maturity Models), demand side (Technology Acceptance Models), and objective (Web Accessibility Guidelines using the Lighthouse automated tool). The results show that demand-side methodologies provide a more comprehensive assessment of e-Government portal quality, while objective methods using automated tools require further development. The analysis concludes that municipalities perform at a medium level regarding e-Government quality in all methods, with the lack of usefulness being the main issue. Considering the lack of usefulness, a crowdsourcing approach was used to determine the citizens' thoughts on the services that should be provided through e-Government portals. The study results in a new typology on how e-Government portals need to be developed in order to be considered useful.

**Keywords:** e-Government, e-Government Maturity Model, Technology Acceptance Model (TAM), Digital Strategy, Digital Transformation, Public Sector, Local e-Government, Municipal e-Government, Smart Cities

# Περίληψη

Η Ευρωπαϊκή Ένωση έχει θέσει ως προτεραιότητα την ανάπτυξη της ηλεκτρονικής διακυβέρνησης και του ψηφιακού μετασχηματισμού, ενώ πληθώρα διεθνών οργανισμών, συμπεριλαμβανομένων των Ηνωμένων Εθνών και της Ευρωπαϊκής Επιτροπής, έχουν προτείνει μεθόδους για τη μέτρησή τους. Ωστόσο, στις διάφορες εκθέσεις αξιολόγησης της ψηφιακής της ετοιμότητας, η Ελλάδα έχει λάβει αντικρουόμενα αποτελέσματα. Η παρούσα μελέτη στοχεύει να εξετάσει τον τρόπο με τον οποίο εφαρμόστηκαν στην Ελλάδα οι στρατηγικές και οι στόχοι της ηλεκτρονικής διακυβέρνησης που προτάθηκαν από την Ευρωπαϊκή Επιτροπή από το 2006 έως το 2020. Τα ευρήματα δείχνουν ότι η Ελλάδα διαφοροποιήθηκε από την προτεινόμενη στρατηγική και ακολούθησε ένα διαφορετικό πλαίσιο ψηφιακού μετασχηματισμού. Η μελέτη συνεχίζει με μια ανάλυση της ανάπτυξης και υιοθέτησης της ηλεκτρονικής διακυβέρνησης σε επίπεδο τοπικής αυτοδιοίκησης λόγω του σημαντικού αντίκτυπού της στην καθημερινή ζωή των ανθρώπων και του αποκλεισμού της από τις εκθέσεις κατάταξης για τον ψηφιακό μετασχηματισμό. Διενεργείται βιβλιογραφική ανασκόπηση αναφορικά με την ανάπτυξη της Ηλεκτρονικής Διακυβέρνησης στους ελληνικούς δήμους και αξιολογείται η ποιότητα 50 δημοτικών πυλών ηλεκτρονικής διακυβέρνησης χρησιμοποιώντας τρεις διακριτές προοπτικές, αυτή της προσφοράς (Μοντέλα ωριμότητας ηλεκτρονικής διακυβέρνησης), της ζήτησης (Μοντέλα αποδοχής τεχνολογίας) και της αντικειμενικής αξιολόγησης (Οδηγίες προσβασιμότητας στον ιστό χρησιμοποιώντας το αυτοματοποιημένο εργαλείο Lighthouse). Τα αποτελέσματα δείχνουν ότι οι μεθοδολογίες από την πλευρά της ζήτησης παρέχουν μια πιο ολοκληρωμένη αξιολόγηση της ποιότητας της πύλης ηλεκτρονικής διακυβέρνησης, ενώ οι αντικειμενικές μέθοδοι που χρησιμοποιούν αυτοματοποιημένα εργαλεία απαιτούν περαιτέρω ανάπτυξη. Η ανάλυση καταλήγει στο συμπέρασμα ότι οι δήμοι αποδίδουν σε μεσαίο επίπεδο όσον αφορά την ποιότητα της Ηλεκτρονικής Διακυβέρνησης σε όλες τις μεθόδους, με κύριο θέμα την έλλειψη χρησιμότητας. Λαμβάνοντας υπόψη την συγκεκριμένη έλλειψη, χρησιμοποιήθηκε η προσέγγιση πληθοπορισμού (crowdsourcing) για να συλλεχθούν οι απόψεις των πολιτών αναφορικά με τις υπηρεσίες που επιθυμούν να παρέχονται μέσω των πυλών ηλεκτρονικής διακυβέρνησης. Η μελέτη καταλήγει σε μια νέα τυπολογία σχετικά με τον τρόπο με τον οποίο πρέπει να αναπτυχθούν οι πύλες ηλεκτρονικής διακυβέρνησης προκειμένου να θεωρηθούν χρήσιμες.

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…. to the memory of my grandmothers, Zoitsa and Chrysanthi, who showed me the power of resilience, courage, and grace and inspired me to embrace life's challenges with courage and conviction.

# DISCLAIMER

I explicitly and unreservedly declare that the doctoral thesis I submit to the Department of Economics of the University of Piraeus is the product of my intellectual effort, does not infringe on the rights of third parties, and follows the internationally recognized standards of academic writing, faithfully observing scientific ethics.

The opinions expressed are the sole responsibility of the author. The supervisor, the members of the seven-member committee, the Department, and the University of Piraeus do not necessarily adopt the opinions expressed nor bear any responsibility for any errors or omissions.

Signer

Zoi Patergiannaki

# Declaration for publications incorporated in the thesis

I declare that the thesis has been composed by myself, and the work has not been submitted for any other degree or professional qualification. I confirm that the work submitted is my own, except where work that has formed part of jointly authored publications has been included. My contribution to this work and those of the other authors have been explicitly indicated below. I confirm that appropriate credit has been given within this thesis where reference has been made to the work of others.

A part of the work presented in Chapter 2 was previously published in the *Proceedings of the 14th International Conference on Theory and Practice of Electronic Governance (ICEGOV* '21). Association for Computing Machinery (AMC), New York, NY, USA, 216–222 (doi: 10.1145/3494193.3494223) with the title "EGovernment Strategies' Evaluation: A qualitative comparative analysis on eGovernment strategic objectives set over the years by the European Commission and the Greek government." by Patergiannaki Z. and Pollalis Y. A.

A part of the work presented in Chapter 3 was previously published in the *Journal of Politics and Ethics in New Technologies and AI,* 2022, 1(1), e30872, (doi: 10.12681/jpentai.30872) with the title *"*A Review of the e-Government Maturity Models: Are They Still Relevant?" by Patergiannaki Z. and Pollalis Y. A.

A part of the work presented in Chapter 3 was previously published in Policy & Internet, 2022, 1-3, (doi: 10.1002/poi3.317) with the title "E-Government maturity assessment: Evidence from Greek municipalities" by Patergiannaki Z. and Pollalis Y. A.

A part of the work presented in Chapter 3 was previously published in the *Proceedings of the XIV. International Conference on e-Government and e-Justice (ICEGEJ 2020*). World of Science, Engineering, and Technology (WASET), Amsterdam, Netherlands, 443, with the title *"*Analyzing the Key Factors Impacting on the Digitalization and Penetration of EGovernment: A Case Study Analysis of Greek Municipalities*"* by Pollalis Y. A., Patergiannaki Z., and Tsatsani O.

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# 1 Introduction

The digital transformation of the public sector is one of the most significant priorities of the European Union (European Commission, 2020a). Multiple techniques and methodologies to measure e-Government and digital transformation development have been proposed by the UN, the European Commission, and academia (European Commission, 2020a; Directorate for Public Governance, 2020; Valdez-de-leon & Christensen, 2016). The EC has been working on digital transformation initiatives since 2006 (European Commission, 2006; European Commission, 2019). Due to the novel COVID-19, providing public services online has become a necessity, and preliminary research has shown that it has numerous benefits for the government, including increased citizens' trust in the government and positive citizens' perceptions of government transparency and reputation (Amosun, et al., 2021; Belyi, 2021).

According to the UN e-Government Survey (2020), Europe is the leader in e-Government development and has the highest number of nations (93%) that provide online services to vulnerable populations. Young people are typically the top service priorities for many countries, whilst low-income individuals and immigrants appear to be mostly neglected (United Nations, 2020). According to the same report, Greece, the Czech Republic, Luxembourg, and Portugal are the European Union countries closest to the EU average e-Government score. As a result, they have a very high position in the e-Government Development Index (United Nations, 2020).

When comparing the findings of the UN e-Government Survey (2020) with the observations of the OECD's Economic Survey of Greece (2020) and Schwab and Zahidi's Global Competitiveness Report (2020), a paradox emerges. Greece has one of the lowest scores in the categories of “Ensure public institutions embed strong governance principles and a long-term vision and build trust by serving their citizens”, “Update education curricula and expand investment in the skills needed for jobs and “markets of tomorrow”, “Expand eldercare, childcare and healthcare infrastructure, access and innovation for the benefit of people and the economy”, “Facilitate the creation of markets of tomorrow", especially in areas that require public-private collaboration” (Schwab &

Zahidi, 2020). Similar issues were discovered in the OECD's Economic Survey of Greece. However, the study places a particular emphasis on COVID-19's impact on Greece's reform efforts (OECD, 2020). Greece is a severely bureaucratic state, unprepared for the digital transition based on its overall bad performance and the categories in which significantly underperforms (Schwab & Zahidi, 2020). Furthermore, Greece is a European country that, besides young people, is responsible for providing services to a considerable number of immigrants (73,215) and the population in poverty (27% of the total population). As a result, the case of Greece provides an opportunity to assess a country for which past studies have produced conflicting results and which is required to provide services to a wide range of vulnerable population groups (Eurostat, 2021a; Eurostat, 2021b).

Even though local governments, such as municipalities, have a closer relationship with citizens and are responsible for addressing issues that affect people's daily lives, the majority of reports that provide a benchmark or ranking on the digital transformation of public services focus on the national level, ignoring local digital agendas (European Commission, 2020a; United Nations, 2020). By assessing 100 municipalities globally, the most recent UN e-Government Surveys, conducted in 2018 and 2020, attempted to provide insights into municipalities' digital transformation. Nevertheless, because the analyzed sample comprised the capitals of the countries surveyed, it does not accurately represent the average municipalities. The importance of analyzing average municipalities is also magnified when considering the number of municipalities in the EU (almost 91000) and their enhanced responsibilities, which illustrates the importance of local governments in EU countries (CEMR, 2016).

The case of the top 50 Greek municipalities was chosen for the study. The importance of municipalities and their direct impact on the well-being of their residents are the reasons for their selection over other institutions. Furthermore, Greece presents an interesting case due to the contradicting findings in e-Government development provided by international organizations.

The purpose of this thesis is to provide a comprehensive review of the various e-Government quality evaluation approaches utilizing fifty Greek municipalities as a case

study. It seeks to address how e-Government strategies are established and what their goals are. How can e-Government quality be evaluated? What characteristics define an effective e-Government in the eyes of the citizens? To answer the first question, the second chapter examines the EU's initiatives and how they have been implemented in Greece, as well as a literature review on the development of e-Government in Greek municipalities. The second issue is addressed by examining the quality of fifty local e-Government portals in Greece from three distinct perspectives: supply side, demand side, and objective. In order to answer the final question, 707 residents of the examined municipalities were surveyed on their thoughts on the services that should be provided through e-Government portals.

This chapter aims to further present the case of greek municipalities, shed more light on the sample selection methodology, and provide an overview of this work.

## 1.1 The case of Greek municipalities

### 1.1.1 Municipalities' role and responsibilities in Greece

The Greek state is organized on a decentralized basis, comprised of two levels of governance the central–state government and the local self-government (Regions and Municipalities) (European Committee of the Regions, 2021). In 1997, the Greek state comprised 1034 municipalities and 13 regions. Since 2011, when the Kallikratis program formally entered into force, the number of municipalities was reduced to 325 (European Committee of the Regions, 2021). In the same official document of the Kallikratis program, the role of all different levels of government is described (Hellenic Republic, 2011). According to law 3852/2010 on the Reorganization of Local Government, the role of municipalities is to exercise their responsibilities in the field of 1. Transportation and Infrastructure, 2. Environmental policy, and urban planning, 3. Economic Development and Employment, 4. Social Policy and Provision of public health, 5. Education, culture, and sport, 6. Administrative responsibilities. All the actions taken by the municipalities towards their responsibilities should be in agreement with the national law and regulations and the regional and European policies (Hellenic Republic, 2011).

For the implementation of the aforementioned actions, those responsible are the elected mayor, the deputy mayors, the city council, the economic commission, the quality-of-life commission, and the administrative commission. For the provision of the services appertain to municipalities' responsibilities, the cities might have the following departments: Human Resources, Accounting, Technical, Planning and Development, Technology, IT and Telecommunication, Legal Support, Citizen's Service Center, Transparency office, Social Policy, and Gender Equality, Environment and Civil Protection, Education culture sport and youth, Agriculture livestock farming and fishery (Hellenic Republic, 2011). Overall, municipalities have a significant role in citizens' and local businesses' daily transactions with the public sector. Also, their decisions have a direct and significant impact on improving citizens' well-being, education, natural environment, protection, equality, and participation in local policy decisions and affairs.

### 1.1.2 Municipal e-Government in Greece

Panayiotou & Stavrou (2019) designed an original assessment framework based on the PROMETHEE II approach for municipal e-services. The framework featured 64 criteria, the weights of which were decided by a committee of five Ministry of Interior decision-makers responsible for local government policy. From September 1, 2017, to December 23, 2017, the researchers looked at the websites of 325 Greek municipalities using these 64 criteria (Panayiotou & Stavrou, 2019). Their research showed that Greek municipalities have an inadequate level of maturity in providing electronic services (Panayiotou & Stavrou, 2019). According to their findings, municipalities with a high maturity level have embraced more demanding internet services such as electronic payments, the use of social media for shareholder communication, and software infrastructure to support their operations (Panayiotou & Stavrou, 2019). Municipalities that are still in their infancy, on the other hand, have built services based mostly on informative materials (Panayiotou & Stavrou, 2019).

It is worth mentioning that Panayiotou & Stavrou's (2019) findings are supported by World Economic Forum's Global Competitiveness Report 2020, which suggested that Greece, along with South Africa, the Russian Federation, and Turkey, has the lowest overall economic transformation readiness (Schwab & Zahidi, 2020). Furthermore, the

Economic Survey of Greece, published by the OECD, revealed similar issues (OECD, 2020). Greece is a severely bureaucratic state that is unprepared for the digital transition based on its overall bad performance and the categories in which it severely underperforms (Schwab & Zahidi, 2020). However, the UN e-Government Survey (2020), which shows that Greece has a very high rank in the e-Government Development Index, contradicts the findings of previous studies (it has acquired the 42nd position of the total 193 countries that participated in the survey).

Nevertheless, despite the importance of Greek municipalities in citizens' well-being, the national digital agenda in Greece until 2019 concentrated mostly on horizontal public-sector activity, with no mention of specific efforts by ministries and organizations of any government level (local, city, and regional councils). Thus, Panayiotou and Stavrou's (2019) findings cannot be deemed relevant to the current situation as they were based on data obtained in 2017 before municipalities' e-Government activities were included in the national digital agenda, and thus a systematic effort started.

Until today, Greek municipalities have taken independent steps to improve their internet presence. Furthermore, as Iannacci, Seepma, de Blok and Resca (2019) pointed out, even little, unpredictably changing environmental factors might activate the improvisation driver. As a result, given the changes in the national and international environment – Greece's exit from the final bailout program, the election of a neoliberal party to government, the spread of the COVID-19 pandemic, and the increased rate of immigration – the priorities and actions taken in the area of e-Government may have been altered. Also, Greece has been characterized by previous researchers as a country that follows the “Mediterranean welfare regime” (Rhodes, 1966; Petmezidou & Mossialos, 2005; Marí-Klose & Moreno-Fuentes, 2013; Zambarloukou, 2015). Countries in that regime are described by unstructured and semi-inclusive social programs and services that split society and use the decisive role of the family to substitute the government’s provision of security and support (Marí-Klose & Moreno-Fuentes, 2013).

The abovementioned observations explain the low participation in politics and trust in the government presented by OECD in the “Government at a Glance 2021” report (OECD, 2021). These characteristics, combined with Greece's proclivity for implementing

external policies without adapting them to the country's culture (Pempetzoglou & Patergiannaki, 2017), make for an interesting case analysis.

## 1.2 Sample Selection

According to earlier research by Panayiotou & Stavrou (2019), municipalities with a population under 10,000 people are considered to be "Laggards" and are susceptible to several issues with underdeveloped portal sites. Municipalities with 10.000 to 60.000 residents belong to the "Majority" cluster, which has adequate information material but has many weaknesses due to the adoption of simpler informative applications. Municipalities with 30,000 to 100.000 residents are drawn to the "Early Adopters" cluster, which has adequate information material and specific Electronic Services. Finally, the "Pioneers" cluster, which provides the user with a wide range of alternatives, is comprised of communities having a population of more than 100.000 inhabitants. To evaluate the progress of towns that have already developed functional e-Government portals, this research has chosen the cases of the 50 largest municipalities with a population of more than 60.000 citizens. The chosen cases represent the 13 administrative areas of Greece. For the selection and the analysis of the cases, the researcher retrieved an updated list of the 325 municipalities from the official website of the Central Union of Municipalities of Greece (KEDE, 2019), where the formal web addresses of municipalities were available, and obtained population data for all municipalities from the Hellenic Statistical Authority, based on the survey conducted in 2011 (Hellenic Statistical Authority, 2011). Combining the two data sets, the researcher identified the 50 most populous Greek municipalities, which account for 49% of the country's population. More information about the selected sample can be found in Appendix A.

## 1.3 Overview of Thesis

In the First Chapter, a brief overview of the concept of e-Government and its relevance to governments and international organizations is presented. It also presents the objective of the thesis as well as the research questions. In addition, it explains why the instance of Greek Municipalities was chosen over other institutions in order to explore the overall

concept of e-Government, and it provides the justification for sample selection. Finally, this section provides a summary of the Chapters.

The Second Chapter evaluates the European Commission's e-Government Strategy and its implementation in Greece from 2006 to 2020, including a comparative case study and a literature review on the development and adoption of e-Government services by Greek municipalities. The analysis aims to understand the strategies set by the EU, the specific themes addressed and how they have been implemented in Greece, and to identify the key factors influencing the development and adoption of e-Government in Greek municipalities.

Section 2.1. attempts to assess the e-Government Strategy of the European Commission and the Greek Government from 2006 to 2020. The European Commission has made significant steps towards establishing e-Government at a national and European level. However, according to the EU e-Government Benchmark 2020, the Greek Government seems to lag in achieving specific digital transformation goals such as Transparency, Cross-border Mobility, Key Enablers. So, digitalization and penetration scores are significantly lower than the average ones of the EU 27+UK. These findings generate questions about the strategy proposed by the EC, how it has been implemented by the Greek Government and the impacts that the proposed strategies have on the digitalization process. Previous literature has addressed several issues of government transformation, such as the barriers and the frameworks for establishing e-Government. By conducting a qualitative comparative case study research and the Grounded theory analysis, the researcher divides the strategic objectives set by the EC and the Greek transcription of them into themes and quantifies the data in order to provide an understanding of the strategies set by the EC, the specific themes that they addressed since 2006 and how the were implemented in Greece. From the analysis, three recurring themes were found: Inclusive Citizen-centric Digital Services, Digital Enablers, Administrative Efficiency & Transparency. However, the findings suggest that there are differences between the strategies proposed by the European Commission and the strategies implemented by the Greek Government. These differences resulted in following two different frameworks,

which may have impacted the lower score of the Greek Government in the EU Benchmark Report 2020.

The scope of Section 2.2. is to conduct a literature review on the development and adoption of e-Government services by Greek municipalities. The review aims to examine the current state of e-Government and identify the key factors that have influenced its development and adoption. The literature review included several studies that have been conducted on the e-Government development in Greek municipalities, including evaluations of the citizens' preferences, content analysis of municipal e-Government portals, analysis of the smart cities' framework, assessment of the municipal e-Government development based on PROMETHEE II, and a survey of the e-services offered by the municipal e-Government portals. The findings of these studies are used to provide an overview of the current state of e-Government in Greek municipalities and to identify the challenges and opportunities for its further development.

Chapter 3 provides an evaluation of e-Government services in terms of quality from both the supply and the demand perspectives. The quality of e-Government services is considered a high priority and a challenge for many governments. The study identifies three methods of e-Government quality assessment: the supply-side approach using e-Government maturity models, the demand-side approach using citizen surveys, and a universal set of rules for website behavior to bridge the supply and demand gap. The study reviews various e-Government quality methods, applies them to 50 Greek municipal e-Government portals and discusses their benefits and limitations.

Section 3.1. attempts the e-Government Evaluation with the use of e-Government maturity models. Several approaches and methodologies have been developed in the past to assess the progress of e-Government and the digital transformation of the public sector. To solve this gap, many e-Government maturity models have been developed throughout the years. This diversity of models, however, has drawn some criticism. The goal of this research is to explore if a simple e-Government maturity model can capture e-Government progress and if operations can be classified into phases to give a realistic picture of e-Government. An adapted version of the United Nations e-Government maturity model was used to assess the portals of the 50 largest municipalities. Also, the

factors influencing the e-Government maturity development and the domain of services provided by the e-Government portals are examined through ordinal regression and binomial logistic regression. The findings suggest that e-Government maturity models have a limited ability to capture e-Government development as it may not be considered linear. Moreover, municipal authorities have taken steps towards e-Government; however, they are missing functionalities that are at the core of digital transformation. Finally, the findings indicate that factors such as population, the political ideology of the ruling party, budget, and the mayor's gender have a limited role in predicting the e-Government maturity in the cases examined.

Section 3.2 analyzes the quality of e-Government from the citizen's standpoint. Various models have been created over the years to evaluate the factors influencing users' satisfaction, perceived quality, and behavioral intention to use e-Government portals. Among these investigations, the Technology Acceptance Model is the method most frequently employed (TAM). This study used a variation of TAM and cognitive theory to investigate the role of Perceived Attractiveness, Perceived Usefulness, Perceived Ease of Use, and Awareness on the Behavioral Intention to utilize municipalities' e-Government portals. In addition, it seeks to evaluate the moderating effect of demographic variables and the digital divide on e-Government quality perceptions in general. The study employs a questionnaire to examine 707 individuals residing in 50 Greek municipalities. Structural Equation Modeling, one-way ANOVA, and moderation analysis are utilized for the analysis. The results reveal that Awareness and Usefulness play a positive role in the overall perceived quality; however, Perceived Ease of Use appears to affect the Behavioral Intention to use e-Government negatively. Furthermore, the majority of demographic characteristics appear to moderate the relationship between Usefulness and Behavioral Intention, whereas the digital divide appears to have a direct effect.

Section 3.3 assess e-Government quality using a universal set of standards. The Web Content Accessibility Guidelines (WCAG) are currently the standard for evaluating the accessibility of websites since they are progressively adopted. This is due to the fact that websites that meet the WCAG standards at the highest-level score higher on users' personal quality criteria, such as cognitive demands and effort. This study aims at

determining if an automated tool can be used to determine the quality of e-Government portals and what factors it measures. Lighthouse, an automated website performance assessment tool, was used to evaluate the homepages of fifty Greek municipalities. The analysis suggests that the factors of usability, usefulness, attractiveness, interactivity, and trust that determine total perceived quality have been incorporated into the Lighthouse instrument. However, the Lighthouse criteria cannot be combined to produce a summative quality score as it is unknown how relevant these variables are in users' decisions to employ e-Government portals.

The purpose of Section 3.4. is to compare the methodologies used to analyze the quality of the e-Government site in sections 3.1, 3.2, and 3.2, as well as their observations, strengths, and limitations. This analysis aims to determine which municipalities have a high-quality e-Government portal according to each method, how they perform using other approaches if there are correlations between the measurements of the various approaches, and which technique appears to provide a more comprehensive perspective. The findings reveal that the three techniques examine different things, and there is no agreement about the features of a high-quality e-Government portal. The correlation matrix validates the descriptive analysis's observation. The majority of detected relationships are within the methods employed. Overall, e-Government quality evaluation methodologies from the demand side are the most reliable approach to assess the desire to utilize e-Government portals and the associated quality perceptions. The demand-side techniques can be helpful in finding broad improvement opportunities. It appears that automated tools are the best way to construct a consistent and continually updated framework for e-Government quality; however, the study indicates that these tools are currently insufficient to capture the perceived quality.

The objective of the Fourth chapter is to examine the disparity between the services offered by municipalities via e-Government portals and the services demanded by residents in the context of smart cities. The purpose of this study is to investigate the information and services supplied by these municipalities, the variables that influence the digital services provided via e-Government portals, and the services that residents desire to be provided via e-Government portals. According to the findings, current e-

Government portals are incapable of offering many of the e-services sought by citizens. The majority of given services are of informative nature, but as found in Section 3.2, they provide no useful information. In response to the participants' recommendations, the study adopts a Mind map depiction of crowdsourced ideas layout to connect the users' recommended e-Government portal structure graphically. These results demonstrate that municipal e-Government websites must offer residents access to various services and information. However, services per se may vary through time and cities as the needs of citizens as well as the capabilities of municipalities alter. Hence, a significant finding of the study is that functionalities such as interactive maps, informative texts, calendars, and the option to submit applications or requests are essential components of usefulness.

In the Fifth and final chapter, the research objectives established at the beginning of this study are reviewed, and the ways in which they were addressed in the previous chapters are discussed. The chapter provides a summary of the key findings and conclusions that were drawn from the prior analysis. Moreover, the chapter acknowledges the limitations of the study and highlights areas where further research could be conducted.

# 2 The e-Government Strategy

## 2.1 Evaluation of the e-Government Strategy of the European Commission the Greek Government from 2006 to 2020

### 2.1.1 Introduction

The creation of an interoperable digital public sector is one of the most crucial objectives of the European Commission. Since 2006, the EC has created many mid-term strategies that European nations have adopted (EU, EFTA & Candidate Countries, 2009; European Commission, 2010; European Commission, 2020a; European Commission, 2016; European Commission, 2006; eGovernment policy Ministers of EU member states, EFTA, 2017). Many European countries seem to have established digital enablers and have achieved several of the proposed goals. According to the latest e-Government Benchmark Report (2020b), which measures four main indicators (User Centricity, Transparency, Cross-border Mobility, and Key Enablers, the EU seems to have achieved User Centricity (87% on the average score), while in the other three dimensions, the EU seems to be in the middle of its journey (Transparency 66%, Cross-border Mobility 61%, Key Enablers 56%). According to the same document, the Greek government is very close to the total average of the EU on User Centricity (85%). At the same time, in all other dimensions, it has underperformed (Transparency - 48%, Cross - border mobility - 40%, and Key enablers - 34%). Another issue addressed in the e-Government Benchmark 2020 is the overall penetration and digitalization. The Greek Government has been left behind in both penetration (30% - Greece and 60% - EU27+UK) and digitalization (53% - Greece and 72% - EU27+UK). The Greek Government seems to underperform in most dimensions measured by the EU Benchmark Report 2020 (European Commission, 2020b).

Previous research has addressed multiple issues of government transformation, such as dimensions of e-Government and the barriers governments meet in the implementation process. Scholars and international institutions have also provided frameworks for dealing with the barriers and achieving the dimensions of e-Government. Furthermore,

researchers have also highlighted that the e-Government strategy is based on the generation of e-Government, as the generation states the goals and methods employed. By reviewing the proposed literature, this research attempts to provide an understanding of the strategies designed and followed by the European Commission (EC) and those that followed the Greek Government. The researcher proceeded in the analysis of the strategic objectives stated in the digital agendas of both institutions since 2006. This study seeks to understand what strategic objectives have been addressed by both institutions and what models they have followed. For the proposed study, a qualitative case study methodology through publicly available secondary data has been selected. For the analysis of data, the Grounded Theory method has been employed to divide the different objectives into themes and to quantify the data for further analysis.

### 2.1.2 Background

e-Government, as a term, has been defined by scholars differently throughout the years. Some researchers have focused on the business (Wassenaar, 2000), technological (Zhiyuan, 2002), process (Bonham, Seifert, & Thorson, 2001), citizen (Burn & Robins, 2003), or functional (Seifert & Petersen, 2002) dimensions. The latest definition of e-Government from the United Nations focuses on the effectiveness and efficiency of governmental services. Specifically, the UN defines e-Government as

"The use of ICTs to more effectively and efficiently deliver government services to citizens and businesses. It is the application of ICT in government operations, achieving public ends by digital means. The underlying principle of e-Government, supported by an effective e-governance institutional framework, is to improve the internal workings of the public sector by reducing financial costs and transaction times to integrate workflows and processes better and enable effective resource utilization across the various public sector agencies aiming for sustainable solutions. Through innovation and e-Government, governments around the world can be more efficient, provide better services, respond to the demands of citizens for transparency and accountability, be more inclusive and thus restore the trust of citizens in their governments." (United Nations, 2021).

Such a definition includes all the different dimensions provided by the researchers throughout the years. Thus, two lessons may derive from the UN's definition. First, e-

Government has many different implications in different aspects of the public sector, and second, it involves and affects different stakeholders.

The stated definition of e-Government by the United Nations includes the benefits of citizen and company satisfaction, operational efficiency, cost reduction, and enhanced service quality. Numerous scholars have identified citizen centricity as the primary objective of e-Government, which refers to using people's demands as a foundation for the creation of e-Government (Weerakkody, Janssen, & Dwivedi, 2011; Jassen & Shu, 2008; Parisopoulos, Tambouris, & Tarabanis, 2009). The second goal of e-Government is to lower costs by integrating and improving processes across different departments and organizations (Pedersen, 2018; Weerakkody & Dhillon, 2008; Fagan, 2006; Irani, Elliman, & Jackson, 2007; Lee J. , 2010). Abbas, Quisar, Xu, and Sun (2021a) contributed to the benefits of e-Government by investigating the effect of e-Government, cybersecurity, and corruption on the sustainability of public services in Asian nations. According to their findings, e-Government development in Asia has improved both public service delivery and accessibility (Abbas, Qaisar, Xu, & Sun, 2021a). Similar results were found in other research, suggesting that secure and efficient digital transformation solutions enhance service performance and the public's trust (Alanezi, Mahmood, & Basri, 2012; Tummers & Rocco, 2015). According to Ullah and colleagues (2021) and Abbas et al. (2021b), who performed a comparative study of e-Government and public policy across Asia, e-Government also increases institutional quality and performance (Abbas, Xu, & Sun, 2021b; Ullah, Pinglu, Ullah, Abbas, & Khan, 2021). A further point provided by the literature reviewed is that in developing nations, digitization improves educational quality, health services, accessibility, and living conditions (Furuholt & Sæbø, 2018; Filgueiras, Flávio, & Palotti, 2019; Verkijika & De Wet, 2018).

The barriers deriving from the broad definition have been previously analyzed by other academics (Schwester, 2009; Eynon & Dutton, 2007; Eynon & Margetts, 2007; Moon, 2002; Norris & Reddick, 2012). Moon (2002) examined the barriers to e-Government adoption. His findings suggest as the main barriers the lack of digital enablers, such as lack of technology and expertise, security and privacy issues, and lack of financial resources. Moon and Norris (2005) conducted a longitudinal study of e-Government

adoption at a municipality level and reached the same results as Moon's previous study (Norris & Moon, 2005). Schwester (2009) reached the same results as the previous research, proposing that e-Government adoption is a function of financial, technical, and human resources. So, the main barriers lie in these three dimensions. Eynon and Dutton (2007) paid attention to organizational problems such as poor coordination, organization inflexibility, and bureaucracy that lead to the lack of innovation (Eynon & Dutton, 2007). Eynon and Margetts (2007) analyzed the barriers of the European Commission's i2010 e-Government Action Plan. They categorized the potential barriers into seven categories: leadership failures, financial inhibitors, digital divide and choices, poor coordination, lack of trust, and poor technical design (Eynon & Margetts, 2007).

Meijer (2015) developed a theoretical model of e-Government innovation based on the barriers highlighted by previous literature. The proposed framework classifies the obstacles into three broad categories. The first one is the innovation barriers that an organization faces at the different stages of e-Government development, from idea generation and selection to idea testing, promotion, and rollout (Meijer, 2015). Specifically, the key obstacles defined are the perception of a new idea (Dougherty, 1992), the limited financial and capacity resources (Margetts & Dunleavy, 2002; Bekkers, Edelenbos, & Steijn, 2011), the technological limitations, and the lack of expertise (Eynon & Dutton, 2007).

The second broad category is the government and citizens barriers (Meijer, 2015). Governmental barriers include personnel, technical capacity, financial viability, legal issues (Moon, 2002; Margetts & Dunleavy, 2002; Meijer, 2015), political support, and lack of leadership (Eynon & Dutton, 2007; Meijer, 2015). The main citizen barrier is the "digital divide", the lack of motivation and skills of citizens for them to engage with the e-Government (Van Deursen & Van Dijk, 2011). Another issue may be the citizens' inaccessibility to new technologies, the lack of trust in the government as an institution, and the difficulty in associating the internet with their daily activities (Margetts & Dunleavy, 2002).

The third broad dimension is the structural and cultural barriers to e-Government (Meijer, 2015). The public sector has a heavily bureaucratic culture (Frissen, 1989; Margetts &

Dunleavy, 2002) that includes high levels of formality, uniformity, and hierarchy. New technology leads to fear of replacement or undermining the robustness and reliability of service or institution (Sørensen & Torfing, 2011; Shewhart, 1980). Cultural obstacles have also been identified on the side of citizens. These obstacles may include the perception of citizens for the government (e.g., unreliable) or the technology and the potential privacy issues (Meijer, Burger, & Ebbers, 2009).

Academics have focused on the factors contributing to e-Government success and propose a framework for successfully implementing it. According to Moon (2002), providing public digital services is one of the most prominent success factors. This suggestion is in agreement with the methodology that the UK followed in practice for its e-Government implementation (Weerakkody & Dhillon, 2008). The results that such a strategy brought to the UK are visible in the EU e-Government Benchmark 2020, as the UK achieved a score of 91% in User Centricity, 66% in Transparency, and 79% in Cross-border Mobility, but only 34% in Key enablers, while the overall digitalization score is 65% and the penetration score is 85% (European Commission, 2020b). According to Lean, Zailani, Ramayah, and Fernando (2009), placing the provision of digital services as a priority in the formation of a digital strategy puts pressure on the enhancement of the delivery systems.

Other researchers have highlighted the importance of a robust, well-structured national digital strategy to establish a vision and overcome cultural barriers (Irani, Love, & Jones, 2008; Weerakkody, El-Haddadeha, Salob, Ghoneima, & Dzupka, 2012). Such a strategy should have a clear definition of the e-Government, the areas addressed, and the target stakeholders to be benefited, an easy-to-understand vision, and a clearly stated plan. Also, the strategy should include measurable goals and policies that support the strategy (Lowery, 2001). Holmes (2001) suggested five underlying principles in e-Government strategies: 1. Develop online services and use the internet and IT in the workplace, 2. Ensure universal access to the internet and online services, 3. Train government employees, 4. Form partnerships, 5. Remove the barriers (Holmes, 2001). The latest digital government policy framework of OECD (2020) suggests that e-Government should involve these six characteristics: incorporate digital in the policy lifecycle, use

data for the formation of public policy, build the government as a platform, become open by default, follow a user-driven approach, and act proactively (Directorate for Public Governance, 2020).

The way of implementing e-Government – the citizen-first orientation or internal capabilities approach – can contribute to the e-Government generation. Charalabidis, Loukis, Alexopoulos and Lachana (2019) conducted a literature review on the e-Government strategy development, including main goals, obstacles, and key methods and tools based on the e-Government Generation. During their research, they identified three generations the “e-Government 1.0”, the e-Government 2.0” and the “e-Government 3.0” (Charalabidis, Loukis, Alexopoulos, & Lachana, 2019).

The term "e-Government 1.0" refers to a first-generation approach to electronic government that focuses mainly on the supply of informational and transactional services, as well as their development via government agencies' internal procedures. This strategy relies primarily on static Information and Communication Technologies (ICT) and websites (Chun, Shulman, Sandoval, & Hovy, 2010; Pardo, Nam, & Burke, 2012; Charalabidis, Loukis, Alexopoulos, & Lachana, 2019).

"e-Government 2.0" is a second-generation strategy that prioritizes the delivery of consultation, participation, and open data services (Lee & Kwak, 2012; Charalabidis & Koussouris, 2012). It employs Web 2.0 principles along with numerous social media management tools and technologies and textual data analysis methodologies (Lee & Kwak, 2012). The ultimate objective is to increase the openness and transparency of government while collecting important information and insight from citizens on societal issues and concerns. This strategy uses crowdsourcing in government policy formation, resulting in the conception of “citizen-sourcing” (Charalabidis, Loukis, Alexopoulos, & Lachana, 2019).

Lastly, "e-Government 3.0" refers to the merging of new disruptive ICTs, such as big data, IoT, analytics, machine learning, and AI, with traditional ICTs for data storage and service delivery (Pereira, et al., 2018). Using crowd/citizen-sourcing and value co-creation, this strategy capitalizes on the collective intelligence of the public

(Alexopoulos, et al., 2019). Its purpose is to facilitate data-driven and evidence-based policymaking in government (Charalabidis, Loukis, Alexopoulos, & Lachana, 2019).

The literature evaluation examined both the benefits and the obstacles that governments encounter in implementing digital strategy. In addition, it outlines the variables that should be addressed in the formulation of an e-Government strategy, as well as the generational impact of such a strategy.

### 2.1.3 Methodology

This research analyzes the Digital strategies designed by European Commission and how the Greek government adopted them from 2006 to 2020. It is important to mention that the data examined for the Greek government's digital strategy are from 2011 to 2020 due to the unavailability of previous statements on the world wide web. Thus, the readers should keep in mind that the Greek government started the digital transformation the same year with the first European digital strategy proposed by the European Commission (European Commission, 2016). The method of case study research has been selected due to its flexibility to examine a contextual phenomenon that is applied in a real-life situation, like the digitalization of the public sector (Luck, Jackson, & Usher, 2006). The specific method has been used widely to provide an understanding of individual, organization, institutional, social and political events (Gerring, 2006). It is important to mention that the research is not aiming at generalizing the research results; instead, the goal is to provide a deeper understanding of the digital strategies designed by the European Commission and the different subjects of e-Government that they address.

The sample consists of secondary data extracted from the official digital strategic document published on the institutions' websites to ensure data validity. Specifically, the strategic documents of the EC examined are the "i2010 e-Government Action Plan 2006-2010" (European Commission, 2006), the "Malmo Ministerial Declaration on e-Government" (EU, EFTA & Candidate Countries, 2009), the "Digital Agenda for Europe" (European Commission, 2010), the "e-Government Action Plan 2011-2015" (European Commission, 2010), the "e-Government Action Plan 2016-2020" (European Commission, 2016), the "Tallinn Ministerial Declaration on e-Government" (e-

Government policy Ministers of EU member states, EFTA, 2017) and the "Shaping the digital transformation in Europe" (European Commission, 2020a). For the analysis of the Greek adaptation of the European Commission's e-Government strategy, the "e-Government Roadmap", the "e-Government strategy", the "Greek Action Plan 2014-2016", as well as the "Digital Transformation Bible" were examined.

This research aims at identifying the different themes addressed by the two institutions and the frequency that they are repeated through the years. For the proposed analysis, the Grounded Theory analysis was employed as a rigorous qualitative research method that can assist in identifying the broad themes of e-Government strategy, compare it with the existing literature review and provide a new theoretical framework (Bhattacherjee, 2012; Morris, 2017; Miles & Huberman, 1984; Glaser & Strauss, 1967; Strauss & Corbin, 1990). The analysis began with the open coding technique to identify the key concepts presented in the two case studies (Strauss & Corbin, 1990). Twelve concepts occurred (Inclusiveness of services, transparency, citizens' satisfaction increase, reduction of administrative burden, provision of digital services, digital literacy for the citizens, acquisition of IT and expertise, active citizens participation, connectivity of public institutions, data availability, Cohesive Interoperability framework across the EU countries, Security). The concepts were then unified into five categories based on the similarity of the subtopics included (Inclusive Citizen-centric Digital Services, Digital Enablers, Administrative Efficiency & Transparency, E-democracy, Unified Interoperability Framework, and Security).

Inclusive Citizen-centric Digital services include concepts like the provision of public services through digital means, the accessibility of e-Government portals by everyone, and citizens' satisfaction due to the easy, useful, and meaningful interaction with the public sector through technology. As digital enablers are mentioned, the development of capabilities for both the public sector and citizens in order to interact digitally by addressing issues like technology availability, human capital training, digital education for the citizens, and legal issues. Administrative efficiency & Transparency is referred to the transformation of internal processes in order to simplify them and reduce the administrative burden while providing access to the public on government laws,

regulations, policies, and finance, gives citizens the ability to electronically manage their personal data and inform them about the data processed by the public bodies. E-democracy is about the co-creation of value by both government and citizens by participating in public digital dialogues, e-voting, etc. The Unified Interoperability Framework and Security include the development of a cohesive interoperability framework across Europe and the protection of citizen's data, electronic transactions, and the overall creation of a secure electronic environment.

Based on these five categories, the strategic objectives were quantified, and the actions described in the strategies were examined to measure the frequency in which they appear and the number of actions to be taken per category. They performed a content analysis by identifying repeated keywords and meanings related to the twelve initial concepts in the different chapters/strategic objectives of the strategic documents. Each concept was assigned a weight of 1 if the concept was included in the strategic documents or 0 if it was not-. By unifying the 12 concepts into five broad categories, the sum of the concepts included in each category was calculated to allocate the appropriate weight based on how many times the related concepts are mentioned in a specific category. For the proposed actions of each category, the researcher calculated the sum of the proposed actions per concept and summed them in the categories. The data we analyzed through descriptive statistical methods to identify the frequency with which they appear in the strategic documents examined per institution and year.

### 2.1.4 Findings

From the descriptive analysis, it occurred that the EC and the Greek government, even if they have the same strategic objectives, their particular focus are different. The review of the strategic plans published by the Greek government in the years 2011 (Hellenic Ministry of Digital Governance, 2011), 2014 (Hellenic Ministry of Digital Governance, 2014a; Hellenic Ministry of Digital Governance, 2014b) (2 different documents were published by the Greek government in the year 2014) and 2020 (Hellenic Ministry of Digital Governance, 2020) revealed that during all four documents a particular focus was paid on the Administrative Efficiency and Transparency (sum=9), and the Digital Enablers (sum=4) (Table 2.1.1). On the other hand, the documentation of seven EC

strategic documents from the years 2006 (European Commission, 2006), 2009 (EU, EFTA & Candidate Countries, 2009), 2010 (European Commission, 2010) (European Commission, 2010), 2016 (European Commission, 2016), 2017 (e-Government policy Ministers of EU member states, EFTA, 2017) and 2020 (European Commission, 2020a) showed that Inclusive Citizen-centric digital services (sum=14) are of special interest for the European Commission along with the Administrative Efficiency & Transparency (sum=9) (Table 2.1.1).

*Table 2.1.1 Strategic Objectives - Descriptive Statistics*

| Institution | Objectives | N | Min | Max | Sum | Mean | Std. Dev |
|---|---|---|---|---|---|---|---|
| Greece | Inclusive Citizen-centric Digital Services | 4 | 0 | 1 | 2 | .50 | .577 |
| | Digital Enablers | 4 | 0 | 2 | 4 | 1.00 | .816 |
| | E-Democracy | 4 | 0 | 2 | 2 | .50 | 1.000 |
| | Administrative Efficiency & Transparency | 4 | 1 | 3 | 9 | 2.25 | .957 |
| | Unified Interoperability Framework & Security | 4 | 0 | 1 | 1 | .25 | .500 |
| | Valid N (listwise) | 4 | | | | | |
| EC | Inclusive Citizen-centric Digital Services | 7 | 1 | 4 | 14 | 2.00 | 1.155 |
| | Digital Enablers | 7 | 0 | 2 | 7 | 1.00 | .577 |
| | E-Democracy | 7 | 0 | 1 | 3 | .43 | .535 |
| | Administrative Efficiency & Transparency | 7 | 0 | 2 | 9 | 1.29 | .951 |
| | Unified Interoperability Framework & Security | 7 | 0 | 2 | 7 | 1.00 | .577 |
| | Valid N (listwise) | 7 | | | | | |

Along with the Strategic objectives' descriptive analysis, the same analysis was performed for the proposed actions (Table 2.1.2). From the analysis, it occurred that the Greek government's actions align with the objectives of Administrative Efficiency & Transparency (sum=41) and Digital Enablers (sum=28). However, in the European Commission's analysis, an abnormality occurred. The actions towards Inclusive Citizen-centric Digital Services (sum=35) were more prominent than the others, a finding that is in agreement with the previous results. However, the actions towards a unified interoperability framework & security (sum=30) were more than those for Administrative Efficiency & Transparency (sum =27).

*Table 2.1.2 Proposed Actions - Descriptive Statistics*

| Institution | Actions | N | Min | Max | Sum | Mean | Std. Dev |
|---|---|---|---|---|---|---|---|
| Greece | Inclusive Citizen-centric Digital Services | 4 | 0 | 7 | 13 | 3.25 | 3.775 |
| | Digital Enablers | 4 | 0 | 11 | 28 | 7.00 | 4.967 |
| | E-Democracy | 4 | 0 | 4 | 4 | 1.00 | 2.000 |
| | Administrative Efficiency & Transparency | 4 | 6 | 15 | 41 | 10.25 | 4.031 |
| | Unified Interoperability Framework & Security | 4 | 0 | 3 | 3 | .75 | 1.500 |
| | Valid N (listwise) | 4 | | | | | |
| EC | Inclusive Citizen-centric Digital Services | 7 | 2 | 10 | 35 | 5.00 | 2.769 |
| | Digital Enablers | 7 | 0 | 6 | 24 | 3.43 | 1.902 |
| | E-Democracy | 7 | 0 | 4 | 9 | 1.29 | 1.704 |
| | Administrative Efficiency & Transparency | 7 | 0 | 7 | 27 | 3.86 | 3.132 |
| | Unified Interoperability Framework & Security | 7 | 0 | 10 | 30 | 4.29 | 3.352 |
| | Valid N (listwise) | 7 | | | | | |

To ensure the relationship between strategic objectives and proposed actions, the researcher conducted a Pearson correlation analysis with the null hypothesis “the actions are correlated with the business objectives,” and the alternative hypothesis “the actions have no relationship with the strategic objectives”. The test results showed a significant correlation between the objectives and the actions (critical value 0.701) (Table 2.1.3). Thus, other factors must be examined to identify why this abnormality occurred. Such factors may include the importance and the underlying tasks included in the proposed actions apart from the overall number. However, analysing the importance of each task is not included in the scope of this research.

*Table 2.1.3 Correlations between strategic objectives and actions*

| | | Objectives | Actions |
|---|---|---|---|
| Objectives | Pearson Correlation | 1 | .701** |
| | Sig. (2-tailed) | | .000 |
| | N | 55 | 55 |
| Actions | Pearson Correlation | .701** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 55 | 55 |

**. Correlation is significant at the 0.01 level (2-tailed).

In the next step, a chronological examination of the strategic objectives shifts was performed for Greece (Figure 2.1.1) and the EC (Figure 2.1.2). Figure 2.1.1 shows the importance of Administrative Efficiency and transparency and Digital Enablers through the years. An interesting finding is that the objectives of Inclusive citizen-centric digital services, e-democracy, and Unified Interoperability Framework & Security have sporadically been addressed through the years. Thus, another topic that could be examined is the results of the actions taken for the strategic objectives as well as the reasoning behind these shifts.

*Figure 2.1.1 Strategic Objectives changes for Greece*

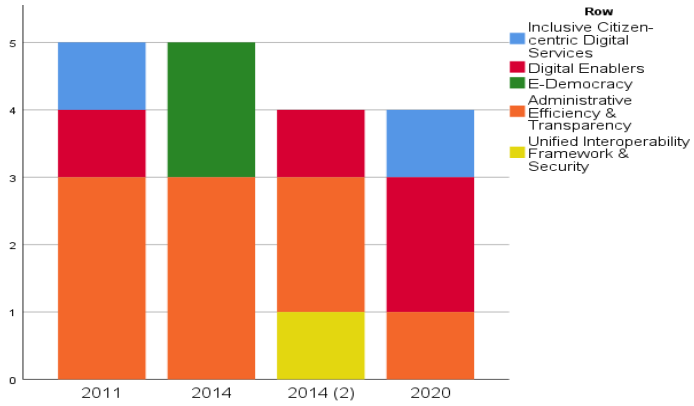
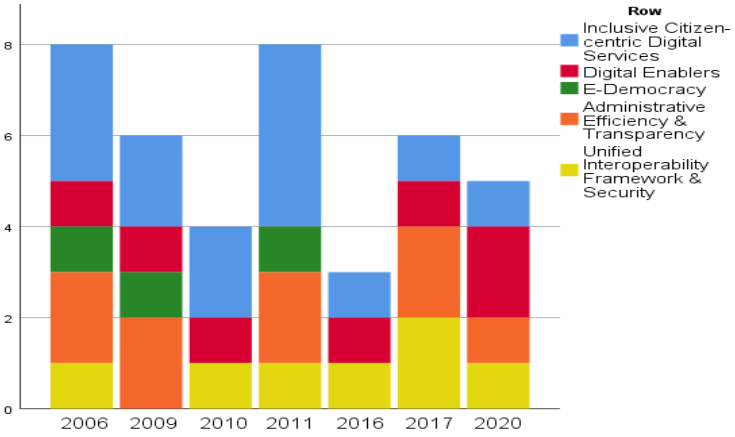



Figure 2.1.2 shows that through all strategic plans, the inclusive centric-digital services are highly prioritised for EC. At the same time, e-democracy has a sporadic presence, mostly during the first years of digital strategy formation.'

*Figure 2.1.2 Strategic Objectives changes for EC*



### 2.1.5 Discussion

The findings presented above are generic as they pay attention to the direction that the digital strategic objectives of the European Commission and the Greek Government are following. Thus, they may include many of the various frameworks' elements presented by previous researchers.

i. What strategic objectives have been addressed by both institutions?

Inclusive Citizen-Centric digital services have multiple underlying goals as well as requirements. Specifically, e-Government services must be inclusive, "No citizen left behind" (European Commission, 2006), actions under this objective include accessibility through digital TV, mobile, fixed telephone, and other interactive devices. Citizen-Centric is focused on the needs that the digital services will cover (European Commission, 2006) as well as the way that they will be developed (European Commission, 2010). The EC specifically mentions the need of co-creating with citizens and other organizations' digital services. The provision of digital services includes the two-way communication between the government and the citizens, and any transaction involved, including eProcurement and eID, digital sign, e-payments, and e-certifications (European Commission, 2006; Ministry of Digital Governance, 2020; Hellenic Ministry of Digital Governance, 2011).

Administrative Efficiency & Transparency is referred to long-term financial and operational sustainability (European Commission, 2006). Setting KPIs, monitoring the performance shifts, optimizing the organization process, reducing carbon footprint, adopting digital means for the execution of internal procedures, and reusing available data are some of the components included in the efficiency of administration (Hellenic Ministry of Digital Governance, 2014; Hellenic Ministry of Digital Governance, 2014a; Hellenic Ministry of Digital Governance, 2011; European Commission, 2006; European Commission, 2010). Transparency is used by the EC for exchanging experiences and best practices between countries (European Commission, 2010) as well as making available open government data and allowing citizens and business to manage their data held by the public administration (Hellenic Ministry of Digital Governance, 2014a).

Digital Enablers include the development and use of technological assets by the administration and the acquisition of technical skills by the employees. (Hellenic Ministry of Digital Governance, 2014a; Hellenic Ministry of Digital Governance, 2014b; Hellenic Ministry of Digital Governance, 2011; European Commission, 2016) However, in this theme, the researcher included the acquisition of digital skills by the citizens as digital enablers as well (European Commission, 2010; Hellenic Ministry of Digital Governance, 2014a).

ii. What models have they followed?

Considering the elements included in the themes presented by the researcher, the EC seems to propose a similar model to the UK, which focuses on starting government transformation from the provision of inclusive services (Moon, 2002; Weerakkody & Dhillon, 2008). The underlying logic of starting an organization's transformation from customer experience is that the internal operation and the human resources must accept and follow the transformation wave. Another reason is that for a government to become successfully digital, it needs citizens' trust and readiness to use, both of which need time to be developed. Therefore, beginning with the provision of services, the citizens will progressively start to use the services. At the same time, the government will create a sense of urgency to the internal operation in order for the internal system to be ready to respond when the citizens' inquiries arrive (Weerakkody, Janssen, & Dwivedi, 2011; Lean, Zailani, Ramayah, & Fernando, 2009). The second reoccurring theme in the EC's strategic documents, "Administrative Efficiency & Transparency", derives from the sense of urgency that providing digital services to the citizens brings. For an organization to successfully and efficiently handle these services, the digitalization of operations and the use of technology is necessary.

Even if the Greek Government started its digitalization strategy with the provision of "Inclusive Citizen-centric digital services" like the EC proposed, it focused on "Administrative Efficiency & Transparency" and the "Digital Enablers". This change can be considered an effect of the European e-Government Benchmark Reports, as the latest report shows that in the case of Greece, the most crucial obstacle to government transformation is the limited use of online channels by the citizens (European

Commission, 2020a). Thus, establishing digital enablers first, as proposed by previous scholars, may be the optimal flow for the Greek Government (Irani, Love, & Jones, 2008; Weerakkody, El-Haddadeha, Salob, Ghoneima, & Dzupka, 2012). However, it is worth mentioning that in previous research, the researcher found that municipalities' websites have significant issues in terms of performance and user-friendliness. A finding that is contradictory to the user-centricity score of Greece in the EU Benchmark Report 2020 (European Commission, 2020a). Thus, citizens' digital readiness may not be the only factor influencing the use of digital services, but another factor may be the user-unfriendliness of services (Patergiannaki, Tsatsani, & Pollalis, 2020). Another contradiction between the Greek digital agenda and the EU Benchmark Report 2020 is that even if the Greek government has targeted administrative efficiency & transparency, and digital enablers for many years now, it significantly underperforms in comparison with the average EU score as well as the inclusive user-centric which is not consistently under the scope of the Greek agenda (European Commission, 2020a). Overall, comparing the government transformation models proposed by previous research, the Greek Government seems to follow the OECD framework, as it proposes to build the government as a platform first and then follow a user-driven approach. So, this shift in strategy implementation may be a data-informed decision based on the implementation barriers they faced through the years and the latest e-Government frameworks (Directorate for Public Governance, 2020).

### 2.1.6 Conclusions

The conducted research raises awareness on many issues that have to be further investigated in the future. First of all, the methodology implemented allowed the researcher to get a deeper understanding of the themes that e-Government strategy addresses when it comes to a large multinational institution like the European Commission as well as its implementation of a national government like Greece. The themes that arose were Inclusive Citizen-centric Digital Services, Digital Enablers, Administrative Efficiency & Transparency, E-democracy, Unified Interoperability Framework, and Security. The Greek government follows the focus of the European Commission on promoting Efficiency & Administrative Transparency and developing

Digital Enablers. However, it seems that the Greek government deviates in terms of the priority of Inclusive Citizen-centric Digital Services. This is the first priority for EC, but it comes in the third position in the Greek government's digital agenda along with the E-democracy. This finding may be explained by the different government transformation models followed by the institutions. The EC seems to follow the model implemented by the UK (Moon, 2002; Weerakkody & Dhillon, 2008), which suggests that focusing on Inclusive Citizen-Centric Digital Services will promote Administrative Efficiency & Transparency as well.

On the other hand, the Greek government seems to follow the model proposed by the OECD, which prioritizes the creation of digital enablers and administrative efficiency before the provision of Inclusive Citizen-centric Digital Services (Directorate for Public Governance (GOV), 2020). Nevertheless, this is only an assumption, as the main limitation of the research stated in the Methodology is the unavailability on the internet of the Greek digital agendas published the years before 2011. Overall, considering the EU Benchmark Report's (2020) findings, the differences observed between the proposed strategies over the years and the results achieved by the UK in terms of penetration and digitalization, it seems that targeting Inclusive Citizen-Centric Digital Services first can exponentially increase the government transformation.

The researcher proposes that further qualitative research needs to be conducted in order to acquire a deeper understanding of the reasoning behind the strategic objectives set by the EC and the deviation of the Greek government from them through the years, the barriers met, and the final results each strategy achieved through the years.

## 2.2 The e-Government Strategy of Greek Municipalities

### 2.1.1 Introduction

E-Government is the use of information and communication technology (ICT) to enhance the delivery of governmental services and encourage citizen involvement and participation in the decision-making process. Municipalities' use of e-Government services has the potential to increase the effectiveness and openness of local government operations, as well as the accessibility and quality of public services for residents (Maditinos & Sidiropoulou, 2020). However, the development and implementation of e-Government services by municipalities is a complicated process driven by different technological, organizational, socioeconomic, and political variables (Maditinos & Sidiropoulou, 2020). This literature review seeks to investigate the present level of e-Government development and adoption by Greek municipalities and to identify the factors that have impacted this process.

### 2.1.2 Previous Research on municipal e-Government development

Several studies have investigated the evolution of e-Government in Greek municipalities. In 2015, Lappas, Triantafillidou, Yannas, and Kleftodimos sought to build a framework for the evaluation of e-Government based on residents' preferences and to evaluate the progress of local e-Government accordingly. Their findings indicate that in 2015 Greek municipalities provided mostly one-way information via their portals about the municipality, the main touristic attractions, the council members, and the mayor. In addition, they argued that Greek municipal authorities were moving slowly to increase their openness and residents' confidence by revealing information regarding the mayor's and committees' decisions. Many municipalities attempted to communicate with their citizens by facilitating primarily passive forms of engagement through contact emails and online forms (Lappas, Triantafillidou, Yannas, & Kleftodimos, 2015). Comparing their findings to those of Yannas and Lappas (2007), it appears that at the local level, e-Government in Greece had not taken the necessary steps towards the adoption of e-Government, as in 2006, the websites primarily provided one-way information and performed poorly at the transaction and interaction-participation levels. Lappas et al.

(2015) stated that municipalities should focus their efforts on the provision of (a) information about municipal projects, (b) services and transactions for residents and companies, and (c) opportunities for individuals to actively engage in municipal affairs.

In 2017, Costopoulou, Ntalianis, Ntaliani, Karetsos and Gkoutzioupa conducted a content analysis of 325 municipal e-Government portals to examine the status and the types of e-services provided by the municipalities. Their results indicate that the overall e-Government development in 2017 can be considered slow-paced compared to the 2015 status. Specifically, the e-information was more developed in the municipal e-Government portals examined. However, the use of Web 2.0 tools and services remained low. Additionally, regarding e-consultation, 233 municipalities supported online complaints, and 166 supported the mayor's direct online contact with citizens. However, the portals lacked online polls and reputation systems (Costopoulou, Ntalianis, Ntaliani, Karetsos, & Gkoutzioupa, 2017). Finally, their survey results indicated that the most needed services by the citizens are cultural events, municipality news and results, communicating with other citizens, expressing opinions, voting, submitting complaints, communicating with the Mayor and getting informed on decisions of the City Council

Alexopoulos, Charalabidis, Vogiatzis and Kolokotronis (2018) proposed an analysis of Smart Cities framework to examine the development of Smart Cities in Greece and identify the existing barriers. They found that the majority of Greek municipalities, in order to develop Smart Cities, focused their actions towards developing ICT Infrastructures and e-Government portals. The most popular actions were the implementation of free wi-fi in public areas and municipal buildings, the hardware and software upgrading to the municipal departments for a highly efficient Backoffice and the development of applications for citizens for their problems and requests reporting. In terms of e-Government, apart from the applications' development, 44 municipalities reported actions towards Electronic Consultation on important decisions and plans (business plan, technical project, etc.) and GIS applications for urban building construction (suitable building sites, land use, objective property values etc.) (Alexopoulos, Charalabidis, Vogiatzis, & Kolokotronis, 2018). On the other hand, most municipalities reported no actions concerning health, transportation and security.

Panayiotou and Stavrou (Panayiotou & Stavrou, 2019) created an evaluation methodology for the development of local e-Government based on PROMETHEE II. From September 1 2017 to December 23 2017, researchers analyzed the websites of 325 Greek municipalities based on sixty-four criteria. Their analysis revealed that Greek municipalities provided electronic services at an insufficient degree of development (Panayiotou & Stavrou, 2019). According to their results, municipalities with a high degree of maturity have adopted more demanding internet services such as electronic payments, social media use for shareholder communication, and software infrastructure to support their operations. Municipalities, in their infancy, on the other hand, centered their services primarily on informational materials (Panayiotou & Stavrou, 2019).

Maditinos and Sidiropoulou (2020) surveyed 113 municipalities about the e-services that local e-Government portals provide in order to determine the evolution of e-Government. Their results indicate that all municipalities had created websites, while 58% provide their services through physical presence or mail as well. In addition, 74 municipalities have a distinct IT department with an average of one to three personnel. Regarding the ICT-e-Government budget of Municipalities, the largest percentage (33,9 %) was found to be greater than € 50,000.00, and 46.8 % of them funded these operations independently. In response to the e-Government strategy, 43 out of 109 municipalities did not have a complete strategic plan, while 46% of them included "Some activities utilizing ICT and e-Government" as part of their overall municipal strategic planning. In addition, the survey indicated that just 7% of organizations performed a public poll to decide the sort of e-services to be implemented. The most common problems faced by Municipalities were the "Lack of personnel technology/web" (76%) and "Lack of technology/web specialization" (49%). Overall, their research showed that services with institutional content or one-way information had been developed to a greater extent than participation-related services (Maditinos & Sidiropoulou, 2020).

### 2.1.3 Factors Influencing E-Government Adoption by Greek Municipalities

In their research, Madition and Sidiropoulou (2020) highlighted the drivers of e-Government development in Greece. Their findings suggested that the adoption of e-Government services by Greek municipalities is primarily motivated by a desire to

increase the effectiveness of information exchange with the external environment. E-Government enables organizations to deliver better services and integrated information and enhance performance in order to achieve more efficiency and effectiveness and so to boost citizen engagement and, as a result, their satisfaction and trust in the institution (Manoharan, Fudge, & Zheng, 2015).

In addition to the reasons and present status of development, Maditinos and Sidiropoulou (2020) underlined the obstacles cities confront. As the vast majority of municipalities employ between one and three employees for the creation and implementation of e-Government services, a lack of employees was identified as the most critical barrier. The absence of appropriate skills in the workforce is another significant obstacle to e-Government advancement (Maditinos & Sidiropoulou, 2020). This outcome is consistent with the findings of Alexopoulos, Charalabidis, Vogiatzis, and Kolokotronis (2018), who highlighted the absence of skilled employees and financial resources as the most prevalent causes.

Bousdekis and Kardaras (2020) performed a more in-depth empirical study on the challenges of local government's digital transformation in order to determine the present condition, maturity readiness, barriers, and priorities/critical success factors. They categorized their findings into five groups: citizen-centered services, strategic digital culture, interoperability, digital skills of employees, and technology procurement. In response to the Citizen-Centered Services, it was determined that the actual presence of citizens at municipal facilities is essential for most services, particularly those involving transactions, while remote service can be offered by phone or email in situations needing information. They noted that digital transformation management is in its early stages due to reluctance to change in terms of strategic digital culture. In addition, they discovered that initiatives in the framework of e-Government, apart from significant fragmentation, lack coordination and collaboration among stakeholders, causing a significant time gap between project launch and completion (Bousdekis & Kardaras, 2020). The municipalities also lack Interoperability. Their analysis showed that municipalities utilize a variety of software solutions in various departments offered by a variety of vendors, including vendors and softwares provided by the national government. The majority of

these softwares serve as information storage; therefore, there is no standard information storage. In addition, their systems are affected by malfunctions and lengthy processing times due to their inadequate hardware infrastructure. In the category “Digital Skills of Employees”, the researchers noted a lack of training and education, resulting in a low level of digital skills among employees. Regarding Technology Procurement, Bousdekis and Kardaras (2020) concluded that municipalities conduct major IT projects in an inefficient manner, resulting in low-quality digital services that are unstable in terms of system delivery and maintenance. Their analysis indicated that the poor e-Government development is due to internal inadequacies.

### 2.1.4 Current development of Municipal e-Government

In December 2020, the Greek government, with the aid of public bodies such as ministries and the central union of municipalities, formulated the new national strategy plan for 2020-2025, which included both horizontal and vertical activities tailored to the needs of each institutional authority (Hellenic Ministry of Digital Governance, 2020). The objective of municipalities, according to this document, is to construct smart cities that improve the quality of life for their residents, safeguard the environment, combat climate change, and lower their energy footprint by using smart digital apps and intelligent equipment in their area (Hellenic Ministry of Digital Governance, 2020). The specific actions include:

2.2 Application for requests management that promotes two-way communication, community involvement, and the effectiveness and response time of municipal authorities.
2.3 Utilizing IoT to monitor available parking spaces, a smart parking system is implemented.
2.4 The digitization of urban planning archive documents.
2.5 Intelligent fleet management system that optimizes the routes they take to save resources and improve service quality.
2.6 Intelligent Farmer’s market management system leveraging IoT to automate the monitoring and pricing of merchants and the control process.
2.7 e-democracy platform.

2.8 Internal training on emerging technology.

2.9 A transactional program that will facilitate online municipal payments and transactions.

2.10 Intelligent Transport Systems.

2.11 Installation of digital hydrometers for the public water companies.

2.12 Unified office support services for local governments and legal bodies.

The measures mentioned above have a medium-term outlook and are anticipated to be implemented by 2025 (Hellenic Ministry of Digital Governance, 2020).

In June 2022, the Greek Government issued an open call for proposals for the Digital Transformation of Local Authorities, with a total budget of € 222.230.000. The purpose of the project was to provide new applications and technological means that improve the management and functionality of the urban environment in Greek cities by creating more efficient, innovative, and high-quality services for residents, visitors, and businesses while increasing the demand for broadband services by exploiting Internet of Things (IoT) technologies (Hellenic Ministry of Digital Governance, 2022). These solutions included intelligent urban mobility and attitude management, energy efficiency, sustainable housing solutions, and digital municipal services provided via the Unified Digital Portal of the Government GOV.GR and political-centric governance, as well as ensuring citizens' confidence in these systems through the responsible use of data on digital platforms and ensuring quality, security, and confidentiality (Hellenic Ministry of Digital Governance, 2022).

The actions that were financed were divided into seven axes, following the Smart Cities Marketplace approach proposed by the European Commission and the methodology “Explore-Shape-Deal" developed for this purpose. Specifically, the proposed methodology is oriented at knowledge sharing, capacity building assistance, development, implementation, replication, and scaling of Smart City solutions (EC, 2023). The seven axes on which the initiatives are based include sustainable transportation, energy efficiency, public service improvement, quality of life enhancement, local democracy and transparency, cybersecurity, and digital infrastructure developments (Hellenic Ministry of Digital Governance, 2022). The government listed 38

activities under these axes, along with broad explanations of their implementation and function. However, it is unclear how the systems and applications to be built would be linked and made available to the public under the Municipalities' jurisdiction. The axes and planned actions are outlined in detail in Table 2.2.1.

*Table 2.2.1 Axes and Actions of Municipal Digital Transformation Strategy*

| | |
|---|---|
| Sustainable Mobility | 1. Smart Controlled Parking System (SCP)<br>2. Smart Bus stops<br>3. Smart system to ensure accessibility for people with mobility problems<br>4. Smart pedestrian crossings and disabled friendly<br>5. Traffic information systems |
| Energy Saving - Municipal Fees Reduction – Energy Footprint of Municipal Buildings Minimization | 6. Smart waste bins<br>7. Interconnection of lamps to a central computer management center<br>8. Organization of the Traffic Office and Management of Municipal vehicle fleet<br>9. Smart energy management systems for municipal and school buildings<br>10. Smart electric lighting systems inside municipal buildings |
| Improving Service to Citizens and Businesses | 11. Smart City / Municipality Guide with listing of local businesses and highlighting of offers<br>12. Management system of municipal cemeteries and digitization of files<br>13. Kindergarten management platform, parent information with smart application<br>14. Digital Platform for the management of vulnerable population<br>15. Management of indoor and outdoor sports, culture and entertainment spaces (planning lessons, informing parents, competitions, mass sports)<br>16. Digital Platform for the Management of Farmer's Markets<br>17. System of electronic documents transfer and digital signatures<br>18. Electronic payment management system<br>19. Provision of telemedicine systems to vulnerable populations for remote diagnosis<br>20. Cultural - Sporting events - Electronic ticket management |
| Improving Quality of Life | 21. Installation of smart air quality measurement systems in the territory of the municipality<br>22. Installation of intelligent water quality measurement systems (drinking water, rivers, lakes and seas in industrial applications, etc.)<br>23. Digitization and file management system for Water Supply and Sewerage Companies<br>24. Intelligent system for warning and dealing with risks (flooding, fire, earthquake, etc.) within the municipality's boundaries and according to their responsibilities.<br>25. Smart irrigation system<br>26. Management system of parks and public spaces.<br>27. Digitization of municipal library catalogues - Creating a smart municipal library<br>28. Digitization of local cultural heritage (the possession and jurisdiction of which belongs to the municipality)<br>29. Development of a digital twin city |

| | |
|---|---|
| Strengthening Local Democracy, Consultation and Transparency | 30. Electronic Consultation System for Budget and technical Programs<br>31. Electronic Consultation System for Regulatory Decisions<br>32. Electronic management and organization system of the Administration and the operational capacity of the Local Governments<br>33. Implementation of public performance measurement indicators according to ISO 37122, adapted to Greek conditions |
| Protection against cyber-attacks and ensuring business continuity | 34. Integrated infrastructure for protection against cyber-attacks (Network Firewall, Endpoint security, etc.) and provision of a telework system |
| Enhancing digital infrastructures | 35. Single central platform for management and data collection of local government digital transformation actions<br>36. Digital Platform for meetings of collective bodies and committees<br>37. Interconnection with high-speed networks between municipal buildings - infrastructures<br>38. Electronic Invoicing |

Source: Hellenic Ministry of Digital Governance (2022)

In addition, the Central Government outlined some horizontal standards that suppliers must adhere to for the development and completion of all municipal projects. Interoperability constitutes the initial horizontal need. Interoperability refers to the proposed project's capacity to share and utilise the data it saves, processes, and exchanges with other information systems (Hellenic Ministry of Digital Governance, 2022). In the context of the proposed actions, all to-be-developed applications and services must be integrated with existing and future databases and applications. The sensors and equipment that will use the Internet of Things (IoT) to monitor and report found issues are also required to have a power supply and telecoms connectivity. Another horizontal need is for the vendor to provide training to two municipal personnel in order for them to support the systems (Hellenic Ministry of Digital Governance, 2022). Other criteria include the establishment of operational infrastructures and networks, compliance with the General Data Protection Regulation (GDPR), cybersecurity, pilot operation management, the supply of guarantees, and system maintenance. Finally, all future systems and apps must adhere to the Web Accessibility Guidelines in order to guarantee the inclusion of people with disabilities.

By developing the new national strategic plan for 2020-2025, the national government has made efforts toward establishing a digital transformation strategy for municipalities. This strategy's objective is to develop smart cities that improve the daily lives of citizens,

safeguard the environment, and minimize their energy footprint. Nevertheless, the suggested strategy is broad and focuses primarily on technology that would make the cities “smart”; there are no specific axes for the development of municipal e-Government websites. It appears that this is purposeful, as the central government seeks to accelerate the expansion of the Unified Digital Portal of the Government GOV.GR. Nevertheless, municipalities utilize their e-Government portals to address the day-to-day concerns of their citizens; hence, they may need to continue using them in order to remain engaged with their stakeholders.

### 2.1.5 Conclusion

The adoption and development of e-Government services in Greek municipalities have been slow and inconsistent, influenced by various factors such as technical, organizational, and socio-economic considerations. Several studies have been conducted to examine the current state of e-Government development in Greece and identify critical factors that have impacted its progress. According to these studies, while some progress has been made in the provision of e-information and limited opportunities for citizen engagement and participation, there remains significant room for improvement in areas such as the implementation of web 2.0 tools, online transactions, and citizen-centric services. Additionally, the development of e-Government services has been hindered by a lack of technology and personnel resources, as well as the absence of comprehensive strategic plans for its implementation. Last but not least, the introduction of a central strategic plan towards digital transformation shows that digital transformation is of high priority. However, this plan lacks a strategic view on the implementation of e-Government. Further research and development efforts are necessary to ensure that e-Government services in Greek municipalities continue to evolve and better meet the needs and expectations of citizens.

# 3 Evaluation of e-Government Quality, Adoption & Development

The majority of governments consider their citizens' satisfaction with their e-Government services to be of high priority (Eggers & Bellman, 2015). However, providing relevant, accessible, high-performing, and high-quality services is a challenge for government agencies (Manolitzas & Yannacopoulos, 2013). This presents a new challenge: evaluating the quality of e-Government as a factor in ongoing e-Government development (Bournaris, 2020).

There seem to be objective and subjective attributes that add up to quality. While the objective part concerns meeting specified standards, the subjective side is centered on the consumers' views of the quality (Shewhart, 1980). An objective assessment is based on definite metrics and measurements, such as the speed at which a website downloads, the quantity and size of images on it, the number and type of links, etc. Service time and reliability metrics are examples of performance metrics that are regarded as objective measurements. Last but not least, metrics that measure how closely a website adheres to standards (such as W3C's Web Content Accessibility Guidelines (W3C, 2022) or Validity of HTML Coding) are another tool for objective website analysis (Ivory & Megraw, 2005). On the other hand, subjective quality refers to the judgment of the public, organizations, or specialists regarding the caliber of services provided by an e-Government portal (Halaris, Magoutas, Papadomichelaki, & Mentzas, 2007).

Ishikawa (1991) defines quality as having both authentic and substitute characteristics. While substitute qualities are concerned with the supply side, real characteristics are concerned with the demand side (end-user). Citizens who use e-Government services are considered the demand, whilst institutions and government departments involved in the electronic delivery of services are considered to be the supply (Qureshi, Salman, Irfan, & Jabeen, 2017). The classification of supply and demand has also been applied to the measurement of quality (Papadomichelaki, Magoutas, Halaris, Apostolou, & Mentzas,

2006; Scott, Delone, & Golden, 2009). Supply-side assessment models prioritize how successfully the government provides services, whereas demand-side evaluation models prioritize how well the e-Government engages the people (Papadomichelaki, Magoutas, Halaris, Apostolou, & Mentzas, 2006).

According to Jansen & Ølnes (2004), E-Government portals are complicated structures with numerous layers and purposes. In its most basic form, an e-Government portal is an information system (IS) composed of digital information and a delivery infrastructure for that information, such as browsers, search engines, encryption, networking systems, etc. (Yang, Cai, Zhou, & Zhou, 2005). The organizational infrastructure (back-office organization), technical infrastructure, and the web portal itself, which includes the user interface and information resources, are the key layers of such an IS (Jansen & Ølnes, 2004). Each of these levels impacts the perceived quality of citizens and has been matched to a corresponding quality layer (Halaris, Magoutas, Papadomichelaki, & Mentzas, 2007). Both the public organization (self-evaluation) and citizens who benefit from the online delivery of public services can evaluate the quality elements and factors of each tier (Halaris, Magoutas, Papadomichelaki, & Mentzas, 2007). Despite this, the process and technical performance layers are concerned with the organization's self-evaluation, whereas the site interface and customer satisfaction layers are concerned with citizens' evaluation (Halaris, Magoutas, Papadomichelaki, & Mentzas, 2007).

Three methods of e-Government quality assessment have been identified for the purposes of this study. The first is the supply side, which is manifested in the growth of e-Government maturity models. The second is a survey of demand, which use the questionnaire approach to examine citizens' perceptions of the quality of e-Government. The final one is a set of universal rules for how a website should behave in order to ensure quality, and it aims to bridge the supply and demand gap.

*e-Government maturity models*

e-Government maturity models are used as a way to rank e-Government portals and as a guide of how portals' quality can be enhanced. Several models have been developed over the years. The most well-known and commonly used is that of Layne & Lee (2001), who offered their own analysis of e-Government maturity by creating a four-stage model. The

first level of this model is that of “Cataloguing" (Layne & Lee, 2001). The second level is the "Transaction", which is when companies and individuals begin conducting electronic commerce with the government. The third level is that of "Vertical Integration", in which higher-level systems in comparable jurisdictions are integrated (Layne & Lee, 2001). The fourth level, "Horizontal Integration", involves connecting systems from various government agencies and turning portals into one-stop shops (Layne & Lee, 2001). Others have proposed a four-stage model for e-Government maturity as well (Andersen & Henriksen, 2006), with some dividing stage two into two stages (2nd level is interaction, 3rd level is transaction) and merging the third and fourth levels into one (United Nations, 2012; Alhomod, et al., 2012; Chandler & Emanuels, 2002).

There are further models with five or six steps in addition to the four-stage models. The researchers have added stages of e-democracy, join-up government, and/or personalization in these models (Shahkooh, Saghafi, & Abdollahi, 2008; Lee & Kwak, 2012; Siau & Long, 2005; Wescott, 2001; Deloitte & Touche, 2000). Fath-Allah et al. (2014) evaluated 25 e-Government maturity models from 2000 to 2012 and found that while most of the maturity models have distinct stage titles, they all address the same issues, while those with restricted stages miss out on critical issues such as e-democracy (Fath-Allah A. , Cheikhi, Al-Qutaish, & Idri, 2014).

The e-Government models developed over the years have been criticized due to their similarities (Kawashita, Baptista, & Soares, 2020), their simplistic nature (Abanumy, Mayhew, & Al-Badi, 2003; Yildiz, 2007) and their one-sided view (Zahran, Al-Nuaim, Rutter, & Benyon, 2015; Montserrat, 2010; Curtin, 2006). Kawashita et al. (2020), by examining 11 meta-analyses and meta-syntheses research, observed that all the models presented in the papers examined are essentially similar. Patergiannaki & Pollalis (2022) suggested that the 39 e-Government models they examine include the same four steps “creation of an institutional online presence, the capacity for interaction, the capacity for transactions, and the vertical and horizontal integration”. Yildiz (2007), Abanumy et al. (2003) indicated that the models are oversimplistic, focusing on generic components that should be included in each stage of e-Government and undervalue the importance of service and user experience. Finally, another major criticism towards the e-Government

maturity models is that they focus on the supply and the use of ICT and overlook qualitative characteristics such as usability, service quality, and user acceptance (Zahran, Al-Nuaim, Rutter, & Benyon, 2015; Montserrat, 2010; Curtin, 2006). Thus, the use of only e-Government maturity models for the evaluation of the e-Government quality leads to an incorrect assessment of the quality because experience has shown that the e-Government site may have elements from multiple phases. At the same time, the variety of services created is not focused on the citizens' needs but on achieving good ratings.

*Citizen Perception of Quality*

In general, evaluation techniques focused on service quality strive to measure user perceptions against service delivery outcomes (Menezes, Pedrosa, Silva, & Figueiredo, 2022). Models such as the Technology Acceptance Model (TAM) (Davis, 1989) have been modified and used to assess many elements of perceived quality.

The technology acceptance model (TAM) explains and predicts user acceptance of new technologies (Lin, Fofanah, & Liang, 2011). According to the TAM, perceived usefulness (PU) and perceived ease of use (PEOU) are important independent variables that can define or impact potential users' attitudes (ATT) toward behavioral intention (BI). The Unified Theory of Acceptance and Use of Technology (UTAUT) is a TAM extension that transmits four important constructs: performance expectancy, effort expectancy, social influences, and facilitating factors (Venkatesh, Morris, Davis, & Davis, 2003). The degree to which an individual believes that using a new invention would increase his or her performance is referred to as performance expectancy. The degree to which an individual believes that the innovation will be simple to use is measured by effort expectancy. Both constructs are comparable to those in TAM. Social influence is the extent to which a person believes that a significant person in their environment thinks they should use the invention. Facilitating conditions assess how much a person believes that the system's technical and organizational infrastructure is in place to enable its utilization (Rodrigues, Sarabdeen, & Balasubramanian, 2016). The proposed models measuring e-Government quality based on the TAM retain the two core dimensions of perceived ease-of-use and perceived usefulness, incorporate the UTAUT social influence construct, and add dimensions such as attraction, interaction, privacy (Wirtz B. W.,

Piehler, Rieger, & Daiser, 2016), trust (Daştan, 2015), information quality (Daştan, 2015; Lin, Fofanah, & Liang, 2011) and personal characteristics (Wirtz, Piehler, & Daiser, 2015).

One of the TAM's drawbacks is that the model does not account for the user's behavioral intention (BI) and interpersonal influence variables (Ajibade, 2018). According to Zahid et al. (2013), the TAM does not take things like age and education into account. Another drawback of TAM and UTAUT is the inability to accurately quantify in an empirical study subjective aspects like social norms and values, as well as individual characteristics and personality traits (Ajibade, 2018; Williams, Rana, & Dwivedi, 2015). William et al. (2015) conducted a systematic literature review on the studies that used the TAM and found that one standard limitation of the studies they looked at was the inability to generalize the findings because of the focus on a single subject (community, culture, country, organization, agency, department, person, or demographic group). A typical drawback is that the TAM is evaluating the participants' adoption of technology at a certain point in time, which is in addition to the limitation resulting from cultural variations (Williams, Rana, & Dwivedi, 2015; Lee, Kozar, & Larsen, 2003). The fact that participants self-report their use of technology is another limitation of the TAM, according to Lee et al. (2003), which contributes to the limited reliability of the studies' findings. Due to the outputs' limited potential to be generalized, the TAM-based models do not tend to allow for the establishment of e-Government quality standards.

*e-Government evaluation against a Universal set of standards*

Various researchers have used the Web Content Accessibility Guidelines (WCAG) to assess the accessibility of e-Government portals, provide an explanation for the country's score on the United Nations Department of Economic and Social Affairs (UN DESA) e-Government development index (EGDI), and offer suggestions for improvement (Paul, 2022). Many academics have employed automated tools to assess the accessibility of e-Government portals for this purpose. Schmutz et al. (2016) claim that by adhering to accessibility requirements, e-Government portals can achieve greater performance in terms of task completion time and rate, as well as a better user experience (perceived usability, aesthetics, workload and trustworthiness). Finally, testing the accessibility

using automatic tools rather than using the assistance of experts can provide a better assessment of the website's accessibility, according to Brajnik, Yesilada, and Harper (2010), as experts tend to miss actual errors and produce false successes.

Furthermore, automated tools are able to produce reports on site performance, SEO (search engine optimization), and best practices (Bureau of Internet Accessibility, 2021). The goal of the SEO process is to evaluate the usability of the website in terms of design, architecture, and content in order to increase the volume and quality of online users who visit the website via search engines (Drivas, Sakas, & Reklitis, 2019). Previous studies have shown that Search Engine Optimization (SEO) is the main factor in generating traffic and improving user experience. They argue that SEO techniques can increase websites' findability on the world wide web and improve the accessibility of e-Government portals for users with limited information literacy (Kopackova, Michalek, & Cejna, 2010). "Best Practices" examines whether the technology and coding utilized are current, adhere to best practices for a positive user experience, and make the website quick and safe (web.dev, 2022). The term "Performance" refers to a system's overall response to human emotional requirements, such as visual aesthetics, attractiveness, and fun-in-ease (Hassenzahl & Ullrich, 2007; Hassenzahl & Tractinsky, 2006), as well as to their practical requirements regarding an interactive interface, such as usability, usefulness, and security.

Overall, automatic tools can run the dimensions of the demand side research against a universal set of standards. However, the current research has only focused on accessibility assessment and has not utilized the full potential of these automated tools. A limitation of the automated tool “Lighthouse” is examined in Section 3.3. The key drawback of using “Lighthouse” as an e-Government quality assessment tool identified by this research is that Lighthouse cannot be combined to provide a summative quality score because it is uncertain how influential these variables are in users' decisions to utilize e-Government portals or not. In order to provide a summative quality score, the four dimensions supplied by Lighthouse cannot be combined because it is unclear how essential these elements are in users' decisions on whether to use e-Government portals. Even though Lighthouse can evaluate the quality of e-Government portals, it is

challenging to directly compare the produced report with academic research using the demand side of e-Government Quality evaluation due to the lack of weight assignment on the metrics that matter more to users and the different categorization that is employed.

The purpose of this chapter is to investigate how these three methods - e-Government maturity models, Technology Acceptance Models, and Universal Set of Standards - are used to evaluate the quality of e-Government, what their advantages and limitations are, and which one of them provides a holistic view of e-Government quality. In addition, the implementation of these methodologies on the same sample of fifty Greek municipal e-Government portals allows for an analysis of the weaknesses and strengths exhibited by those portals concerning each quality area. In the last section (3.4), the differences and similarities between these three models are examined. This assessment aims to answer the following questions: (i) Which municipalities have a high-quality e-Government portal according to each method, and how do they perform using other approaches? (ii) Do any relationships exist between the measurements of the different approaches? (iii) Which technique appears to give a more comprehensive perspective?

# 3.1E-Government Evaluation with the use of Maturity Models

## 3.1.1 Introduction

The digital transformation of the public sector is one of the most significant priorities of the European Union (European Commission, 2020a). Multiple techniques and methodologies to measure e-Government and digital transformation development have been proposed by the UN, the European Commission, and academia (European Commission, 2020a; Directorate for Public Governance (GOV), 2020; Valdez-de-leon & Christensen, 2016). The EC has been working on digital transformation initiatives since 2006 (European Commission, 2006; European Commission, 2019). Due to the novel COVID-19, providing public services online has become a necessity, and preliminary research has shown that it has numerous benefits for the government, including increased citizens' trust in the government and positive citizens' perceptions of government transparency and reputation (Amosun, et al., 2021).

For several years, academics, practitioners, and international organizations have worked on developing an e-Government maturity model as a one-size-fits-all solution that outlines the way that public institutions need to accomplish an effective digital transformation (Layne & Lee, 2001; Fath-Allah A. , Cheikhi, Al-Qutaish, & Idri, 2014). Several of these models have also been utilized as tools for e-Government evaluation (Shahkooh, Saghafi, & Abdollahi, 2008; Lee & Kwak, 2012; Siau & Long, 2005; Wescott, 2001; Deloitte & Touche, 2000). The numerous models that have been released throughout the years, as well as the disparities that exist between them, have increased the criticism level against them. e-Government is a never-ending process that evolves in tandem with technological advancements, innovative thinking, and the ever-changing needs of users. The critique stems from the fact that e-Government maturity models provide insight into the current condition of the industry while ignoring the causes, consequences, and attributes of these developments (Nograšek & Vintar, 2014). Further and more inclusive research in terms of context and stakeholders, according to Bélanger and Carter (2012), is necessary to contribute to the Theory of e-Government Evolution. Another recent study alludes to the pivotal moments in the evolution of e-Government

(Iannacci, Seepma, de Blok, & Resca, 2019). This study sought to provide a critique of the e-Government maturity models by utilizing a simple four stages model and identify factors that predict the e-Government maturity model in Greece. The following research questions were posed as part of this evaluation of e-Government maturity models. (i) Can the local e-Government evolution be captured by a basic e-Government maturity model? (ii) How are Greek municipalities classified in terms of e-Government maturity? (iii) Do the municipality's size, the budget per citizen, the ruling party's ideology, and the mayor's gender affect the e-Government development? A basic e-Government model adapted for municipalities is used to measure the e-Government evolution and provide answers to the first two questions.

The population, the per-citizen budget available, the ideology of the governing party, and the gender of the mayor are utilized as independent factors to determine the impact they have on the maturity of the e-Government development.

The rest of the work is organized as follows. The "Literature Review" section describes the advantages of e-Government and assesses various e-Government maturity models. The study strategy, research questions, and sample selection are all presented in the "Methodology" section. The "Findings" section depicts the current state of Greek municipalities and their e-Government progress over time. The results of the statistical analysis are also reported in this section. The "Discussion" section draws some observations from the statistical analysis and explores theoretical and practical ramifications. The "Conclusion" section summarizes the research's main findings and discusses future research directions and the work's limitations.

### 3.1.2 Literature review

*Drivers of e-Government development*

There seem to be internal and external drivers of e-Government development. The institution's size (Samuel, Doctor, & Baradi, 2020), economic concerns (Jaeger & Thompson, 2003), leadership (Samuel, Doctor, & Baradi, 2020; Conklin, 2007), corporate culture (Alassaf, Zaien, & Olah, 2020), and ICT utilization (Alassaf, Zaien, & Olah, 2020; Apriliyanti, Kusumasari, Pramusinto, & Setianto, 2021) are all internal

drivers. On the other hand, external forces include the nation's population (Alassaf, Zaien, & Olah, 2020; Ahn, 2011; Lee, Chang, & Berry, 2011), economic status (Ingrams, Manoharan, Schmidthuber, & Holzer, 2020; Gallego-Alvarez, Rodríguez-Domínguez, & García-Sánchez, 2010), and digital transformation agenda (Apriliyanti, Kusumasari, Pramusinto, & Setianto, 2021; Tolbert, Mossberger, & McNeal, 2008).

Financial constraints and financial capacity are considered to be important influencing factors in the development of e-Government. The launch of e-Government is impeded by a significant infrastructure cost, according to Basamh et al. (2014). The availability and accessibility of suitable infrastructure, whether it be technological, organizational, or human, has also been noted by several academics as one of the critical aspects affecting the success of e-Government (Alassaf, Zaien, & Olah, 2020; Basamh, Qudaih, & Suhaimi, 2014). These results are corroborated by Ahn (2011), who claimed that of the 3,007 municipalities and 403 counties he looked at, financial competence had a positive effect on e-Government. Similar findings were reached when Lee et al. (2011) investigated 131 countries' e-Government progress and its correlation with GDP per capita. Budgetary expenditures, according to Gallego-Alvarez and her colleagues' (2010) research on the 81 largest municipalities worldwide, have a significant influence on the development of e-Government. In accordance with the arguments examined, the following hypothesis has been expressed:

$H_1$: Municipalities with larger budgets will have a higher level of e-Government maturity.

The impact of organizational culture is predicated on the fact that public institutions have a risk-averse culture and are resistant to change (Voorberg, Bekkers, & Tummers, 2015). However, according to the institutional theory, people will agree to an organizational change if they consider it to be beneficial to them; hence if employees in public institutions and agencies sense benefits from e-Government, change resistance will be reduced (Lawrence & Sudddaby, 2006). This idea emphasizes how crucial leadership is in overcoming internal barriers and advancing e-Government progress. In fact, some contend that leadership is the most critical organizational factor to the success of e-Government since leaders are in charge of making decisions (Conklin, 2007; Samuel, Doctor, & Baradi, 2020).

Several leadership-related characteristics have been found to influence their attitude toward e-Government. According to Al-Shboul et al. (2014), low and medium-level politicians may provide challenges to e-Government because they are afraid of ceding control or reallocating power (Al-Shboul, Rababah, Ghnemat, & Al-Saqqa, 2014; Toots, 2019). Other researchers have indicated that the political ideology of the ruling party also affects e-Government development (Cárcaba & García, 2008; Tolbert, Mossberger, & McNeal, 2008). The Socialist Party of Spain (Cárcaba & García, 2008) and the Republican Party of the United States have been proven to have favorable influences towards e-Government. However, Gallego-Alvarez and her colleagues, who analyzed political indicators such as the level of political rivalry and the ruling party's political tendencies in 81 countries' largest municipalities, suggest that there is no evidence of a link between political variables and e-Government (Gallego-Alvarez, Rodríguez-Domínguez, & García-Sánchez, 2010). As there is not enough historical data to determine which political tendency may be more prone to using digital government, the following hypothesis has been articulated:

$H_2$: There is a link between the governing party's political ideology and e-Government maturity.

The intention to employ technology seems to be influenced by demographic traits as well. While many researchers have found that younger people are more likely to use technology due to that technology's perceived complexity (Venkatesh, Morris, Davis, & Davis, 2003), Abu-Shanab (2015) found that older people who find online services to be very useful are more likely to use them. Furthermore, while statistically significant differences in e-Government adoption between men and women were seen in Turkey and the UK, these differences were not seen in the U.S. or Kuwait (Susanto, 2013). Additionally, the role of gender as an influencing factor in e-Government adoption is found to depend on the cultural characteristics of the society (Alawadhi & Morris, 2008; Patel & Jacobson, 2008). In a recent study, Funk and Philips (2018) analyzed 5400 Brazilian cities over the course of eight years. According to their findings, female mayors are more likely to reallocate government spending to feminine topics such as education, health care, and social assistance (Funk & Philips, 2018). Other studies have looked at

the gender of mayors as a factor in determining how municipalities use social media (Lameiras, Silva, & Tavares, 2018; Guillamon, Ríos, Gesuele, & Metallo, 2016; Silva, Tavares, Silva, & Lameiras, 2019). They have not, however, seen any substantial effect of gender on municipal social media use. Due to the controversial arguments on the topic of the influence of culture on gender differences in leadership, the following hypothesis has been proposed to be examined:

$H_3$: There is a relationship between the gender of the mayor and the e-Government maturity.

As an external driver, the investments in e-Government are long-term strategic projects that require both the development of domestic financial sources and long-term governmental financing (Alassaf, Zaien, & Olah, 2020). Given the challenges of delivering guaranteed and ongoing funding for major projects throughout their lengthy durations in a climate of intense pressure on the public sector to limit its expenditure and resources, this constitutes a barrier to their implementation (Kovacova, Kliestik, Valaskova, Durana, & Juhaszova, 2019; Ojha & Pandey, 2017). All aspects of e-Government require a substantial investment in technology, regardless of external or internal leadership pressure to innovate. As a result, prosperous governments with strong financial standing are more inclined to use cutting-edge e-Government tools (Tolbert, Mossberger, & McNeal, 2008; Ma, 2014). In terms of national e-Government strategy, previous research examining the digital transformation strategy proposed by the European Commission and implemented by the Greek Government from 2006 until 2020 found that the documents were very generic, providing guidelines without any indication of the stages through which e-Government should develop or the qualities that must be met (Patergiannaki & Pollalis, 2021).

Finally, a significant external driver that encourages municipalities to enhance their e-Government potential is population size (Ahn, 2011; Lee, Chang, & Berry, 2011). This seems to apply to electronic information, electronic services, and electronic involvement (Norris & Reddick, 2012; Gallego-Alvarez, Rodríguez-Domínguez, & García-Sánchez, 2010; Guillamon, Ríos, Gesuele, & Metallo, 2016). The government serves as a provider

and must be more innovative to fulfil the demands of a population that is densely inhabited (Ingrams, Manoharan, Schmidthuber, & Holzer, 2020). Ahn's (2011) findings, which show that the municipality's size had a favorable impact on e-Government in the 3,007 municipalities and 403 counties that were analyzed, lend credence to this notion. Similar findings were reached when Lee et al. (2011) looked at 131 nations' e-Government development in relation to population, GDP per capita, and other factors and Gallego-Alvarez and her coworkers who examined the population density in 81 countries' major municipalities and found that it significantly affects the growth of e-Government (Gallego-Alvarez, Rodríguez-Domínguez, & García-Sánchez, 2010). Taking into consideration the theoretical arguments, the following hypothesis is tested:

$H_4$: The population of municipalities has a positive impact on the e-Government maturity.

*e-Government maturity models comparison*

The many usability and functionality stages that an e-portal may go through are described by the e-Government maturity models. Therefore, maturity models can be used to evaluate e-Government portals and as a roadmap for achieving e-Government portal maturity (Fath-Allah A. , Cheikhi, Al-Qutaish, & Idri, 2014). The 40 e-Government maturity models that have been put forth over the years are presented in the remaining paragraphs of this section.

Numerous four-stage maturity models have been offered by scholars over the years, and this work examined 11 of them. A four-stage maturity model was proposed in 1999 by the Australian National Audit Office. The first phase is called "Web Presence". It involves presenting the public information about the government, the state or province, the variety of services offered, and contacts for more information. Users can view and interact with the agency's database in the second phase, known as "Database queries online." Users may enter secure information and conduct business with the government through the third step, "Agency interaction with clients, including client entry of confidential data." The government agency shares the user's information with other government agencies in the fourth stage, "Agencies receiving authenticated information share data with other agencies with prior approval of individual clients" (ANAO, 1999). Both the Swedish Agency for Administrative Development and the Gartner Group

developed their respective four-stage e-Government maturity models in 2000. As the first stage, both provide an information-sharing website with static content, the ability to interact is categorized as the second stage, and the integration (vertical and horizontal) is referred to as the fourth stage (Statskontoret, 2000; Baum & Di Maio, 2000). The third stage is where the sole difference can be seen, as the Swedish Agency for Administrative Development concentrated on the capacity to enter and retrieve personal information, whereas Gartner Group offered the "Transaction."

The most well-known e-Government maturity model was introduced by Layne and Lee (2001), who presented their analysis of e-Government maturity by developing a four-stage maturity model. The government institution only has a webpage at the "cataloguing" level. The second stage is the "transaction," during which businesses and citizens start electronic transactions with the government. In the third stage, "vertical integration", higher-level systems in comparable jurisdictions are integrated. "Horizontal integration" is the last level, where systems are connected across many government entities, and portals act as one-stop shopping (Layne & Lee, 2001). Windley (2002) and Chandler and Emanuels (2002) also proposed four-stage maturity models. These stages included "Information", where the website contains static informational pages, "Interaction", which enables interaction between users and the government body, "Transaction", which allows citizens to conduct transactions; and "Integration", where the systems are integrated both vertically and horizontally. The third stage is where Windley (2002) adds service customization to the integration process, thereby differentiating the models from one another. Along these lines, West (2004), Andersen and Henriksen (2006), Al-Hashmi (2012), the United Nations (2012), and Janowski (2015) all proposed analogous four-stage e-Government models (Table 3.1.1).

For the purpose of this work, 10 five-stage maturity models have been examined. Five of the ten five-stage maturity models looked at for this work's purposes are similar but differ in the fifth stage. Five-stage maturity models that differ in the fifth stage have been developed by Hiller and Belanger (2001), Sia and Long (2005), Chan et al. (2008), Shahkooh et al. (2008), and Kim and Grand (2010). The existence of an online presence, the ability for interaction, the capacity for the transaction, and vertical and horizontal

integration are the first four stages. Hiller and Belanger (2001), Siau and Long (2005) and Shahkooh et al. (2008) recommended e-Democracy and Political Participation as the fifth stage. On the other hand, Chan et al. (2008) suggested tri-party integration between public, private, and stakeholders and Kim and Grant (2010) proposed continuous improvement as the final stage. Netchaeva's (2002) model was organized as follows: "Scattered information," "Emails and FAQ," "Other Online Services" (such as discussion forums and opinion polls), "e-Government portal" with transaction feature, "Possible Democracy" where citizens can cast ballots, participate in online discussions, and offer policy recommendations. In 2002, the UK National Audit Office proposed a model that progressed from a "Basic site" with scant information about authorities to "Electronic publishing" with more content, "E-publishing" with customizable search tools and personalization options, and "Transactional" and "Joined-up" e-governance through vertical and horizontal integration. Finally, the stages of creating an online presence, providing basic capabilities, delivering services, maturing services, and transforming services were presented by Accenture in 2003 as a five-stage model.

Three-stage e-Government maturity models are also common; in this study, 5 are explored. In 2001, Howard and Toasaki (2003) suggested a three-stage maturity model with publications for "Publishing," "Interaction," and "Transaction" (2003). Publishing is the process of disseminating static information such as laws, regulations, documents, and forms. Users may comment and provide comments at the "Interaction" stage. The "Transaction" step includes safe online transactions and electronic payments. The provision of information was designated as the first stage by the Cisco IBSG (2007), Chen & Mingins (2011), and Almuftah et al. (2016) as well, while the ability to interact with public services through portals was established as the second level. The third and final stage, however, is the integration and consolidation of administrative services across various government jurisdictions.

Deloitte & Touche (2000) developed the first six-stage maturity model to serve as a road map for the successful adoption of e-Government. Since then, three further six-stage e-Government models have been presented. There were six stages in that model. "Information Publishing/Dissemination" is the first stage. The "Official Two-Way

Transaction" is the second stage, which allows clients to give personal information to various departments and make financial transactions with them. Customers use the e-Government portal as a single point of entry to send and receive information and to perform financial transactions across several departments in the third stage, which is known as "Multi-Purpose Portals." Governments provide users with the option to add the features they want to portals at the fourth stage, "Portal Personalization". The fifth stage, “Clustering of Common Service”, accelerates the delivery of shared services by clustering them along similar axes. The overarching objective of the sixth stage, “Full Integration and Enterprise Transformation”, is to demolish outdated walls designating silos of services. Technology is integrated across the company to bridge the shorter gap between the front and back office (Deloitte & Touche, 2000). Wescott (2001) added a six-stage maturity model a year later. His model was divided into six stages, the first of which included the development of internal networks and email systems, the second of which focused on public and organizational information sharing, the third on two-way communication, the fourth on the exchange of value through information sharing, the fifth on digital democracy, and the sixth on integrated government. Another six-stage maturity model consisting of the stages "Presence," "Interaction," "Transaction," "Vertical & Horizontal Integration," "E-participation and digital inclusion," and "Open government" was developed in 2014 by Fath-Allah et al. after reviewing 25 maturity models.

The literature review revealed that 2 other research had suggested a two-stage maturity model. Reddrick (2004) proposed that e-Government is developed in two stages: "Cataloguing," where the web presence offers a list of the available offline services and information about the agency, and "Transactions," where public agencies offer online services and the capability to conduct transactions with the general public. Persson and Goldkuhl (2005), on the other hand, suggested that in the first stage, the web presence integrates offline services through the online ecosystem, and in the second stage, the web presence enables data sharing and serves as a central hub for all services provided by various public agencies. Overall, both models give a general overview of the stages, which more stage-rich models portray in greater depth.

Kawashita, Baptista, and Soares (2020) published a most recent e-Government maturity model, which was based on a meta-synthesis technique of eleven separate research publications. They created a seven-stage model encompassing all the stages discussed in the literature review (Kawashita, Baptista, & Soares, 2020). The stages of this model include “Information Publishing," in which there are no requirements for ease of use, utility, or content to be included, and "Interaction between the government and users," in which the scalability of two-way communication is not standardized as long as the usefulness of the interactions is not. The third stage is "Online Transactions", in which portals enable users to plan and execute tasks. The fourth stage, "Integrations", includes vertical and horizontal integrations that enhance operational and technological efficiency. The fifth stage is called "Transformation of the State-Society Relationship," and it focuses on improving organizational and service provision while also considering user satisfaction and the usefulness of services. The sixth stage is "Social Participation and e-Governance," wherein citizens can voice their opinions and vote on important issues using e-portals. "Contextualization or Policy-Driven Electronic Governance" is the seventh and final stage and refers to the execution of public policies via an e-portal that targets certain social groups such as low-income single-parent households, agricultural areas, and so on (Kawashita, Baptista, & Soares, 2020).

The models mentioned above are broad; however, some researchers have tried to develop e-Government maturity models dedicated to municipalities. Three four-stage and three five-stage e-Government models were found among the six municipality e-Government maturity models. All of them recommend developing a web presence that presents details about the authority as the first stage. At the second level, Kaylor et al. (2001) suggested that the public be given contact information (e.g. phone number, email). Ore and Lozada (2017) proposed "Urban information", providing details on the city, transportation, productive municipal activities, and photographic record as the second stage. The capacity for interaction was included in the second stage by Moon (2002), Flak et al. (2005), and Arslan (2008). As the third stage, The Interaction has been proposed by Kaylor et al. (2001) and Ore & Lozada (2017). Moon (2002) and Flak et al. (2005) designated the "Transaction" as the third stage, while Arslan (2008) proposed a two-way interaction that comprised the functionalities of forms processing and authentication.

While Flak et al. (2005) advocated e-Democracy and Moon (2002) Integration, Kaylor et al. (2001), Arslan (2008), and Ore & Lozada (2017) incorporated the potential for transactions in the fourth stage. Finally, the fifth step of participation was included by Moon (2002) and Ore & Lozada (2017), while Aslan proposed Service Integration as a fifth stage.

Another model for municipalities' e-Government assessment was developed by Khalid & Lavilles (2019). Their approach is based on an adapted model used previously by Al-Hashmi, Surash, and Darem (2012) to assess the e-Government maturity of ministries in Yemen. E-portals provide fundamental characteristics, including office information, a search engine, external linkages, and regular updates throughout the "Emerging Information Services" stage, which is the initial stage. In the second stage, the "Enhanced Information Services" e-portals include elements like printable forms, accessibility widgets, a multilingual interface, a contact form, and more. "Transactional information services" is the third step, which enables users to log in, upload forms, carry out financial transactions, and apply for credentials and licenses. At the top level, "Connected Information Services," elements like e-voting, using web 2.0 for online participation in decision-making, online consultations, and appointment scheduling are all available. This model defined specific requirements and integrated the many functions suggested by the earlier works by adapting the UN's four-stage model (Emerging information services, Enhanced information services, Transactional services, Connected Services) to the municipal level (Khalid & Lavilles, 2019).

Overall, all the models under review appear to share the same fundamental functionalities. Except for Wescott (2001), who chose a different approach, they all advocate for the development of a web presence as a first step in the dissemination of knowledge. The ability to interact (included as a stage in 20 of the models assessed) and make transactions are the following most frequent functionalities derived from the analysis (included as a stage in 19 of the models examined).

*Table 3.1.1 Overview of the existing e-Government Models*

| Generic e-Government Models | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Authors** | **Year** | **No. of Stages** | **Stage 1** | **Stage 2** | **Stage 3** | **Stage 4** | **Stage 5** | **Stage 6** | **Stage 7** |
| (ANAO) | 1999 | 4 | Publishing and Information | Interaction | Transaction of secure information | Information exchange | - | - | - |
| (Baum & Di Maio) | 2000 | 4 | Information | Interaction | Transaction | Vertical & horizontal integration | - | - | - |
| (Statskontoret) | 2000 | 4 | Information | Interaction | Web & Communication via | Vertical & Horizontal Integration | - | - | - |
| (Deloitte & Touche) | 2000 | 6 | Information publishing | 'Official' two-way transaction | Multi-purpose portals | Portal personalization | Clustering of common services | Fully integration | - |
| (Hiller & Belanger) | 2001 | 4 | Web presence | Interaction | Transaction | Integration | Political Participation | - | - |
| (Howard) | 2001 | 3 | Publishing | Interaction | Transaction | - | - | - | - |
| (Layne & Lee) | 2001 | 4 | Catalogue | Transaction | Vertical integration | Horizontal integration | - | - | - |
| (Wescott) | 2001 | 6 | Email system and internal network | Inter-organizational and public access to information | Two-way communication | Exchange of value | Digital democracy | Joined-up government | - |
| (Chandler & Emanuels) | 2002 | 4 | Information | Interaction | Transaction | Integration | - | - | - |
| (Netchaeva) | 2002 | 5 | Information | Emails and FAQ | Interaction via forums and surveys | E-Government portals offering e-services | Possible democracy | - | - |
| (Windley) | 2002 | 4 | Simple website | Online government | Integrated government | Transformed government | - | - | - |
| (UK National Audit Office) | 2002 | 5 | Basic site | Electronic publishing | Personalization of services | Transactional | Joined-up e-governance | - | - |
| (Toasaki) | 2003 | 3 | Publish | Interact | Transact | - | - | - | - |
| (Accenture) | 2003 | 5 | Online presence | Basic capability | Service availability | Mature delivery | Service transformation | - | - |
| (Reddick) | 2004 | 2 | Cataloguing | Transactions | - | - | - | - | - |
| (West) | 2004 | 4 | Bill-board | Partial-service-delivery | Portal for information and services | Interactive democracy | - | - | - |
| (Siau & Long) | 2005 | 5 | Web presence | Interaction | Transaction | Transformation integration | E-democracy | - | - |
| (Persson & Goldkuhl) | 2005 | 2 | Integration of services | Integration in services across agencies | - | - | - | - | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | focusing on services | | | | | | |
| (Andersen & Henriksen) | 2006 | 4 | Cultivation (website with static content) | Extension (e-services, basic personalization) | Maturity (user-centricity, open data) | Revolution (Data ownership transferred to the end-user) | - | - | - |
| (Cisco) | 2007 | 3 | Information interaction | Transaction efficiency | Vertical & Horizontal Integration | - | - | - | - |
| (Chan, Lau, & Pan) | 2008 | 5 | Publishing | Interaction | Transaction | Vertical & Horizontal Integration | Tri-party integration (public, private and stakeholder) | - | - |
| (Shahkooh, Saghafi, & Abdollahi) | 2008 | 5 | Online presence | Interaction | Transaction | Vertical & Horizontal Integration | Digital democracy | - | - |
| (Almazan & Gil-Garcia) | 2008 | 6 | Presence | Interaction | Transaction | Vertical & Horizontal Integration | Political participation | - | - |
| (Kim & Grant) | 2010 | 5 | Web presence | Interaction | Transaction | Vertical & Horizontal Integration | Continuous improvement | - | - |
| (Lee J. ) | 2010 | 5 | Presenting | Assimilating | Reforming | Morphing | e-Governance | - | - |
| (Chen & Mingins) | 2011 | 3 | Catalogue | Transaction | Integration | - | - | - | - |
| (Alhomod, et al.) | 2012 | 5 | Initial conditions (one-way, static interaction) | Data transparency | Open participation (includes e-voting and e-petitioning) | Open collaboration | Ubiquitous engagement (vertical & horizontal integration) | - | - |
| (European Committee) | 2012 | 5 | Emerging Presence | Enhanced Presence | Interactive | Transactional | Seamless (horizontal and vertical integration) | - | - |
| (Al-Hashmi, Surasha, & Darem) | 2012 | 4 | Emerging Presence | Enhanced Presence | Interactive | Transactional | - | - | - |
| (United Nations) | 2012 | 4 | Emerging Presence | Enhanced Presence | Transactional Presence | Connected Presence | - | - | - |
| (Fath-Allah A. , Cheikhi, Al-Qutaish, & Idri) | 2014 | 6 | Presence | Interaction | Transaction | Vertical & Horizontal Integration | E-participation and digital inclusion | Open government | - |
| (Janowski) | 2015 | 4 | Digitization Technology in Government | Transformation Electronic Government | Engagement Electronic Governance | Contextualization Policy-Driven electronic Governance | - | - | - |
| (Almuftah, Weerakkody, & Sivarajah) | 2016 | 3 | Presence | Communication | Full Integration | - | - | - | - |
| (Kawashita, Baptista, & Soares) | 2020 | 7 | Presenting Information | Interaction | Transaction | Integration | Transformation | e-Governance | Policy Driven e-governance |

**Municipality e-Government models**

| Authors | Year | No. of Stages | Stage 1 | Stage 2 | Stage 3 | Stage 4 | Stage 5 | Stage 6 | Stage 7 |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (Kaylor, Deshazo, & Van Eck) | 2001 | 4 | Information | Link to relevant contact | Downloadable forms | Transaction or other interaction | - | - | - |
| (Moon) | 2002 | 5 | Web presence | Interaction | Transaction | Transformation / Integration | Participation | - | - |
| (Flak, Olsen, & Wolcott) | 2005 | 4 | Information Dissemination | Interactive functions | E-commerce | E-democracy | - | - | - |
| (Arslan) | 2008 | 5 | Information | Interaction | Two-way Interaction | Transaction | Service Integration | - | - |
| (Ore & Lozada) | 2017 | 5 | Presence | Urban Information | Interaction | Transaction | e-Democracy | - | - |
| (Khalid & Lavilles) | 2019 | 4 | Emerging information services | Enhanced information services | Transactional services | Connected Services | - | - | - |

*The criticism of e-Government models*

It seems that the research lacks a consistent framework for evaluating e-Government activities, even if there may not be any substantial differences amongst e-Government models. According to Virgo & Brajik (2011), this issue appears to have resulted from a lack of empirical study evaluations of the metrics that are now in use (Vigo & & Brajnik, 2011). Another view coming from the UN in the e-Government Survey (2014) is that "e-Government maturity models" are no longer applicable since the technology as well as the goals, the challenges and the processes towards increasing public value, change constantly. Several researchers have also provided a more thorough critique of the current models, pointing out their flaws.

The primary criticism of the e-Government models is that they are essentially indistinguishable (Kawashita, Baptista, & Soares, 2020). The literature reviewed shows that the majority of the models are based on early models that were created between 1999 and 2003. The concepts, descriptions, and perspectives that are derived from the majority of e-Government models appear to be the same despite the apparent (Kawashita, Baptista, & Soares, 2020). They place a strong emphasis on technology and supply, and they see ICT as a tool for achieving government reform and transformation (Nielsen, 2016). The emphasis on ICT and supply orientation results in the exclusion of crucial qualitative indicators like usability and service quality, failing to estimate the effectiveness of e-Government portals as well as user acceptance (Curtin, 2006; Zahran, Al-Nuaim, Rutter, & Benyon, 2015). The eventual objective of e-Government has been overlooked due to the imbalance between the availability of government-side surveys and the dearth of

citizen-side studies. The current paradigm forces governments to emphasize receiving high ratings for developing numerous services without concern for whether citizens use them (Montserrat, 2010; Zahran, Al-Nuaim, Rutter, & Benyon, 2015).

The e-Government maturity models have also been criticised for being overly simplistic (Yildiz, 2007). In particular, the UN model appears to be overly generic and to have too many elements, which place an excessive emphasis on features and not enough on services (Abanumy, Mayhew, & Al-Badi, 2003). Therefore, regardless of the number of services an e-Government portal may provide, the score and stage of e-Government maturity will be focused on the features it has, which undervalues the significance of the services. As Nielsen (2016) emphasized, features like information, transaction capacity, and personal data should not be regarded as distinct maturity levels but rather as components of a specific service request and subsequent delivery. Additionally, experience shows that the e-Government portal may include features from several stages, so the abundance of features and the ranking system result in an inaccurate maturity assessment (Nielsen, 2016). The evolutionary phases do not proceed sequentially or linearly, and higher levels may not incorporate traits from earlier ones (Zahran, Al-Nuaim, Rutter, & Benyon, 2015)

The fact that e-participation and e-democracy should not be viewed as an e-Government maturity stage is another point raised by Nielsen (2016). Instead, engagement, petitioning, and voting solutions should be considered service types because they all include information, transactional capability, and some form of data. For instance, election-related information, an online voting platform that enables voting, and data like a voter's name, address, and unique ID number are all examples of such information. Hence, rather than being viewed as e-Government maturity levels, the e-participation and e-democracy stage(s) should be viewed as an indication of democratic development and a level of transparency in a country (Nielsen, 2016).

Bélanger and Carter (2012) reviewed the history of e-Government research, identifying the main study themes and making recommendations for future e-Government research. According to their findings, existing e-Government models failed to include a range of stakeholders and contexts in their research (e.g. culture) (Bélanger & Carter, 2012). e-

Government maturity models provide insight into the current state of e-Government without addressing the reasons, implications, and characteristics of these changes (Nograšek & Vintar, 2014). Nograsek and Vintar (2014) developed a theoretical framework that links e-Government to the organizational transformation that occurs in response to digital transformation. The approach divided qualities into two categories: organizational level and nature (processes, people, culture, and structure). Their paradigm provides a comprehensive examination of the various variables that should be considered in digital transformation and alludes to why providing a single e-Government maturity model is problematic.

In response to this criticism, Iannacci, Seepma, de Blok, and Resca (2019) established a trajectory-turning point theory of e-Government maturity by investigating the English criminal justice system. According to their observations, e-Government maturity is an unpredictable process in which turning points (or radical alterations) are critical in the e-Government strategy-making process. They argue that, contrary to popular e-Government models, the assumptions of linear, progressive, and irreversible changes leading to e-Government are unrealistic as these changes may come across historical and institutional impediments. They proposed the trajectory-turning point theory to circumvent these limitations since it accounts for the dialectical conflicts that characterize e-Government maturity while also considering evolutionary and improvisation mechanisms (Iannacci, Seepma, de Blok, & Resca, 2019).

### 3.1.3 Methodology

Given the importance of having an e-Government model for practitioners and academia, as well as the criticism levelled at existing models, the research examines the case of 50 Greek municipalities using a simplified version of the e-Government maturity model provided by Khalid & Lavilles (2019) and variables proposed by the most recent e-Government UN report (2020) to assess if a standardized model can address all of the characteristics of e-Government. Ultimately, this study seeks to answer the research questions "How are Greek municipalities classified in terms of e-Government maturity?" and "Does the municipality's population, the available budget per citizen, the ruling party’s ideology and the mayor’s gender have an impact on the stage of e-Government

maturity?" to examine if evaluating e-Government maturity using standardized e-Government models is a realistic option.

The author examined Greek municipalities using an adapted version of Khalid and Lavilles' model (2019). The rationale for using an adapted version of the suggested model is that it incorporates some modern critical factors for analyzing a website. However, it lacks vital capabilities based on recent technological advancements and user expectations, as reported in the United Nations' most recent survey (United Nations, 2020). Table 3.1.2 shows the suggested model and the requirements for each level.

*Table 3.1.2 Website Maturity Assessment criteria (adapted version)*

| **Maturity Stage** | **Criteria** | **Description of the Portal:** |
|---|---|---|
| Emerging Information Services | Information about the Office | Contains basic information about the office (e.g. location, policy, departments, city council decision, contact information, budget allocation, etc.) |
| | External Links | Contains links to other offices/organization websites or social media pages |
| | Regular Updates | Regular updates on municipality news, decisions, and events |
| | Search Engines | Allows the user to search on-site for the information they need |
| Enhanced Information Services | Downloadable Documents | Allows a user to download relevant forms |
| | Accessibility | Becomes user-friendly for people with disabilities |
| | Newsletter | Allows users to register and receive relevant information |
| | Contact Form | Allows users to contact the institution through an online contact form |
| | Multilingual Interface | Allows a user to choose different languages |
| Transactional Services | Uploading Forms | Allows a user to upload forms |
| | Financial Transactions | Allows sending payments and fees online |
| | Log-in | Allows users to connect to the system and create a profile |
| | Applying for Certificates/ Licenses | Allows application for certificates/licenses |
| Connected Services | E-Voting | Allows a user to vote online |
| | Web 2.0 | Engage citizens through forums, social media, comment boxes, etc. |
| | Online Consultation | Allows users to consult online through chatbots, online meetings, etc. |
| | Appointment Booking | Allows users to book online appointments with the office they are interested in |

Source: Khalid and Lavilles (2019), UN (2020)

The researcher conducted a content and functionality analysis of 50 municipal websites to determine which requirements were met based on the criteria set (Table 3.1.2). Each criterion was given a weight of 1 if the website meets the criteria and 0 if it does not. Only websites that meet all of the requirements are allowed to advance to the next round. Ordinal regression was performed to determine whether the response variable, which reflects the Stage of e-Government Maturity (Emerging Information, Enhanced Information, Transactional Services, Connected Services), is explained by the continuous predictive variables Population and Budget and the categorical predictors, Political Ideology (Social Democrat, Conservative-Liberal, No connection to political ideology) and Gender. The analysis was repeated without the criterial rule to determine if the predictors can better explain the outcome variable one and determine if the use of a standard maturity model is able to provide a complete assessment of the e-Government development.

### 3.1.4 Findings

*e-Government Maturity Assessment of Greek Municipalities*

In the first phase of the analysis, the researcher looked at the municipalities' current level of e-Government. All 50 municipalities evaluated have an Emerging Information website, and 88% of the overall sample has successfully progressed from the Emerging Information stage to the Enhanced Information presence (Table 3.1.3). Only 14% of the websites reviewed have entered Transactional Services, and none of the websites examined fit the criteria for connected services. The complete table of the level of e-Government maturity achieved by each municipality can be found in Appendix D.

*Table 3.1.3 Classification of e-Government Maturity*

| | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Emerging Information | 6 | 12.0 | 12.0 |
| Enhanced Information | 37 | 74.0 | 86.0 |
| Transactional Services | 7 | 14.0 | 100.0 |
| Total | 50 | 100.0 | |

The researcher examined the functionalities of the websites at each level to discover the websites' drawbacks at each stage (Table 3.1.4.) The only capability not included in 12%

of the sample in the Emerging Information stage was the "Search Engine," At the Enhanced Information level, 94% of the websites lacked a multilingual interface, implying that they only served the Greek-speaking population. The lack of a "Newsletter" (66%) and a "Contact Form" were the second and third most common website flaws, respectively (40%). Furthermore, Accessibility features and widgets are absent in 38% of the sample. Table 3.1.4 also demonstrated that if the criterion of meeting all criteria before moving on to the next stage had not been established, more websites would have passed the Transactional Services and Connected Services stages.

*Table 3.1.4 Frequency, Percent numbers of criteria met in each stage of e-Government Maturity based on 50 municipalities*

| | | | Total N | N % |
|---|---|---|---|---|
| **Emerging Information** | Information about the Office | No | 0 | 0.0% |
| | | Yes | 50 | 100.0% |
| | External Links | No | 0 | 0.0% |
| | | Yes | 50 | 100.0% |
| | Regular updates | No | 0 | 0.0% |
| | | Yes | 50 | 100.0% |
| | Search Engine | No | 6 | 12.0% |
| | | Yes | 44 | 88.0% |
| **Enhanced Information** | Downloadable documents | No | 4 | 8.0% |
| | | Yes | 46 | 92.0% |
| | Accessibility | No | 19 | 38.0% |
| | | Yes | 31 | 62.0% |
| | Newsletter | No | 33 | 66.0% |
| | | Yes | 17 | 34.0% |
| | Contact form | No | 20 | 40.0% |
| | | Yes | 30 | 60.0% |
| | Multilingual Interface | No | 47 | 94.0% |
| | | Yes | 3 | 6.0% |
| **Transactional Services** | Uploading forms | No | 28 | 56.0% |
| | | Yes | 22 | 44.0% |
| | Financial Transaction | No | 32 | 64.0% |
| | | Yes | 18 | 36.0% |
| | Log-in | No | 11 | 22.0% |
| | | Yes | 39 | 78.0% |
| | Applying for certificates/ licenses | No | 22 | 44.0% |
| | | Yes | 28 | 56.0% |
| **Connected Services** | E-voting | No | 48 | 96.0% |
| | | Yes | 2 | 4.0% |
| | Web 2.0 | No | 43 | 86.0% |
| | | Yes | 7 | 14.0% |
| | Online consultations | No | 47 | 94.0% |
| | | Yes | 3 | 6.0% |
| | Appointment Booking | No | 41 | 82.0% |
| | | Yes | 9 | 18.0% |

*e-Government Maturity Assessment of Greek Municipalities without predefined criterial rule*

Without the rule of meeting all the criteria in order to pass to the next stage, 98% of websites would have passed to the Enhanced Information Stage instead of 88%, 78% instead of 14% would have advanced to the Transactional Service Stage, and 30% would have gotten to the Connected Services Stage (Table 3.1.5).

*Table 3.1.5 Classification of e-Government maturity without predefined criteria rule*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Emerging Information | 1 | 2.0 | 2.0 | 2.0 |
| | Enhanced Information | 8 | 16.0 | 16.0 | 18.0 |
| | Transactional Services | 26 | 52.0 | 52.0 | 70.0 |
| | Connected Services | 15 | 30.0 | 30.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

*Factors influencing e-Government development based on e-Government maturity models*

Variance inflation factors (VIF) were assessed to determine whether multicollinearity was a problem. The VIF coefficients are reported in Table 3.1.6; All the Tolerance values are greater than 0.1 (the lowest is 0.579), and VIF values are less than 2. Therefore, it is unlikely that the results are distorted by multicollinearity.

*Table 3.1.6 Collinearity Diagnostics*

| Model | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| Population | .937 | 1.068 |
| Social Democrat | .590 | 1.696 |
| Conservative- Liberal | .579 | 1.728 |
| Budget | .854 | 1.171 |
| Gender | .943 | 1.061 |

a. Dependent Variable: Level of e-Government Maturity

Table 3.1.7 contains the correlations among the variables proposed. There are no significant correlations between the predictive variables and the control variable at 95% CI. The only correlation observed at 90%CI is that of Gender (.0278). Moreover, this matrix reveals no high correlations between predictors and control variables, which can lead to multicollinearity problems.

*Table 3.1.7 Correlation Matrix of e-Government maturity, population, Political Ideology, Budget and Mayors Gender*

| | e-Government Maturity | Population | Social Democrat | Conservative-Liberal | No Connection to Political Ideology | Budget | Gender |
|---|---|---|---|---|---|---|---|
| e-Government Maturity | 1 | | | | | | |
| population | -.026 | 1 | | | | | |
| Social Democrat | .066 | .005 | 1 | | | | |
| Conservative-Liberal | -.196 | -.033 | -.593 | 1 | | | |
| No Connection to Political Ideology | .066 | .005 | 1.000 | -.593 | 1 | | |
| Budget | -.118 | .220 | .052 | .206 | .052 | 1 | |
| Gender | .278 | -.074 | -.175 | .000 | -.175 | -.125 | 1 |

A cumulative odds ordinal logistic regression with proportional odds was run to determine the effect of population, the political ideology of the governing party, budget per habitant, and the mayor's gender on the e-Government maturity of the municipalities (Table 3.1.8). There were proportional odds, as assessed by a full likelihood ratio test comparing the fitted model to a model with varying location parameters, $\chi^2(5) = 63.601$, p = .345. The deviance goodness-of-fit test, $\chi^2(93) = 69.222$, p = .969 and the Pearson goodness-of-fit $\chi^2(93) = 96.159$, p= .391, indicated that the model was a good fit to the observed data. However, the final model did not statistically significantly predict the outcome variable over and above the intercept-only model, $\chi^2(5) = 6.028$, p = .303. The only predictive variable that seems to have a limited impact on the maturity of municipalities' e-Government is Gender at 90%CI. The odds of municipalities with male mayors being at a higher e-Government maturity level is .107, 90% CI [.011, 1.063] times that for municipalities with female mayors, a non-statistically significant effect at a=0.05, $\chi^2(1) = 3.731$, p = .056.

*Table 3.1.8 Ordinal logistic regression of e-Government & Population, Political Ideology, Budget & Mayors Gender with predefined Criteria rule*

| Parameter | | | | | | | | 95% Wald CI for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|---|
| | | *B* | Std. Error | Wald $\chi^2$ | *df* | *p* | Odds Ratio | Lower | Upper |
| Threshold | Emerging Information | -5.025 | 1.8452 | 7.415 | 1 | .006 | .007 | .000 | .245 |
| | Enhanced Information | -.808 | 1.6600 | .237 | 1 | .627 | .446 | .017 | 11.539 |
| Population | | 9.493E-8 | 3.6949E-6 | .001 | 1 | .980 | 1.000 | 1.000 | 1.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Social Democrats | -.039 | .9868 | .002 | 1 | .968 | .962 | .139 | 6.652 |
| Liberal-Conservative | -.961 | .8475 | 1.286 | 1 | .257 | .382 | .073 | 2.013 |
| No Connection to Political Ideology | 0[a] | . | . | . | . | 1 | . | . |
| Budget | .000 | .0012 | .082 | 1 | .775 | 1.000 | .997 | 1.002 |
| Male | -2.230 | 1.1692 | 3.639 | 1 | .056 | .107 | .011 | 1.063 |
| Female | 0[a] | . | . | . | . | 1 | . | . |
| (Scale) | 1[b] | | | | | | | |

| Test | $\chi^2$ | *df* | *p* |
|---|---|---|---|
| Goodness-of-fit test | | | |
| Deviance | 69.222 | 93 | .969 |
| Pearson | 96.159 | 93 | .391 |
| Test of Parallel Lines | 5.621 | 5 | .345 |
| Model Fitting Information | 6.028 | 5 | .303 |

Dependent Variable: e-Government Maturity
Model: (Threshold), Population, Political Ideology, Budget, Gender
a. Set to zero because this parameter is redundant.
b. Fixed at the displayed value.

### 3.1.5 Discussion

i. Can the local e-Government evolution be captured by a basic e-Government maturity model?

The Literature Review's analysis of e-Government models demonstrates that the criticism of them being too similar is valid (Kawashita, Baptista, & Soares, 2020). The construction of an informative online presence, the ability to interact, the capacity for transactions, and the vertical and horizontal integration are the four basic steps that practically every model suggests.

The adapted e-Government maturity model of Khalid and Lavilles (2019), including variables from the e-Government UN report 2020 applied in the research, failed to capture the overall progress of the e-Government maturity. Table 3.1.3 shows that 86% of the municipalities investigated are at stage two, whereas only 14% have progressed to stage three (Transactional Services). Table 3.1.8 indicates that 78% of the municipalities examined have adopted Transactional Services functions, and 30% of the e-portals include Connected Services services. This comparison indicates that establishing a single e-Government maturity model is problematic. Such a critique has been previously made by Yildiz (2007), who suggested that they are very simplistic and by Abanumy, Mayhew, & Al-Badi (2003), who claimed they place too much emphasis on features and not

enough on services. Additionally, this observation supports the argument made by Zahran et al. (2015) that evolutionary stages may not occur sequentially or linearly and that higher levels may not incorporate features from earlier ones.

The limited capacity of these models to capture usability and service quality appears to be another criticism that this research corroborates (Curtin, 2006; Zahran, Al-Nuaim, Rutter, & Benyon, 2015). The only features that can assess the usability of e-Government at a minimum level are a multilingual interface and accessibility, both of which the municipalities under study performed poorly in (62% of them had an accessibility feature, and only 6% had a multilingual interface). So, social groups that do not speak the local language or have some impairment are excluded because of the lack of such traits. The lack of such features leads to the exclusion of social groups that do not speak the native language or have some form of disability. Those results are in line with research by Patergiannaki, Pollalis and Tsatsani (2020) on the user experience of Greek municipal websites, which revealed that the absence of these accessibility features is a contributor to Greece's overall low user acceptance score (Patergiannaki, Tsatsani, & Pollalis, 2020). Municipal e-Government portals also lack fundamental features like newsletter subscriptions that may significantly increase citizen involvement and help spread important information.

This study also examines Nielsen's (2016) notion that e-participation and e-democracy should not be considered signs of e-Government maturity. The "Connected Services" stage of the e-Government maturity model included solutions for voting, petitions, and involvement that, according to Nielsen (2016), should be viewed as services and a sign of a nation's level of democratic growth and transparency. In this study, the low emergence of services like electronic voting (4%) and online consultation (6%) was seen after removing the requirement of satisfying all criteria in earlier phases. However, as features and not services were examined in the previous stages, these results cannot be evaluated properly to identify if integrations and data-sharing techniques have been used, in order to make services useful and usable.

ii. How are Greek municipalities classified in terms of e-Government maturity?

Another point raised in the introduction that this research attempts to provide an answer to is “how are Greek municipalities classified in terms of e-Government maturity?”. This question stems from the conflicting conclusions of the UN e-Government Survey (2020), the OECD's Economic Survey of Greece (2020), and the Global Competitiveness Report by Schwab and Zahidi (2020). It is important to note that the research's limitations, such as its inclusion of only 50 municipalities and the exclusion of national institutions, mean that it can only represent the lowest level of authority, which is nevertheless the one that is closest to the people and can meet their needs on a daily basis. Researchers have previously made similar criticisms on the e-Government maturity models for ignoring the demands and concerns of the population (Curtin, 2006; Montserrat, 2010; Zahran, Al-Nuaim, Rutter, & Benyon, 2015).

Table 3.1.4 indicates that the greek municipalities lack essential features that allow them to proceed in a complete e-Government portal. If a model should be applied to measure e-Government development, the four stages models proposed by the literature review seem to be more appropriate for this study (Layne & Lee, 2001; Fath-Allah A. , Cheikhi, Al-Qutaish, & Idri, 2014; Andersen & Henriksen, 2006; United Nations, 2012; Alhomod, et al., 2012; Chandler & Emanuels, 2002), as the five and six stages maturity model seem to be more optimistic about the capabilities of e-Government ( Shahkooh, Saghafi, & Abdollahi, 2008; Lee & Kwak, 2012; Siau & Long, 2005; Wescott, 2001) and the 2 or 3 stages models are overwhelmingly generic (Toasaki, 2003; Reddick, 2004; Persson & Goldkuhl, 2005; Cisco, 2007; Chen & Mingins, 2011). Only 7 out of 50 municipalities that were examined met all the criteria to be at the Transactional Services stage, considered the second or third stage of e-Government maturity in most of the models examined. Stages like Transformation of the relationship between state and society (Persson & Goldkuhl, 2005; Janowski, 2015; Kim & Grant, 2010; Kawashita, Baptista, & Soares, 2020), Social Participation & e-Governance and Contextualization (Fath-Allah A. , Cheikhi, Al-Qutaish, & Idri, 2015; Almuftah, Weerakkody, & Sivarajah, 2016; Persson & Goldkuhl, 2005; Kim & Grant, 2010; Kawashita, Baptista, & Soares, 2020) or Policy-Driven Electronic Governance (Janowski, 2015; Kawashita, Baptista, & Soares, 2020) seem to be far away from the reality in the case of Greek municipalities.

In response to the development of Greek municipalities throughout the years, a direct comparison of the Panayiotou and Stavrou (2019) findings with those of this study is not possible due to the varied methodology and variables used; however, the researcher noted specific changes that reflect a progression throughout the four years. The municipalities with the highest maturity, according to Panayiotou and Stavrou (2019) - count 16 in total - have implemented features such as electronic services and permits, social media integration, and e-payments. The majority of these elements were included in this study's third stage, "Transactional Services," while social media were included in the "Connected Services" stage's criterion ", Web 2.0." According to the data gathered for this study, 39 of the 50 municipalities analyzed have proceeded to implement these features.

Another finding of their research was that the majority of municipalities included "Home Page Info Services" – contact information, mission, vision statement, organizational structure – and "Alternative Ways of Communication" – SMS, Email, push-up notifications – (Panayiotou & Stavrou, A proposed maturity assessment framework of the Greek local government Web Electronic Services, 2019). However, most of them have begun to evolve by adding more complex features such as regular updates, a search engine, the ability to download documents and log in to e-services, apply for certificates/licenses, and contact via contact forms. Overall, progress is being made in providing certain transactional services, but the overall transformation is moving at a slower pace.

The analysis of Table 3.1.3 showed that even if Greece is considered to be in the average score of the continent with the highest score in the e-Government Development Index (United Nations, 2020), its municipalities significantly underperform. A fact that enhances the argument that governments emphasize on receiving high ratings at a global level and overlook the needs of citizens at a basic level that municipalities provide to them (Montserrat, 2010; Zahran, Al-Nuaim, Rutter, & Benyon, 2015). Furthermore, these findings are in agreement with Schwab’s and Zahidi's Global Competitiveness Report (2020), which suggested that Greece has one of the lowest scores in the categories of “Ensure public institutions embed strong governance principles and a long-term vision and build trust by serving their citizens”, and “Expand eldercare, childcare and healthcare

infrastructure, access and innovation for the benefit of people and the economy". The low score in the e-Government maturity and the lack of e-participation and e-democracy at the lower level of governance is an indication of the overall limited ability of the government to build trust and serve its citizens. In the same context, as the online provision of services for eldercare and childcare falls under the jurisdiction of the municipalities, and the municipalities have a reported low score in the e-Government maturity, the findings of Schwab and Zahidi (2020) are further supported.

iii. Do the municipality's size, the budget per citizen, the ruling party's ideology, and the mayor's gender affect e-Government development?

The final question this work attempts to address is whether the municipality's size, the budget per citizen, the ruling party's ideology and the mayor's gender affect e-Government development. The ordinal regression of municipalities' e-Government maturity with the rule of criteria indicated that none of the predictors could explain the outcome variable at 95%CI. These results are in contrast with the findings of Gallego-Alvarez et al. (2010), Ahn (2011) and Lee et al. (2011), who suggested that the higher the budget per capita, the higher the e-Government development would be. The results also failed to prove that political ideology impacts e-Government maturity (Cárcaba & García, 2008; Tolbert, Mossberger, & McNeal, 2008). However, Gallego-Alvarez et al. (2010) reached similar results with this work. Finally, even if the population has been considered by the literature review as a major influential factor for e-Government development (Ingrams, Manoharan, Schmidthuber, & Holzer, 2020; Lee, Chang, & Berry, 2011; Ahn, 2011; Gallego-Alvarez, Rodríguez-Domínguez, & García-Sánchez, 2010), the results of the work do not prove this theory. The only hypothesis that seems to be proven by the analysis at the 90%CI is that of the gender's impact on e-Government development. As proposed by the literature review, males are more likely to progress e-Government at a higher stage as females are more likely to reallocate government spending to more feminine topics such as education, health care, and social assistance (Funk & Philips, 2018; Susanto, 2013).

The findings, however, do not rule out the impact of population, budget, political ideology, and the gender of the mayor on e-Government development in general.

However, they do imply that in the case of Greek municipalities, other internal and external variables may play a more prominent role in municipal e-Government progress. In terms of providing public services to residents, these equivocal results are consistent with the overall picture of Greece's unstructured and semi-inclusive welfare state (Rhodes, 1966; Petmezidou & Mossialos, 2005; Marí-Klose & Moreno-Fuentes, 2013; Zambarloukou, 2015).

### 3.1.6 Conclusion

The use of a standardized e-Government model to measure progress in the digital transformation of public bodies, even if utilizing a simple four-stage model, seems problematic, according to the research's key findings. This research contradicts the notion that e-Government is a sequential process controlled by strict rules. Each organization's digital transformation journey is unique, as multiple variables interact to disrupt the growth trajectory. Even in a small country like Greece, where the environment is relatively stable, municipalities appear to use various technologies and tools to satisfy their individual demands. This work failed to identify any predictors proposed by the literature review that can predict the e-Government maturity development as well as the realms of the municipalities' services that are offered through the e-Government portals in the case of Greek municipalities. As a result, in addition to looking at parameters such as population, political ideology, budget and the mayor's gender, other internal and external factors should be considered (Bélanger & Carter, 2012; Iannacci, Seepma, de Blok, & Resca, 2019).

Since Panayiotou and Stavrou's (2019) research and until recently, Greek municipalities appear to have taken some substantial steps toward decreasing bureaucracy by providing online services, but they still lack some other features that most models and the UN believe to be the foundation of e-Government (United Nations, 2020).

Future research could further investigate the social, cultural, organizational, and environmental factors influencing the e-Government's evolution (Bélanger & Carter, 2012). Accordingly, performing longitudinal case studies in various e-Government contexts could highlight shifting dynamics which influence e-Government progress and

build upon the findings of the trajectory-turning point theory (Iannacci, Seepma, de Blok, & Resca, 2019). Comparative case studies measuring the total organizational transformation process, rather than just e-Government attributes, could be included in future studies as well (Nograšek & Vintar, 2014). Apart from the organizational perspective, another critical factor to consider for future research is the user perspective, given the user-centric approach that has arisen in the last decade, as users could provide significant findings in the course they want and need e-Government to follow.

There are certain limitations to this research. Statistical generalizations are not supported by the findings (Yin, 2014). The overall analysis shows the current situation in Greece's 50 largest municipalities. In this instance, the simplified version of the e-Government model utilized fell short of providing a complete picture of the digital transformation process. So more research is required before dismissing this notion. Another weakness of this study is that, due to the limited sample size, it is unable to draw a connection between e-Government progress and population size. However, Panayiotou and Stavrou (2019) have presented some evidence that such an association may exist.

## 3.2 E-Government Evaluation based on Citizen Perception of Quality

### 3.2.1 Introduction

Information technology and communications (ITC) have had a significant impact on society since the late 1990s. The rise of the internet is mainly responsible for this. Governments worldwide have begun to implement information and transactions online in what is now known as e-Government after realizing the opportunity ITC offers to meet citizens' expectations. Even though governments are working hard to improve e-Government services, they still face problems, including a lack of acceptance of e-Government and a lack of citizen knowledge of its benefits.

Many studies focusing on citizens' perspectives in adopting e-Government services imply that fulfilling citizen needs is a crucial issue in user satisfaction and adoption. Connecting citizen demand for services with the supply side of e-Government has created a significant challenge for governments worldwide (Al Athmay, Fantazy, & Kumar, 2016). According to previous research, governments that focus on the genuine needs of individuals have achieved substantial advantages by delivering excellent e-Government services (Al Athmay, Fantazy, & Kumar, 2016). Perceived Attractiveness, Perceived Usefulness, Perceived Ease of Use, and Awareness appear to be the most frequently examined factors influencing e-Government perceived quality and acceptance. Furthermore, demographic indicators, as well as the digital literacy gap, appear to play a moderating role in the overall view of e-Government quality. The purpose of this research is to investigate what factors influence website quality and user satisfaction. The impetus for this study arose from discussions and arguments inside and beyond academia about measuring information system (IS) success and investing in website quality enhancement. The research question set out to serve the scope of this work are (i) How are Greek municipalities performing in terms of e-Government perceived quality? and (ii) What factors influence the perceived quality of e-Government?

The rest of the work is organized as follows. First, the numerous models and methodologies established over the years are briefly discussed in the "literature review". Then, the aspects that previous researchers have determined to be the most influential

constructs on behavioral intention and perceived quality are investigated. In the “Methodology”, the sampling and the data collection process, along with the structure of the questionnaire and the validity of the model, are discussed. The analysis results are reported in the "Findings" section, and the research questions are answered in the "Discussion". Finally, the findings are summarized in the "Conclusion," the work's shortcomings are acknowledged, and future study directions are suggested.

### 3.2.2 Literature Review

According to Tan, Benbasat, and Cenfetelli (2013), the degree to which government websites enable effective and efficient information search, online transactions, as well as communication between the government and citizens can be used to define the level of e-Government service quality from the perspective of the user (Blut, 2016). The quality of an e-Government service is a reflection of all the characteristics and qualities that go into providing a particular public service (Baker, 2009; Lindgren & Jansson, 2013; Li & Shang, 2020).

User satisfaction can be used to assess the quality of e-Government from the viewpoint of the public (Halaris, Magoutas, Papadomichelaki, & Mentzas, 2007). Bailey and Pearson (1983) first defined user satisfaction as a benchmark for computer usage success. Scholars and practitioners have since acknowledged that satisfaction is a crucial issue in e-Government because citizens associate high service quality with efficient and user-friendly management of public services through E-Government portals (Schellong & Mans, 2004; Wirtz & Kurtz, 2016). Higher levels of citizen satisfaction with the online service are necessary to ensure the adoption and ongoing use of e-Government, which in turn defines the success of e-Government (Liu, Chen, & Wang, 2010; Lai & Pires, 2010). Alawneh's et al. (2013) argument that "User satisfaction is a vital determinant for continued usage of e-Government services and for the success or failure of e-Government initiatives" is also in agreement with this (Alawneh, Al-Refai, & Batiha, 2013). Understanding the factors influencing e-Government user satisfaction is therefore crucial for managerial practice in order to meet citizen needs and promote e-Government adoption (Wirtz & Kurtz, 2016).

Researchers and professionals aim to assess how well government websites suit citizens' requirements and measure the quality of the services supplied in order to analyze e-Government user satisfaction and, subsequently, service quality. Nevertheless, despite substantial research on the caliber of e-Government services, there is no agreement on the evaluation standards (Li & Shang, 2020). Using a systematic literature review, Rana et al. (2011) examined the body of knowledge already available on e-Government-related topics. They assessed 434 research articles and observed that TAM (25 studies), DeLone and McLean's IS Success Model (11 studies), Diffusion of Innovation (11 studies), Unified Theory of Access and Use of Technology (UTAUT) (9 studies) and Theory of Planned Behavior (TPB) (8 studies) were the most frequently used models and theories for analyzing the issues related to electronic government adoption (Rana, Williams, Dwivedi, & Williams, 2011). According to their findings, 28% of the reviewed literature incorporates two or more models and ideas into their research. 87% of these studies used the survey technique to depict their cases, while the remainder used secondary data analysis, case studies, the descriptive approach, and literature review and synthesis (Rana, Williams, Dwivedi, & Williams, 2011). Rana et al. (2011) discovered 177 distinct factors that were categorized into four major categories: environmental, organizational, individual, and innovation. Environmental elements include Competition, External Influence, Social Norms, and Web Adoption. Organizational characteristics include Administrative Autonomy, Business Competitiveness, Enacted Technology, Facilitating Conditions, IT Leadership, and Job Productivity ( (Rana, Williams, Dwivedi, & Williams, 2011). Demographic characteristics (age, education, gender, income, etc.), as well as psychological and behavioral aspects (anxiety, behavioral intention, effort expectation, empathy, etc.), are taken into account when analyzing the influence of individual variables (Rana, Williams, Dwivedi, & Williams, 2011). Innovation encompasses portal features such as accessibility, complexity, usability, service quality, and system quality (Rana, Williams, Dwivedi, & Williams, 2011). However, reported ease of use, perceived utility, education, age, trust, and gender were evaluated more frequently in e-Government adoption studies (Rana, Williams, Dwivedi, & Williams, 2011).

The primary paradigm used in the adoption of e-Government, TAM, suggests that assessing user acceptance and use of e-Government may help determine the quality of e-Government. Initially, measuring technological adoption using perceived ease of use (PEOU) and perceived usefulness (PU) as independent variables, TAM was first developed by Davis (1989). TAM has been adapted, modified, and partially incorporated into other theoretical techniques inside the e-Government research assessing user satisfaction (Wirtz & Kurtz, 2016). For instance, Lai and Pires (2010) assessed the effects of quality constructs using an integrated model of user satisfaction and technology acceptance to pinpoint and investigate factors affecting the adoption and satisfaction of e-Government portals. This cross-sectional study verified that user satisfaction and adoption are positively influenced by information quality, system quality, and social influence. Using constructs based on acceptance theories, Udo et al. (2012) examined the effect of national culture (Nigerians and Americans) on satisfaction and acceptance. They, therefore, tested an integrated model of the TAM, the Theory of Planned Behavior (TPB), and the D&M model. Their findings show that perceived usefulness, information, and system quality all have an impact on user satisfaction, which in turn has an impact on users' behavioral intention to continue using e-Government Services.

Overall, some of the main factors that have been examined in the field of e-Government study are perceived usefulness, awareness, trust, quality of service, ease of use, information quality, perceived effectiveness, social influence, user satisfaction, and intention to use (Venkatesh V. , Morris, Davis, & Davis, 2003; Zhao, 2011; Singh, Pathak, & Naz, 2010; Ahmad, Markkula, & Oivo, 2013; Al Athmay, Fantazy, & Kumar, 2016). These studies have provided useful insights for understanding citizen (user) intention to use e-Government services.

In order to provide a more solid foundation for the optimization potential of e-Government portals, Wirtz et al. (2015) investigated both previous empirical research and theoretical justification. The outcome was a research model that incorporates user perception. The suggested paradigm is based on the Technology Acceptance Model (TAM) and cognitive theory, which focuses on understanding individual behavior instead of the stimulus-response patterns of behaviorism (Toates, 1997). According to cognitive

theory, human conceptualization, comprehension, and decision-making are inner-psychological processes based on information processing. These processes, which are not part of observable behavior, are based on social realities created by individuals or groups rather than on the laws of nature (Wirtz, Piehler, & Daiser, 2015). They present as plans or imagined constructs (Johnson-Laird, 1983; Piaget, 1997). People can standardize conditions and deal with complexity by using schemes and mental models (Wirtz, Piehler, & Daiser, 2015). The study by Wirtz et al. (2015) used a research model to demonstrate the impact that various mental models may have on how well an e-Government portal is perceived overall. A survey that examined the following dimensions—attractiveness, usefulness, awareness, and ease of navigation—was constructed to capture the many cognitive aspects of the overall integrated view. It was then tested on 312 participants from thirteen local German communities (Wirtz, Piehler, & Daiser, 2015). The dimensions of attractiveness, usefulness, awareness, and ease of navigation were found to be valid and reliable reflective latent measures of intention to use.

According to the literature review, attractiveness, usefulness, ease of use awareness, demographics, and digital divide are the primary factors of e-Government satisfaction and, consequently, intention to use.

The notion of attractiveness is derived directly from the psychological study on physical attractiveness (Morrow, 1990). In contrast to acceptance, which is a logically determined notion, attractiveness is a relatively emotive outcome of human information processing. Self-perception and other-perception exerted powerful impacts in various contexts (Langlois, et al., 2000). According to prior studies, information attractiveness appears to have a significant impact on willingness to use e-Government portals (Jung, Chung, & Soo Rhee, 2018; Robins & Holmes, 2008; Fogg, 2003). Information attractiveness is a notion between information quality and design or aesthetics-related factors (Alanezi, Kamil, & Basri, 2010; Hartmann, Sutcliffe, & de Angeli, 2007). Attractiveness is likely to be attributed to the information that satisfies both utilitarian and aesthetic user-based criteria (Wirtz, Piehler, & Daiser, 2015; Wolk & Theysohn, 2007). Consequently,

information attractiveness reflects the perceived quality and amount of information on the e-Government portal. The proposed hypothesis, therefore, reads as follows:

H1: Perceived attractiveness of municipalities' e-Government portals positively influences the intention to use e-Government.

The idea of perceived usefulness, which TAM examines, relates to the extent to which a person thinks that utilizing a certain technology improves their own efficiency (Davis, 1989). Nevertheless, it may also be seen in other theories and models like relative advantage -in Diffusion of Innovation (Rogers, 1995) - and result expectancies -in Social Cognitive Theory (Compeau, Higgins, & Huff, 1999) - and performance expectation -in UTUAT (Venkatesh, Morris, Davis, & Davis, 2003; Rana, Williams, Dwivedi, & Williams, 2011). Using the theoretical foundations of TAM by Davis et al. (1989) and DTPB by Taylor and Todd (1995), it was found that perceived usefulness greatly influenced attitude in the context of IS/IT adoption (Rana, Dwivedi, Lal, Williams, & Clement, 2017). Numerous studies have investigated the correlation between perceived perceptions of usefulness and ease of use and their impact on the behavioral intention of e-Government adoption. Zahid et al. (2022) also reported consistent results. They performed a study on 396 Pakistani residents. They discovered that performance expectations (usefulness) and effort expectations (ease of use) were critical variables in individuals' attitudes toward e-Government adoption (Zahid, Ali, Abu-Shanab, & Javed, 2022). The proposed hypothesis, therefore, reads as follows:

H2: Perceived usefulness of municipalities' e-Government portals positively influences the intention to use e-Government.

The idea of ease of use is derived from TAM-based research and relates to the user's perception of the technological system's simplicity of use (Davis, 1989). Numerous studies in the field of e-Government have utilized this notion effectively (Wirtz & Kurtz, 2016; Barnes & Vidgen, 2006; Ozkan & Kanat, 2011; Wang, 2003; Rana, Dwivedi, Lal, Williams, & Clement, 2017). In Taiwan, Hung et al. (2009) discovered that an individual's attitude toward utilizing an electronic document management system was significantly influenced by their perception of the system's ease of use. Udo et al. (2012) and Mohamed et al. (2009) have experimentally demonstrated that e-Government user

satisfaction is favorably influenced by the simplicity of use. Chen and Aklikokou (2020) investigated the citizen adoption of e-Government services in Togo, focusing on the mediating roles of perceived usefulness and ease of use. Their findings from 482 respondents indicate that behavioral intent to utilize e-Government services is substantially impacted by the perceived usefulness and ease of use (Chen & Aklikokou, 2020). In the context of information-based services, ease of navigation is a specific component of ease of use (Ladhari, 2010). It refers to the facilitation of the user's informative navigation via functional information architecture (Miller & Remington, 2004). Thus, the proposed hypothesis reads as follows:

H3: Perceived ease of use of municipalities' e-Government portals positively influences the intention to use e-Government.

Awareness is "a comprehension of the activities of others that gives a context for one's own activity" (Dourish & Bellotti, 1992). As a notion, it can be derived from psychological studies of human information processing and marketing-based consumer decision-making research (Wirtz, Piehler, & Daiser, 2015). In the realm of human information processing, awareness is evaluated as an experience-based mental state, with an emphasis on situational and emotional factors (Endsley, 1995; Lane, Quinlan, Schwartz, Walker, & Zeitlin, 1990). Awareness influences a person's perception of other individuals and items, which is enhanced by simply co-presence (Bornstein, 1989). Within the subject of consumer research, awareness is understood as prior knowledge about market offerings and their influence on the decision-making process (Wirtz, Piehler, & Daiser, 2015). Proper communication needs to not only generate product or service awareness, but also intrigue, want, and action (Butt, Warraich, & Tahira, 2019). For the online service, awareness can determine how well users comprehend and employ the service. Awareness can also influence user trends, allowing users to choose between excellent and poor services (Al-Somali, Gholami, & Clegg, 2009). Wirtz et al. (2015) stated that in the sphere of e-Government, awareness is a crucial element influencing the intention to utilize e-Government. Van et al. (2019), who surveyed 462 residents in Vietnam and Korea to evaluate the factors influencing the desire to use e-Government, corroborate this theory and recommend that increasing user awareness is one strategy to

increase the utilization rate of E-Government systems/services (Van, Kim, Lee, & Gim, 2019). Thus, the proposed hypothesis reads as follows:

H4: Awareness of municipalities' e-Government portals positively influences the intention to use e-Government.

The literature review has also identified demographic parameters such as age, gender, and educational level as significant moderators of e-Government usage (Wirtz, Piehler, & Daiser, 2015). However, the literature regarding the effect of age on e-Government adoption is inconclusive (Botrić & Božić, 2021). Welch et al. (2004), as well as Colesca and Dobrica (2008), and Gounopoulos et al. (2020) show a negative influence, while Mensah and Mi (2019), as well as Venkatesh et al. (2014) did not find a significant correlation between age and e-Government adoption. Botrić & Božić (2021), examining the impact of age on e-Government adoption across Europe using Eurostat's Community Statistics on Information Society (CSIS) microdata for the period 2008–2017, noticed that the variable of age alone does not have a direct impact. However, age is a moderating factor when combined with educational level, economic activity, and gender. Thus, older populations with lower educational attainment are less likely to use e-Government services, although economic activity among older populations correlates positively with their adoption. In conclusion, older women will not use e-Government services, whereas gender has little impact on the younger population (Botrić & Božić, 2021).

Nam and Sayogo (2011) investigated the influence of age, financial situation, education, and gender on the use of e-Government among 1,199 Americans. The findings indicate that younger, more affluent, and better-educated citizens are more inclined to adopt e-Government. Also, men utilize e-Government services more than women (Nam & Sayogo, 2011). Taipale (2013) surveyed 612 Finnish residents regarding the socio-demographic and economic predictors of e-Government service utilization. Their findings indicate that age is not a direct predictor of e-Government usage. Gender and income have a moderate impact on the economic activity of e-Government use. In particular, a negative correlation existed between income and e-Government usage. The respondents' educational level had a beneficial impact on e-Government usage. Yera et al. (2020),

utilizing Eurostat data to estimate the use of e-Government in six European nations, likewise support the positive impact of education.

Gounopoulos et al. (2020), who evaluated data obtained by the Greek Statistical Authority in 2017 to determine the adoption of e-Government services and the active e-participation of Greek citizens, discovered that socioeconomic characteristics had a substantial impact on the use of e-Government services. In particular, they discovered that age, education, and citizenship significantly affect e-Government usage. There is a negative correlation between age and e-Government adoption; older persons (55-64) are less likely to use the Internet to receive information from government websites. Well-educated citizens (tertiary education) are more likely to use the Internet to access all e-Government services (Gounopoulos, Kontogiannis, Kazanidis, & Valsamidis, 2020). Non-Greek citizens are less likely to access e-Government services via the Internet (Gounopoulos, Kontogiannis, Kazanidis, & Valsamidis, 2020). Low-income citizens are more likely to use e-Government services than those with high household incomes, indicating that income has a moderate effect on e-Government usage. They also discovered that gender and economic activity have little bearing on the adoption of e-Government. The proposed hypothesis, therefore, reads as follows:

H5: Demographic characteristics such as age, gender, educational level, income, and economic activity influence the intention of citizens to use e-Government.

The digital divide refers to the difference between people who have internet access and are able to utilize new services available on the World Wide Web and those who are unable to access these services. Citizens' engagement in the information society is contingent upon their access to ICTs and their acquisition of the skills required to participate in the information society (Eurostat, 2019). Over the years, digital divide research has identified various facets of the phenomena, beginning with the problems of Internet adoption, access, and unique usage patterns across various subgroups of the population (Pearce & Rice, 2013; Botrić & Božić, 2021). According to Gounopoulos et al. (2020), the access gap is narrowing in most industrialized nations. The disparity in technology use, skills, and literacy is determined by whether or not a person can associate possible benefits from the available technology that enables continuous usage and

whether or not citizens are confident in their capacity to use online services (Botrić & Božić, 2021; Yera, Arbelaitz, Jauregui, & Muguerza, 2020). Wirtz et al. (2015) suggested that access to information technology expertise moderates the intention to use e-Government. Alneyadi et al. (2022) surveyed 364 inhabitants of the United Arab Emirates. They concluded that for users to be satisfied with e-Government portals, they must know the proper approach and procedure for getting the necessary services. Therefore, users must possess the proper ICT abilities (Palaco, Park, Kim, & Rho, 2019). Khanra and Joseph (2019), who surveyed 714 e-Government users in India, showed that the digital divide is a significant factor impacting individuals' willingness to utilize e-Government. The proposed hypothesis, therefore, reads as follows:

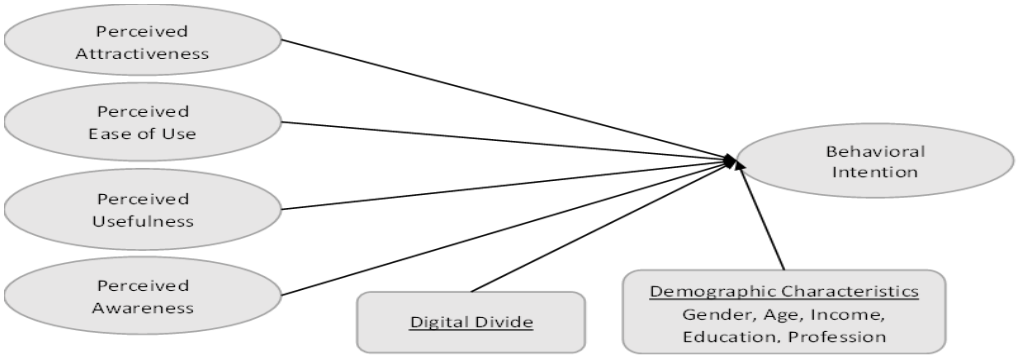
H6: Digital Divide negatively influences the intention of citizens to use e-Government.

### 3.2.3 Methodology

*Research Objective & Structural Model*

The objective of this research is to determine the direction of the effects of factors listed as perceived attractiveness, perceived ease-of-use, perceived usefulness, awareness, digital divide and demographic characteristics on the intention of citizens to use the e-Government platforms of municipalities. The conceptual model used to answer the hypotheses stated previously is based on the model developed and validated by Wirtz et al. (2016). The model is displayed in Figure 3.2.1.

*Figure 3.2.1 Proposed Structural Model*



*Sampling & Data Collection*

Within the scope of this research covering the 50 largest municipalities in Greece according to the census of the Hellenic Statistical Authority conducted in 2011, the questionnaire was constructed in the Greek language on Google forms and disseminated through Facebook ads utilizing the virtual snowball sampling method (Baltar & Brunet, 2012; Kühne & Zindel, 2020). The advertisement campaign ran for three months (13 April 2022 –13 July 2022), targeting over 18 years old citizens of the 50 municipalities examined. The total spent was 120.17 euros, the total reach was 41.803, and the total clicks on the advertisement were 1.817. With the exclusion of incomplete questionnaires, there were 707 usable responses from 49 of the municipalities targeted. No incentives were used to stimulate participation for the voluntary survey artificially. The survey form used in the research consisted of three sections. In the first part of the questionnaire, the demographic factors were assessed. In the second part, the digital divide was examined through relevant questions that have been previously included in the "Community Survey on Use of Information and Communication Technologies by households and individuals (ICT)" conducted by the Hellenic Statistical Authority in 2019 (Hellenic Statistical Authority, 2019). The third part was comprised of 5 factor groups with 23 questions using a 5-point Likert scale from 1 denoting "strongly disagree" to 5 denoting "strongly agree", ranging in total about perceived attractiveness, perceived ease-of-use, perceived usefulness, and awareness, the intention of use based on Wirtz et al. (2016) survey. The complete questionnaire is available in Appendix B.

Of all participants, 327 were male (46.3%), and 380 were female (53.7%). 11.6% of individuals had income levels below € 500, 24.9% had income levels between €501-1,000, 36.1% had income levels between €1,001-1,500, 14.9% had income levels between €1,501-2,000, 10.3% had income levels between €2,001-6,000, and 2.5% had income levels above €6,000. 2.4% of participants were elementary or lower secondary school graduates, 27.8% were upper secondary school or post-secondary non-tertiary education graduates, 35.1% were university graduates, 29.4% held a master's degree, and 5.1% held a PhD (Table 3.2.1). Daily internet usage of the respondents varied, with 47.7% reporting between one to three hours of use, 34.4% reporting more than four hours of use, and 7.9% reporting none to less than 1 hour. 24.9% of the respondents reported

that they did not own a Laptop or a Desktop, while 12.0% reported that they did not own a Smartphone (Table 3.2.1). The statistics in response to the municipality of residence of the respondents are included in Appendix C.

*Table 3.2.1 Demographic Composition of the Sample*

| N=707 | Categories | Frequency | Percent |
|---|---|---|---|
| Gender | Male | 327 | 46.3% |
| | Female | 380 | 53.7% |
| Age | 18-24 | 28 | 4.0% |
| | 25-34 | 52 | 7.4% |
| | 35-44 | 128 | 18.1% |
| | 45-54 | 210 | 29.7% |
| | 55-64 | 222 | 31.4% |
| | 65-74 | 57 | 8.1% |
| | 75+ | 10 | 1.4% |
| Education | Dropped out Primary | 1 | 0.1% |
| | Primary | 5 | 0.7% |
| | Lower Secondary | 12 | 1.7% |
| | Upper Secondary | 97 | 13.7% |
| | Tertiary no University degree | 100 | 14.1% |
| | University Degree (Bachelor) | 248 | 35.1% |
| | Master | 208 | 29.4% |
| | PhD | 36 | 5.1% |
| Economic Activity | Domestic Tasks | 17 | 2.4% |
| | Student | 23 | 3.3% |
| | Unemployed | 54 | 7.6% |
| | Retired | 129 | 18.2% |
| | Self-Employed | 87 | 12.3% |
| | Private employee | 164 | 23.2% |
| | Public Servant | 233 | 33.0% |
| Salary | up to 500 | 82 | 11.6% |
| | 501-1000 | 176 | 24.9% |
| | 1001-1500 | 255 | 36.1% |
| | 1500-2000 | 105 | 14.9% |
| | 2001-6000 | 73 | 10.3% |
| | 6000+ | 16 | 2.3% |
| Internet time spent | less than 1 hour | 56 | 7.9% |
| | 1-3 hours | 337 | 47.7% |
| | 4-6 hours | 205 | 29.0% |
| | More than 6 hours | 109 | 15.4% |
| Desktop /Laptop | No | 176 | 24.9% |
| | Yes | 531 | 75.1% |
| Smartphone | No | 85 | 12.0% |
| | Yes | 622 | 88.0% |

*Instrument Reliability*

Confirmatory Factor Analysis (CFA) was computed using AMOS version 22 to test the measurement models. As part of the confirmatory factor analysis, factor loadings were assessed for each item. No items were identified as having low factor loadings (Table 3.2.2).

*Table 3.2.2. Confirmatory Factor Analysis*

| Items | Standardized Item Loadings |
|---|---|
| *Perceived Attractiveness* | |
| The online city portal provides relevant information | .878 |
| The online city portal provides timely information | .902 |
| The online city portal provides easy-to-understand information | .903 |
| The online city portal provides believable information | .843 |
| All in all, the online city portal provides attractive information | .915 |
| *Perceived Usefulness* | |
| The information on the online city portal is presented in a useful format | .914 |
| I have generally received sufficient information on the online city portal | .973 |
| The online city portal can provide the precise information I need for my concern | .858 |
| The information on the online city portal meets my needs | .862 |
| All in all, the online city portal provides useful information | .905 |
| *Perceived Ease of Use* | |
| Learning to operate the online city portal is easy | .915 |
| The interaction/dialogue with the online city portal is clear and understandable | .946 |
| The online city portal is user-friendly | .966 |
| The online city portal is easy to use | .928 |
| All in all, the online city portal is easy to operate | .946 |
| *Awareness* | |
| All in all, I have good knowledge of the online city portal | .872 |
| I know where to find specific information on the online city portal | .861 |
| I am very familiar with the online city portal | .909 |
| I have often used the online city portal successfully | .940 |
| *Behavioral Intention* | |
| I intend to use the online city portal within the next 3 months | .941 |
| I predict that I will use the online city portal within the next 3 months | .949 |
| I plan to use the online city portal within the next 3 months | .976 |
| I am going to use the online city portal in the future | .928 |

Note: All factor loadings are significant at $p < 0.001$.

The model-fit measures were used to assess the model's overall goodness of fit ($\chi^2$/df, GFI, CFI, TLI, SRMR and RMSEA) and values were within their respective typical acceptable levels (Ullman, 2019; Hu & Bentler, 1998; Bentler, 1990). The five-factor model (Perceived Attractiveness (PA), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Awareness (AWA) and Behavioral Intention (BINT) yield a good fit (Table 3.2.3) for the data: $\chi 2/df = 3.394$, GFI = .923, TLI = .973, CFI = .980, SRMR = .0253, RMSEA = .058. The results are presented in Table 3.2.3

*Table 3.2.3 Model fit*

| Fit Indices | Recommended Value | Source(s) | Obtained Value |
|---|---|---|---|

| | | | |
|---|---|---|---|
| P | >.05 | Bagozzi and Yi (1988) | .000 |
| $\chi^2$/df | 3-5 | Schumacker and Lomax (2022) | 3.394 |
| GFI | > .90 | Hair et al. (2010) | .923 |
| CFI | >.90 | Bentler (1990) | .980 |
| TLI | >.90 | Bentler (1990) | .973 |
| SRMR | <.08 | Hu and Bentler (1998) | .025 |
| RMSEA | <.08 | Hu and Bentler (1998) | .058 |

The reliability analysis was conducted to check the internal validity and consistency of the items used for each factor through Composite Reliability and Cronbach alpha. The perceived attractiveness construct consisted of 5 questions (CR = .949, α =.945), the perceived ease-of-use construct consisted of 5 questions (CR = .937, α =.940), the perceived usefulness construct consisted of 5 questions (CR = .944, α =.945), awareness construct consisted of 4 questions (CR = .942, α =.944) and the intention of use construct was consisted of 4 questions (CR = .933, α =.939). Overall, it seems that all of the scales had an excellent level of internal consistency. The results of the Reliability Analysis are summarized in Table 3.2.4. The convergent validity of scale items was estimated using Average Variance extracted (Fornell & Lacker, 1981). The average variance-extracted values were above the threshold value of 0.50 (Fornell & Lacker, 1981). Therefore, the scales used for the present study have the required convergent validity.

*Table 3.2.4 Composite Reliability & Convergent Validity*

| Construct | No of Items | Composite Reliability | Cronbach α | AVE (Convergent Validity) |
|---|---|---|---|---|
| Perceived Attractiveness | 5 | .949 | .945 | .790 |
| Perceived Usefulness | 5 | .937 | .940 | .816 |
| Perceived Ease of Use | 5 | .944 | .945 | .884 |
| Awareness | 4 | .942 | .944 | .803 |
| Intention to use | 4 | .933 | .939 | .900 |

Discriminant validity in the study was assessed using Fornell and Larcker Criterion and Heterotrait-Monotrait (HTMT) Ratio. According to Fornell and Larcker criterion, discriminant validity is established when the square root of AVE for a construct is greater than its correlation with the other constructs in the study. However, Fornell and Larcker criterion has recently been criticized, and a new method to assess the discriminant

validity, that is HTMT ratio, is increasingly utilized. In the present study, discriminant validity is not entirely established using Fornell and Larcker criterion (Table 3.2.5).

*Table 3.2.5 Fornell and Larcker criterion*

| | PA | PU | PEOU | AWA | BINT |
|---|---|---|---|---|---|
| Perceived Attractiveness | **.889** | | | | |
| Perceived Usefulness | .925 | **.903** | | | |
| Perceived Ease of Use | .804 | .896 | **.940** | | |
| Awareness | .705 | .760 | .727 | **.896** | |
| Behavioral Intention | .637 | .656 | .576 | .654 | **.949** |

When constructs were assessed using HTMT ratio, all ratios were less than the required limit of .85 (Henseler, Ringle, & Sarstedt, 2015). Hence, discriminant validity was established (Table 3.2.6)

*Table 3.2.6 Discriminant Validity Heterotrait Monotrait Ratio (HTMT)*

| | PA | PU | PEOU | AWA | BINT |
|---|---|---|---|---|---|
| Perceived Attractiveness | | | | | |
| Perceived Usefulness | .848 | | | | |
| Perceived Ease of Use | .556 | .836 | | | |
| Awareness | .715 | .729 | .728 | | |
| Behavioral Intention | .673 | .664 | .601 | .686 | |

### 3.2.4 Findings

The descriptive statistics presented in Table 3.2.7 show mean differences across all constructs. The Behavioral Intention seems to be relevantly pro-using municipalities' e-Government portals (M = 3.175, SD = 1.208). The participants seem to be relevantly aware of the portals and perceive them as relevantly easy to use (M = 3.210, SD = 1.141) and attractive (M = 3.164, SD = 1.069). On the other hand, the main drawback of the municipalities' e-Government portals is that they do not provide useful content (M = 2.936, SD =1.110).

*Table 3.2.7 Descriptive Statistics of PA, PU, PEOU, AWA & BINT*

| | N | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| Perceived Attractiveness | 707 | 1.00 | 5.00 | 3.164 | 1.069 |
| Perceived Usefulness | 707 | 1.00 | 5.00 | 2.936 | 1.110 |
| Perceived Ease of Use | 707 | 1.00 | 5.00 | 3.210 | 1.141 |
| Awareness | 707 | 1.00 | 5.00 | 3.082 | 1.144 |
| Behavioral Intention | 707 | 1.00 | 5.00 | 3.175 | 1.208 |

| | |
|---|---|
| Valid N (listwise) | 707 |

Further, it was attempted to classify the perceived level of municipalities' e-Government quality, categorizing the municipalities in 3 levels – Low, Medium, and High – based on the citizens' responses on how they perceive the Attractiveness, Usefulness, Ease of Use, Awareness and Behavioral Intention. Municipalities whose rounded mean scored lower than 3 in participants' responses were considered Low; Medium were considered those who scored 3, and High were considered those who scored higher than 3. Regarding Behavioral Intention, only one portal scored high in the intention of the citizens to use it, 13 of them scored medium, and 35 of them scored low. The best-performed dimension is Perceived Attractiveness, where 4.1% of the assessed e-Government portals perform well, 7% perform at a medium level, and 81.6% of the websites were found to be not attractive (Table 3.2.8). In terms of Awareness, 2% scored high, 17.4% scored medium, and 79.6% scored low. In dimension Perceived Ease of Use, none of the portals scored high, 30.6% scored medium, and 69.4% scored low. The primary problem of the portals appears to be Perceived Usefulness as it is the worst performed dimension, as none of the portals performed high, 14,3% performed medium, and 85.7% performed poorly (Table 3.2.8). The complete table of the level of e-Government quality score achieved by each municipality can be found in Appendix D.

*Table 3.2.8 Classification Table of e-Government PA, PU, PEOU, AWA & BINT*

| | Perceived Attractiveness | | Perceived Usefulness | | Perceived Ease of Use | | Awareness | | Behavioral Intention | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| Low | 40 | 81.6 | 42 | 85.7 | 34 | 69.4 | 39 | 79.6 | 35 | 71.4 |
| Medium | 7 | 14.3 | 7 | 14.3 | 15 | 30.6 | 9 | 18.4 | 13 | 26.5 |
| High | 2 | 4.1 | 0 | 0.0 | 0 | 0.0 | 1 | 2.0 | 1 | 2.0 |
| Total | 49 | 100 | 49 | 100 | 49 | 100 | 49 | 100 | 49 | 100 |

The Correlation Matrix (Table 3.2.9) shows that Perceived Attractiveness (PA), Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and Awareness (AWA) have a strong positive correlation with Behavioral Intention (BINT) as well as with each other. So multicollinearity issues among the predictors may exist. Furthermore, In response to the demographic characteristics, Gender, Age, Education, and time spent on the internet are not correlated with the intention to use municipalities' e-Government portals (BINT).

On the other hand, there is a weak positive correlation between Economic Activity, Income and BINT. Furthermore, Economic activity is correlated with the constructs PA, PU, PEOU and AWA as well. AWA is also weakly correlated with Education, Income, Economic Activity and Digital Divide. Finally, Digital Divide has a negative and weak correlation with BINT, PA, PEOU and AWA, meaning that digital illiteracy is associated with lower scores in perceived e-Government Quality and Behavioral Intention.

*Table 3.2.9 Correlation Matrix of BINT, PA, PU, PEOU, AWA, Demographics & Digital Divide*

| | BINT | PA | PU | PEOU | AWA | Gender | Age | Education | Economic Activity | Income | Internet time spent |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BINT | | | | | | | | | | | |
| PA | .642** | | | | | | | | | | |
| PU | .651** | .867** | | | | | | | | | |
| PEOU | .579** | .769** | .825** | | | | | | | | |
| AWA | .659** | .675** | .715** | .716** | | | | | | | |
| Gender | .000 | .036 | .036 | .054 | .054 | | | | | | |
| Age | .020 | -.015 | -.011 | -.069 | -.002 | -.125 | | | | | |
| Education | .068 | .059 | .020 | .059 | .099** | -.069 | -.047 | | | | |
| Economic Activity | .182** | .178** | .142** | .126** | .226** | -.020 | -.081* | .306** | | | |
| Income | .132** | .057 | .050 | -.003 | .076* | -.266** | .363** | .355** | .261** | | |
| Internet time spent | .032 | .016 | .015 | .006 | .066* | -.031 | -.225** | .031 | .017 | -.028 | |
| Digital Divide | -.142** | -.105** | -.064 | -.107** | -.180** | .045 | .188** | -.282** | -.269** | -.132** | -.246** |

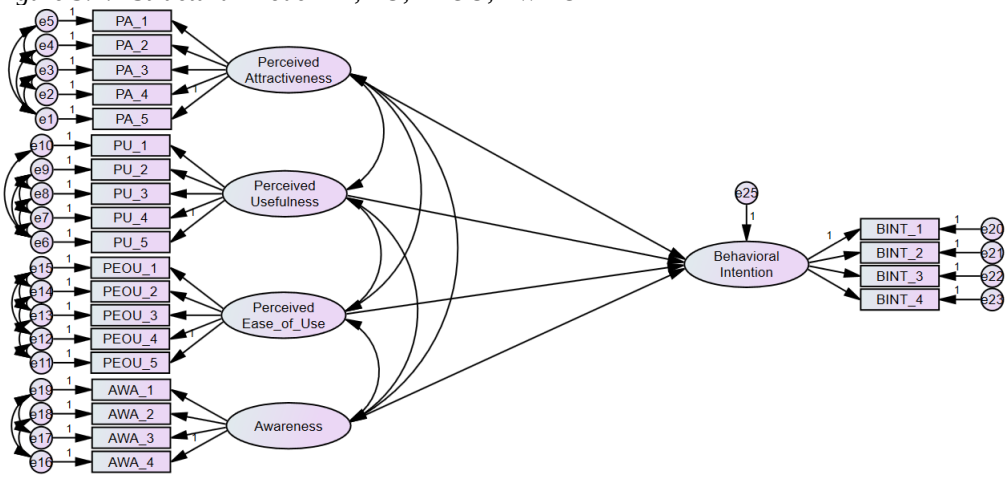
**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

*Effect of Attractiveness, Usefulness, Ease-of-Use & Awareness on Behavioral Intention*

The Amos version 22 was used to assess the hypothesized paths through structural equation modelling (SEM). The squared multiple correlation was .511 for the Intention to Use of e-Government Portal; this shows that 51.1% variance in the Intention to Use of e-Government Portal is counted by Perceived Attractiveness, Perceived Usefulness, Perceived Ease of Use and Awareness. The model is represented in Figure 3.2.2.

*Figure 3.2.2 Structural Model PA, PU, PEOU, AWA & BINT*




The study assessed the impact of Perceived Attractiveness, Perceived Usefulness, Perceived Ease of Use and Awareness on the Intention to Use of e-Government Portal. The impact of Perceived Attractiveness on Behavioral Intention was positive but insignificant at 95%CI level (b = .101, t = 1.010, p = .313); hence, H1 was not supported. The impact of Perceived Usefulness on Behavioral Intention was positive and significant (b = .373, t = 2.432, p < .05), supporting H2. The impact of Perceived Ease of Use on Behavioral Intention was negative and significant (b = -.164, t = -2.068, p < .05), in contrast with H3, which proposed a positive and significant relationship. The impact of Awareness on Behavioral Intention was positive and significant (b = .441, t = 9.260, p < .001), supporting H4. Model fit indices and Hypotheses results are presented in Table 3.2.10.

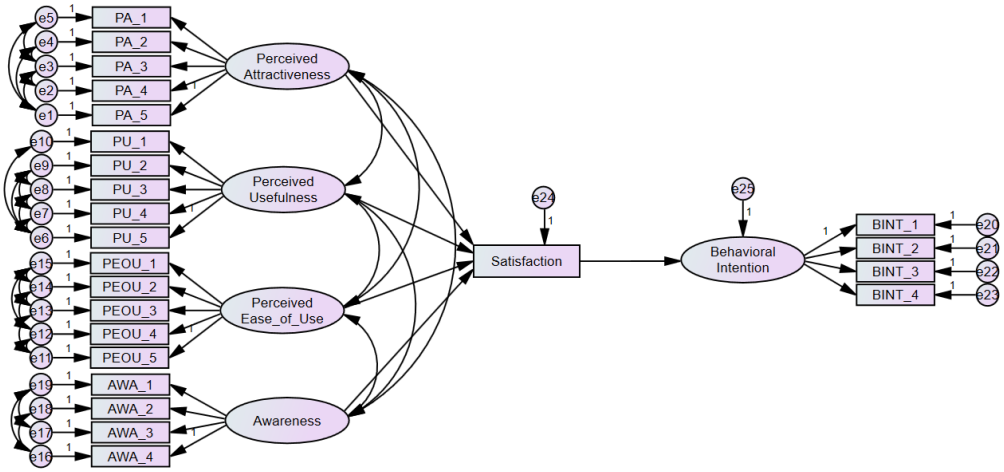
*Table 3.2.10 Effect of PA, PU, PEOU, AWA on BINT: Hypothesis Results*

| Hypothesized Relationship | S.E. | t-value | p-value | Decision |
|---|---|---|---|---|
| PA -> BINT (positive) | .101 | 1.010 | .313 | Not Supported |
| PU -> BINT (positive) | .373 | 2.432 | .015 | Supported |
| PEOU -> BINT (positive) | -.164 | -2.068 | .039 | Not Supported |
| AWA -> BINT (positive) | .441 | 9.260 | .000 | Supported |
| **R-Square** | | | | |
| BINT | .511 | | | |
| **Model Fit** | | | | |
| $\chi^2$/df = 3.394, GFI = .923, TLI = .973, CFI = .980, SRMR = .0253, RMSEA = .058 | | | | |

*The Mediating Effect of Attractiveness, Usefulness, Ease-of-Use Awareness to User Satisfaction and Behavioral Intention.*

324 of the participants answered that they had used the municipality's portal not only for informational purposes but also for specific services. These participants were asked to evaluate their satisfaction with the overall service provision. So, for this part of the sample, it was assessed the mediating effect of PA, PU, PEOU, and AWA on the relationship between User Satisfaction (US) and Behavioral Intention (BINT) and the model was modified as presented in the following diagram (Figure 3.2.3).

*Figure 3.2.3 Structural Model of Mediating Effect of PA, PU, PEOU, AWA to US & BINT*




The results revealed two positive and significant indirect effects. The first is User Satisfaction on Behavioral Intention through Perceived Attractiveness (PA) (b = .263, t = 2.683 p = .008). The second one is User Satisfaction (US) on Behavioral Intention (BINT) through Awareness (AWA) (b = .309, t = 6.574 p = .009). The mediating role of Perceived Usefulness (PU) (b = .051, t = .354, p = 644) and Perceived Ease of Use (PEOU) (b = -.005, t = -.067, p = .979) on the connection between US and BINT were insignificant. Furthermore, the direct effect of US on BINT in the presence of the mediators was insignificant (b = -127, t = .088, p = .150). Hence, PA and AWA fully mediated the relationship between US and BINT. The mediation Analysis summary is presented in Table 3.2.11.

*Table 3.2.11 Mediating effect of PA, PU, PEOU, AWA to US and BINT*

| Relationship | Direct Effect | Indirect Effect | CI | | p-value | Conclusion |
|---|---|---|---|---|---|---|
| | | | Lower | Upper | | |

| | | | Bound | Bound | | |
|---|---|---|---|---|---|---|
| US->BINT | -.127 | | | | .150 | |
| US -> PA -> BINT | | .263 | .075 | .468 | .008 | Full Mediation |
| US -> PU -> BINT | | .051 | -.219 | .338 | .644 | No mediation |
| US -> AWA -> BINT | | .309 | .227 | .405 | .009 | Full Mediation |
| US -> PEOU -> BINT | | -.005 | -.132 | .133 | .979 | No mediation |

*Effect of Demographic characteristics & Digital Divide on Behavioral Intention*

Due to potential multicollinearity issues presented in the Correlation Matrix (Table 3.2.9), each demographic – Gender, Age, Education, Economic Activity, Income, Time Spent on the Internet – Digital Divide was treated separately. SPSS 25 was used initially to examine if there is a difference between the groups of the independent variable in response to the Behavioral Intention through one-way ANOVA. In demographics with multiple categories – Age, Education, Economic Activity, and Income - some groups have been unified in order to acquire a sufficient sample in each group. The sample is formed as shown in Table 3.2.12. According to the Central Limit Theorem, the normal distribution is assumed due to the large size of the sample (n > 30) (Rosenblatt, 1956).

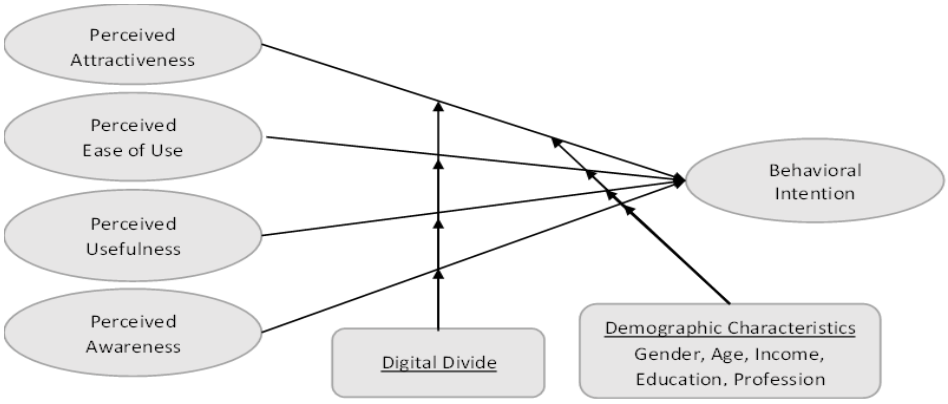
*Table 3.2.12 New demographics Groups*

| **N=707** | **Categories** | **Frequency** | **Percent** |
|---|---|---|---|
| Gender | Male | 327 | 46.3% |
| | Female | 380 | 53.7% |
| Age | 18-34 | 80 | 11.3% |
| | 35-44 | 128 | 18.1% |
| | 45-54 | 210 | 29.7% |
| | 55-64 | 222 | 31.4% |
| | 65+ | 67 | 9.5% |
| Education | Primary (up to upper secondary) | 115 | 16.3% |
| | Tertiary (no University degree) | 100 | 14.1% |
| | Bachelor | 248 | 35.1% |
| | Postgraduate | 244 | 34.5% |
| Economic Activity | Inactive | 94 | 13.3% |
| | Retired | 129 | 18.2% |
| | Self-employed | 87 | 12.3% |
| | Private employee | 164 | 23.2% |
| | Public Servant | 233 | 33.0% |
| Income | up to 500 | 82 | 11.6% |
| | 501-1000 | 176 | 24.9% |
| | 1001-1500 | 255 | 36.1% |
| | 1500-2000 | 105 | 14.9% |
| | 2001+ | 89 | 12.6% |
| Internet time spent | less than 1 hour | 56 | 7.9% |
| | 1-3 hours | 337 | 47.7% |
| | 4-6 hours | 205 | 29.0% |
| | More than 6 hours | 109 | 15.4% |

| | | | |
|---|---|---|---|
| Digital Divide | Above Basic Users | 501 | 70.9% |
| | Basic Users | 206 | 29.1% |

In order to examine the moderating effect of them in the relationship between Perceived Attractiveness, Perceived Usefulness, Perceived Ease of Use, Awareness and Behavioral Intention, Amos 22 was employed. The model proposed is presented in Figure 3.2.4.

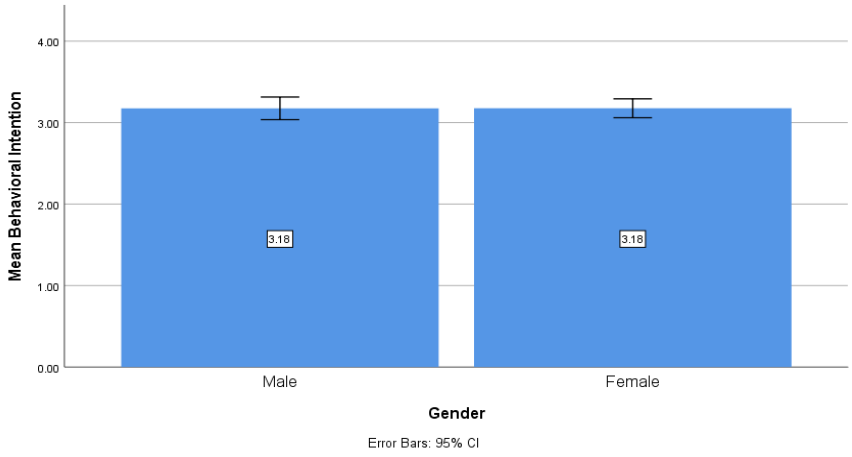
*Figure 3.2.4 Structural Model with Moderating Effect of Demographics & Digital divide*




*Gender*

There was heterogeneity of variances, as assessed by Levene's test of homogeneity of variances (p = .021). The results of the one-way Welch ANOVA showed that there is no statistically significant difference between females (M = 3.176, SD = 1.148) compared to males (M = 3.175, SD = 1.275), Welch's F (1, 666.318) = .000, p = .995, in terms of their Behavioral Intention to use e-Government portal (Figure 3.2.5).

*Figure 3.2.5 Simple Bar Mean of Behavioral Intention by Gender*



The results of the Moderation test show that there is a significant difference at 90%CI between Males and Females in terms of the influence that Perceived Ease of Use ($\chi^2$ = 3.661, p =.056) has in the Intention to use municipalities' e-Government Portal. However, there is no significant difference in terms of Perceived Attractiveness ($\chi^2$ = 1.908, p = .167), Perceived Usefulness ($\chi^2$ = 2.62, p = .106) and Awareness ($\chi^2$ = 0, p = .982). Specifically, the influence of PA on BINT is significant in Males at 90%CI (b = .358, t = 1.871, p = .061), while it is not significant in females (b = .019, t = .132, p = .895). In terms of Females, PU has a positive and significant influence on BINT (b = .667, t = 2.831, p = .005). PEOU has a negative and significant influence on BINT (b = -.302, t = -2.463, p = .014) in Females, while no such significant relationship was found in males. Finally, in both genders, Awareness influences the BINT significantly, but there is a stronger relationship between them in females (b =.449, t = 5.677, p = .000) in comparison to males (b = .447, t = 6.013, p= .000) (Table 3.2.13).

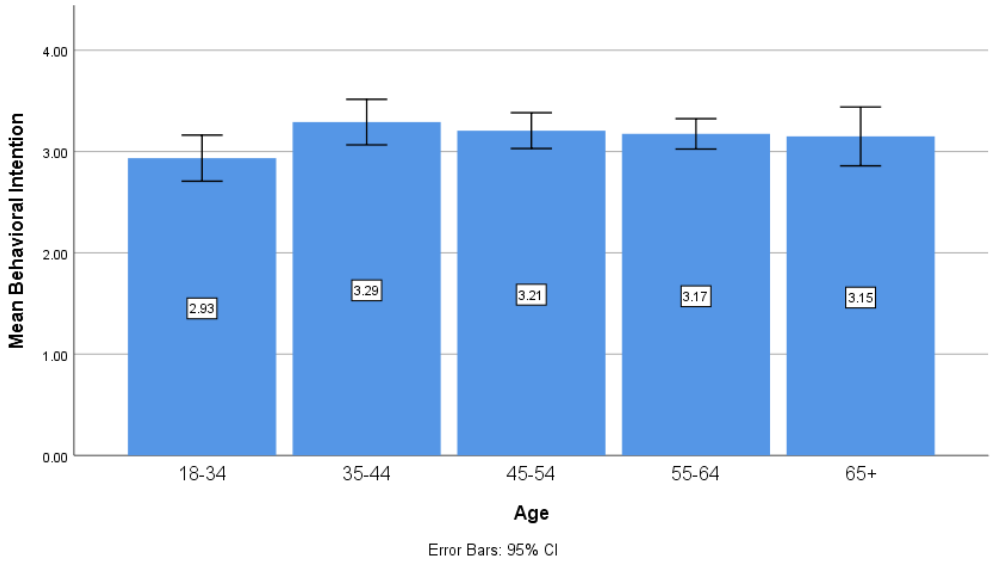
*Table 3.2.13 Moderating effect of Gender on BINT*

| **Hypothesized Relationship** | **S.E.** | **t-value** | **p-value** |
|---|---|---|---|
| *Males (N = 327)* | | | |
| PA -> BINT | .358 | 1.871 | .061 |
| PU -> BINT | .114 | .467 | .640 |
| PEOU -> BINT | .015 | .129 | .897 |
| AWA-> BINT | .447 | 6.013 | .000 |
| *Females (N = 380)* | | | |
| PA -> BINT | .019 | .132 | .895 |
| PU -> BINT | .664 | 2.831 | .005 |
| PEOU -> BINT | -.302 | -2.463 | .014 |
| AWA-> BINT | .449 | 5.677 | .000 |

*Age*

The homogeneity of variances was violated, as assessed by Levene's Test of Homogeneity of Variance (p = .003). There was not statistically significantly difference, Welch's F(4, 252.138) = 1.372, p = .244, between 18-34 (M = 2.934, SD = 1.022), 35-44 (M = 3.291, SD = 1.286), 45-54 (M = 3.206, SD = 1.300), 55-64 (M = 3.174, SD = 1.133) and 65+ age group (M = 3.149, SD = 1.192) on the Behavioral Intention to use e-Government Portal (Figure 3.2.6)

*Figure 3.2.6 Simple Bar Mean of Behavioral Intention by Age*




The results of the Moderation test show that there is no significant difference between age groups in terms of the influence that Perceived Attractiveness ($\chi^2$ = 3.144, p = .534), Perceived Usefulness ($\chi^2$ = 1.908, p = .699), Perceived Ease of Use ($\chi^2$ = 6.616, p = .158) and Awareness ($\chi^2$ =2.255, p = .689) have on Intention to use municipalities' e-Government Portal. Specifically, Perceived Usefulness (b =.67, t = 2.108, p = .035) and Perceived Ease of Use (b = -.451, t = -2.529, p = .008) are only significant in the age group 35-44. Perceived Attractiveness does not have a significant impact on behavioral intention in all age groups, and Awareness has a significant impact in all age groups. Nevertheless, there is a stronger relationship between them in the age group 65+ (b = .498, t = 2.813, p = .005) compared to other age groups. The results are presented in Table 3.2.14.

*Table 3.2.14 Moderating effect of Age on BINT*

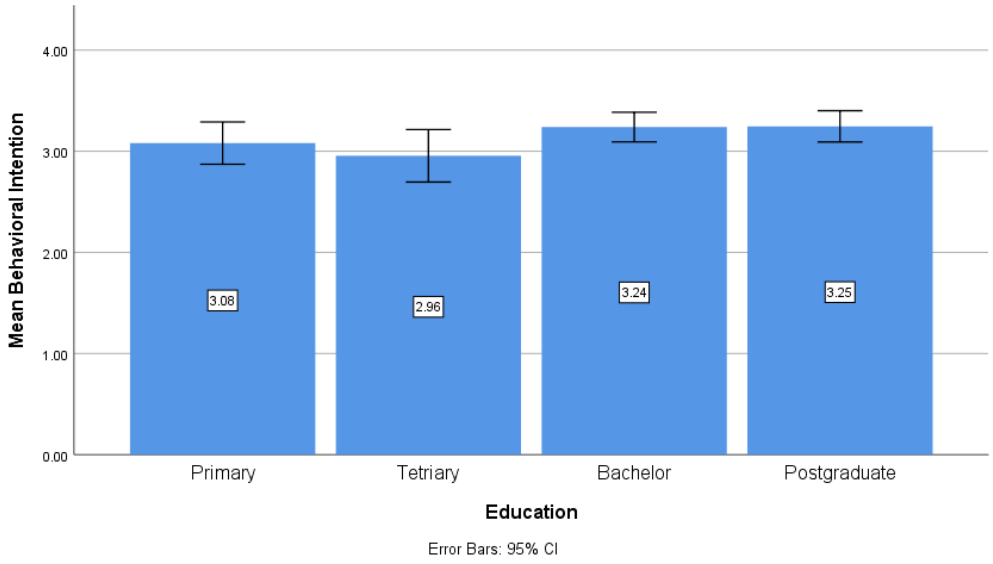
| **Hypothesized Relationship** | **S.E.** | **t-value** | **p-value** |
|---|---|---|---|
| *18-34 (N =80)* | | | |
| PA -> BINT | -.155 | -.873 | .383 |
| PU -> BINT | .654 | 1.554 | .120 |
| PEOU -> BINT | -.218 | -.791 | .429 |
| AWA-> BINT | .371 | 2.34 | .019 |
| *35-44 (N = 128)* | | | |
| PA -> BINT | .039 | .082 | .935 |
| PU -> BINT | .039 | .082 | .935 |
| PEOU -> BINT | .128 | .714 | .475 |
| AWA-> BINT | .398 | 2.529 | .011 |
| *45-54 (N = 210)* | | | |

| | | | |
|---|---|---|---|
| PA -> BINT | .277 | 1.248 | .212 |
| PU -> BINT | .670 | 2.108 | .035 |
| PEOU -> BINT | -.451 | -2.639 | .008 |
| AWA-> BINT | .415 | 4.38 | .000 |
| *55-64 (N = 222)* | | | |
| PA -> BINT | .254 | 1.071 | .284 |
| PU -> BINT | .180 | .460 | .645 |
| PEOU -> BINT | .009 | .052 | .958 |
| AWA-> BINT | .267 | 3.326 | .000 |
| *65+ (N = 67)* | | | |
| PA -> BINT | -.145 | -.397 | .692 |
| PU -> BINT | .833 | 1.454 | .146 |
| PEOU -> BINT | -.347 | -1.009 | .313 |
| AWA-> BINT | .498 | 2.813 | .005 |

*Education*

There was homogeneity of variances, as assessed by Levene's test of homogeneity of variances (p = .224). Behavioral Intention increased from Tertiary (no University degree) (M = 2.955, SD = 1.307), to Primary (up to upper Secondary) (M = 3.08, SD = 1.334), to Bachelor (M = 3.239, SD = 1.172) to Postgraduate (Master and PhD) (M = 3.246, SD = 1.228) groups, in that order (Figure 3.2.7), but the differences between these education groups were not statistically significant, F(3, 703) = 1.859, p = .135.

*Figure 3.2.7 Simple Bar Mean of Behavioral Intention by Education*




The results of the Moderation test show that there is no significant difference between educational levels in terms of the influence that Perceived Attractiveness ($\chi^2$ = 2.913, p = .405), Perceived Usefulness ($\chi^2$ = 3.463, p =.326), Perceived Ease of Use ($\chi^2$ = 6.077, p =

.108) and Awareness ($\chi^2$ =.96, p = .811) have on Intention to use municipalities' e-Government Portal. Specifically, Perceived Usefulness (b =.707, t = 3.313, p = .000) and Perceived Ease of Use (b = -.285, t = -2.065, p = .039) are only significant at the educational level with a university degree. Perceived Attractiveness does not have a significant impact on behavioral intention at all educational levels and Awareness has a significant impact at all educational levels except those with Tertiary education. The strongest relationship between Awareness and Behavioral Intention is in the University degree educational level (b = .369, t = 4.241, p = .000) compared to other age groups. The results are presented in Table 3.2.15

*Table 3.2.15 Moderating effect of Education on BINT*

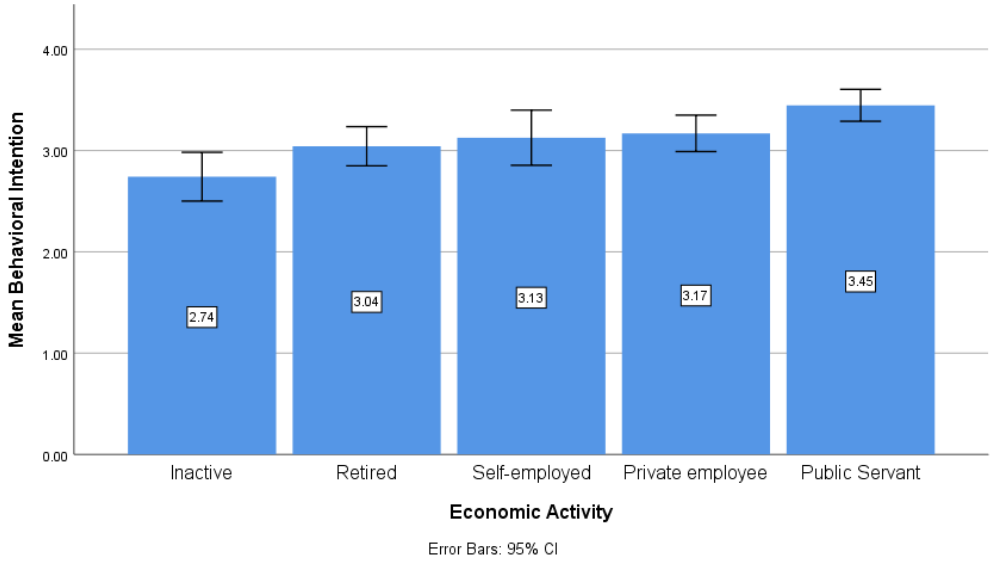
| **Hypothesized Relationship** | **S.E.** | **t-value** | **p-value** |
|---|---|---|---|
| *Up to upper secondary education (N= 115)* | | | |
| PA -> BINT | .406 | 1.384 | .166 |
| PU -> BINT | -.342 | -.605 | .545 |
| PEOU -> BINT | .428 | 1.807 | .071 |
| AWA-> BINT | .361 | 2.711 | .007 |
| Tertiary no University degree (N = 100) | | | |
| PA -> BINT | .481 | 1.073 | .283 |
| PU -> BINT | .176 | .299 | .765 |
| PEOU -> BINT | .068 | .327 | .743 |
| AWA-> BINT | .202 | 1.343 | .179 |
| *University Degree (N = 248)* | | | |
| PA -> BINT | -.023 | -.174 | .861 |
| PU -> BINT | .707 | 3.313 | .000 |
| PEOU -> BINT | -.285 | -2.065 | .039 |
| AWA-> BINT | .369 | 4.241 | .000 |
| *Postgraduate education (N = 244)* | | | |
| PA -> BINT | .229 | .883 | .377 |
| PU -> BINT | .337 | .943 | .346 |
| PEOU -> BINT | -.246 | -1.689 | .091 |
| AWA-> BINT | .359 | 4.083 | .000 |

*Economic Activity*

Variances were homogeneous, as assessed by Levene's test of homogeneity of variances (p = .494). Behavioral Intention was statistically significant between different Economic Activity groups, F(4,702) = 6.585, p<.0005, $\omega^2$ = .036. Behavioral Intention from Inactive (including students, unemployed & fulfilling domestic tasks) (M = 2.742, 1.175), to Retired (M = 3.042, SD = 1.11), to Self-employed (M = 3.126, SD = 1.278) to Private employees (M = 3.169, SD = 1.165) to Public Servants (M = 3.446, SD = 1.219), in that

order (Figure 3.2.8). Tukey post hoc analysis revealed that the increase from Inactive to Private Employees (.427, p = .045 (.005 to .848)) and Public Servants (.70433, p < .0005 (.307 to 1.102)) were statistically significant, as well as the increase from Retired to Public Servants (.704, p = .018 (.047 to .761)), but no other group differences were statistically significant.

*Figure 3.2.8 Simple Bar Mean of Behavioral Intention by Economic Activity*




The results of the Moderation test show that there is a significant difference between groups of economic activity in terms of the influence that Awareness ($\chi^2$ = 10.509, p = .033) has in the Intention to use municipalities' e-Government Portal. However, there are no significant differences with respect to Perceived Attractiveness ($\chi^2$ = 7.405, p =.116), Perceived Usefulness ($\chi^2$ = 6.281, p =.179), and Perceived Ease of Use ($\chi^2$ = 6.098, p = .192). Specifically, Perceived Usefulness (b =1.512, t = 2.077, p= .038) is significant only in the Inactive population. Perceived Attractiveness, as well as Perceived ease-of-Use, do not have a significant impact on the behavioral intention in all economic activity groups, and Awareness has a significant impact on Private employees and Public Servants. The strongest relationship between Awareness and Behavioral Intention is in public servants (b =.553, t = 6.565, p = .000) compared to private employees (b =.25, t = 2.285, p = .022). The results are presented in Table 3.2.16

*Table 3.2.16 Moderating effect of Economic Activity on BINT*

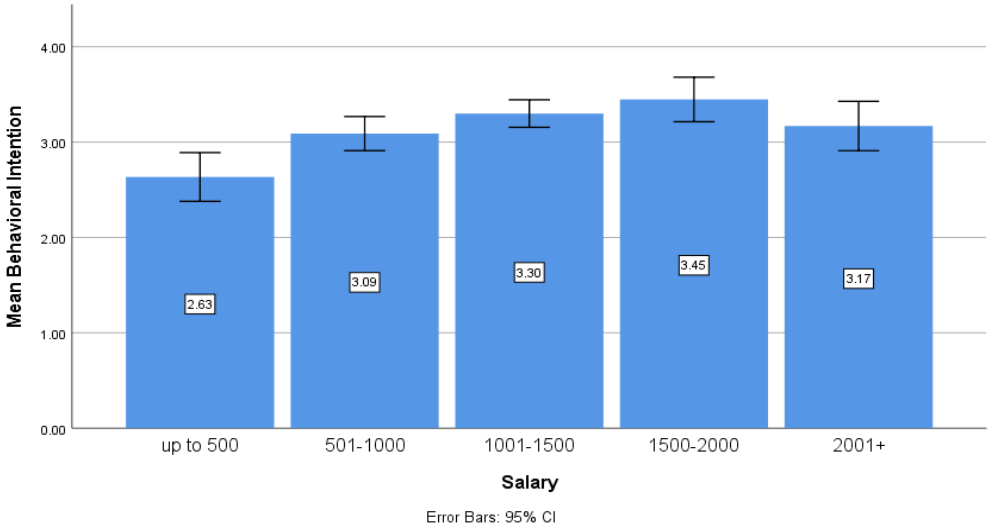
| Hypothesized Relationship | S.E. | t-value | p-value |
|---|---|---|---|
| *Inactive, including students, fulfilling domestic tasks and* | | | |

| | | | |
|---|---|---|---|
| *unemployed (N =94)* | | | |
| PA -> BINT | -.602 | -1.429 | .153 |
| PU -> BINT | 1.512 | 2.077 | .038 |
| PEOU -> BINT | -.291 | -1.009 | .313 |
| AWA-> BINT | .210 | .990 | .322 |
| *Retired (N = 129)* | | | |
| PA -> BINT | -.148 | -.791 | .429 |
| PU -> BINT | .465 | 1.401 | .161 |
| PEOU -> BINT | 1.094 | .662 | .508 |
| AWA-> BINT | .257 | 1.112 | .266 |
| *Self-Employed (N = 87)* | | | |
| PA -> BINT | 1.99 | .821 | .412 |
| PU -> BINT | -2.483 | -.608 | .543 |
| PEOU -> BINT | 1.094 | .662 | .508 |
| AWA-> BINT | .257 | 1.112 | .266 |
| *Private Employee (N = 164)* | | | |
| PA -> BINT | .305 | .860 | .390 |
| PU -> BINT | .265 | .500 | .617 |
| PEOU -> BINT | -.207 | -.973 | .331 |
| AWA-> BINT | .250 | 2.285 | .022 |
| *Public Servant (N = 233)* | | | |
| PA -> BINT | .196 | 1.080 | .280 |
| PU -> BINT | .344 | 1.361 | .174 |
| PEOU -> BINT | -.211 | -1.701 | .089 |
| AWA-> BINT | .553 | 6.565 | .000 |

*Monthly Income*

There was homogeneity of variances, as assessed by Levene's test of homogeneity of variances (p = .956). Behavioral Intention was statistically significant between different Monthly Income groups, F(4,702) = 6.540, p<.0005, $\omega^2$ = .036. Behavioral Intention from up to € 500 (M = 2.634, 1.162), to € 501-1000 (M = 3.1, SD = 1.2), to € 2001+ (M = 3.169, SD = 1.229) to € 1001-1500 (M = 3.299, SD = 1.168) to € 1501-2000 (M = 3.448, SD = 1.21), in that order (Figure 3.2.9). Tukey post hoc analysis revealed that the increase from € 500 to € 501-1000 (.455, p = .035 (.02 to .89)), € 1001-1500 (.665, p < .0005 (.252 to 1.078)), € 1501-2000 (.813, p < .0005 (.334 to 1.293)) and € 2001+ (.534, p = .028 (.036 to 1.032) were statistically significant, but no other group differences were statistically significant.

Figure 3.2.9 Simple Bar Mean of Behavioral Intention by Monthly Income




The results of the Moderation test show that there is a significant difference between groups of monthly income in terms of the influence that Perceived Usefulness ($\chi^2$ = 9.350, p = .053) has in Intention to use municipalities' e-Government Portal at 90%CI. However, there are no significant differences with respect to Perceived Attractiveness ($\chi^2$ = 6.315, p = .177), Perceived Usefulness ($\chi^2$ = 5.662, p = .226), and Perceived Ease of Use ($\chi^2$ = 6.538, p =.162). Specifically, Perceived Usefulness is significant only in the population with monthly income up to €500 (b =1.545, t = 2.359, p = .018) and up to €1000 (b = .59, t = 2.43, p = .015). Perceived Attractiveness, as well as Perceived ease-of-Use, do not have a significant impact on behavioral intention in all income groups, and Awareness has a significant impact in populations with incomes €501-1000, €1001-1500 and €1501-2000. The strongest relationship between Awareness and Behavioral Intention is in the sample with monthly income €1501-2000 (b = .595, t = 3.939, p = .000) compared to other groups. The results are presented in Table 3.2.17

*Table 3.2.17 Moderating effect of Income on BINT*

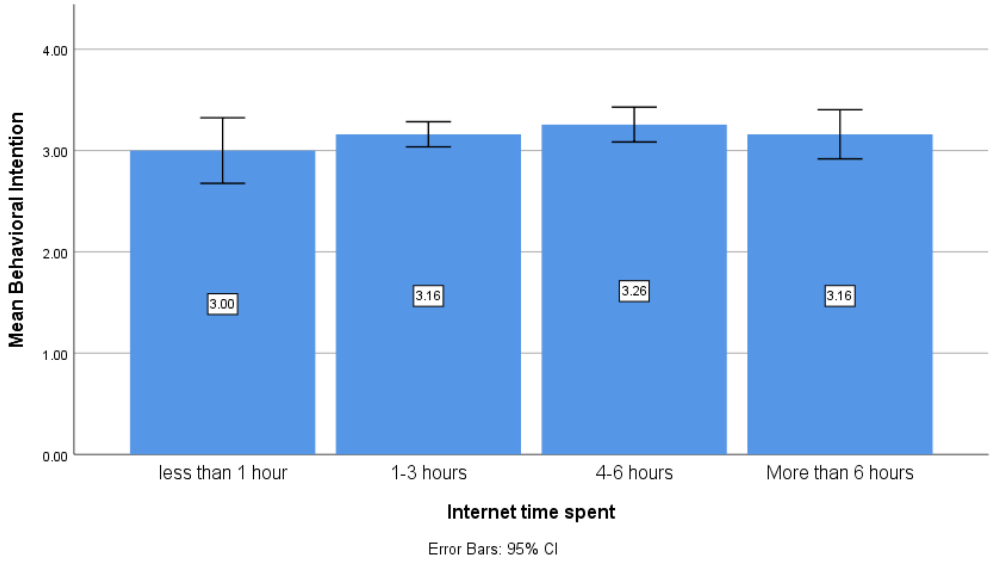
| **Hypothesized Relationship** | **S.E.** | **t-value** | **p-value** |
|---|---|---|---|
| *0-500 (N =82)* | | | |
| PA -> BINT | -.532 | -1.274 | .203 |
| PU -> BINT | 1.545 | 2.359 | .018 |
| PEOU -> BINT | -.361 | -1.301 | .193 |
| AWA-> BINT | .28 | 1.654 | .098 |
| *501-1000 (N = 176)* | | | |
| PA -> BINT | .06 | .379 | .705 |
| PU -> BINT | .59 | 2.43 | .015 |
| PEOU -> BINT | -.229 | -1.412 | .158 |

| | | | |
|---|---|---|---|
| AWA-> BINT | .308 | 2.447 | .014 |
| *1001-1500 (N = 255)* | | | |
| PA -> BINT | -.015 | -.056 | .955 |
| PU -> BINT | .525 | 1.404 | .16 |
| PEOU -> BINT | -.11 | -.719 | .472 |
| AWA-> BINT | .385 | 4.816 | .000 |
| *1501-2000 (N = 105)* | | | |
| PA -> BINT | .688 | 1.121 | .262 |
| PU -> BINT | -1.201 | -1.137 | .256 |
| PEOU -> BINT | .731 | 1.533 | .125 |
| AWA-> BINT | .595 | 3.939 | .000 |
| *2001+ (N = 89)* | | | |
| PA -> BINT | .348 | 1.598 | .110 |
| PU -> BINT | .318 | .950 | .342 |
| PEOU -> BINT | -.106 | -.593 | .553 |
| AWA-> BINT | .061 | .484 | .628 |

*Time Spent on the Internet*

There was homogeneity of variances, as assessed by Levene's test of homogeneity of variances (p = .289). Behavioral Intention increased from less than 1 hour (M = 3.00, SD = 1.207) to 1-3 hours (M = 3.16, SD = 1.158), to more than 6 hours (M = 3.161, SD = 1.278), to 4-6 hours (M = 3.26, SD = 1.251) groups, in that order (Figure 3.2.10), but the differences between these Time Spent on the Internet groups were not statistically significant, F(3, 703) = .721, p = .540.

*Figure 3.2.10 Simple Bar Mean of Behavioral Intention by Internet time spent*



The results of the Moderation test show that there is a significant difference between the different groups of time spent on the internet in terms of the influence that Perceived Ease of Use ($\chi^2$ = 7.211, p = .064) has on Intention to use municipalities' e-Government Portal at 90%CI. However, there is no such difference in terms of Perceived Attractiveness ($\chi^2$ = 2.628, p = .453), Perceived Usefulness ($\chi^2$ = .508, p =.917), and Awareness ($\chi^2$ = 3.99, p =.263). Specifically, Perceived Ease of use (b = -.446, t = -3.086, p = .002) at 95%CI and Perceived Attractiveness (b = .358 t = 1.749, p = .08) at 90%CI have a significant impact in those who spent 3-6 hours on the internet daily. Perceived Usefulness does not have a significant impact on the behavioral intention in all groups of time spent on the Internet, and Awareness has a significant impact in all groups except those who spent more than 6 hours. The strongest relationship between Awareness and Behavioral Intention is in those who spent less than an hour on the Internet (b = .570, t = 2.716, p = .007) compared to other groups. The results are presented in Table 3.2.18

*Table 3.2.18 Moderating effect of time spent on the Internet on BINT*

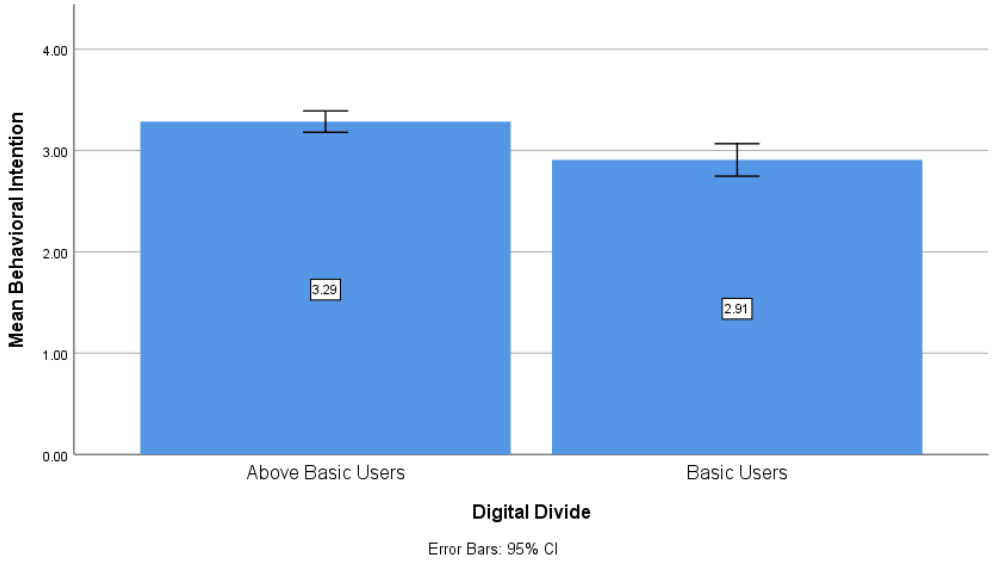
| **Hypothesized Relationship** | **S.E.** | **t-value** | **p-value** |
|---|---|---|---|
| *Less than 1 hour (N= 56)* | | | |
| PA -> BINT | .406 | 1.384 | .166 |
| PU -> BINT | -.342 | -.605 | .545 |
| PEOU -> BINT | .428 | 1.807 | .071 |
| AWA-> BINT | .361 | 2.711 | .007 |
| *1-3 hours* (N = 337) | | | |
| PA -> BINT | .481 | 1.073 | .283 |
| PU -> BINT | .176 | .299 | .765 |
| PEOU -> BINT | .068 | .327 | .743 |
| AWA-> BINT | .202 | 1.343 | .179 |
| *4-6 hours (N = 205)* | | | |
| PA -> BINT | -.023 | -.174 | .861 |
| PU -> BINT | .707 | 3.313 | .000 |
| PEOU -> BINT | -.285 | -2.065 | .039 |
| AWA-> BINT | .369 | 4.241 | .000 |
| *More than 6 hours (N = 109)* | | | |
| PA -> BINT | .229 | .883 | .377 |
| PU -> BINT | .337 | .943 | .346 |
| PEOU -> BINT | -.246 | -1.689 | .091 |
| AWA-> BINT | .359 | 4.083 | .000 |

*Digital Divide*

There was homogeneity of variances, as assessed by Levene's test of homogeneity of variances (p = .393). Behavioral Intention was statistically significant between different

Basic and Above Basic Users, F (1,705) = 14.545, p<.0005, $\omega^2$ = .020. Behavioral Intention from Basic Users (M = 2.908, 1.169) to Above Basic Users (M = 3.285, SD = 1.207) (Figure 3.2.11).

*Figure 3.2.11 Simple Bar Mean of Behavioral Intention by Digital Divide*




The results of the Moderation test show that there is no significant difference between the above basic users and basic users in terms of the influence that Perceived Attractiveness ($\chi^2$ = .886, p = .347), Perceived Usefulness ($\chi^2$ = .313, p = .576), Perceived Ease of Use ($\chi^2$ = 1.428, p = .232) and Awareness ($\chi^2$ = 1.765, p =.184) have on Intention to use municipalities' e-Government Portal. Specifically, the influence of PU (b = .477, t = 1.944, p = .052) and PEOU (b = -.196, t = -1.907, p = .057) on BINT are significant in the above basic users at 90%CI, while it is not significant in basic users. Finally, Attractiveness is not essential for both types of users, while Awareness significantly influences the BINT in both of them, but there is a stronger relationship between them in basic users (b =.440, t = 4.372, p = .000) in comparison to above basic users (b = .282, t = 4.961, p = .000). The results are presented in Table 3.2.19.

Table 3.2.19 Moderating effect of Digital Divide on BINT

| **Hypothesized Relationship** | **S.E.** | **t-value** | **p-value** |
|---|---|---|---|
| *Basic Users (N = 206)* | | | |
| PA -> BINT | .000 | .000 | 1.000 |
| PU -> BINT | .276 | 1.101 | .271 |
| PEOU -> BINT | .050 | .291 | .771 |
| AWA-> BINT | .440 | 4.372 | .000 |

| | | | |
|---|---|---|---|
| *Above Basic Users (N = 501)* | | | |
| PA -> BINT | .213 | 1.303 | .193 |
| PU -> BINT | .477 | 1.944 | .052 |
| PEOU -> BINT | -.196 | -1.907 | .057 |
| AWA-> BINT | .282 | 4.691 | .000 |

### 3.2.5 Discussion

i. How are Greek municipalities performing in terms of e-Government perceived quality?

From the point of view of the users, the quality of the electronic government is assessed by how well the online presence of the municipalities meets the expectations of the users (Tan, Benbasat, & Cenfetelli, 2013). According to Tan Benbasat and Cenfetelli (2013), Behavioral Intention indicates the total Perceived Quality because it comprises the users' satisfaction due to fulfilling their needs. According to Wirtz et al. (2015), the most influential dimension of Behavioral Intention is Usefulness, attractiveness is the second most influential element on Behavioral Intention and Usability is the third influential (Wirtz, Piehler, & Daiser, 2015). According to Wirtz et al. (2015), the least influential factor on behavioral intention, Awareness. Overall, it appears that citizens perceive the performance of e-Government portals of Greek municipalities to be, at best poor to moderate. According to Wirtz et al. (2015), the most potent constructs of behavioral intention are perceptions of attractiveness and usefulness. This appears to be the most significant obstacle.

ii. What factors influence the perceived quality of e-Government?

According to Wirtz et al. (2015), predictors of behavioral intention and, as a result, the perceived quality of e-Government portals include attractiveness, usefulness, ease-of-use, and awareness. Along with these factors, previous researchers have also indicated as essential factors the Digital Divide, which refers to the gap in digital literacy that exists in different populations (Alneyadi, Hilmi, Ayub, & Abudaqa, 2022; Alneyadi, Hilmi, Ayub, & Abudaqa, 2022; Joseph & Khanra, 2019; Botrić & Božić, 2021), and the demographic characteristics such as gender, age, educational level, income, economic activity and time spent on the internet (Gounopoulos, Kontogiannis, Kazanidis, & Valsamidis, 2020; Yera, Arbelaitz, Jauregui, & Muguerza, 2020). All these factors were examined by this work to

determine if indeed they affect the intention of the Greek population to use the municipal e-Government portals.

It was claimed by Jung, Chung, and Rhee (2018) that even minor alterations in the presentation of online content could have a significant impact on how users evaluate the legitimacy and quality of a website, as well as their overall behavioral intention. Robins and Holmes (2008) suggested that when the same content is presented using different levels of aesthetic treatment, the content with a greater aesthetic treatment is assessed as having better credibility. This was found to be the case even when the levels of aesthetic treatment were the same. According to Wirtz et al. (2015), attractiveness is the characteristic that has the second most significant influence on a person's decision to behave in a certain way. The conclusions of prior research are partially supported by this research's findings. It would appear that individuals' perception of the attractiveness of an e-Government portal has no direct bearing on their desire to use such portal. However, when the indirect impact of perceived attractiveness on the relationship between user satisfaction and the behavioral intention was measured for users who have used certain services, it was found that perceived attractiveness has a strong mediating effect.

One of the fundamental components of TAM is what is known as perceived usefulness (Davis, 1989). A significant number of researchers over the years have emphasized its significance for end users in order to make use of e-Government portals and websites in general (Rogers, 1995; Compeau, Higgins, & Huff, 1999; Venkatesh, Morris, Davis, & Davis, 2003; Rana, Dwivedi, Lal, Williams, & Clement, 2017). When measuring the relationship between social influence, trustworthiness, and facilitating conditions and behavioral intention to use e-Government, Chen & Aklikokou (2020) claimed that usefulness and simplicity of use have a direct as well as a mediating effect. These findings are in line with those of a more recent study conducted by Zahid et al. (2022), which proposed that performance expectancy (usefulness) and effort expectancy (ease of use) were crucial elements in citizens' attitudes toward the implementation of e-Government. The findings of this research show that Perceived usefulness does indeed have a significant direct impact on the intention of citizens to use e-Government, but

when measuring the relationship between User Satisfaction and Behavioral Intention for users that have used specific services, there was no mediation effect found.

Perceived Ease of Use is another concept derived from the initial TAM (Davis, 1989). Rana et al. (2017) confirmed that the strong and positive influence of Ease of Utilize on the intention of citizens to use e-Government was proven by analyzing the responses of 389 participants located in various districts across India. Chen and Aklikokou's (2020) research confirmed their findings and also proposed the existence of a mediating influence. According to Wirtz et al. (2016), ease of use was the factor that had the least influence on behavioral intention, although it was still judged to be relevant. However, contrary to the Hypothesis and the findings of the earlier research, the results of the analysis showed that there was a significant negative impact on the intention of the citizens to use e-Government. At the same time, there was no mediation on the relationship between User Satisfaction and use of e-Government. These findings are rather controversial. Comparing them to the descriptive statistics, it is possible to hypothesize that, even though citizens find e-Government portals simple to use, they are so useless and unattractive that they prefer not to use them. Consequently, it may be, as Wirtz et al. (2016) stated, the least influential factor when citizens perceive no purpose in using them.

Wirtz et al. (2016) suggested that awareness was the most important component in their ranking of influential factors. According to the findings of a survey conducted by Van et al. (2019) on 462 residents of Vietnam and Korea, one of the strategies to increase the percentage of people using e-Government systems and services is to raise users' levels of awareness. Butt et al. (2019) pointed out that effective communication generates not only knowledge of a product or service but also interest, desire, and subsequent action. According to the results of the study, raising public awareness about e-Government portals can have a favorable impact on citizens' intentions to utilize e-Government services, and it can also play a mediating role in the relationship between user satisfaction and behavioral intention.

In contrast to previous studies, in terms of demographic characteristics, variables such as gender (Nam & Sayogo, 2011), age (Colesca & Dobrica, 2008; Gounopoulos,

Kontogiannis, Kazanidis, & Valsamidis, 2020), education (Nam & Sayogo, 2011; Taipale, 2013) and time spent on the internet were not significant. The results of this study indicate that active population (private employees and public servants) have a more favorable view of e-Government than inactive population (retired, students, unemployed and people fulfilling domestic tasks). Those with a higher monthly income are likewise more inclined to utilize e-Government. This result contradicts Gounopoulos et al. (2020) hypothesis that low-income citizens are more likely to use e-Government services than high-income individuals. The results of the moderation study indicate that demographic variables can influence the association between Perceived Attractiveness, Perceived Usefulness, Perceived Ease of Use, Awareness, and Behavioral Intention. Specifically, in females, Perceived Usefulness had a positive effect on Behavioral Intention, while Perceived Ease of Use had a negative effect; however, in males, there was no such moderation effect. Thus, the results are consistent with Botrić & Božić (2021) proposal that gender acts as a moderator. The link between Awareness, Perceived Usefulness, and Behavioral Intention is moderated by Economic Activity. Specifically, Private and Public Servants exhibited a substantial correlation between Awareness and Behavioral Intention. There was a strong link between Perceived Usefulness and Behavioral Intention in the Inactive population. A similar moderating impact was observed in the group with the lowest income. Overall, the results indicate that Perceived Usefulness influences the intention to use e-Government services of municipalities more than any other factor among economically inactive women with a monthly income of less than € 500.

Botrić & Božić (2021) posited that the disparity in technology use, skills, and literacy stems from a person's inability to correlate future benefits with the accessible technology that enables ongoing use. Yera et al. (2020) and Khanra & Joseph (2019) hypothesized that advanced users are more confident in using online services, making e-Government Services more accessible. Alneyadi et al. (2022) argue that the digital gap impacts the overall satisfaction with e-Government portals and, by extension, the perceived quality as a whole. The findings of this research are in agreement with the Alneyadi et al. (2022) observations. Wirtz et al. (2015) suggested that access to information technology expertise moderates the intention to use e-Government. Nevertheless, a substantial moderating effect of the digital divide on the link between Perceived Attractiveness,

Perceived Usefulness, Perceived Ease of Use, Awareness, and Behavioral Intention was not detected in this study.

### 3.2.6 Conclusion

Overall, Awareness appears to be the most influential factor in the e-Government adoption intentions of citizens among Greek municipalities. Awareness reflects the municipalities' effective communication of the benefits of e-Government portals to citizens as well as the users' familiarity with them. Perceived Usefulness, which describes the tasks users can do and the information they receive through portals, is the second construct influencing users' behavioral intentions. According to the literature review, perceived ease of use has a favorable effect; however, this study indicated that it has a negative effect. As paradoxical as this finding may appear, it suggests that Ease of Use may not be as crucial as previously believed when consumers do not find portals beneficial.

Regarding demographic characteristics, it appears that most of them have a moderating effect on the relationship between Perceived Usefulness and Behavioral Intention, meaning that economically inactive females with a monthly income of less than € 500 depend more on Perceived Usefulness than other factors in order to use e-Government portals. Additionally, Awareness was a key factor for the majority of demographic groupings. In conclusion, the digital divide is an influential factor on the behavioral intention of users; thus, contrary to Gounopoulos et al. (2020) assertion that the divide is narrowing in the majority of developed nations, authorities must pay attention to the technology, skills, and digital literacy gap among users.

This research entails limitations in response to the sample selected and the methodology used. Specifically, the choice of sample from only one country - Greek municipalities – cannot allow generalizations and cultural comparisons. A cross-national study could aid in the generalization of the findings and the identification of the demographic factors that genuinely influence e-Government adoption. Greek municipalities use e-Government portals primarily for informational purposes, so the questionnaire was modified accordingly to accommodate the most common type of use. Consequently, the system's

quality, the security of transactions, and the login process - as well as the participation and collaboration expectation – e-democracy, participation in political and administrative processes, and interoperability – were not investigated. Research on more complex e-Government websites could provide additional information regarding the factors influencing perceived quality. In addition, the method of questionnaire distribution makes it impossible to establish the dependability of the responses. Specifically, the research is predicated on the assumption that users are truthful regarding their use of the portal and appraisal of their overall experience. Future studies could benefit from requiring users to complete tasks through e-Government portals in a controlled environment, followed by a questionnaire. Perceived Ease of Use has a negative effect on behavioral intention, which is an intriguing but disputed finding. Future research could throw more light on this issue through qualitative approaches in order to understand the reasoning of the users.

## 3.3 E-Government Evaluation against a Universal Set of Standards through automated tools

### 3.3.1 Introduction

e-Government has been adopted since the early 1990s to modernize public services, include the community in policy and decision-making, and improve the efficacy, efficiency, and openness of government operations (Anthopoulos & Sirakoulis, 2015). Internet and communication technologies (ICTs) are considered the most effective method to provide individuals with more information about government services and policy in a user-friendly setting (Bournaris, 2020; Grigoroudis & Siskos, 2000; Introna, Hayes, & Petrakaki, 2009).

Many initiatives have been launched to transform the government. Campaigns, public process innovation, investments in information and communication technology (ICT), ICT skills training for public officials, and alignment of the pertinent legislation are a few of them. Each of these efforts fosters the growth of a more democratic and open culture where citizens and other civil actors can have more meaningful interactions with the government through digital touchpoints (Anthopoulos & Sirakoulis, 2015; Qureshi, Salman, Irfan, & Jabeen, 2017).

Numerous academics have studied how to evaluate e-Government portals and websites, while evaluating e-Government itself is of great scientific and political importance. On how to assess the effectiveness of e-Government services, however, there is controversy. The development of e-Government maturity models, which assess the supply side, as well as frameworks for measuring customer satisfaction and Web Content Accessibility Guidelines, are just a few of the various approaches and methodologies suggested for developing a global framework that quantifies the quality of e-Government. The term "quality of e-Government services" is harder to define and widens the gap between these disciplines of study due to the various metrics used to assess e-service quality in strategy, marketing, and web development. This study intends to show how other scientific disciplines might use a web development tool that evaluates portal quality as an additional tool to strengthen their findings. The research questions that this research

attempts to answer are: (i) How are Greek municipalities performing in terms of e-Government quality? (ii) Can an automated tool for improving the quality of web pages capture the basic e-Government quality? and (iii) What are factors - the municipality's size, the budget per citizen, the ruling party’s ideology and the mayor’s gender - that affect the e-Government development?

The rest of the work is divided into the following sections. The "Literature Review" describes how the Web Content Accessibility Guidelines have been proposed as a set of universal standards to measure the quality of e-Government, how the dimensions of accessibility, search engine optimization (SEO), best practices, and performance represent the various e-Government quality dimensions that previous researchers have proposed, and how an automated tool is capable of assessing them. The tool chosen and the data collection procedure are shown in the "Methodology" section. The results from the report of Lighthouse's analysis of the 50 homepages of the Greek municipalities are presented in the "Findings" Section. The “Discussion” answers the research questions and attempts to provide a deeper understanding of the e-Government evaluation dimensions. The "Conclusion" section explores future research directions, summarizes the study's key findings, and acknowledges the work's limitations.

### 3.3.2 Literature Review

The Web Content Accessibility Guidelines (WCAG) are increasingly widely utilized and are now the de facto criteria for evaluating the quality of websites (Qureshi, Salman, Irfan, & Jabeen, 2017). The reason for this is that, in accordance with Schmutz et al. (2016; 2017), websites that meet the WCAG criteria at a top-level score higher in users' personal quality criteria, including the user's mental demands and effort. These criteria include usability, aesthetics, trustworthiness, workload, and user experience.

In order to provide a single, universally accepted standard for web content accessibility that satisfies the demands of individuals, companies, and governments worldwide, the W3C, in cooperation with other stakeholders, established the Web Content Accessibility Guidelines (WCAG) 2 (W3C, 2022). WCAG 2.0 has received ISO/IEC 40500:2012 approval. The following four principles provide the framework required for anybody to

access and use Web material, and they form the basis of the guidelines and Success Criteria (Caldwell, et al., 2008):

- Perceivable - Information and user interface elements need to be presented in a way that people can understand. As a result, people must understand the information being displayed; it cannot be hidden from their senses. For a website to be deemed perceivable, it must meet the meta criteria of offering text alternatives, alternatives for time-based media, and making information adaptive and identifiable. There are 29 sub-criteria in these criteria.
- Operable - Navigation and user interface elements must be usable. In other words, users must be able to use the interface (the interface cannot require interaction that a user cannot perform). A website must have all functionalities accessible from the keyboard; users must have enough time to read and use content. They must be able to navigate easily, find content, and know where they are, they must be able to use other inputs besides the keyboard to operate functionality, and the content must be created in a way that is known not to trigger seizures or other physical reactions. There are 29 sub-criteria in these criteria.
- Comprehensible - Information and user interface functionality must be comprehensible. This means that users must comprehend both the material and how the user interface works (the content or operation cannot be beyond their understanding). The readability and comprehension of the text content, as well as the predictability of the web pages' design and use, are specific criteria. Additionally, the system and design must aid users in avoiding and fixing errors. There are 17 sub-criteria in these criteria.
- Robust - Content must be sufficiently robust to be reliably interpreted by a wide range of user agents, including assistive technology. This means that when technology develops, people must be able to access the content (as technologies and user agents evolve, the content should remain accessible). In particular, the compatibility with present and future user agents must be optimized for a website to be resilient. Three sub-criteria are part of these criteria.

There are 78 distinct sets of requirements for each of these four dimensions. Each criterion can be tested for whether it is satisfied. Websites can be categorized into one of three groups based on how closely they adhere to these standards: low accessibility (A), high accessibility (AA), and highest accessibility (AAA) (Schmutz, Sonderegger, & Sauer, 2016).

In the field of e-Government research, various researchers have used the Web Content Accessibility Guidelines (WCAG) to assess the accessibility of e-Government portals, provide an explanation for the country's score on the United Nations Department of Economic and Social Affairs (UN DESA) e-Government development index (EGDI), and offer suggestions for improvement (Paul, 2022). Many academics have employed automated tools to assess the accessibility of e-Government portals for this purpose. Paul (2022) used an automated technique to review 65 websites for India Ministries. He found that none of them matched the standards for high accessibility (AAA), while 83% of the problems were associated with the low accessibility category (A). Al Mourad et al. (2019) assessed 19 Dubai e-Government websites and found that most violations are of low accessibility and medium accessibility categories and are under the Perceivable dimension. Micheal (2019) used an automatic tool to examine 64 websites belonging to government ministries, departments and agencies in Uganda. The most common violations were under the Robust and the Perceivable dimensions at level AA. The studies presented to reach the same conclusion that e-Government portals need to follow the WCAG in order to improve the overall accessibility of the websites and improve their ranking in that field (Al Mourad, Hussein, & Kamoun, 2019; Micheal, 2019; Kuzma, 2010; Paul, 2022). Furthermore, Schmutz et al. (2016) claim that by adhering to accessibility requirements, e-Government portals can achieve greater performance in terms of task completion time and rate, as well as a better user experience (perceived usability, aesthetics, workload and trustworthiness). Finally, testing the accessibility using automatic tools rather than using the assistance of experts can provide a better assessment of the website's accessibility, according to Brajnik, Yesilada, and Harper (2010), as experts tend to miss true errors and produce false successes.

**Lighthouse as an e-Government evaluation tool**

Lighthouse is an open-source, automated tool for enhancing web page quality. Any web page, whether one that requires authentication or is public, can be subject to it. It generates automated reports on site performance, SEO (search engine optimization), accessibility and best practices (Bureau of Internet Accessibility, 2021). Google Lighthouse evaluates web content in accordance with the WCAG and satisfies many of the WCAG 2.1 Level AA requirements. The score it displays to users is a weighted average of all the tests that Lighthouse administers.

Google Lighthouse's main flaw is that it is ineffective in detecting some WCAG conformance issues, including (Bureau of Internet Accessibility, 2021):

- Inaccurate or Unhelpful Alt Text
- Unnecessary Alt-Text on Decorative Images
- Irrelevant Page Titles and Low-Quality Content
- Using Colour Alone to Convey Meaning

In addition to accessibility, Lighthouse evaluates a website's Search Engine Optimization (SEO), which is influenced by several criteria, including the website's content quality, delivery speed, and accessibility across a range of devices (Hanlon, 2022). The goal of the SEO process is to evaluate the usability of the website in terms of design, architecture, and content in order to increase the volume and quality of online users who visit the website via search engines (Drivas, Sakas, & Reklitis, 2019). Previous studies have shown that Search Engine Optimization (SEO) is the main factor in generating traffic and improving user experience. Search engine optimization was attempted to be validated empirically by Ergi and Bayrak (2014). To retain users on a website, they specifically measured the value of time, speed, a lower bounce rate, page views, and page layout. According to the findings of their experiment, having a website that is search engine optimized can lengthen visitors' visits to a website, which improves the user experience as a whole (Egri & Bayrak, 2014). Kopackova, Michalek, and Cejna (2010) investigated the accessibility and discoverability of 39 Czech municipal government websites between March 2006 and April 2008. They argue that SEO techniques can increase websites' findability on the world wide web and improve the accessibility of e-

Government portals for users with limited information literacy. Failing to optimize e-Government portals for Search Engine prevents users from finding and displaying the needed information (Kopackova, Michalek, & Cejna, 2010).

"Best Practices" is the third dimension of the Lighthouse report. This component examines the adherence to recommended practices for coding and web development (web.dev, 2022). This dimension's objective is to determine whether the technology and coding utilized are current, adhere to best practices for a positive user experience, and make the website quick and safe (web.dev, 2022). In their examination of the typology of trust in e-Government, Papadopoulou, Nikolaidou, and Martakos (2010) split the trust into seven categories: institutional-based trust, trust in stored data, trust in transactions, trust in services, trust in information, and confidence in systems. In order to earn the trust of the public, government entities must take steps outside the sphere of the internet, such as passing laws and directives, as well as other steps that improve the institution's transparency, accountability, integrity, sufficiency, and reliability (Papadopoulou, Nikolaidou, & Martakos, 2010). However, the categories of "Trust in Stored Data," "Trust in Transaction," and "Trust in the System" also include the application of cutting-edge technology, standard security protocols like SSL, TLS, HTTPS, S-HTTP, and S/MIME, as well as cryptography and encryption techniques (Papadopoulou, Nikolaidou, & Martakos, 2010). As a result, the "Best Practices" dimension of the Lighthouse report can provide an assessment of the "Trust" dimension, which has been cited by previous researchers as a contributing element to the quality of e-Government (Barnes & Vidgen, 2006; Kaisara & Pather, 2011; Belanche, Casaló, Flavián, & Schepers, 2014; Papardomichelaki & Mentzas, 2012; Daştan, 2015).

The final component of Lighthouse reports is "performance." According to Andersen & Nielsen (2020), performance has a significant impact on users' adoption of the system as it affects the total user experience. The term "performance" refers to a system's overall response to human emotional requirements, such as visual aesthetics, attractiveness, and fun-in-ease (Hassenzahl & Ullrich, 2007; Hassenzahl & Tractinsky, 2006), as well as to their practical requirements regarding an interactive interface, such as usability, usefulness, and security. It also refers to a system's response to technical issues, such as

speed or the product's technical characteristics (Hartson & Pyla, 2012; Albert & Tullis, 2017; Bevan, 2008). Tan, Benbasat, and Cenfetelli (2008) explored how the performance of websites affected the experiences of 647 users of e-Government services in the United States of America. Their research demonstrates a connection between an excellent website and user pleasure (Tan, Benbasat, & Cenfetelli, 2008). They used a variety of evaluation techniques, such as looking at the overall website performance, taking into account Tangibles - the web interface's appearance and features -, Reliability - the consistency of the functionality given -, Responsiveness - the accessibility of services from any device and at any time -, and Empathy - the capability of content personalization - are the four criteria. Using automatic web tools, Jati and Dominic (2009) evaluated the performance of the websites of the governments of Singapore, Korea, Japan, Hong Kong, and Malaysia. Their findings suggest that the perceived quality and general usability of e-Government portals are impacted by the speed of these systems, which includes measures like server response, load times, size, and the number of items above the value defined by IBM. Users who visit slow websites often have frustrating experiences (Jati & Dominic, 2009).

The "Performance" dimension that the Lighthouse tool uses was created by Chrome in conjunction with the W3C Web Performance Working Group. It is constructed based on a number of APIs and metrics that measure how people feel about a web page's performance. In particular, the performance component assesses potential issues that prevent visitors from accessing the website, as well as its value, usability, appeal, and engagement (Walton, 2022). The questions that Performance Dimensions aim to measure, a more thorough explanation of the questions' meaning, and the performance measures employed are all included in Table 3.3.1.

*Table 3.3.1 Lighthouse e-Government Quality Measures*

| Dimension | Description | Performance metrics |
|---|---|---|
| Interaction | Did the navigation start successfully? Has the server responded? | First Contentful Paint (FCP) |
| Usefulness | Has enough content rendered that users can engage with it? | Largest Contentful Paint (LCP) |
| Usability | Can users interact with the page, or is it still busy loading? | Time to Interact (TTI) |
| Attractiveness | Are the interactions smooth and natural, free of lag and junk? | Total Blocking Time (TBT)<br>Cumulative Layout Shift (CLS) |

*(Walton, 2022)*

Schmutz et al. (2016), as previously noted, suggested that by adhering to the accessibility criteria, e-Government portals are able to perform better in terms of task completion time and rate as well as enhanced user experience (perceived usability, aesthetics, workload and trustworthiness). The researcher wants to investigate the following idea with the help of Lighthouse.

H1: There is a relationship among Accessibility, Performance, SEO and the Use of Best Practices

By adhering to the Web Content Accessibility Guidelines (WCAG), e-Government portals can improve the user experience by improving perceived usability, ease-of-use, interaction, and trust (Schmutz, Sonderegger, & Sauer, 2017). The use of Lighthouse for WCAG assessment may fail to identify errors in some of its dimensions. However, the other three categories (search engine optimization (SEO), best practices, and performance) can provide an objective assessment of the factors that researchers using TAM suggest that affect the quality of e-Government, such as perceived ease-of-use (Kaisara & Pather, 2011; Papardomichelaki & Mentzas, 2012; Rasyid & Alfina, 2017) and perceived usefulness, attractiveness, interaction (Karunasena & Deng, 2012; Papardomichelaki & Mentzas, 2012; Rasyid & Alfina, 2017; Desmal, Othman, Hamid, & Zolait, 2019; Wirtz B. W., Piehler, Rieger, & Daiser, 2016), privacy (Wirtz B. W., Piehler, Rieger, & Daiser, 2016), and privacy (Wirtz, Piehler, & Daiser, 2015), and trust (Barnes & Vidgen, 2006; Kaisara & Pather, 2011; Papardomichelaki & Mentzas, 2012; Daştan, 2015; Belanche, Casaló, Flavián, & Schepers, 2014).

### 3.3.3 Methodology

The goal of this study is to offer a different and objective technique for evaluating the quality of e-Government systems using a set of global criteria. 50 local public administration homepages in Greece with a population of more than 60.000 people were selected for this purpose. In earlier studies, the accessibility of e-Government websites has been examined using a variety of automated accessibility testing tools, including TAW, WAVE, AChecker, eXaminator, EvalAccess 2.0, TAW 1.0, TAW 2.0, SortSite,

etc. (Isa, Suhami, Safie, & Semsudin, 2011; Al Mourad & Kamoun, 2013; Akgül & Vatansever, 2016; Paul, 2022; Al-Faries, Al-Khalifa, Al-Razgan, & Al-Duwais, 2013). The automated website performance testing tool called Lighthouse was employed in this investigation (Bureau of Internet Accessibility, 2021). The URL of the home pages was entered into the application to evaluate the websites using Lighthouse. The main page of websites is used because it serves as a portal to other pages and typically provides visitors with their initial impression of the website (Latif & Masrek, 2010). The homepage should ideally offer the best overview of all website features, including navigation, picture use, color scheme, and text (Nakatumba-Nabende, Kanagwa, Kivunike, & Tuape, 2019). Furthermore, as it is the page that is changed the most regularly, the home page is the component of the website that is the most recent, according to Ahmi and Mohamad (2016).

### 3.3.4 Findings

The initial analysis employed the Lighthouse categories of Accessibility, SEO, Best Practices, and Performance to examine the municipalities' current level of e-Government quality. In terms of accessibility, 32% of the assessed e-Government portals perform well, 66% perform at a reasonable level, and only 1 website was found to function poorly (Table 3.3.2). Similar findings were made for SEO, where no websites performed poorly, 34% of e-Government portals performed well, and 66% of them performed at a medium level (Table 3.3.2). 88% of the portals examined receive a medium score in terms of "Best Practices," compared to 1 website that performs poorly and just 18% that perform well. The primary problem of the portals appears to be "Performance," as none of the e-Government portals under examination perform well, just 18% perform medium, and 82% perform poorly (Table 3.3.2). The complete table of the level of e-Government quality score achieved by each municipality can be found in Appendix D.

*Table 3.3.2 Classification of e-Government Quality based on Lighthouse Analysis*

| | **Accessibility** | | **SEO** | | **Best Practices** | | **Performance** | |
|---|---|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| Bad | 1 | 2.0 | - | - | 1 | 2.0 | 41 | 82.0 |
| Medium | 33 | 66.0 | 33 | 66.0 | 40 | 80.0 | 9 | 18.0 |
| Good | 16 | 32.0 | 17 | 34.0 | 9 | 18.0 | - | - |
| Total | 50 | 100 | 50 | 100 | 50 | 100.0 | 50 | 100 |

Following the first analysis, the study examines the types of errors and the frequency with which they appeared in each Lighthouse e-Government report. In terms of accessibility, the vast majority of websites assessed had no errors in "Tables & Lists" (90%), "Internationalization & Localization" (92%), and "Best Practices" (74%). Errors in the technique of announcing lists are included in the "Tables & Lists" category; such flaws might lead to inaccurate interpretation of the elements, and therefore disabled individuals may not be notified about the listing items. "Internationalization & Localization" is significant because users who speak several languages and access websites in more than one language may have text not pronounced correctly by the screen reader if the website language is not set. "Best Practices" contain approaches that may not directly affect individuals with impairments but may cause them distress. An example discovered through the investigation is the provision of the option for the user to zoom in on a page.

In response to the "Contrast" category, the majority of the e-Government portals reviewed appear to suffer the same challenge. The Text elements on most homepages analyzed lacked sufficient color contrast against the background. People with limited vision may struggle to differentiate contours, borders, edges, and details, and text may be challenging to read.

Most of the problems were discovered in the categories "Navigation," "ARIA," and "Labels & Names (Table 3.3.3)." "Navigation" refers to activities that affect users' ability to navigate correctly through the e-Government portal, such as duplicating an element's ID property, utilizing a tab index with a value larger than 0, and not placing headings in hierarchical order. These flaws cause screen readers to skip large sections of websites. ARIA stands for "Accessible Rich Internet Applications," and its goal is to let screen readers comprehend the elements on a web page and allow users to interact with those elements efficiently by giving responsibilities, states, and characteristics to them (Accessibility Center - California Community Colleges, 2022). Buttons without accessible names, images without alternative attributes, frames without titles, and links without discernable names are examples of "Labels & Names" errors. All of these flaws

impact screen reader functionality since it cannot access and read essential information to the user, limiting impaired users' capacity to access the e-Government portal.

Table 3.3.3 Frequencies of number of Accessibility Errors occurred in the e-Government portals

| | | No of errors detected | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **0** | **1** | **2** | **3** | **4** | **6** | **Total** |
| **Navigation** | Frequency | 22 | 21 | 6 | 1 | - | - | 50 |
| | Percent | 44.0 | 42.0 | 12.0 | 2.0 | - | - | 100.0 |
| **ARIA** | Frequency | 34 | 11 | 2 | 1 | 1 | 1 | 50 |
| | Percent | 68.0 | 22.0 | 4.0 | 2.0 | 2.0 | 2.0 | 100.0 |
| **Labels & Names** | Frequency | 7 | 16 | 17 | 9 | 1 | - | 50 |
| | Percent | 14.0 | 32.0 | 34.0 | 18.0 | 2.0 | - | 100.0 |
| **Best Practices** | Frequency | 37 | 13 | - | - | - | - | 50 |
| | Percent | 74.0 | 36.0 | - | - | - | - | 100.0 |
| **Contrast** | Frequency | 9 | 41 | - | - | - | | 50 |
| | Percent | 18.0 | 82.0 | - | - | - | - | 100.0 |
| **Tables & Lists** | Frequency | 45 | 3 | 2 | - | - | - | 50 |
| | Percent | 90.0 | 6.0 | 4.0 | - | - | - | 100.0 |
| **Internationalization & Localization** | Frequency | 46 | 4 | - | - | - | - | 50 |
| | Percent | 92.0 | 8.0 | - | - | - | | 100 |

Overall, the e-Government portal scored at least a medium in Search Engine Optimization (SEO). However, just a small percentage accomplished no faults in Lighthouse's three areas – Mobile Friendliness (24%), Content (22%), and Crawling & Indexing (30%) - (Table 3.3.4). The Mobile Friendliness standards ensure that users can use the e-Government portal from any device. The three observed faults include the portals' restricted ability to be sized correctly on all devices, small unreadable fonts on mobile devices, and small tap targets (buttons, links and forms). Crawling and indexing errors impair the findability of e-Government portals by users searching for them using search engines. The most common error detected (70% of e-Government portals) is that they incorporate links that are not crawlable in the homepage. The second error detected in two portals is that the homepage is blocked from indexing, and thus, the search engines do not have permission to crawl them, and finally, the robot.txt file that allows search engines to crawl a page has an invalid syntax in one portal. In terms of content, the faults

discovered were that the site lacked a meta description, the image provided lacked alternative attributes, and the links lacked descriptive language.

*Table 3.3.4 Frequencies of number of SEO Errors occurred in the e-Government portals*

| | | No of errors detected | | | | |
|---|---|---|---|---|---|---|
| | | **0** | **1** | **2** | **3** | **Total** |
| **Mobile Friendliness** | Frequency | 12 | 34 | 1 | 3 | 50 |
| | Percent | 24.0 | 68.0 | 2.0 | 6.0 | 100.0 |
| **Content** | Frequency | 11 | 25 | 12 | 2 | 50 |
| | Percent | 22.0 | 50.0 | 24.0 | 4.0 | 100.0 |
| **Crawling & Indexing** | Frequency | 15 | 32 | 3 | - | 50 |
| | Percent | 30.0 | 64.0 | 6.0 | - | 100.0 |

The majority of the portals evaluated received a medium ranking on Best Practices (80%), and the majority of faults leading e-Government portals to fail to advance to a high ranking were discovered in the category "General" (Table 3.3.5). The "General" category evaluates the portals' ability to run as expected by users, that there are no unresolved problems due to network request failures, insufficient security controls, or other browser concerns, and that the debugging process through source maps for large first-party JavaScript is in place. All three flaws were discovered in three of the portals investigated. The most prevalent issue identified in "User Experience" (74%) is that the homepage has low-resolution images and, thus, low clarity. The second problem (32%) was that images were shown in the wrong aspect ratio. "Trust & Security" ensures the portals are safe from attacks and communication manipulation. The most prevalent fault discovered is that of front-end JavaScript libraries with known security vulnerabilities (66%), while 16% of the portals studied did not employ HTTPS, prohibiting hackers from interfering with or passively listening in on portal-to-user connections. Six of the portals investigated in the category "Browser Compatibility" appear to lack the HTML doctype, causing the page to render in unexpected ways.

*Table 3.3.5 Frequencies of number of Best Practices Errors occurred in the e-Government portals*

| | | No of errors detected | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | Total |
| **User Experience** | Frequency | 13 | 21 | 16 | - | 50 |
| | Percent | 26.0 | 42.0 | 32.0 | - | 100.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Trust & Security** | Frequency | 17 | 25 | 8 | - | 50 |
| | Percent | 34.0 | 50.0 | 16.0 | - | 100.0 |
| **General** | Frequency | 14 | 20 | 13 | 3 | 50 |
| | Percent | 28 | 40.0 | 26.0 | 6.0 | 100.0 |
| **Browser Compatibility** | Frequency | 44 | 6 | - | - | 50 |
| | Percent | 88.0 | 12.0 | - | - | 100.0 |

The rendering speed is measured in six dimensions - First Contentful Paint (FCP), Speed Index, Largest Contentful Paint (LCP), Time to Interact (TTI), Total Blocking Time (TBT), and Cumulative Layout Shift (CLS) - and classified as Poor, Medium, or Good. Each indicator measures a different component of page load speed. The time it takes the browser to render the initial pictures, fonts, and SVGs after a user navigates to the portal is measured by First Contentful Paint (FCP). Most of the portals analyzed (84%) perform poorly on this dimension, with only 2% performing well (Table 3.3.6). The performance of 92% of the websites analyzed in the Speed Index, which assesses how quickly content is visibly displayed during page load, is bad. In Largest Contentful Paint, 94% of portals are rated poor. The Largest Contentful Paint (LCP) monitors perceived load speed and indicates when the page's primary content has most likely loaded. Largest Contentful Paint (LCP) is a user-centric metric since a quick LCP reassures the user that the page is helpful. Time to Interact (TTI) assesses the time it takes for a page to become completely interactive after the previous tests have been completed; 84% of the portals did poorly in this dimension as well, with only 2% doing well. Total Blocking Time (TBT) measures how long a page is prevented from responding to user input, such as mouse clicks, screen taps, or keyboard inputs. According to this indicator, 54% of websites perform poorly, 20% perform moderately, and 26% perform well. In the visual stability metric Cumulative Layout Shift (CLS), 52% of the portals scored well, 20% ranked medium, and 28% performed poorly. A good Cumulative Layout Shift (CLS) is thought to improve user-centricity and user experience because the measure quantifies how frequently users encounter unexpected layout shifts—a low CLS helps ensure the website is enjoyable.

*Table 3.3.6 Frequencies of Performance Classification in the e-Government portals*

| | Classification |
|---|---|

| | | Poor | Medium | Good | Total |
|---|---|---|---|---|---|
| **First Contentful Paint** | Frequency | 42 | 7 | | 50 |
| | Percent | 84.0 | 14.0 | 2.0 | 100.0 |
| **Speed Index** | Frequency | 46 | 4 | - | 50 |
| | Percent | 92.0 | 8.0 | - | 100.0 |
| **Largest Contentful Paint** | Frequency | 47 | 3 | - | 50 |
| | Percent | 94.0 | 6.0 | - | 100.0 |
| **Time to Interact** | Frequency | 42 | 6 | 2 | 50 |
| | Percent | 84.0 | 12.0 | 4.0 | 100.0 |
| **Total Blocking Time** | Frequency | 27 | 10 | 13 | 50 |
| | Percent | 54.0 | 20.0 | 26.0 | 100.0 |
| **Cumulative Layout Shift** | Frequency | 14 | 10 | 26 | 50 |
| | Percent | 28.0 | 20.0 | 52.0 | 100.0 |

A Kendall's tau-b correlation was run to determine the relationship between Performance, Accessibility, Best Practices and SEO amongst 50 municipalities' e-Government portals (Table 3.3.7). There was a statistically significant, weak negative association between SEO and Performance, $\tau b = -.255$, $p < .005$, a statistically significant, moderate positive association between SEO and Accessibility, $\tau b = .397$, $p < .001$, and a statistically significant, moderate positive association between SEO and Best Practices, $\tau b = .339$, $p < .001$. However, in contrast to the literature examined, there was not a statistically significant relationship between accessibility and performance.

*Table 3.3.7 Correlation Matrix of Performance, Accessibility, Best Practices & SEO*

| | Performance | Accessibility | Best Practices | SEO |
|---|---|---|---|---|
| Performance | 1.000 | | | |
| Accessibility | -.083 | 1.000 | | |
| Best Practices | -.098 | .179 | 1.000 | |
| SEO | -.255* | .397** | .339** | 1.000 |

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

*Factors influencing e-Government development based on Lighthouse Quality Assessment*

To determine whether multicollinearity was a problem, variance inflation factors (VIF) were assessed. The VIF coefficients are reported in Table 3.3.8; All the Tolerance values are greater than 0.1 (the lowest is 0.914), and VIF values are less than 2. Therefore, it is unlikely that the results are distorted by multicollinearity.

*Table 3.3.8 Collinearity Diagnostics*

| Model | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| Population | .944 | 1.060 |
| Budget | .902 | 1.109 |
| Gender | .943 | 1.061 |
| Political Ideology | .914 | 1.095 |

a. Dependent Variable: Medium Performance

*Accessibility*

Binomial logistic regression was performed to ascertain the effects of population, ruling party political ideology, mayor's gender, and budget per inhabitant on the e-Government portal's accessibility. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. There was no standardized residual detected. According to Hosmer & Lemeshow test, the logistic regression model fits well, $\chi2(8) = 12.28$, $p > .05$. The model explained 9.1% (Nagelkerke R2) of the variance in performance and correctly classified 74.0% of cases. Sensitivity was 25.0%, specificity was 97.1%, positive predictive value was 80%, and negative predictive value was 73.3%. Of the seven predictor variables, none was statistically significant (Table 3.3.9).

*Table 3.3.9 Binomial logistic Regression Predicting the Likelihood of high accessibility of e-Government based on Population, Political Ideology, Budget, and Gender*

| | B | S.E. | Wald | *df* | *p* | Odds Ratio | 95% C.I. for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| population | .000 | .000 | .149 | 1 | .700 | 1.000 | 1.000 | 1.000 |
| Budget | .002 | .001 | 2.669 | 1 | .102 | 1.002 | 1.000 | 1.004 |
| Gender | -.142 | 1.238 | .013 | 1 | .909 | .868 | .077 | 9.822 |
| No Connection to Political Ideology | | | .933 | 2 | .627 | | | |
| Conservative-Liberal | -.713 | .835 | .730 | 1 | .393 | .490 | .095 | 2.517 |
| Social Democrat | -.169 | .910 | .034 | 1 | .853 | .845 | .142 | 5.024 |
| Constant | -2.052 | 1.177 | 3.038 | 1 | .081 | .128 | | |

*Notes: Gender is for Females compared to Males*

*SEO*

Binomial logistic regression was performed to ascertain the effects of population, ruling party political ideology, mayor's gender, and budget per inhabitant on the e-Government portal's Search Engine Optimization (SEO). The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. There was one standardized residual with a value of 2.861 standard deviations, which was kept in the analysis. According to Hosmer & Lemeshow test, the logistic regression model fits well, $\chi 2(8) = 9.584$, $p > .05$. The model explained 4.1% (Nagelkerke R2) of the variance in performance and correctly classified 64.0% of cases. Sensitivity was 0.0%, specificity was 97.0%, positive predictive value was 0%, and negative predictive value was 65.3%. Of the seven predictor variables, none was statistically significant (Table 3.3.10).

*Table 3.3.10 Binomial logistic Regression Predicting the Likelihood of High SEO of e-Government based on Population, Political Ideology, Budget, and Gender*

| | B | S.E. | Wald | *df* | *p* | Odds Ratio | 95% C.I. for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| population | .000 | .000 | .487 | 1 | .485 | 1.000 | 1.000 | 1.000 |
| Budget | .001 | .001 | .804 | 1 | .370 | 1.001 | .999 | 1.003 |
| Gender | -.407 | 1.230 | .109 | 1 | .741 | .666 | .060 | 7.421 |
| No Connection to Political Ideology | | | .294 | 2 | .863 | | | |
| Conservative-Liberal | -.367 | .815 | .203 | 1 | .653 | .693 | .140 | 3.425 |
| Social Democrat | -.046 | .891 | .003 | 1 | .959 | .955 | .167 | 5.472 |
| Constant | -1.035 | 1.142 | .821 | 1 | .365 | .355 | | |

*Notes: Gender is for Females compared to Males*

### *Best Practices*

Binomial logistic regression was performed to ascertain the effects of population, ruling party political ideology, mayor's gender, and budget per inhabitant on implementing best practices on the e-Government portal. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. There was one standardized residual with a value of 3.833 standard deviations, which was kept in the analysis.

According to Hosmer & Lemeshow test, the logistic regression model fits well, $\chi^2(8) = 3.079$, $p > .05$. The model explained 11.5% (Nagelkerke $R^2$) of the variance in performance and correctly classified 82.0% of cases. Sensitivity was 0.0%, specificity was 100.0%, positive predictive value was 0%, and negative predictive value was 82.0%. Of the seven predictor variables, only budget per inhabitant was statistically significant at 90%CI. Of the seven predictor variables, none was statistically significant (Table 3.3.11).

*Table 3.3.11 Binomial logistic Regression Predicting the Likelihood of e-Government scoring high in the Best Practices category based on Population, Political Ideology, Budget, and Gender*

| | B | S.E. | Wald | *df* | *p* | Odds Ratio | 95% C.I. for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| population | .000 | .000 | .338 | 1 | .561 | 1.000 | 1.000 | 1.000 |
| Budget | .001 | .001 | .220 | 1 | .639 | 1.001 | .998 | 1.003 |
| Gender | -19.980 | 19636.472 | .000 | 1 | .999 | .000 | .000 | . |
| No Connection to Political Ideology | | | 1.675 | 2 | .433 | | | |
| Conservative-Liberal | -1.303 | 1.030 | 1.601 | 1 | .206 | .272 | .036 | 2.045 |
| Social Democrat | -.521 | 1.003 | .270 | 1 | .603 | .594 | .083 | 4.238 |
| Constant | -.843 | 1.410 | .357 | 1 | .550 | .431 | | |

*Notes: Gender is for Females compared to Males*

### *Performance*

Binomial logistic regression was performed to ascertain the effects of population, ruling party political ideology, mayor's gender, and budget per inhabitant on the e-Government portal's performance. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. There was one standardized residual with a value of 3.833 standard deviations, which was kept in the analysis. The logistic regression model was statistically significant, $\chi^2(5) = 11.273$, $p < .05$. The model explained 11.5% (Nagelkerke $R^2$) of the variance in performance and correctly classified 86.0% of cases. Sensitivity was 22.2%, specificity was 100.0%, positive predictive value was 100%, and negative predictive value was 85.4%. Of the seven predictor variables, only budget per inhabitant was statistically significant at 90%CI (Table 3.3.12). Increasing the budget was

associated with a reduction in the likelihood of medium e-Government portal's performance.

*Table 3.3.12 Binomial logistic Regression Predicting the Likelihood of medium performance of e-Government based on Population, Political Ideology, Budget, and Gender*

| | B | S.E. | Wald | *df* | *p* | Odds Ratio | 95% C.I. for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| population | .000 | .000 | 1.809 | 1 | .179 | 1.000 | 1.000 | 1.000 |
| Budget | -.004 | .002 | 3.456 | 1 | .063 | .996 | .992 | 1.000 |
| Gender | -19.269 | 19925.733 | .000 | 1 | .999 | .000 | .000 | . |
| No Connection to Political Ideology | | | 1.956 | 2 | .376 | | | |
| Conservative-Liberal | 1.835 | 1.363 | 1.811 | 1 | .178 | 6.263 | .433 | 90.585 |
| Social Democrat | 1.766 | 1.407 | 1.575 | 1 | .210 | 5.848 | .371 | 92.237 |
| Constant | -.713 | 1.912 | .139 | 1 | .709 | .490 | | |

*Notes: Gender is for Females compared to Males*

### 3.3.5 Discussion

i. How are Greek municipalities performing in terms of e-Government quality?

Kopackova, Michalek, and Cejna (2010) proposed that the main benefit of Search Engine Optimization (SEO) is that it improves the ease-of-use for people with limited information literacy as well as the overall user experience (Egri & Bayrak, 2014). According to this viewpoint, the findings of this study indicate that 34% of the portals analyzed to provide a good user experience, and 66% provide a middling one. This finding is consistent with the Accessibility metrics (good-32%, medium-66%), which measure overall ease-of-use for disabled users and, as proposed by Schumtz et al. (2016), the ease-of-use and user experience across different categories of users. The Accessibility metrics of Contrast and Labels & Names, as well as the Content and Mobile Friendliness metrics in SEO, appear to affect users regardless of disability. Overall, similar findings between SEO and Accessibility indicate that they may measure the same dimensions of ease-of-use and user experience as recommended by the literature review. However, the metric of User Experience in the "Best Practices" dimension shows that just 26% of the portals evaluated were error-free, while 74% of the portals had problems regarding

website aesthetics. As Schmutz et al. (2016) noted, User Experience is comprised of perceived usability, aesthetics, workload, and trustworthiness, and SEO, Accessibility, and Best Practices appear to measure different aspects of User Experience. Thus, in order to measure the overall quality of e-Government portals, additional characteristics such as usability, workload, and trustworthiness should be examined.

In terms of trustworthiness, "Best Practices" assess the use of cutting-edge technologies, industry-standard security protocols such as SSL, TLS, HTTPS, S-HTTP, and S/MIME, as well as cryptography/encryption algorithms that have been identified as factors influencing trust in Stored Data, Transactions, and the System (Papadopoulou, Nikolaidou, & Martakos, 2010). Most e-Government websites analyzed rate medium (80%), whereas 2% perform poorly in these areas, with the Trust & Security and General issues discovered being the primary reasons for these rankings. Both of these dimensions are used to assess system failures, inadequate security controls, and security vulnerabilities. The vulnerabilities discovered are critical in terms of trustworthiness and may endanger users. So, while SEO and accessibility are high, the privacy and security flaws discovered indicate that these two criteria are insufficient to establish whether or not the user experience is satisfactory. These findings agree with researchers who have suggested that privacy, trust, and security are factors that contribute to overall quality (Barnes & Vidgen, 2006; Belanche, Casaló, Flavián, & Schepers, 2014; Kaisara & Pather, 2011; Papardomichelaki & Mentzas, 2012; Daştan, 2015) and complement the suggestions of Egri & Bayrak (2014) and Schmutz et al. (2016) that accessibility and SEO can enhance user experience.

According to Walton (2022), "Performance" is capable of measuring the interaction, usefulness, usability, and attractiveness of a website. The majority of the portals (82%) scored poorly in this "Lighthouse" dimension, while none scored high. So, it appears that the sample investigated performed poorly in four of the six characteristics identified by demand research as e-Government quality criteria. Interaction, as defined by First Contentful Paint (FCP), was found to be poor in 84% of the sample, usefulness as measured by Largest Contentful Paint (LCP) was poor in 94%, and usability, as measured by Time to Interact (TTI), was poor in 84%. Total Blocking Time (TBT) and Cumulative

Layout Shift (CLS), on the other hand, were shown to have inconsistencies in their results. Total Blocking Time (TBT) was defined as poor 54% of the time, 20% as medium, and 26% as good, whereas Cumulative Layout Shift (CLS) was classed as poor 28% of the time, 20% as medium, and 52% as good. Because the two metrics are used to assess two facets of the same dimension - attractiveness - the inconsistency is tolerable. Combining the findings of these metrics may be more suited for assessing beauty.

ii. Is there any relationship among Accessibility, SEO, Best Practices and Performance?

Schmutz et al. (2016) argued that by adhering to accessibility requirements, e-Government portals could achieve improved task completion time and rate, as well as a better user experience (perceived usability, aesthetics, workload and trustworthiness). The user experience aspects given by Schmutz et al. (2016) are all included in Lighthouse's "Performance" and "Best Practices" metrics; thus, Kendall's tau-b correlation was performed to see if there was a relationship between them. This study, however, cannot corroborate this notion because there was no statistically significant association between them.

On the other hand, Egri's and Bayrak's (2014) findings from their experimental study suggest that SEO is able to enhance the overall user experience due to attention that is paid to the quality of content, the speed of delivery and the accessibility from various devices. The results of the correlation matrix indicate that there is indeed a positive relationship between SEO and Accessibility and SEO and Best Practices which measures trustworthiness as well as User Experience. This positive relationship is logical, as the purpose of SEO is to increase accessibility and user experience.

Finally, there was a negative correlation between SEO and performance. This could be explained by the developers' efforts to meet SEO goals in order to rank high in search engines in comparison to the actual user experience or by the funding allotted by the authority for the creation of e-Government portals. More research is needed to investigate the causes of this phenomenon.

iii. Can an automated tool for improving the quality of web pages capture the e-Government quality?

Previous research has employed automated tools to assess the accessibility of e-Government (Paul, 2022; Micheal, 2019; Al Mourad, Hussein, & Kamoun, 2019; Kuzma, 2010). The reason for employing automatic tools rather than expert evaluation is that experts and user assessments fail to find errors and identify errors. In contrast, automatic tools offer precise results (Brajnik, Yesilada, & Harper, 2010). This study used an automatic technique that, in addition to accessibility, assesses Search Engine Optimization, Best Practices implementation, and Performance to establish overall quality. These categories appear to cover the ease-of-use, usefulness, attraction, interaction, trust, and privacy that researchers assessing the demand side have suggested that influence the overall quality.

The findings of this study demonstrate that an automated tool can objectively measure the characteristics of e-Government quality. The Lighthouse assessment provided an overall score in four aspects that include measurements used by previous academics to assess e-Government maturity. It also discovered the exact problems and proposed improvements, as suggested by Brajnik et al. (2010). However, due to the little information provided for the score calculation procedure, the researcher was unable to treat the tool's reported results in order to provide a score for the six dimensions of e-Government quality. As a result, even though the tool's purpose is to improve the overall quality of web pages and includes academic research dimensions, it employs a different categorization, making it difficult to directly compare the produced report with academic research using the demand side of e-Government Quality evaluation. However, Lighthouse is a user-friendly and simple tool for assessing the quality of a web page against global standards, and thus it can be beneficial for future research.

### 3.3.6 Conclusion

Overall, the ease-of-use, usefulness, attractiveness, interactivity, and trust quality elements that literature analysis has suggested affect overall perceived quality seem to be incorporated into the Lighthouse instrument. The tool, however, uses a different

taxonomy, preventing direct comparison. According to the Lighthouse report's findings, Greek municipalities score poorly in the performance dimension and at a medium level for the other three aspects (accessibility, SEO, and best practices). While Performance evaluates the usefulness, attractiveness, and interaction of the e-Government portals, Accessibility, SEO, and Best Practices appear to focus on ease-of-use and trust. Thus, while most of the portals under investigation appear to have attained a medium degree of usability and trustworthiness, they struggle in the areas of usefulness, attractiveness, and interactivity.

The four dimensions reported by Lighthouse cannot be combined to provide a summative quality score because it is uncertain how influential these variables are in users' decisions to utilize e-Government portals. In order to provide a summative quality score, the four dimensions supplied by Lighthouse cannot be combined because it is unclear how essential these elements are in users' decisions on whether to use e-Government portals. Even though Lighthouse is able to evaluate the quality of e-Government portals, it is challenging to directly compare the produced report with academic research using the demand side of e-Government Quality evaluation due to the lack of weight assignment on the metrics that matter more to users and the different categorization that is employed. Therefore, future research on this topic could focus on determining the metrics that are more crucial for user engagement and deciphering the precise metrics of the Lighthouse report that represent usability, usefulness, attractiveness, interactivity, and trust.

The scope of this study has several limitations. The results do not support statistical generalizations (Yin, 2014). An outline of the 50 largest municipalities in Greece is provided by the analysis. In this case, the Lighthouse tool could only provide a partial picture of the state of e-Government portals, and more study is required to make full use of this instrument and provide a complete picture of e-Government quality.

## 3.4 A comparison of e-Government Evaluation Methodologies

The comparison of the approaches utilized proceeds with responding to the questions set at the beginning of this chapter.

(i) Which municipalities have a high-quality e-Government portal according to each method, and how do they perform using other approaches?

The municipalities that achieved the highest score and ranked as Transactional Services in the e-Government maturity analysis are Athens, Kalamaria, Katerini, Larissa, Nikaia – Agios Ioannis Rentis, Pilaia Chortiatis and Chalandri. However, only Nikaia – Agios Ioannis Rentis achieved a relatively high score in the dimensions e-Government Maturity without criteria and average lighthouse score. The Municipality of Chalandri had a relatively high score in the dimensions behavioral intention and average lighthouse score. Regarding the citizens' perspective, only the municipality of Agios Dimitrios had a high intention of use. However, the score achieved in the e-Government maturity with criteria was relatively low, and the average Lighthouse performance score was medium. On the other hand, even though it does not incorporate all the features of the second stage of e-Government Maturity, it seems to incorporate many functionalities of the third and fourth stage that make the portal attractive and relatively useful and easy to use (Table 3.4.1). According to the Lighthouse report, only Piraeus municipality achieved medium score in performance and a good score in the other dimensions; this municipality achieved a medium score in behavioral intention, a high rank in the e-Government maturity assessment without criteria and a low rank in the assessment with the criteria rule. Overall, through the analysis of the descriptive findings, it seems that the three methodologies evaluate different things, and there is no consensus on what the features that make an e-Government portal of high quality are. The complete table of the scores can be found in Appendix D.

*Table 3.4.1 Municipalities ranking according to e-Government maturity model, TAM & Lighthouse score*

| | **Nikaia – Agios Ioannis Rentis** | **Chalandri** | **Agios Dimitrios** | **Piraeus** |
|---|---|---|---|---|
| ***E-Gov Maturity (with criteria)*** | ***Transactional Services*** | ***Transactional Services*** | *Enhanced Information* | *Enhanced Information* |

| ***E-Gov Maturity (without criteria)*** | ***Connected Services*** | *Transactional Services* | ***Connected Services*** | ***Connected Services*** |
|---|---|---|---|---|
| ***Behavioral Intention*** | *Low* | *Medium* | ***High*** | *Medium* |
| Perceived Attractiveness | Low | Medium | High | Low |
| Perceived Usefulness | Low | Medium | Medium | Low |
| Perceived Ease of Use | Low | Medium | Medium | Low |
| Awareness | Low | Low | High | Medium |
| Performance | Low | Low | Low | **Medium** |
| Accessibility | Medium | Medium | Medium | **Good** |
| Best Practices | Good | Medium | Medium | **Good** |
| SEO | Good | Medium | Medium | **Good** |

(ii) Do any relationships exist between the measurements of the different approaches?

A Kendall's tau-b correlation matrix was run to determine the e-Government Maturity Model's, TAM's and Lighthouse's measurements amongst 50 municipalities' e-Government portals (Table 3.4.2). The correlation matrix confirms the observation of descriptive analysis. The majority of correlations observed are within the different methodologies employed. However, there is an interesting observation that is worth mentioning. There was a statistically significant, moderate positive association between SEO and e-Government Maturity Assessment without criteria, $\tau b = .418$, $p < .001$, meaning that portals that have utilized features of Connected Services tend to be Search Engine Optimized.

*Table 3.4.2 Correlation Matrix of the e-Government Maturity Model's, TAM's and Lighthouse's measurements*

| | PE | ACC | BP | SEO | PA | PU | PEOU | AWA | BINT | EM | EMWC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Performance (PE) | 1.000 | | | | | | | | | | |
| Accessibility (ACC) | -.154 | 1.000 | | | | | | | | | |
| Best Practices (BP) | -.039 | -.231 | 1.000 | | | | | | | | |
| SEO | -.226 | .327* | .228 | 1.000 | | | | | | | |
| Perceived Attractiveness (PA) | .035 | -.106 | -.026 | -.159 | 1.000 | | | | | | |
| Perceived Usefulness (PU) | -.043 | -.222 | -.023 | -.036 | .666** | 1.000 | | | | | |
| Perceived Ease of Use (PEOU) | -.089 | -.064 | -.102 | .029 | .751** | .535** | 1.000 | | | | |
| Awareness (AWA) | .014 | -.131 | .186 | -.009 | .579** | .247 | .540** | 1.000 | | | |
| Behavioral Intention (BINT) | -.040 | -.118 | .190 | .087 | .631** | .438** | .569** | .528** | 1.000 | | |
| E-Government Maturity with | .080 | -.180 | .171 | -.109 | -.052 | .080 | -.141 | -.247 | -.143 | 1.000 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| criteria (EM) | | | | | | | | | | |
| E-Government Maturity Assessment without criteria (EMWC) | -.075 | .176 | .054 | .418** | -.011 | .160 | .002 | -.029 | .141 | .047 | 1.000 |

**. Correlation is significant at the 0.05 level (2-tailed).*
***. Correlation is significant at the 0.01 level (2-tailed).*

(iii) Which technique appears to give a more comprehensive perspective?

Each of the three approaches, which are known as the e-Government Maturity Models, the Technology Acceptance Model, and Evaluation against a Universal Set of Standards, offers a distinct insight into the portals that are analyzed. However, each of them has limitations that prevent them from delivering a comprehensive assessment of the e-Government quality.

E-Government Maturity Models are used to evaluate the features and functionalities of websites. This provides professionals and academics with the opportunity to gain insight into the best practices that contribute to the usefulness and usability of a website. However, there are two fundamental limitations. According to the findings of the previous analysis, the development of e-Government is not a linear process. Furthermore, the previous study showed that portals may integrate features from higher ranks without also incorporating aspects from lower tiers. This issue leads to the second limitation, which is the fact that every website and e-Government portal is developed to meet different, unique business objectives and user needs. As a result, features that are deemed "best practices" may not be appropriate for specific portals and websites.

Technology Acceptance Model (TAM) or other models that incorporate user viewpoint are intended to assess citizen satisfaction and intent to use e-Government portals or websites. Such an assessment is important for gaining a comprehensive understanding of what matters most to visitors and why they intend to use or not use a certain website. In the performed analysis, it was determined that most portals had satisfactory usability, with the primary issue being that they were neither useful nor attractive. Even though e-Government portals have included features and functionalities that make the website user-friendly and in line with the e-Government Maturity Model, they have not considered the demands of the users. Comparing these results to those of the e-

Government Maturity Model suggests that the maturity models are ineffective and are unable to capture quality from the demand side, which is essential in the services industry. However, TAM has demonstrated a limited capacity for identifying the most problematic areas for consumers and recommending appropriate measures. Given that the concerns identified in the research were a lack of attractiveness and usefulness, experts should make corrections. However, it is unclear in what direction, as the broad and generic character of the survey did not provide explicit standards on what customers view as attractive or useful. In addition, even if such questions were posed and their attractiveness and usefulness were specified, the conclusions could not be extrapolated to construct a universal model. Lastly, the personal bias of the respondents who self-reported their perceived quality contributes to the data's low generalizability and reliability.

The evaluation of e-Government against a Universal Set of Standards through automated tools is a common practice in the industry of digital marketing and web development in order to determine the objective quality of a portal or website. Using automated technologies like Lighthouse provides a simple and rapid method for objectively evaluating the technical quality of a website, as well as a course of action for fixing issues that reduce the quality score. Issues such as accessibility, which is essential for certain types of visitors, Search Engine Optimization, which increases awareness; and Best Practices, which evaluate the technological security of the website, are effectively evaluated. Nevertheless, according to Table 3.4.2, none of these measures corresponds with the behavioral intention of the users and, by extension, the perception of quality. "Performance" is the single dimension intended to quantify, from a technical standpoint, usability, usefulness, and attractiveness. The fact that these aspects are combined into one, however, renders "Performance" inadequate, as neither the issue nor what constitutes a good score can be identified. The general and technical nature of the Lighthouse report is evident in Table 3.4.1, since the portal supposed to be of high quality, obtained only a medium score for participant intent to use. There is great potential for automated technologies to contribute to the development of a standardized e-Government quality measurement framework. Despite this, the findings of the study indicate that it is currently unable to produce meaningful data about user satisfaction and intention to use.

Overall, it can be stated that e-Government quality evaluation methods from the demand side are the most reliable way to evaluate the desire to use e-Government portals and the corresponding quality perceptions. The demand side methods can be helpful in identifying broad areas for improvement. If the identified challenges come from the portal's poor usability, e-Government Maturity Models can be a suitable tool for assessing which features and capabilities are presently being utilized and which ones could be added to improve the portal's overall usability. However, since they are based on the self-reported perceptions of specific respondents for a particular e-Government portal, these results cannot be generalized. It appears that automated tools are the optimum approach to build a consistent and constantly updated framework for e-Government quality. However, the findings of the research indicate that these tools are currently insufficient to capture the perceived quality. It may be feasible to establish a comprehensive, effective, and standardized e-Government model using web-based automated technology equipped with machine learning capabilities. Nonetheless, multidisciplinary research and collaboration are necessary.

# 4 Assessment of e-Government Services per Domain of Responsibility

## 4.1 Introduction

Literature review on smart cities often treats e-Government as a distinct subject, primarily focusing on sustainability and resource reusability rather than service provision to citizens. This distinction is limits the understanding of the full potential of smart city initiatives in improving the quality of life for citizens, as e-Government plays a crucial role in delivering smart city benefits to citizens through enhanced access to information and services. Recent years have seen a growing trend in the adoption of smart cities via e-Government portals, with numerous cities worldwide leveraging these platforms to improve citizens' quality of life, optimize government operations, and promote sustainability.

The concept of smart city development is emerging as a significant reaction to the rising urbanization, and socioeconomic issues cities experience worldwide (Israilidis, Odusanya, & Mazhar, 2021; Morris, 2017; Chong, Habib, Evangelopoulos, & Park, 2018). Municipalities constantly seek to attract resources and improve the quality of life for their residents (Jung, Lee, Yap, & Ineson, 2014; Belanche, Casalo, & Orus, 2016). Smart cities emphasize the intensive use of innovative information technology as a crucial component of local government development and urban revitalization (King & Coterill, 2007). Municipalities personalize and increase the efficiency of their local services, offer citizens choices and extensive urban information, and allow citizen–infrastructure interactions, among other approaches, to move urban administration toward a citizen orientation (King & Coterill, 2007). These initiatives aim to fulfil the present expectations and needs of citizens, fostering a real and dynamic relationship between citizens, municipal services, and infrastructure. Prior research demonstrates that the success of these programs is highly dependent on attaining a critical volume of regular users in order to ensure the medium-term efficiency and sustainability of local services(Neirotti, De Marco, Cagliano, Mangano, & Scorrano, 2014). Despite the

considerable work and expense put into updating municipal services, there are occasions when these projects fail as citizens do not consume them frequently (Belanche, Casalo, & Orus, 2016; Mulley & Moutou, 2015).

In recent years, the adoption of smart cities via e-Government portals has been a developing trend, with many cities worldwide utilizing these portals to enhance the quality of life for citizens, improve government operations, and promote sustainability. Several cities have successfully adopted smart city programs using e-Government websites. Singapore, for instance, has established a variety of e-Government platforms, such as "MyHEALTH" and "OneService," which provide residents with access to a vast array of government services and information. These portals have improved the delivery of public services and increased citizen involvement and participation in government with great success (Chen, Liu, & Wang, 2018).

Another example is Amsterdam, which has built a "Smart City Platform" that uses data and analytics to improve city operations in sectors such as transportation, electricity, and waste management. This platform has successfully reduced transportation congestion, improved energy efficiency, and enhanced trash management (Liu, Li, & Chen, 2020). The "Smart City Dashboard" has been introduced in Toronto, Canada, to improve city operations and increase community involvement. The dashboard leverages data and analytics to improve city operations in sectors like transportation, electricity, and waste management by informing decision-making. Additionally, it enables individuals to obtain information and offer feedback on municipal services (Chen, Liu, & Wang, 2018).

In Madrid, Spain, the "Digital City Hall" has been implemented, to enhance the coordination of government services and make them more accessible to citizens by leveraging digital technologies. This platform has been effective in enhancing public involvement and participation in government by providing citizens with access to a variety of government services and information, including transportation, housing, and education (Liu, Li, & Chen, 2020). The "One Stop Site" in Dubai is an e-Government portal that provides access to more than 3,000 government services on a single platform, hence increasing the coordination of government activities. In addition, Dubai has created a "Smart Dubai Platform" that utilizes data and analytics to improve municipal operations

in sectors such as transportation, electricity, and waste management and to increase public involvement and participation in government(Chen, Liu, & Wang, 2018).

Nevertheless, the Smart Cities literature review focuses mainly on the application of technology and Artificial Intelligence to tackle problems related to transportation, utilities, and building. In local e-Government studies, little focus has been made on how it may solve citizens' problems. Due to this gap in the literature and the findings of Chapter 3 that citizens do not use municipalities' e-Government portals because of their limited usefulness, the purpose of this research is to examine (i) What information and services are offered by the 50 municipalities, (ii) Which factors - population, budget per citizen, ruling party’s ideology and mayor’s gender - affect the digital services provided via e-Government portals and (iii) What services want the citizens to be provided through the e-Government portals.

The study suggests that through e-Government portals, the implementation of Smart Cities can be viable as citizens will be able to assess important information about the smart services and use them through the portals. Furthermore, the research method employed defines what e-services and information are essential to the users and should be included in the e-Government portals of municipalities and allow the institutions to access the smart services that are considered useful by the citizens. The study following the approach of Kumar, Singh, Gupta, & Madaan (2020), who proposed a Smart City Transformation Framework (SCTF) to show the complex process of smart city design, utilizes the Mind map representation of crowdsourced ideas layout to interlink the desired by the citizens' e-Government portal structure into a visualized format. In the section that follows, the "Literature Review" on the concept of Smart Cities is presented, including a definition, the components that make a city smart, the benefits and objectives of a smart city, and the existing typology approaches and how they respond to user mental models in the e-Government portals. In the "Methodology" section, the methods utilized to investigate the study issues are outlined. The "Findings" part is divided into three sub-sections presenting the study subject's findings. The "Discussion" attempts to respond to each question. The final part, "Conclusion," discusses future research prospects, summarizes the study's important results, and recognizes the limits of the work.

## 4.2 Literature Review

The concept of smart city has garnered significant attention from both academics and practitioners in recent years. However, the definition of a smart city remains unclear (Caragliu, Del Bo, & Nijkamp, 2011). There have been several descriptions of what constitutes a smart city (Israilidis, Odusanya, & Mazhar, 2021), with Hollands (2008) collecting several examples and concluding that a smart city maximizes the utilization of networked infrastructure to improve economic and political efficiency and enables social, cultural, and urban development.

Caragliu et al. (2011) expanded upon this definition, stating that a city is considered smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure are used to enhance sustainable economic growth and high quality of life. This is achieved through intelligent management of natural resources and participatory governance. In addition, for a city to be considered smart, it must develop and manage various innovative services that provide information to all citizens about all aspects of city life via interactive and internet-based applications (Kuk & Janssen, 2011; Lee & Lee, 2014). The European Commission also defines a smart city as a place where traditional networks and services are made more efficient through digital and telecommunication technologies for the benefit of its inhabitants and businesses (European Commission, 2010). Ismagilova et al. (2019) propose that smart cities use an IS-centric approach that enables the intelligent use of ICT within an interactive infrastructure to provide advanced and innovative services to its citizens, impacting the quality of life and sustainable management of natural resources.

The components that make a city "smart" include the use of technology to improve the efficiency and effectiveness of city services, such as traffic management, energy usage, and waste management (Bhatia, 2016; Krogulecki, 2016), the use of data and analytics to inform decision-making and improve city operations (Santos, 2015), the use of citizen engagement platforms to involve citizens in the decision-making process for city initiatives (Krogulecki, 2016) the integration of sustainable practices to reduce the environmental impact of the city (Santos, 2015) and the use of internet-connected devices to improve the quality of life for citizens, such as providing access to information and

services (Bhatia, 2016). Prior literature also has established that the efficiency of urban services delivery improves when local governments have a better understanding and knowledge of the citizens' preferences and needs (Cuadrado-Ballesteros, García-Sánchez, & Prado-Lorenzo, 2013).

Smart cities encompass services in the domains of infrastructures, transport, mobility, and natural resources, as well as culture, social inclusion, economy, and welfare (Neirotti, De Marco, Cagliano, Mangano, & Scorrano, 2014). As a primary geographical role for integrating and linking city people and areas, local governments are responsible for ensuring that local services and facilities (such as libraries, sport and leisure centers, and community centers) are easily accessible (Dempsey, Bramley, Power, & Brown, 2011). Moreover, a well-structured, efficient network of services serves a larger number of residents, especially vulnerable groups like the elderly, who may rely heavily on these services (Webb, Netuveli, & Milett, 2012). Consequently, cities that provide superior services in terms of public access and mobility attain higher geographical and social equity (Chang & Liao, 2011; Belanche, Casalo, & Orus, 2016). The increased usage of urban services also promotes sustainability regarding urban management's social, environmental, and economic aspects (Neirotti, De Marco, Cagliano, Mangano, & Scorrano, 2014). Furthermore, by enhancing their infrastructures and information-based services, smart cities area able to provide businesses with opportunities (Dempsey, Bramley, Power, & Brown, 2011; King & Coterill, 2007). Finally, more frequent use of urban services correlates strongly with good service performance, greater satisfaction with urban management, and a higher quality of life in the city (Belanche, Casalo, & Orus, 2016; Zenker & Rütter, 2014)

Overall, the primary objective of the development of smart cities is to improve the quality of life of citizens (Neirotti, De Marco, Cagliano, Mangano, & Scorrano, 2014), as well as environmental efficiency, safety and sustainability (Bulu, 2014; Niaros, Kostakis, & Drechsler, 2017) with centrally controlled and monitored technological infrastructures (Kumar, Singh, Gupta, & Madaan, 2020). According to Cuadrado-Ballesteros, Garcia-Sánchez, and Prado-Lorenzo (2013), implementing dynamic smart cities through e-Government portals can reduce the number of bureaucratic processes that need to be

completed, provide services more quickly, understand the demands of citizens, and lead to greater satisfaction of the users. The greater use of urban services by citizens is also linked to improved levels of satisfaction and performance, establishing a direct connection to loyalty (King & Coterill, 2007). Therefore, the effectiveness of the provision of urban services is dependent not only on coordination across the activities of local government but also on the consumption levels of people (Mulley & Moutou, 2015; King & Coterill, 2007; Belanche, Casalo, & Orus, 2016).

*Classification of Municipal Services*

Traditionally, municipal services are categorized according to administrative functions, including transportation, urban planning, and social welfare (Lee & Lee, 2014). This typology is created as a functional decomposition structure for administrative convenience by compiling functionally similar services. Lee & Lee (2014) conducted a literature review and identified various traditional typologies of smart cities that maintain their bureaucratic perspectives following the administrative classification of functions. In the same study, they examined contemporary typologies that deviate somewhat from the functional criteria of government and appear to be somewhat different from traditional ones. However, these new typologies still maintain providers' perspective. In this context, these typologies do not give an informative description of smart city services based on service features or user perspectives (Lee, Kim, & Lee, 2012; Lee & Lee, 2014). A popular typology is that of Giffinger et al. (2010), who suggested that smart cities are based on Smart Economy, Smart Governance, Smart Living, Smart Citizens, Smart Environment, and Intelligent Mobility. Michel (2005) suggested that smart cities consist of e-Administration, e-Government and e-Governance. Kuk & Janssen (2011) adapted an e-business model framework including eight categories – Content provider, Direct-to-Customer, Value-net-integrator, Full-Service Provider, Infra-Service Provider, Market, Collaboration and Virtual Communities -. A significant issue noted with the analyzed typologies is that they lack a citizen's perspective and do not represent the real qualities of services. Bellini, Nesi and Pantaleo (2022) reviewed the leading smart city concepts and frameworks, resulting in a typology with eight domains: "Smart Governance," "Smart Living & Infrastructure," "Smart Mobility and Transportation," "Smart Industry

& Production," "Smart Energy," and "Smart Healthcare." The problem with this proposed typology is that it adheres to conventional concepts and reflects supply rather than demand (Bellini, Nesi, & Pantaleo, 2022; Lee & Lee, 2014). As a typology is a categorization scheme that unites items with similar features into a finite set of categories, it plays a crucial role in understanding the nature of current services and strategically designing new ones (Linders, 2012; Lee & Lee, 2014).

The absence of a demand-side typology is due to the fact that a major way that cities utilize to construct smart cities is technology push (Angelidou, 2015), also known as the techno-driven method (TDM) (Kummitha & Crutzen, 2017). The techno-driven method asserts that technologies are typically pushed in potential smart cities by external stakeholders, typically technological service providers or corporate organizations, through lobbying with local government officials and policymakers (Kummitha, 2018). Thus, the typologies and e-Government websites are established based on the existing services.

Another approach is that of demand-pull (Angelidou, 2015) or the human-driven method (HDM), which requires the active engagement of residents in order to discover and build technologies based on local requirements (Kummitha, 2018). According to Lee and Lee (2014), for urban planners and administrators to create and implement smart services, they must solicit the opinions and needs of citizens to determine local priorities and needs. Through crowdsourcing suggestions, Kumar et al. (2020) established a typology and Smart City Transformation Framework using this method. They presented a mind map comprising five main concepts that presented similar ideas expressed by 23 experts from various fields: "Economic Infrastructure & Business Activities", "Environmental Protection & City Cleanliness", "Smart Services", Government Planning & Policy Design", and "ICT infrastructure" (Kumar, Singh, Gupta, & Madaan, 2020). The suggested framework included smart education, smart economic process, disaster alerts & emergency responses, smart tourism, smart cleanliness, smart utility, online civic amenities, smart transport system, public safety & crime control, and smart healthcare (Kumar, Singh, Gupta, & Madaan, 2020).

Even though Kumar et al. (2020) implement a human-driven method, such as crowdsourcing, to develop a typology of smart cities, they have not incorporated the citizens as participants in order to investigate the demand side. Therefore, the suggested typology fails to capture the mental models of users and cannot be adequately integrated into an e-Government portal that users find useful. A mental model is a simplification of reality that people employ to comprehend and navigate their surroundings (Gentner, 1983). It is a cognitive framework that organizes and analyzes information, enabling humans to comprehend new data and predict future occurrences (Reed, 1996). Mental models are created by experiences, education, and information exposure, and they are continuously updated and altered as new knowledge is obtained(Klein, 1999). In terms of websites and e-Government portals, a mental model is a user's mental representation of the website and its content, including the organization, labels, and connections between the various pages and information (Nielsen & Molich, 1990).

User mental models are critical in the effectiveness of websites and applications' Information Architecture (IA). According to Nielson and Molich (1990), users have a more difficult time accessing the information on websites that does not fit with their mental models, and they are more likely to quit a website if they are unable to locate the desired information. Similarly, Spool et al. (1997) suggested that users are more satisfied with a website if its Information Architecture matches their mental models.

Utilizing precise and consistent labelling and organizing is one technique to connect website and application Information Architecture with user mental models. According to Koyani and Allison (2003), users are more likely to locate content on a website when the labelling and arrangement are identical across all pages and sections. This shows that utilizing consistent labelling and organizing can help users build a clear mental image of a website and its content, making it easier to navigate and locate the information they want.

In terms of e-Government, Kim et al. (2012) suggest that e-Government portals with a clear and consistent Information Architecture that matches the users' mental models can increase user satisfaction. The study surveyed users of a government e-portal and showed that those having a clear mental image of the site's structure and organization were more

satisfied with the portal. His result is consistent with the findings of Wank, Liu, and Chen (2020), who observed that user-friendly navigation could increase the alignment of users' mental models with e-Government portals. In addition, Al-Naser and Al-Dabbagh (2016) reported that implementing user-centered design in e-Government portals can increase the perceived value of online services. Specifically, their research showed that users with a user-centered experience, such as user testing and feedback, were more inclined to utilize online services and deemed them more helpful.

Overall, the typologies produced throughout the years are oriented on the supply side and adhere to a bureaucratic strategy based on municipal responsibilities. The absence of incorporating the users' mental models in the creation of smart services has constrained the adoption of them by the population. Given that Smart Cities incorporate the idea of municipality e-Government, the typologies need to serve this goal as well; hence a clear information architecture with labelling based on users' mental models is regarded as crucial.

Costopoulou et al. (2017) developed a typology based on citizens' perspective by deploying an e-participation survey with 212 participants from Greek municipalities as a sample. They suggested that the focus of the digital transformation of municipalities should be on providing services in response to cultural events, and municipal news, communicating with other citizens, expressing opinions, voting, submitting complaints, communicating with the mayor, and being informed of City Council decisions. In order to generate meaningful e-services for people, they advised that Greek municipalities establish a clear digital strategy for delivering high-maturity e-participation based on the Citizen Web Empowerment Index (CWEI). CWEI proposes that e-services should focus on four dimensions (Costopoulou, Ntalianis, Ntaliani, Karetsos, & Gkoutzioupa, 2017; Buccoliero & Bellio, 2016):

- E-information on the municipal e-Government portal, including basic information about the city and its policies.
- Web 2.0 tools and services, including social networking tools, Web TV, and the open government data policy.

- E-consultation that describes a variety of aspects associated with the method of receiving information via the municipal portal, such as online polls and surveys, online complaints, and online communication between the Mayo and citizens
- E-decision-making process, which evaluates evidence that municipal decision-making procedures take into account the opinions of residents.

Specifically, in Greece, Costopoulou et al. (2017) found that particular emphasis should be paid to integrating social media tools and mobile services into their portals for local public affairs, as well as giving proof of citizen consideration in the "e-decision making process." The problem with the typology provided by Costopoulou et al. (2017) is that it focuses solely on e-participation and ignores other aspects of Smart Cities development.

## 4.3 Methodology

To address the first research question, “What information and services do the 50 municipalities provide?” a content analysis of the websites was conducted (Bengtsson, 2016). The information and services offered by the municipal e-Government portal were categorized using the domains of responsibilities as a traditional typology approach (Lee & Lee, 2014). The categories determined were as follows (Hellenic Republic, 2011):

1. Transportation and Infrastructure, including digital services related to available parking spots, public transportation, etc.
2. Environmental Policy and Urban Planning refer to interactive information about urban planning, recycling, animal protection, etc.
3. Economic Development and Employment refer to the online unemployment actions and the available electronic business interactions.
4. Social Policy and Provision of public health include every aspect of social policy and protection (e-lawyer, e-doctor, municipality issues reporting, etc.)
5. Education, Culture, and Sport are about the website's capabilities to offer online registration to events, educational and sports programs.
6. Administrative Responsibilities are all the bureaucratic interactions of citizens with the municipalities (application for certifications, inquiries, transactions, etc.)

To determine the frequency with which services and information related to these categories appeared on each portal, a weight of 1 was assigned if the website offered digital services connected to the specified domain of responsibility and a weight of 0 if it did not.

For the second question, “Which factors - population, budget per citizen, ruling party’s ideology and mayor’s gender - affect the digital services provided via e-Government portals”, a correlation matrix and binomial regression was performed for each of the domains of responsibility to determine whether the predictors Population, Political Ideology (Social Democrat, Conservative-Liberal, No connection to political ideology), Budget, and Gender have an impact on the digital services provided by municipalities for the various domains of responsibility.

Crowdsourcing was used to analyze the third question, "What services do citizens desire to be given through e-Government portals?" Crowdsourcing is a process used to generate ideas for the creation of a new product (Hossain & Kauranen, 2015; Schweitzer, Buchinger, Gassmann, & Obrist, 2012). Poetz and Schreier (2012) showed that crowds could outperform professionals on several stages of new product conceptual design. The crowdsourcing of ideas was conducted by distributing a survey with five open-ended questions, using the traditional typology, and asking citizens what services they would like to receive through municipal e-Government portals in terms of Education, Culture, and Sport, Environment, Transportation and Urban Planning, Economic Development and Employment, Social Policy and Provision, and Transactions with the City's Administration. Crowdsourcing occurred in the fourth portion of the Facebook-distributed questionnaire to evaluate the quality of local e-Government portals based on users' perceptions (Section 3.2). Consequently, the same limitations and sample methods are utilized.

The questionnaire was constructed in the Greek language on Google forms and disseminated through Facebook ads utilizing the virtual snowball sampling method (Baltar & Brunet, 2012; Kühne & Zindel, 2020). The advertisement campaign ran for three months (13 April 2022 –13 July 2022), targeting over 18 years old citizens of the 50 municipalities examined. The total spent was 120.17 euros, the total reach was 41.803,

and the total clicks on the advertisement was 1.817. With the exclusion of incomplete questionnaires, there were 707 usable responses from 49 of the municipalities targeted. No incentives were used to stimulate participation for the voluntary survey artificially.

Of all participants, 327 were male (46.3%), and 380 were female (53.7%). 11.6% of individuals had income levels below € 500, 24.9% had income levels between €501-1,000, 36.1% had income levels between €1,001-1,500, 14.9% had income levels between €1,501-2,000, 10.3% had income levels between €2,001-6,000, and 2.5% had income levels above €6,000. 2.4% of participants were elementary or lower secondary school graduates, 27.8% were upper secondary school or post-secondary non-tertiary education graduates, 35.1% were university graduates, 29.4% held a master's degree, and 5.1% held a PhD (Table 4.3.1). Daily internet usage of the respondents varied, with 47.7% reporting between one to three hours of use, 34.4% reporting more than four hours of use, and 7.9% reporting none to less than 1 hour. 24.9% of the respondents reported that they did not own a Laptop or a Desktop, while 12.0% reported that they did not own a Smartphone (Table 4.3.1).

*Table 4.3.1 Demographic Composition of the Sample*

| **N=707** | **Categories** | **Frequency** | **Percent** |
|---|---|---|---|
| Gender | Male | 327 | 46.3% |
| | Female | 380 | 53.7% |
| Age | 18-24 | 28 | 4.0% |
| | 25-34 | 52 | 7.4% |
| | 35-44 | 128 | 18.1% |
| | 45-54 | 210 | 29.7% |
| | 55-64 | 222 | 31.4% |
| | 65-74 | 57 | 8.1% |
| | 75+ | 10 | 1.4% |
| Education | Dropped out Primary | 1 | 0.1% |
| | Primary | 5 | 0.7% |
| | Lower Secondary | 12 | 1.7% |
| | Upper Secondary | 97 | 13.7% |
| | Tertiary no University degree | 100 | 14.1% |
| | University Degree (Bachelor) | 248 | 35.1% |
| | Master | 208 | 29.4% |
| | PhD | 36 | 5.1% |
| Economic Activity | Domestic Tasks | 17 | 2.4% |
| | Student | 23 | 3.3% |
| | Unemployed | 54 | 7.6% |
| | Retired | 129 | 18.2% |
| | Self-Employed | 87 | 12.3% |
| | Private employee | 164 | 23.2% |
| | Public Servant | 233 | 33.0% |

| | | | |
|---|---|---|---|
| Salary | up to 500 | 82 | 11.6% |
| | 501-1000 | 176 | 24.9% |
| | 1001-1500 | 255 | 36.1% |
| | 1500-2000 | 105 | 14.9% |
| | 2001-6000 | 73 | 10.3% |
| | 6000+ | 16 | 2.3% |
| Internet time spent | less than 1 hour | 56 | 7.9% |
| | 1-3 hours | 337 | 47.7% |
| | 4-6 hours | 205 | 29.0% |
| | More than 6 hours | 109 | 15.4% |
| Desktop /Laptop | No | 176 | 24.9% |
| | Yes | 531 | 75.1% |
| Smartphone | No | 85 | 12.0% |
| | Yes | 622 | 88.0% |

To analyze the responses, qualitative content analysis was utilized. Initially, the replies were classified using the traditional typology and municipal domains of responsibility. The responses were later recoded based on similarities across the various categories to establish a new typology. Cho & Lee (2014) have previously proposed the employed content analysis approach. The new typology was then used to generate a Site Map using Miro Software. A site map is a diagram depicting the organization of a website (Newman & Landay, 2000). It reflects the information architecture and the navigation structure of the site as it is being constructed. Typically, site maps are comprised of labelled blocks and lines, as well as extra elements to identify specific types of groups. The blocks represent individual pages and include basic summaries of the page's content. The lines and arrows denote page navigational pathways (Newman & Landay, 2000).

## 4.4 Findings

### 4.4.1 Current Services in Municipal e-Government Portals using Traditional Typology

The author examined what domains of responsibility the services provided by e-Government portals are focused on. The whole service provision via digital means is relatively low, as predicted by the previous stage of the analysis (Table 4.4.1). According to the data, most e-Government portals (78%) provide some services for the Social Policy & Public Health domain and the Administrative Responsibilities domain (70%). However, for the other three domains of responsibility, less than 30% of municipalities

provide digital services. Overall, the municipalities score poorly in the other four categories (lower than 22%).

*Table 4.4.1 Frequency, Percent numbers of Services that appear in e-Government portals based on 50 municipalities*

| | | Total N | N % |
|---|---|---|---|
| Transportation and Infrastructure | No | 44 | 88.0% |
| | Yes | 6 | 12.0% |
| Environmental Policy and Urban Planning | No | 41 | 82.0% |
| | Yes | 9 | 18.0% |
| Economic Development and Employment | No | 39 | 78.0% |
| | Yes | 11 | 22.0% |
| Social Policy and Provision of public health | No | 11 | 22.0% |
| | Yes | 39 | 78.0% |
| Education, Culture and Sport | No | 45 | 90.0% |
| | Yes | 5 | 10.0% |
| Administrative Responsibilities | No | 15 | 30.0% |
| | Yes | 35 | 70.0% |

### 4.4.2 Factors influencing the choice of services displayed in municipalities' e-Government Portals

The correlations between the variables proposed are listed in Table 4.4.2. The Population variable shows significant correlations with outcome variables, Transportation & Infrastructure (.482, $p < 0.01$), Environmental Policy & Urban Planning (.350, $p < 0.05$), Education, Culture & Sports (.299, $p < 0.05$)

*Table 4.4.2 Correlation Matrix of Services appeared in e-Government portals & Population, Political Ideology, Budget & Mayors Gender*

| | Transportation & Infrastructure | Environmental & Urban Planning | Economic Development & Employment | Social Policy & Public Health | Administrative Responsibilities | Education, Culture & Sport | Population | Political Ideology | Gender | Budget |
|---|---|---|---|---|---|---|---|---|---|---|
| Transportation & Infrastructure | 1 | | | | | | | | | |
| Environmental & Urban Planning | .147 | 1 | | | | | | | | |
| Economic Development & Employment | .250 | .631 | 1 | | | | | | | |
| Social Policy & Public Health | .196 | .123 | .049 | 1 | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Administrative Responsibilities | .107 | .193 | .242 | .074 | 1 | | | | | |
| Education, Culture & Sport | .082 | .191 | .145 | .177 | .218 | 1 | | | | |
| Population | .482** | .350* | .310* | .110 | .088 | .299* | 1 | | | |
| Political Ideology | -.272 | -.087 | -.152 | -.122 | -.228 | -.104 | -.017 | 1 | | |
| Gender | -.109 | -.138 | -.157 | .157 | -.129 | -.098 | -.074 | -.217 | 1 | |
| Budget | .258 | .004 | -.070 | .101 | -.077 | -.121 | .220 | .210 | -.125 | 1 |

*Transportation & Infrastructure*

The impacts of population, ruling party political ideology, mayor's gender, and budget per inhabitant on the delivery of Transportation and Infrastructure services via their e-Government Portal were investigated using binomial logistic regression. The Box-Tidwell (1962) procedure was used to determine the linearity of the continuous variables with respect to the logit of the dependent variable. The logit of the dependent variable was found to have a linear relationship with all continuous predictive variables. The study retained two standardized residuals with values of 3.145 standard deviations and 4.238 standard deviations, respectively. The logistic regression model was statistically significant, $\chi^2(5) = 16.055$, $p < .05$. The model correctly classified 94.0% of cases and explained 52.8% of the variation in Transportation & Infrastructure (Nagelkerke $R^2$). Sensitivity was 50.0%, specificity was 100%, positive predictive value was 100%, and negative predictive value was 93.6%. There were no statistically significant predictive variables among the seven examined (as shown in Table 4.4.3).

*Table 4.4.3 Logistic Regression Predicting Likelihood of Transportation & e-Government Services via e-Government based on Population, Political Ideology, Budget, and Gender*

| | *B* | SE | Wald | *df* | *p* | Odds Ratio | 95% CI for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Population | .000 | .000 | .435 | 1 | .510 | 1.000 | 1.000 | 1.000 |
| Social Democrat | | | 1.364 | 2 | .506 | | | |
| Conservative-Liberal | -1.768 | 1.514 | 1.364 | 1 | .243 | .171 | .009 | 3.318 |
| No Connection to Political Ideology | -21.065 | 10765.902 | .000 | 1 | .998 | .000 | .000 | . |
| Budget | .003 | .002 | 2.091 | 1 | .148 | 1.003 | .999 | 1.007 |
| Gender | -18.956 | 20049.484 | .000 | 1 | .999 | .000 | .000 | . |
| Constant | -4.643 | 2.196 | 4.468 | 1 | .035 | .010 | | |

*Notes: Gender is for Females compared to Males*

*Environment & Urban Planning*

Binomial logistic regression was performed to ascertain the effects of Population, Political ideology of the ruling part, Mayor's Gender and Budget per inhabitant on the provision of Environmental & Urban Planning services via their e-Government Portal. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. All continuous predictive variables were found to be linearly related to the logit of the dependent variable. There were two standardized residuals with a value of 3.145 standard deviations and 4.238, respectively, which were kept in the analysis. The logistic regression model was statistically significant at 90%CI, $\chi^2(5) = 10.457$, $p = .063$. The model explained 30.9% (Nagelkerke $R^2$) of the variance in Environmental Policy and Urban Planning and correctly classified 86.0% of cases. Sensitivity was 22.0%, specificity was 100%, positive predictive value was 100%, and negative predictive value was 85.4%. Of the seven predictor variables only, Population was statistically significant at 90%CI (as shown in Table 4.4.4). Increasing Population was associated with an increased likelihood of providing Environmental & Urban Planning Services through e-Government.

*Table 4.4.4 Logistic Regression Predicting Likelihood of Environmental & Urban Planning Services via e-Government based on Population, Political Ideology, Budget, and Gender*

| | *B* | SE | Wald | *df* | *p* | Odds Ratio | 95% CI for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Population | .000 | .000 | 3.280 | 1 | .070 | 1.000 | 1.000 | 1.000 |
| Social Democrat | | | 3.392 | 2 | .183 | | | |
| Conservative-Liberal | .700 | .967 | .524 | 1 | .469 | 2.014 | .302 | 13.412 |
| No Connection to Political Ideology | -1.411 | 1.120 | 1.586 | 1 | .208 | .244 | .027 | 2.193 |
| Budget | .000 | .001 | .016 | 1 | .899 | 1.000 | .997 | 1.003 |
| Gender | -19.759 | 19093.351 | .000 | 1 | .999 | .000 | .000 | . |
| Constant | -1.896 | 1.508 | 1.582 | 1 | .209 | .150 | | |

*Notes: Gender is for Females compared to Males*

*Economic Development & Employment*

Binomial logistic regression was performed to examine the impact of predictors - Population, Political ideology of the ruling part, Mayor's Gender and Budget per inhabitant - on the availability of Economic Development and Employment services through their e-Government Portal. The Box-Tidwell (1962) method was used to assess

the linearity of the constant variables with respect to the logit of the response variable. All continuous predictive variables were found to be linearly related to the logit of the dependent variable. There were two standardized residuals with a value of 3.070 standard deviations and 2.690, respectively, which were kept in the analysis. The logistic regression model was not statistically significant, $\chi^2(5) = 8.252$, $p = .143$. The model explained 23.4% (Nagelkerke $R^2$) of the variance in Economic Development and Employment and correctly classified 82.0% of cases. Sensitivity was 18.0%, specificity was 100%, positive predictive value was 100%, and negative predictive value was 81.3%. Of the seven predictor variables, none was statistically significant (as shown in Table 4.4.5).

*Table 4.4.5 Logistic Regression Predicting Likelihood of Economic Development & Employment Services via e-Government based on Population, Political Ideology, Budget, and Gender*

| | *B* | SE | Wald | *df* | *p* | Odds Ratio | 95% CI for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Population | .000 | .000 | 1.971 | 1 | .160 | 1.000 | 1.000 | 1.000 |
| Social Democrat | | | 1.101 | 2 | .577 | | | |
| Conservative-Liberal | 1.090 | 1.041 | 1.097 | 1 | .295 | 2.976 | .387 | 22.908 |
| No Connection to Political Ideology | .561 | .994 | .319 | 1 | .572 | 1.753 | .250 | 12.290 |
| Budget | -.001 | .001 | .811 | 1 | .368 | .999 | .996 | 1.001 |
| Gender | -20.243 | 19876.608 | .000 | 1 | .999 | .000 | .000 | . |
| Constant | -1.562 | 1.476 | 1.119 | 1 | .290 | .210 | | |

*Notes: Gender is for Females compared to Males*

*Social Policy & Public Health*

Binomial logistic regression was performed to examine the impact of predictors - Population, Political ideology of the ruling part, Mayor's Gender and Budget per inhabitant - on the delivery of services about Social Policy & Public Health via their e-Government Portal. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. All continuous predictors were found to be linearly related to the logit of the dependent variable. There were two standardized residuals with a value of 2.972 standard deviations and 2.807, respectively, which were kept in the analysis. The logistic regression model was not statistically significant, $\chi^2(5) = 5.761$, $p = .330$. The model explained 16.7% (Nagelkerke $R^2$) of the variance in Social Policy & Public Health and correctly classified

78.0% of cases. Sensitivity was 100.0%, specificity was 0%, positive predictive value was 78%, and negative predictive value was 0%. There were no statistically significant predictive variables among the seven examined (Table 4.4.6).

*Table 4.4.6 Logistic Regression Predicting Likelihood of Social Policy & Public Health Services via e-Government based on Population, Political Ideology, Budget, and Gender*

| | *B* | SE | Wald | *df* | *p* | Odds Ratio | 95% CI for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Population | .000 | .000 | .253 | 1 | .615 | 1.000 | 1.000 | 1.000 |
| Social Democrat | | | 1.745 | 2 | .418 | | | |
| Conservative-Liberal | 1.204 | 1.277 | .889 | 1 | .346 | 3.334 | .273 | 40.769 |
| No Connection to Political Ideology | -.384 | .831 | .214 | 1 | .644 | .681 | .134 | 3.471 |
| Budget | .001 | .001 | 1.089 | 1 | .297 | 1.001 | .999 | 1.004 |
| Gender | 19.904 | 19797.258 | .000 | 1 | .999 | 4407037 20.849 | .000 | . |
| Constant | -.496 | 1.519 | .106 | 1 | .744 | .609 | | |

*Notes: Gender is for Females compared to Males*

*Administrative Responsibilities*

Binomial logistic regression was performed to ascertain the effects of Population, Political ideology of the ruling part, Mayor's Gender and Budget per inhabitant on the provision of administrative services via their e-Government Portal. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. All continuous predictors were found to be linearly related to the logit of the dependent variable. There was one standardized residual with a value of -2.334 standard deviations, which was kept in the analysis. The logistic regression model was not statistically significant, $\chi^2(5) = 5.013, p = .414$. The model explained 14.2% (Nagelkerke $R^2$) of the variance in Administrative Responsibilities and correctly classified 63.8% of cases. Sensitivity was 81.3%, specificity was 26.7%, positive predictive value was 70.3%, and negative predictive value was 60%. Of the seven predictor variables, only the Political Ideology of the governing party was statistically significant at 90%CI (Table 4.4.7). Governing Parties with Conservative-Liberal political ideology have 6.541 times higher odds of providing Administrative services through e-Government portals.

*Table 4.4.7 Logistic Regression Predicting Likelihood of Administrative Services via e-Government based on Population, Political Ideology, Budget, and Gender*

| | *B* | S.E. | Wald | *df* | *p* | Odds Ratio | 95% CI for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Population | .000 | .000 | .121 | 1 | .728 | 1.000 | 1.000 | 1.000 |
| Social Democrat | | | 3.516 | 2 | .172 | | | |
| Conservative-Liberal | 1.878 | 1.074 | 3.060 | 1 | .080 | 6.541 | .798 | 53.639 |
| No Connection to Political Ideology | 1.093 | .803 | 1.852 | 1 | .174 | 2.982 | .618 | 14.381 |
| Budget | -.001 | .001 | .200 | 1 | .655 | .999 | .997 | 1.002 |
| Gender | -1.480 | 1.156 | 1.639 | 1 | .201 | .228 | .024 | 2.195 |
| Constant | .166 | 1.462 | .013 | 1 | .910 | 1.180 | | |

*Notes: Gender is for Females compared to Males*

*Education, Culture & Sport*

Binomial logistic regression was performed to ascertain the effects of Population, Political ideology of the ruling part, Mayor's Gender and Budget per inhabitant on the provision of services about Education, Culture & Sport via their e-Government Portal. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. All continuous predictive variables were found to be linearly related to the logit of the dependent variable. There were two standardized residuals with a value of 3.081 standard deviations and 4.987, respectively, which were kept in the analysis. The logistic regression model was not statistically significant, $\chi^2(5) = 5.903, p = .316$. The model explained 23.3% (Nagelkerke $R^2$) of the variance in Education, Culture & Sport and correctly classified 92.0% of cases. Sensitivity was 20.0%, specificity was 100%, positive predictive value was 100%, and negative predictive value was 91.8%. Of the seven predictor variables, only Population was statistically significant at 90%CI (Table 4.4.8). Increasing Population was associated with an increased likelihood of providing Education, Culture & Sport Services through e-Government.

*Table 4.4.8 Logistic Regression Predicting Likelihood of Education, Culture & Sport via e-Government based on Population, Political Ideology, Budget, and Gender*

| | *B* | SE | Wald | *df* | *p* | Odds Ratio | 95% CI for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Population | .000 | .000 | 3.375 | 1 | .066 | 1.000 | 1.000 | 1.000 |
| Social Democrat | | | .553 | 2 | .758 | | | |
| Conservative- | .868 | 1.363 | .406 | 1 | .524 | 2.383 | .165 | 34.452 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Liberal | | | | | | | | |
| No Connection to Political Ideology | .148 | 1.414 | .011 | 1 | .916 | 1.160 | .073 | 18.528 |
| Budget | -.002 | .002 | 1.462 | 1 | .227 | .998 | .994 | 1.001 |
| Gender | -19.277 | 19493.052 | .000 | 1 | .999 | .000 | .000 | . |
| Constant | -1.236 | 1.791 | .476 | 1 | .490 | .291 | | |

*Notes: Gender is for Females compared to Males*

### 4.4.3 Typology of services to be provided by the municipal e-Government portals based on citizens' view

*Traditional Typology*

The content analysis of the crowdsourced proposals from the participants indicated that the residents need access to 149 services and pieces of information through municipal e-Government portals. In addition to the information and services, the participants identified functionalities that would facilitate the supply of information/services. Within the domain of Transportation & Infrastructure, 12 services/information kinds were found. Most of them like to be educated via informative text and interactive maps (Table 4.4.9.) Providing information in the form of a calendar and submitting an application or request are two more popular features. Only two of the services covered in this category are deemed to need Push-up notifications and the ability to perform transactions. This category includes a wide range of services and information, such as providing updates on ongoing construction projects, submitting tenders, and reserving parking spaces (Table 4.4.9)

*Table 4.4.9 List of desired services in Transportation & Infrastructure*

| | | Information | Application | Transactions | Calendar | Push-up Notification | Interactive Map |
|---|---|---|---|---|---|---|---|
| **Transportation and Infrastructure** | Schedule of Construction | | | | X | | X |
| | Request for infrastructure repair and upgrade | | X | | | | |
| | Update on roads under construction | | | | X | X | X |
| | Update on planned interruption of electricity and water supply | | | | X | X | X |
| | Announcement of tenders of the municipality and submission of proposals | X | X | X | | | |
| | Information for contractors of municipal projects | X | | | | | |
| | Registration of Complaints regarding the conduct of projects | | X | | | | |
| | Maintenance of Municipal facilities | | | | X | | X |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Municipal parking lots | | | | | | X |
| | Urban and local transport schedule | X | | | | | X |
| | Parking space reservation and parking meter payment | | X | X | | | |
| | Environmental ways to access points of interest | X | | | | | X |

In terms of the environment and urban planning, 18 services are outlined. Because the majority of the services that are highlighted are informative, the functionalities that are most frequently mentioned are the interactive map and the informative text (Table 4.4.10). Another valuable feature is the opportunity to submit an application to participate in a given event or volunteer activity. In this domain, participant attention is concentrated on activities such as participation in events and volunteerism, as well as environmental preservation and sustainable living-related awareness issues. At last, the index and chat functions were observed.

*Table 4.4.10 Desired services in the category Environment & Urban Planning*

| | | Information | Application | Transactions | Calendar | Interactive Map | Index | Chat |
|---|---|---|---|---|---|---|---|---|
| **Environment & Urban Planning** | Information and participation in voluntary ecology and environmental protection actions | X | X | | X | X | | |
| | Environmental awareness and citizen education | X | | | | | | |
| | Waste Management and Recycling | X | | | | X | | |
| | Environmental indicators of the municipality | X | | | | | | |
| | Tree Cutting Application | X | X | | | | | |
| | Green spaces and municipal parks available | X | | | | X | | |
| | Redevelopment program announcement | X | | | | | | |
| | Information and application for participation in the Park Adoption Action | X | X | X | | | | |
| | Fire protection, tree-cutting plan | X | | | X | X | | |
| | Adoption of Strays | X | X | | | | | |
| | Participation in voluntary actions | X | X | | X | | | |
| | Animal Rescue Association | X | X | | | | | X |
| | Contact the municipal veterinary clinic | X | | | | X | X | X |
| | Infrastructure for disabled people | | | | | X | | |
| | Available municipal taps | | | | | X | | |
| | Municipal spaces with Wi-Fi | | | | | X | | |
| | Comparison of actions with the sustainable development plan | X | | | | | | |

Within the category of Economic Development and Employment, a total of 12 were found (Table 4.4.11). These services are also capable of being classified under the headings of "local entrepreneurship," "employment," and "public finances," respectively. Since the services are focused primarily on providing information, the most frequent functions are an informational text, an interactive map, and an index. Participants in the employment-related services would want to have the option to submit their applications for open positions or be redirected to the relevant job posting in order to finish their applications. Integration with other platforms is also a functionality related to local entrepreneurship, as participants would like to be able to find local companies in the portal and then move to the company's website. The functionality of the Newsletter is a new feature that has been added to this category.

*Table 4.4.11 Desired services in the category Economic Development & Employment*

| | | Information | Application | Transactions | Calendar | Interactive Map | Index | Newsletter | Integration with other platforms |
|---|---|---|---|---|---|---|---|---|---|
| **Economic Development & Employment** | Promotion of Local Businesses | X | | | | X | X | | X |
| | Highlighting jobs in local businesses | X | | | | | | | X |
| | Discounts and offers from local stores | X | | | | X | X | X | X |
| | Local store hours | X | | | | | | | |
| | Funding applications for institutions and NGOs | X | X | X | | | | | |
| | Information about the Farmers and Organic Markets | X | | | X | X | | | |
| | Announcement of open vacancies | X | | | | | | | X |
| | Registration in vocational training seminars of the municipality | X | X | X | X | | | | |
| | Information and application for citizen's card | X | X | X | | | | | |
| | Municipal financial statements | X | | | | | | | |
| | Municipal supply contracts | X | | | | | | | |
| | Update on municipal fees | X | X | | | | | | |

Nineteen different types of services are classified into groups of Social Policy and Public Health (Table 4.4.12). The services provided include informative aspects and applications for social welfare-related activities. The most crucial capabilities are informational content, registration forms, a calendar, and an interactive map. Transactions, push-up

notifications, chat, an index, a newsletter, and interaction with other platforms are some of the additional functions.

*Table 4.4.12 Desired services in the category Social Policy & Public Health*

| | | Information | Application | Transactions | Calendar | Push-up Notification | Interactive Map | Index | Chat | Newsletter | Integration with other platforms |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Social Policy & Public Health** | Municipal benefits to vulnerable social groups | X | X | X | | | | | X | | |
| | Accommodation structures for socially vulnerable groups | X | X | | | | | X | | | |
| | Publication of municipal social policy actions and program | X | | | X | | X | | | | |
| | Social welfare programs | X | X | | | | | | | | |
| | Posting allowances and benefits of other bodies | X | | | | | | | | | X |
| | Municipal Grocery Store | X | | | | | | | | | X |
| | Participation in social contribution programs | X | X | X | X | | | | | X | |
| | Informing Citizens of emergency assistance | X | X | X | | X | | | | | |
| | Psychosocial support structures | X | | | | | | | X | | |
| | Open Care Center for the Elderly | X | X | | X | | X | | | | |
| | Actions to inform and raise awareness on social issues | X | X | | X | | | | | | |
| | Services of the health center, municipal doctors | X | X | | X | X | X | X | | | |
| | Blood donation | X | X | | X | X | X | | | | |
| | Local Pharmacies on duty | X | | | X | | X | | | | |
| | Local health centers and hospitals on duty | X | | | X | | X | | | | |
| | Online contact with a Doctor | | | | | | | | X | | |
| | Social drugstore | X | | | | | | | | | |
| | Information and education in matters of public health and personal hygiene | X | | | | | | | | | |
| | Assistance at Home Program | X | X | | | | | | X | | |

The Administrative Responsibilities and Transactions with the City category includes 61 types of services (Table 4.4.13). The corresponding department was used to assign the coding for each of these subcategories of services. Each of the services that fall under this category is applicational and transactional in nature. However, some services are already provided by the national e-Government platform. The problem that has been brought up by the participants is that it is not always clear which service is provided by which

platform. As a result, it would be helpful if all of these services were listed in the municipal e-Government portal, and users would be redirected to the national portal for those services that are already available there.

*Table 4.4.13 Desired services in the category Administrative Responsibilities and Transactions with City*

| | | Application | Transactions | Integration with other platforms |
|---|---|---|---|---|
| **Civil Registry** | Certificate of marital status | | | X |
| | Certificate of citizenship | | | X |
| | Certificate of locality | X | X | |
| | Certificate of Next of kin | X | X | X |
| | Opening a family portion | X | X | |
| | Application for post-publication | X | X | |
| | certificate of permanent residence | X | X | |
| | Certificate of registration in male registers | X | X | X |
| **Register Office** | Birth certificate | X | X | X |
| | Marriage certificate | X | X | X |
| | Registry Deed of Cohabitation Agreement | | | X |
| | Declaration of naming act | X | X | |
| | Issuance of a license for the performance of a civil marriage | X | X | X |
| | Foreign marriage registration | X | X | |
| | Death Certificate | X | X | X |
| **Technical Office** | Request to create, and complete road reconstruction | X | X | |
| | Construction or reconstruction of a sidewalk by the Municipality | X | X | |
| | Construction or reconstruction of a sidewalk by Citizen | X | X | |
| | Permission to partially occupy the road surface | X | X | |
| | Altitude certificate | X | X | |
| | Excavation (cutting) permit | X | X | |
| | Drain application | X | X | |
| **Urban planning** | Application for street identification | X | X | |
| | Request for updates on the progress of urban planning procedures | X | X | |
| | Application for modification of the zoning plan | X | X | |
| | Application for acceptance/deletion/suspension of arbitrary fine | X | X | |
| | Application for Executives and Building Permit files | X | X | |
| | File a complaint | X | X | |
| | Small-Scale License Application | X | X | |
| | Certificate of Loss of Files | X | X | |
| | Electricity and Water Supply Certificate | X | X | |
| | Finding Building Permits | X | X | |
| | Grant of Land Use Certificate | X | X | |
| | Grant of Construction Terms | X | X | |
| | Issuance of Conservator's Certificate | X | X | |
| | Proof of Flood-proof Ownership | X | X | |

| | | | |
|---|---|---|---|
| **Municipal Fees - Income** | Issuance of Construction Inspection Certificate | X | X |
| | Statement of Outstanding Debts | X | X |
| | Debt Settlement Application | X | X |
| | Certificate of Municipal Awareness | X | X |
| | Real Estate Fee Certificate | X | X |
| | Declaration of Change of Ownership | X | X |
| | Payment of Fines for Violations of the C.O.K. | X | X |
| | Charge rate modification request | X | X |
| | Declaration of non-electrified property | X | X |
| | Application for exemption/reduction of municipal fees | X | X |
| | Application for supply/ reconnection of Electricity | X | X |
| | Payment of Real Estate Tax | X | X |
| **Municipal Cemetery** | Burial Application | X | X |
| | Application for Exhumation | X | X |
| | Osteopathy application | X | X |
| | Bone Transfer Application | X | X |
| | Responsible cemetery declaration | X | X |
| | Responsible declaration of the beneficiary of a grave of three years of use | X | X |
| | Application for the construction/repair of a grave | X | X |
| | Payment of Ossuary, Family Grave, Grave Extension | X | X |
| **Licensing of Commercial Actions** | License to establish and operate a shop | X | X |
| | Administrative fee payment | X | X |
| | License Amendment | X | X |
| **License to Use Public Space** | Application for granting a license to use a common area with table seats | X | X |
| | Application for the granting of additional square meters of table seating | X | X |

There are 19 different types of services that are covered under Education, Culture, and Sport (Table 4.4.14). The vast majority of services are of an applicational and transactional nature, whereas the required information may be provided in the form of a calendar, interactive map, or index. There are a variety of ways that information regarding the services can be presented, including multimedia presentations and concise summaries. Participation in sports, formal education, learning for life, learning about history and culture, and lifelong learning all fall under this category, which also includes a varied variety of services.

*Table 4.4.14 Desired services in the category Education, Culture & Sport*

| | | Information | Application | Transactions | Calendar | Push-up Notification | Interactive Map | Index |
|---|---|---|---|---|---|---|---|---|
| **Education, Culture &** | School Enrolment | | X | X | | | | |
| | School Information, Important dates | X | | | X | X | X | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sport** | and events | | | | | | | |
| | Day Centers for Disabled People | | X | X | | | | |
| | Library, online books & copy reservation | X | X | X | | | | X |
| | Enrolment in lifelong learning workshops and training programs | | X | X | X | | | |
| | Parent Guidance | | X | | X | | | |
| | Tutoring Programs | | X | X | | | | |
| | Schedule and Registration for Events | | X | X | X | | | X |
| | Presentation of Archaeological and cultural sites | X | | X | X | X | X | |
| | Programs of cultural seminars | | X | X | X | | | |
| | History of the Town | X | | | | | X | |
| | Conservatory | | X | | X | | X | |
| | Lease and Provision of event spaces | | X | X | X | | X | X |
| | Presentation and Registration to Cultural Associations | X | X | X | | | | |
| | Registration in Municipal Gym and Sports Clubs | | X | X | | | X | X |
| | Sports Activities Program and benefits of each sports Activity | X | | | | | | |
| | Information and Schedule of Local Games and Sports Clubs | | | | X | X | | X |
| | Municipality camps | | X | X | X | | | |
| | Lease and Provision of sports facilities | | X | X | X | | X | X |

In addition to the services already accounted for in the categories shown above, the participants suggested an additional eight services that do not fit into the above classification system (Table 4.4.15). E-democratic processes such as crowdsourcing ideas, electronic voting, and complaint forms are included in this category. Furthermore, the respondents requested that the municipal organizational chart and the people responsible for each municipal department be visible in the portal. They also demanded the ability to book appointments with authorities online and the functionality to track their request management. Moreover, they highlighted the provision of updates in response to extreme weather conditions as being of great importance. Finally, they communicated their desire to get a manual on how to make use of the services provided by the municipality as well as an index of the documents that were necessary for the processing of the case.

*Table 4.4.15 Desired services that do not fall under the aforementioned typology*

| Information | Application | Transactions | Calendar | Push-up Notification | Interactive Map | Index |
|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **e-Democracy** | Crowdsourcing Ideas Platform, e-Voting | | X | X | | | | |
| | Complaint form | | X | X | | | | |
| | Municipality organizational chart with contact details of the authorities and office hours | X | | | | | | |
| | Book an appointment with municipality services | | X | X | X | | | |
| **Other** | Requests Tracking | | | | | X | | |
| | Issue management guide and index of related documents | X | | | | | | X |
| | Emergency weather updates | X | | | | X | | |
| | Updating the operation of municipal structures in extreme weather conditions | X | | | | X | | |

*New Typology*

The traditional typology failed to capture all the services that a smart city should provide through its e-Government portal, while there are many shared functionalities in different categories. So, a content analysis of the responses was conducted in order to identify shared concepts in the different categories that will assist in the inclusion of the services demanded by the respondents and that will be able to accommodate future intelligent services.

The common themes identified are presented in Figure 4.4.1 as a Site Map designed with the use of Miro software. The Figure does not show any interconnection that may exist between the different pages, as it aims at providing a generic guide. Also, the categories, as well as the subcategories, are not classified in any specific order, as municipalities may choose to customize it based on their individual objectives, needs as well as existing e-services. The labels of the categories are also indicative, as user testing is needed in order to understand the mental models.

In the first category, “Education, Sport & Cultural Activities”, the services of the history of the Town, Events, Seminars & Trainings, and Volunteerism activities are presented. So, the users assessing one category can find a diverse set of events and activities that may be of their interest. In this category, functionalities such as a calendar, interactive map, newsletter subscription, and push-up notifications as well as register forms for events and advanced searching, can make the content easier to use and more useful.

"Online Services" is the second category, in which the user is able to find services that are executed completely online, such as e-library, reserving a parking spot, acquiring a citizen card, communicating with a doctor or a psychologist through chat or teleconference and booking appointments with municipality's departments or healthcare services. Each of these services requires a different set of functionalities. However some standard features may be online booking with the ability to conduct transactions and chat, while in the reserving parking spot service, an interactive map may be a useful addition.

"Applications & Transactions" are referred to a diverse set of official applications that the citizen can carry out online, such as leasing a public space, school enrolment, application for certificates, proposal submission for Tender or Funding and application to social welfare programs. Furthermore, in this category, users should be able to conduct official transactions such as paying fines and municipal fees. Useful functionalities in this category are considered sign-up/sign-in functionality, form wizards that will guide users throughout the process of submitting their requests, file upload functionalities, as well as payment functionalities.

In the category "Municipal Initiatives", the traditional typology has been followed, as in this section, the users can find the goals, the decisions, the action plan and all related information in response to the different domains of responsibility of municipalities. For example, in the subcategory "Construction", the related information should be the construction schedule, a map of the roads under construction, the schedule of power or water outages, a list of the municipal constructors and updates about the maintenance of municipal facilities. In the category of "Urban Development", the sustainable development program and actions, as well as the municipal environmental footprint, will be available. This category should also include a map of Public Wi-Fi spots, Parks, Municipal parking spaces, available water taps, recycling bins and infrastructure for disabled people. The timetable of public transportation, as well as a route map with pinned points of interest and bus live tracking, will be available in the "Transportation" section, where also can be found the alternative eco-friendly municipal means of transport and a map with pinned parking locations of eco-friendly means of transport. In the "Social Welfare", the social welfare program, the list of available allowances and

offerings of the municipality and the government will be available. In the category "Labor", the users would find municipal job openings and a map of local companies which are hiring, as well as useful links related to labor issues. In the last section, "Finances", the annual budget, quarter balance sheets, council tax, and public procurement & services contracts will be available.

"Local Entrepreneurship" is informational. Content includes working hours, available offers, contact information about local businesses, the local Farmers & Organic Markets, and the shifts of local pharmacies. Useful functionalities in all sections include interactive maps and indexes with advanced search functionalities.

The "Information of municipal Organizations" contains informational content about the Departments and Offices of the city, Schools, Educational & Cultural Organizations, Health & Social Welfare Facilities, and Associations - such as cultural & environmental associations, sports clubs and animal rescue associations -. In the "Departments and Offices of the city", the information available is in response to the description of responsibilities of each department, the number of employees, the head of the department, the office hours and the contact info. In "Schools", an annual calendar with important days such as events and terms beginning and end, as well as a short bio of the principal and list of the teachers, were requested by the citizens to be included. In "Educational & Cultural Organizations" as well as "Health & Social Welfare Facilities" and "Associations", a short description, prerequisites of entry, working hours, and contact info and events are the informational content included. The users will be able to register or apply for specific services offered by these organizations or book appointments where this is possible.

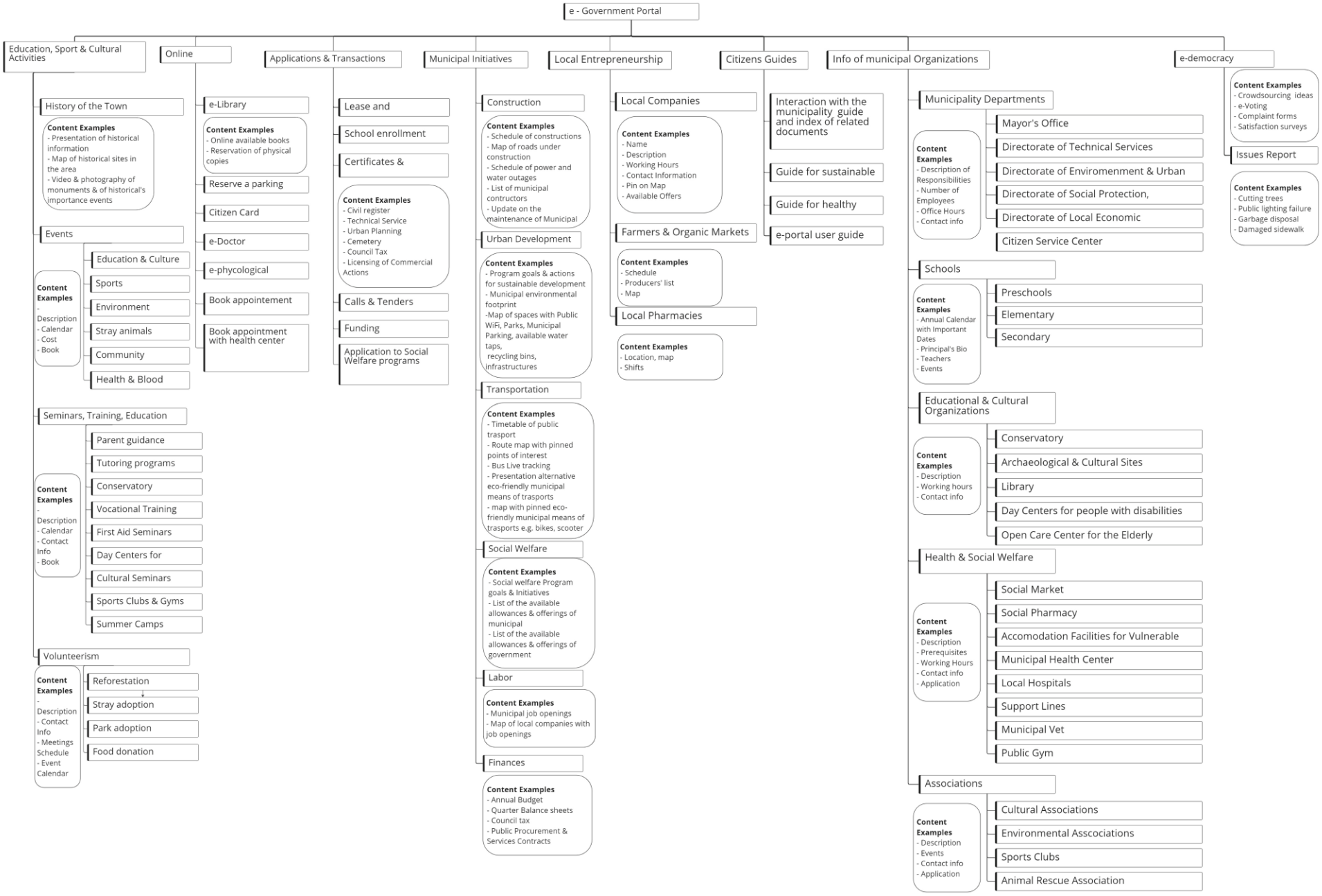
In the category "News & Announcements", apart from regular updates on the municipal activities and news that the municipality wants to disseminate, there will be a "Citizens Alert" section in which extreme weather conditions, as well as events that citizens should be alert of such as multiple scams of thefts in the area, will be announced along with consultation on how they can protect themselves. Also, this section will act as a community outreach for help in cases of emergency. For this section to be useful, citizens

would be able to register their phone numbers to receive a push-up notification of such announcements.

The last category is that of "e-Democracy". As expressed by the citizens, they would like to be able to participate in the decision-making process by offering their ideas through a crowdsourcing platform, voting on important issues, and filling in complaint forms in response to the way activities or employees of the municipalities manage things as well as competing satisfaction surveys in response to their interaction with city's services. Last but not least, through this section, citizens will be able to report issues or make requests in response to things that affect their everyday life, such as cutting trees, public lighting failure, garbage disposal or damaged sidewalk. This service is currently available in the majority of municipalities examined through an app that citizens should be registered, but it would be more useful if this functionality was integrated into the portal.

Overall, the typology proposed is based on the tasks that citizens can complete in each category and not on the services offered. In that way, the portal is able to accommodate more than one type of user, e.g. citizens, visitors and travelers, businesses, and Non-Governmental Organizations (NGOs). Also, the portal is able to accommodate future services in the respective category and use the appropriate functionalities.

*Figure 4.4.1 New typology of services provided by a smart city through e-Government portal*



## 4.5 Discussion

i. Which realms of municipality authority do their e-Government portals cover?

Regarding the services and information offered by a domain of responsibility, the results showed that only two domains have been developed in the e-Government portals by the majority of municipalities -Social Policy & Public Health (78%) and Administrative Responsibilities (70%). The availability of these domains online may help meet some of the goals outlined in the UN's definition of e-Government (2021) for efficiency, openness, and accountability, as well as address the issue of heavy bureaucracy (Schwab & Zahidi, 2020). However, these domains are not able to easily achieve the goals set in the national strategy 2020-2025 (Hellenic Ministry of Digital Governance, 2020) for environmental protection, climate change management, and energy footprint reduction. Online services and information provided in the domains of Transportation & Infrastructure and Environmental Policy & Urban Planning could help to achieve the proposed objectives, but only 12% and 18% of municipalities, respectively, offer some form of related services. Furthermore, the portals do not provide significant services to many vulnerable groups. Most towns have services connected to Social Policy & Public Health, indicating that they are capable of accommodating online services for persons living near or at the poverty line on some level. The paucity of digital services in Economic Development and Unemployment, on the other hand, demonstrated that digital actions aimed at improving citizens' lives are limited.

ii. Does the municipality's population, the available budget per citizen, the ruling party’s ideology and the mayor’s gender impact the digital services provided via e-Government portals?

The correlation analysis between the predictive variables – Population, Political Ideology, Budget and Mayor’s Gender – and the outcome variables, which represent the realms of municipalities’ responsibilities that are covered through e-Government portals – Transportation & Infrastructure, Environmental Policy & Urban Planning, Economic Development & Employment, Social Policy & Public Health, Education, Culture & Sport and Administrative Responsibilities- revealed that there are significant correlations

between Population and Transportation & Infrastructure (.482, p <0.01), Environmental Policy & Urban Planning (.350, p< 0.05), Education, Culture & Sports (.299, p <0.05). Nonetheless, the binomial logistic regression of all aspects of municipalities' responsibilities covered by e-Government portals revealed that none of the independent factors can predict the outcome variable with a 95%CI. At the 90%CI, a larger population was associated with an increased likelihood of offering Environmental & Urban Planning Services through e-Government. At the 90%CI, population growth was also linked to a higher likelihood of offering Education, Culture, and Sport services through e-Government. Finally, in Administrative Services, governing parties with a Conservative-Liberal political ideology have a 6.541 times higher chance of providing Administrative Services through e-Government portals with 90%CI. These inconclusive findings, which are similar to those of the e-Government maturity assessment, may indicate that other important factors that have not been thoroughly examined may impact the decision to provide services through e-Government.

iii. What services do the citizens want to be provided through the e-Government portals?

Based on the literature review, it is clear that the development of smart cities is aimed at improving the quality of life for citizens and is characterized by the integration of technology in various city services, the use of data and analytics, citizen engagement, and sustainable practices (Caragliu, Del Bo, & Nijkamp, 2011; European Commission, 2010; Ismagilova, Hughes, Dwivedi, & Raman, 2019). The typologies of smart cities found in the literature, however, tend to lack a citizen's perspective and often reflect the supply side rather than the demand side. This is primarily due to the technology-push approach adopted by cities in constructing smart cities, which is dominated by external stakeholders (Linders, 2012; Lee & Lee, 2014). The lack of demand-side typologies and the absence of citizens as participants in the development process may lead to e-Government portals that fail to meet the expectations and mental models of users (Kim, Lee, & Kim, 2012).

The findings highlight the importance of considering the mental models of users in the development of smart cities. The mental models of users play a critical role in the

effectiveness of the information architecture of e-Government portals and websites (Kim, Lee, & Kim, 2012). As such, a demand-side approach that incorporates the perspectives of citizens in the development of smart cities was adopted in the analysis. According to the results of the content analysis of the crowdsourced recommendations, it is clear that municipal e-Government portals need to provide citizens with access to a vast array of services and information. Some services have been previously presented by the e-participation survey of Costopoulou et al. (2017), such as the e-information, the e-consultation, the use of web 2.0 tools and services and the e-decision-making process. This crowdsourcing research adds to Costopoulou's et al. one by identifying many other e-services covering all the realms of municipalities' responsibilities. Nevertheless, the e-Services per se may vary through time and cities as the needs of citizens as well as the capabilities of municipalities alter. However, the most important finding is the functionalities that want to be included, such as interactive maps, informational texts, calendars, and the ability to submit applications or requests are highly desired features. The participants also sought push-up notifications and the ability to perform transactions for certain services.

The study identified several categories of services that citizens require, including transportation and infrastructure, environment and urban planning, economic development and employment, social policy and public health, administrative responsibilities and transactions with the city, education, culture, and sport, among others. These categories are similar to previous typologies suggested by Bellini, Nesi and Pantaleo (2022). Additionally, the study found that several common themes emerged from the responses, which were captured in the form of a Site Map. These common themes included functionalities such as interactive maps, informative texts, calendars, and the ability to submit applications or requests.

When it comes to obtaining services and information through local e-Government portals, the findings of the content analysis give invaluable insights into the requirements and preferences of residents. The study emphasizes the significance of delivering a complete array of conveniently accessible and user-friendly services and features. Furthermore, it dismisses the notion of traditional typologies and recommends that a new typology based

on the activities that users may perform in each category is more relevant owing to the rapidly evolving nature of technology and its effect on the engagement with the municipality.

## 4.6 Conclusion

This research attempts to fill the gap in the literature on the use of e-Government portals in smart cities by focusing on the services and information that are important to citizens and their impact on the implementation of smart city development. The study employs a Mind map representation of crowdsourced ideas layout to visually link the desired e-Government portal structure as suggested by citizens.

The findings showed that the existing e-Government portals fail to accommodate many e-services demanded by the citizens. The majority of the services provided are informational while, as presented in Section 3.2, are not useful. Furthermore, even though the respondents in the previous survey found the portals easy to use, the lack of features identified in this section, such as push-up notifications, newsletter, calendar, transaction, registration forms, and interactive map, make the available information useful.

Overall, this study adds to the existing literature on smart cities by focusing on how e-Government portals can provide citizens with important information and services. The study highlights the need for municipalities to consider the factors affecting the usefulness of the provided information and services through e-Government portals and to ensure that the typologies used are meaningful to the user and adaptable in order to accommodate future services and technologies.

This research entails limitations in response to the sample selected as well as the methodology used. Specifically, the choice of sample from only one country - Greek municipalities – cannot allow generalizations and cultural comparisons. A cross-national study could aid in the generalization of the findings and the identification of the variety of services and functionalities that could be considered useful and push the implementation of Smart Cities through e-Government portals further. Given the informational nature of Greek, the crowdsourced proposals may lack originality and innovation. Research on more complex e-Government websites could provide additional

information regarding the services that can be included in e-Government portals to enhance smart cities' development. In addition, the typology developed is based on observation regarding the common themes that arise from the responses of the participants. Thus, future studies could benefit from implementing user testing in order to improve and validate the typology.

# 5 Final Remarks

This thesis sought to provide a comprehensive review of the different e-Government quality evaluation methodologies using fifty Greek municipalities as a case study, highlight the significant pain points of the evolution of municipal e-Government in Greece, and propose a typology for future development. The case of 50 Greek municipalities, comprising 13 administrative areas and 49% of the total population, was chosen in order to achieve the predetermined objectives.

Greece was selected due to the inconsistent results Greece has earned in numerous international surveys evaluating the maturity of e-Government and the digital readiness of the public sector. The selection of municipalities is based on the significance they play in the residents' everyday lives. Municipalities are responsible for local transportation and infrastructure, the implementation of environmental policy and urban planning, the local economic development and employment, the provision of social welfare and public health, the organization of educational, cultural, and sporting events, and the provision of administrative services, particularly in Greece.

To meet the objectives of this thesis, the study was separated into three core sections.

The primary subject addressed in the first section was "What is the e-Government Strategy of the European Union, the Greek state, and the Greek municipalities?" To answer this question, the 2006-2020 strategy papers of the European Commission and the Greek government were analyzed. In addition, a literature review was conducted in response to the development of municipal e-government in Greece. The data indicate that e-Government in Greece was implemented differently than the European Commission's intended approach, resulting in two distinct frameworks. In response to the municipal assessment, it became evident that there would be no single e-Government Plan in place until 2020 and that progress in this area would result from individual initiatives without a defined plan or strategy. A national policy addressing the digital transformation strategy of municipalities was not formed until around 2020. Yet, there is no particular mention of municipal e-Government in the proposed strategy.

The purpose of the second section is to evaluate the quality of municipal e-Government portals. This section also makes a significant theoretical contribution as it employs three different quality evaluation methodologies. The first methodology employed is that of e-Government maturity models. A literature review presenting 46 e-Government maturity models, as well as the critique received, was conducted. A simple model was then used to empirically examine the 50 municipal e-Government Portals. The results indicated that most portals examined are in the second stage of maturity out of four. However, it was suggested that such models have limited ability to capture the e-Government development as it may not be considered linear.

The second methodology employed is that of the Technology Acceptance Model (TAM). Using this approach, 707 citizens of the examined municipalities were asked via an online survey to evaluate the Attractiveness, Usefulness, Ease of Use, and Awareness of their municipality's e-Government Portal and their intention to use it. The results demonstrated that the most significant issue with municipal e-Government portals is their low usefulness and that both Awareness and Usefulness contribute positively to the overall perception of quality. Nevertheless, it shows that Perceived Ease of Use has a negative impact on behavioral Intention to use e-Government.

The third methodology employed is that of measuring e-Government quality against a universal set of standards. The Lighthouse automated tool was used to assess the Accessibility based on the Web Content Accessibility Guidelines (WCAG), the Search Engine Optimization, the use of Best Practices and the technical Performance. The results showed that the biggest issue of the e-Government portals is the technical performance. The Performance dimension measures the interaction, usefulness, usability and attractiveness of websites. However, the Lighthouse criteria cannot be combined to produce a summative quality score as it is unknown how relevant these variables are in the users' decisions to employ e-Government portals.

Overall, the empirical examination of the three approaches showed that the three techniques examine different things, and there is no agreement about the features of a high-quality e-Government portal. Nevertheless, e-Government quality evaluation methodologies from the demand side are the most reliable approach to assess the desire to

utilize e-Government portals and the associated quality perceptions. The demand-side techniques can be useful for finding broad improvement opportunities. It appears that automated tools are the best way to construct a consistent and continually updated framework for e-Government quality. However the study indicates that these tools are currently insufficient to capture the perceived quality.

In addition, this part investigated the factors that influence the development of e-Government and its adoption by citizens. Using the e-Government maturity model and the Lighthouse application, it was investigated if the population, political ideology of the governing party, budget, and gender of the mayor, as indicated by the literature study, had an influence on the e-Government development. Both analyzes demonstrated that these variables play a limited influence in predicting e-Government maturity. Given that Greece has been described by previous researchers as an unstructured and semi-inclusive welfare state where strategies are adopted from policies implemented in other countries rather than being implemented based on internal variables, the results of this study were anticipated, and additional external factors must be investigated.

The effect of demographic factors as well as the digital divide on the e-Government adoption by the citizens, were examined through the survey of 707 participants. The following demographic characteristics measured were proposed by the literature review: gender, age, educational level, type of employment, monthly income and time spent on the internet. The findings indicated that the majority of demographic characteristics moderate the relationship between Usefulness and Behavioral Intention, whereas the digital divide has a direct effect.

The last part sought to address what a local e-Government strategy must include to increase its usefulness and overall perceived quality and proposed a typology. Using a traditional typology, a study of the existing e-services and information offered by municipal e-Government portals was undertaken to identify the missing aspects of the e-Government portals. In addition, utilizing the last component of the online questionnaire distributed to 707 participants, a crowdsourcing approach was used to identify the aspects that should be included in local e-Government portals. Current e-Government portals provide services of an informational type that are not useful, while the availability of e-

services is inadequate, according to the findings. Citizen demand that municipalities digitize the majority of their offline services and provide them through a centralized portal with a variety of functionalities, including interactive maps, informative texts, calendars, and the ability to submit applications or requests. Overall, the crowdsourcing findings were presented in a diagram that recommends a taxonomy comparable to the e-Government maturity models described in section 3.1. However, the critical distinction between the typology and maturity models is that the former provides cities with recommendations on how to establish viable e-Government portals and the latter measures e-Government development.

Overall, the summarized conclusion of this research is that for an e-Government strategy to be successfully developed, implemented, evaluated and adopted by the citizens, they need to be included during all the phases of the project. E-Government development allows governmental bodies to come closer to the citizens, satisfy their needs, enhance their engagement and trust and implement a direct form of democracy through digital means.

## 5.1 Research Limitations

This analysis provides a snapshot of the present state of the 50 largest municipalities in Greece. Thereby, the thesis has significant limitations that must be addressed due to the sample size and methodology employed. Firstly, the study was limited to 50 Greek municipalities. Therefore the results may not apply to other nations or locations. Thus, caution should be used when drawing conclusions or making suggestions based on the study's findings.

Due to the lack of essential e-Government features in Greek municipalities, the findings of the analysis of e-Government maturity models and the universal set of standards using automated tools are inadequate for determining the full extent of the tools' evaluation. Also, due to the small sample size, this study is unable to establish a correlation between e-Government development and the independent variables examined.

Similarly, the low overall performance of the municipalities from which the study's participants come indicates some basic problems. The system's quality, the security of

transactions, and the login procedure were not explored, nor were the participation and cooperation expectations - e-democracy, engagement in political and administrative processes, and interoperability. Hence, the evaluation of more sophisticated e-Government portals by citizens can stimulate them to uncover various flaws and increase the innovation of services. Utilizing self-reported data from participants is an additional restriction of this thesis. Due to the fact that the data provided by the participants is based on their own perceptions and experiences, its accuracy and reliability cannot be guaranteed. This may lead to bias or inaccuracy in the data analysis and conclusions.

Essentially, the evaluation of the quality of municipal e-Government portals may not be regarded as complete due to the use of three approaches. Other methods, such as surveying municipal employees or in-depth interviews with subject matter experts, could provide unique insights into e-Government quality evaluation. In addition, the study focuses solely on the e-Government portals of the municipalities and ignores other important components of the e-Government ecosystem, including mobile applications, social media, and other digital channels. This narrow perspective may lead to an incomplete comprehension of the e-Government landscape.

In terms of the development of a new typology, the study of a limitedly developed e-Government portal yields a typology that contains services that may not be regarded as innovative on an international level. Given the informative nature of Greek municipal portals, crowdsourcing suggestions may lack creativity and inventiveness. In addition, the established typology is based on observation of the common themes that emerged from the participants' responses and has not been user-tested to confirm its validity.

Finally, the thesis provides no insight into the cost-benefit analysis of implementing e-Government portals in the municipalities. It does not consider the financial and organizational implications of such implementations, and therefore the recommendations provided may not be practical or feasible for all municipalities.

## 5.2 Future Research Directions

Future research could consider expanding the sample size to include municipalities from other countries to enable cross-cultural comparisons and statistical generalizations. This

would allow for a more comprehensive assessment of e-Government maturity models and the universal set of standards, as well as a more complete analysis of the impact of population size on e-Government progress. Including a broader range of countries and regions could offer to understand better the factors that influence the development and adoption of e-Government portals as well. In this direction, a longitudinal study could be conducted to examine the evolution of e-Government quality over time and establish causal relationships.

Additionally, other methodologies could be employed to assess the quality of municipal e-Government portals, such as expert evaluation or focus group interviews with citizens and municipal employees. To improve the validity of the research, future studies could also consider using more rigorous methods for questionnaire distribution and analysis, such as stratified sampling or randomized control trials. Moreover, more innovative approaches to crowdsourcing proposals and ideas from citizens could be explored to enhance the overall service innovation of e-Government portals. This could include leveraging social media platforms or other digital tools to engage citizens and foster collaboration with government agencies.

Continuing this research, there are two most important future research directions to consider. The first one is for the development of an automated tool for the e-Government quality assessment that measures the dimensions that the literature review has determined as influential. As a tool, Lighthouse metrics seem to be related to the dimensions of quality determined by academic research. However, currently, the reports' results cannot be compared to the quality dimensions. Hence, future research could focus on drawing correlations between the dimensions of Lighthouse and the demand side research to develop a tool that would be publicly available and would offer a rigorous and objective e-Government quality evaluation.

The other future direction is with respect to the typology developed by this research. More research could be done to include more services and functionalities. For this purpose, data from citizens from municipalities in other countries as well as from the inclusion of additional stakeholders such as businesses, experts, officials and other institutions in the research, could offer useful insights that will create a more complete

typology. Finally, the new typology needs to be user tested in order to validate its effectiveness.

# APPENDIX A – SAMPLE INFORMATION

| a/a | Municipality | Administrative Region | Population | Budget per Inhabitant | Mayor's Gender | Website |
|---|---|---|---|---|---|---|
| 1 | Acharnes | Attica | 106,943 | 1050.93 | Male | www.acharnes.gr |
| 2 | Agioi Anargyroi-Kamatero | Attica | 62,529 | 871.7 | Male | www.agan.gov.gr |
| 3 | Agios Dimitrios | Attica | 71,294 | 609.67 | Female | www.dad.gr |
| 4 | Agrinio | Western Greece | 94,181 | 1253.24 | Male | www.agrinio.gov.gr |
| 5 | Aigaleo | Attica | 69,946 | 1003.77 | Male | www.egaleo.gr |
| 6 | Alexandroupoli | Eastern Macedonia and Thrace | 72,959 | 994.4 | Male | www.alexpolis.gr |
| 7 | Amarousion | Attica | 72,333 | 783.64 | Male | www.maroussi.gr |
| 8 | Athens | Attica | 664,046 | 1253.4 | Male | www.cityofathens.gr |
| 9 | Chalandri | Attica | 74,192 | 1104.73 | Male | www.halandri.gr |
| 10 | Chalcis | Central Greece | 102,223 | 1013.71 | Female | www.dimoschalkideon.gr |
| 11 | Chania | Crete | 108,642 | 1065.74 | Male | www.chania.gr |
| 12 | Corfu | Ionian Islands | 102,071 | 1057.83 | Female | www.corfu.gr |
| 13 | Glyfada | Attica | 87,305 | 792.61 | Male | www.glyfada.gr |
| 14 | Heraklion | Crete | 173,993 | 245.95 | Male | www.heraklion.gr |
| 15 | Ilion | Attica | 84,793 | 579.92 | Male | www.ilion.gr |
| 16 | Ilioupoli | Attica | 78,153 | 536.23 | Male | www.ilioupoli.gr |
| 17 | Ioannina | Epirus | 112,486 | 1339.15 | Male | www.ioannina.gr |
| 18 | Kalamaria | Central Macedonia | 91,518 | 855.6 | Male | www.kalamaria.gr |
| 19 | Kalamata | Peloponnese | 69,849 | 1322.75 | Male | www.kalamata.gr |
| 20 | Kallithea | Attica | 100,641 | 848.05 | Male | www.kallithea.gr |
| 21 | Katerini | Central Macedonia | 85,851 | 1423.25 | Male | www.katerini.gr |
| 22 | Kavala | Eastern Macedonia and Thrace | 70,501 | 1045.54 | Male | www.kavala.gov.gr |
| 23 | Keratsini - Drapetsona | Attica | 91,045 | 972.4 | Male | www.keratsini-drapetsona.gr |
| 24 | Kifissia | Attica | 71,259 | 1428.15 | Male | www.kifissia.gr |
| 25 | Komotini | Eastern Macedonia and Thrace | 66,919 | 845.72 | Male | www.komotini.gr |
| 26 | Kordelio-Evosmos | Central Macedonia | 101,753 | 613.34 | Male | www.kordelio-evosmos.gr |
| 27 | Korydallos | Attica | 63,445 | 697.94 | Male | www.korydallos.gr |
| 28 | Kozani | Western Macedonia | 71,388 | 1424.7 | Male | www.cityofkozani.gov.gr |
| 29 | Lamia | Thessaly | 75,315 | 1047.83 | Male | www.lamia.gr |
| 30 | Larissa | Thessaly | 162,591 | 899.78 | Male | www.larissa-dimos.gr |
| 31 | Mytilene | North Aegean | 86,436 | 1409.52 | Male | www.mytilene.gr |
| 32 | Nea Ionia | Attica | 67,134 | 674.34 | Female | www.neaionia.gr |
| 33 | Nea Smyrni | Attica | 73,076 | 813.27 | Male | www.neasmyrni.gr |
| 34 | Neapoli-Sykies | Central Macedonia | 84,741 | 896.89 | Male | www.dimosneapolis-sykeon.gr |
| 35 | Nikaia-Agios Ioannis Rentis | Attica | 105,430 | 797.17 | Male | www.nikaia-rentis.gov.gr |
| 36 | Palaio Faliro | Attica | 64,021 | 684.01 | Male | www.palaiofaliro.gr |
| 37 | Patras | Western Greece | 213,984 | 1386.44 | Male | www.patras.gr |

| | | | | | | |
|---|---|---|---|---|---|---|
| 38 | Pavlos Melas | Central Macedonia | 99,245 | 770.9 | Male | www.pavlosmelas.gr |
| 39 | Pella | Central Macedonia | 63,122 | 681.84 | Male | www.giannitsa.gr |
| 40 | Peristeri | Attica | 139,981 | 629.11 | Male | www.peristeri.gr |
| 41 | Piraeus | Attica | 163,688 | 1487.45 | Male | www.piraeus.gov.gr |
| 42 | Pylaia - Chortiatis | Central Macedonia | 70,110 | 725.56 | Male | www.pilea-hortiatis.gr |
| 43 | Rhodes | South Aegean | 115,490 | 1807.13 | Male | www.rhodes.gr |
| 44 | Serres | Central Macedonia | 76,817 | 962.18 | Male | www.serres.gr |
| 45 | Thessaloniki | Central Macedonia | 325,182 | 1298.35 | Male | www.thessaloniki.gr |
| 46 | Trikala | Thessaly | 81,355 | 1150.07 | Male | www.trikalacity.gr |
| 47 | Veroia | Central Macedonia | 66,547 | 813.71 | Male | www.veria.gr |
| 48 | Volos | Thessaly | 144,449 | 825.99 | Male | www.dimosvolos.gr |
| 49 | Xanthi | Eastern Macedonia and Thrace | 65,133 | 870.16 | Male | www.cityofxanthi.gr |
| 50 | Zografou | Attica | 71,026 | 689.63 | Male | www.zografou.gov.gr |

# APPENDIX B – E-GOVERNMENT ASSESSMENT QUESTIONNAIRE

## Greek Version

Καλείστε να συμμετέχετε στην έρευνα που διεξάγεται από τη Ζωή Πατεργιαννάκη, Υποψήφια Διδάκτωρ του Τμήματος Οικονομικής Επιστήμης, Πανεπιστημίου Πειραιά, στο πλαίσιο της διδακτορικής διατριβής της με θέμα "Digital Transformation: Η Μετάβαση του Δημοσίου Τομέα στην Ψηφιακή Εποχή" απαντώντας 30 ερωτήσεις πολλαπλής επιλογής και σύντομης συμπλήρωσης. Για τη συμμετοχή σας στο ερωτηματολόγιο πρέπει να είστε άνω των 18 ετών.

Η ειλικρινής συμβολή σας στην έρευνα είναι πολύτιμη καθώς η έρευνα αποσκοπεί στην διερεύνηση των παραγόντων που επηρεάζουν τη δημιουργία σχέσης των πολιτών με την πρωτοβάθμια τοπική αυτοδιοίκηση μέσω της διαδικτυακής πύλης του δήμου και των σελίδων τους στα μέσα κοινωνικής δικτύωσης. Στο τελευταίο μέρος της έρευνας θα σας ζητηθεί επίσης η συμβολή σας για τις υπηρεσίες ή/και τις πληροφορίες που θα θέλατε να λαμβάνετε μέσα από τη διαδικτυακή πύλη και μέσα κοινωνικής δικτύωσης του δήμου σας.

Η συμμετοχή σας είναι εθελοντική και δεν απαιτείται καταγραφή κανενός δεδομένου που μπορεί να σας ταυτοποιήσει, έτσι ώστε να εξασφαλίσουμε πως οι απαντήσεις σας είναι όσο το δυνατόν πιο αβίαστες και ειλικρινείς. Σε περίπτωση που τα αποτελέσματα της έρευνας δημοσιευτούν ή παρουσιαστούν σε συνέδρια δεν θα συμπεριληφθούν πληροφορίες που θα αποκαλύπτουν την ταυτότητά σας.

Ο χρόνος συμπλήρωσης του ερωτηματολογίου είναι 20 λεπτά.

Δεν υπάρχουν κίνδυνοι συνδεόμενοι με τη συμμετοχή στη μελέτη και μπορείτε να αποχωρήσετε οποιαδήποτε στιγμή χωρίς καμία συνέπεια. Επιπλέον δεν θα έχετε κάποιο οικονομικό όφελος από τη συμμετοχή σας στην παρούσα έρευνα.

Εάν έχετε οποιεσδήποτε ερωτήσεις ή ανησυχίες, τώρα ή αργότερα, σχετικά με τη συμμετοχή σας, τη διεξαγωγή της μελέτης, τους κινδύνους ή τα δικαιώματά σας, μπορείτε να επικοινωνήσετε με την ερευνήτρια Ζωή Πατεργιαννάκη στην ηλεκτρονική διεύθυνση zoi.patergiannaki@outlook.com

Ενότητα Α: Δημογραφικά Χαρακτηριστικά

Φύλο

☐ Γυναίκα

☐ Άνδρας

- [ ] Προτιμώ να μην απαντήσω

Ηλικία

- [ ] 18 - 24
- [ ] 25 – 34
- [ ] 35 – 44
- [ ] 45 – 54
- [ ] 55 – 64
- [ ] 65 - 74
- [ ] 75 +

Μορφωτικό Επίπεδο

- [ ] Εγκατέλειψα το Δημοτικό
- [ ] Απόφοιτος/η Δημοτικού
- [ ] Απόφοιτος/η Γυμνασίου
- [ ] Απόφοιτος/η Λυκείου
- [ ] Πτυχιούχοι Μεταδευτεροβάθμιας εκπαίδευσης (ΙΕΚ, Κολλέγια κλπ.)
- [ ] Πτυχιούχοι Πανεπιστημίου (ΑΕΙ,ΤΕΙ, κλπ)
- [ ] Κάτοχος Μεταπτυχιακού Διπλώματος
- [ ] Κάτοχος Διδακτορικού

Εργασία

- [ ] Εργαζόμενος/η στον Δημόσιο Τομέα
- [ ] Μισθωτός/η στον Ιδιωτικό Τομέα
- [ ] Αυτοαπασχολούμενος/η – Ελεύθερος Επαγγελματίας
- [ ] Συνταξιούχος
- [ ] Άνεργος/η

- [ ] Οικιακά
- [ ] Μαθητής/τρια ή Φοιτητής /τρια
- [ ] Άλλη Περίπτωση

Μηνιαίο Εισόδημα σε ευρώ

- [ ] Μέχρι 500 ευρώ
- [ ] 501 - 1.000
- [ ] 1.001 - 1.500
- [ ] 1.501 - 2.000
- [ ] 2.001 – 6.000
- [ ] Από 6.000 και άνω

Συμπληρώστε το όνομα του δήμου που κατοικείτε

Ενότητα Β: Χρήση διαδικτύου και Ψηφιακές Δεξιότητες

Πόσο χρόνο την ημέρα καταναλώνετε στο διαδίκτυο (internet);

- [ ] Καθόλου
- [ ] Λιγότερο από 1 ώρα
- [ ] 1-3 ώρες
- [ ] 4-6 ώρες
- [ ] Περισσότερο από 7 ώρες

Ποιες από τις παρακάτω συσκευές χρησιμοποιείτε για να συνδεθείτε στο διαδίκτυο και στα μέσα κοινωνικής δικτύωσης (social media);

(Δεκτές περισσότερες από μία απαντήσεις)

- [ ] Επιτραπέζιο Υπολογιστή
- [ ] Φορητό Υπολογιστή (laptop/notebook)

- [ ] Κινητό τηλέφωνο (smartphone)
- [ ] Άλλη συσκευή (π.χ. έξυπνη τηλεόραση, έξυπνο ρολόι κλπ.)

Ποιες από της παρακάτω εργασίες έχετε κάνει το τελευταίο τρίμηνο;

(Δεκτές περισσότερες από μία απαντήσεις)

- [ ] Αντιγραφή ή μεταφορά αρχείων μεταξύ φακέλων η σε διαδικτυακούς αποθηκευτικούς χώρους (cloud)
- [ ] Λήψη ή εγκατάσταση λογισμικού ή εφαρμογών
- [ ] Τροποποίηση των παραμέτρων διαμόρφωσης λογισμικού, εφαρμογών ή συσκευών (π.χ. της γλώσσας, των χρωμάτων, του μεγέθους των γραμμάτων / κειμένου, του φόντου, της γραμμής εργαλείων / μενού)

Ποιες από τις παρακάτω εργασίες, οι οποίες σχετίζονται με λογισμικό, έχετε κάνει το τελευταίο τρίμηνο;

(Δεκτές περισσότερες από μία απαντήσεις)

- [ ] Χρήση λογισμικού επεξεργασίας κειμένου (π.χ. word)
- [ ] Δημιουργία αρχείων (π.χ. εγγράφου, εικόνας, βίντεο) με ενσωμάτωση κειμένου, εικόνων, πινάκων, γραφημάτων, ήχου, κινουμένων σχεδίων, ήχου κ.ά.
- [ ] Χρήση λογισμικού υπολογιστικών φύλλων (π.χ. excel)
- [ ] Χρήση λογισμικού για επεξεργασία φωτογραφιών, βίντεο ή ηχητικών αρχείων
- [ ] Σύνταξη κώδικα σε γλώσσα προγραμματισμού
- [ ] Καμία από τις παραπάνω

Ενότητα Γ: Πρόθεση χρήσης της διαδικτυακής πύλης των δήμων

Στη συγκεκριμένη ενότητα σας ζητείται να αξιολογήσετε τη διαδικτυακή πύλη (ιστοσελίδα, website) του δήμου σας

Αξιολογήστε την ελκυστικότητα της διαδικτυακής πύλης του δήμου σας

Βαθμολογήστε τις παρακάτω ερωτήσεις σε κλίμακα από το 1 έως το 5 που περιγράφει καλύτερα την άποψή σας. (1-Διαφωνώ απόλυτα, 2—διαφωνώ, 3—ούτε συμφωνώ/ ούτε διαφωνώ, 4—συμφωνώ και 5—συμφωνώ απόλυτα)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Η διαδικτυακή πύλη του δήμου παρέχει πληροφορίες που με αφορούν | | | | | |
| 2. Οι πληροφορίες που παρέχει η διαδικτυακή πύλη του δήμου είναι επίκαιρες | | | | | |
| 3. Οι πληροφορίες που παρέχει η διαδικτυακή πύλη του δήμου είναι εύκολα κατανοητές | | | | | |
| 4. Η διαδικτυακή πύλη του δήμου παρέχει αξιόπιστες πληροφορίες | | | | | |
| 5. Συνολικά, η διαδικτυακή πύλη του δήμου παρέχει πληροφορίες που με ενδιαφέρουν | | | | | |

Αξιολογήστε τη χρησιμότητα της διαδικτυακής πύλης του δήμου σας

Βαθμολογήστε τις παρακάτω ερωτήσεις σε κλίμακα από το 1 έως το 5 που περιγράφει καλύτερα την άποψή σας. (1-Διαφωνώ απόλυτα, 2—διαφωνώ, 3—ούτε συμφωνώ/ ούτε διαφωνώ, 4—συμφωνώ και 5—συμφωνώ απόλυτα)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Οι πληροφορίες στη διαδικτυακή πύλη του δήμου παρουσιάζονται με εύχρηστο τρόπο | | | | | |
| 2. Γενικά έχω βρει αρκετές πληροφορίες στη διαδικτυακή πύλη του δήμου | | | | | |
| 3. Η διαδικτυακή πύλη του δήμου παρέχει τις πληροφορίες που χρειάζομαι για ένα ζήτημα | | | | | |
| 4. Οι πληροφορίες στη διαδικτυακή πύλη του δήμου ανταποκρίνονται στις ανάγκες μου | | | | | |
| 5. Συνολικά, η διαδικτυακή πύλη του δήμου παρέχει χρήσιμες πληροφορίες | | | | | |

Αξιολογήστε την ευκολία πλοήγησης στη διαδικτυακή πύλη του δήμου σας

Βαθμολογήστε τις παρακάτω ερωτήσεις σε κλίμακα από το 1 έως το 5 που περιγράφει καλύτερα την άποψή σας. (1-Διαφωνώ απόλυτα, 2—διαφωνώ, 3—ούτε συμφωνώ/ ούτε διαφωνώ, 4—συμφωνώ και 5—συμφωνώ απόλυτα)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Η εκμάθηση χειρισμού της διαδικτυακής πύλης του δήμου είναι εύκολη | | | | | |
| 2. Η αλληλεπίδραση με τη διαδικτυακή πύλη του δήμου είναι σαφής και κατανοητή | | | | | |
| 3. Η διαδικτυακή πύλη του δήμου είναι φιλική προς το χρήστη | | | | | |
| 4 Η περιήγηση στη διαδικτυακή πύλη του δήμου είναι εύκολη | | | | | |
| 5. Συνολικά, η διαδικτυακή πύλη του δήμου είναι εύκολη στη διαχείριση | | | | | |

Αξιολογήστε την εξοικείωση σας με τη διαδικτυακή πύλη του δήμου σας

Βαθμολογήστε τις παρακάτω ερωτήσεις σε κλίμακα από το 1 έως το 5 που περιγράφει καλύτερα την άποψή σας. (1-Διαφωνώ απόλυτα, 2—διαφωνώ, 3—ούτε συμφωνώ/ ούτε διαφωνώ, 4—συμφωνώ και 5—συμφωνώ απόλυτα)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Συνολικά, έχω καλή γνώση της διαδικτυακής πύλης του δήμου | | | | | |
| 2. Ξέρω που μπορώ να βρω συγκεκριμένες πληροφορίες στην ηλεκτρονική πύλη του δήμου | | | | | |
| 3. Είμαι πολύ εξοικειωμένος με την διαδικτυακή πύλη του δήμου | | | | | |
| 4. Έχω χρησιμοποιήσει συχνά με επιτυχία την ηλεκτρονική πύλη του δήμου | | | | | |

Αξιολογήστε την πρόθεσή σας να χρησιμοποιήσετε τη διαδικτυακή πύλη του δήμου σας

Βαθμολογήστε τις παρακάτω ερωτήσεις σε κλίμακα από το 1 έως το 5 που περιγράφει καλύτερα την άποψή σας. (1-Διαφωνώ απόλυτα, 2—διαφωνώ, 3—ούτε συμφωνώ/ ούτε διαφωνώ, 4—συμφωνώ και 5—συμφωνώ απόλυτα)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Σκοπεύω να χρησιμοποιήσω τη διαδικτυακή πύλη του δήμου εντός των επόμενων 3 μηνών | | | | | |
| 2. Προβλέπω ότι θα χρησιμοποιήσω τη διαδικτυακή πύλη του δήμου μέσα στους επόμενους 3 μήνες | | | | | |
| 3. Σχεδιάζω να χρησιμοποιήσω τη διαδικτυακή πύλη του δήμου μέσα στους επόμενους 3 μήνες | | | | | |
| 4. Θα χρησιμοποιήσω την διαδικτυακή πύλη του δήμου κάποια στιγμή στο μέλλον | | | | | |

Έχετε χρησιμοποιήσει ποτέ οποιαδήποτε διαδικτυακή υπηρεσία που παρέχεται από τη διαδικτυακή πύλη του δήμου σας;

Παραδείγματα υπηρεσιών μπορεί να περιλαμβάνουν: κλείσιμο ραντεβού, αναφορά προβλήματος, αίτηση για υπηρεσίες που παρέχονται από τον δήμο.

☐ Ναι

☐ Όχι

16. 1. Πώς θα αξιολογούσατε την εμπειρία σας από την παροχή αυτών των διαδικτυακών υπηρεσιών;

☐ Πολύ Ικανοποιητική

☐ Ικανοποιητική

☐ Ουδέτερη

☐ Δυσάρεστη

☐ Πολύ Δυσάρεστη

Ενότητα Δ: Προτάσεις αναφορικά με την Διαδικτυακή πύλη του δήμου σας.

Ποιες υπηρεσίες ή/και πληροφορίες του δήμου θα θέλατε να σας παρέχονται μέσω της ιστοσελίδας του σε θέματα Παιδείας, Πολιτισμού και Αθλητισμού;

Ποιες υπηρεσίες ή/και πληροφορίες του δήμου θα θέλατε να σας παρέχονται μέσω της ιστοσελίδας του σε θέματα Περιβάλλοντος και Αστικής Ανάπτυξης;

Ποιες υπηρεσίες ή/και πληροφορίες του δήμου θα θέλατε να σας παρέχονται μέσω της ιστοσελίδας του σε θέματα Οικονομίας και Εργασίας;

Ποιες υπηρεσίες ή/και πληροφορίες του δήμου θα θέλατε να σας παρέχονται μέσω της ιστοσελίδας του σε θέματα Κοινωνικής Πολιτικής και Δημόσιας Υγείας;

Ποιες υπηρεσίες ή/και πληροφορίες του δήμου θα θέλατε να σας παρέχονται μέσω της ιστοσελίδας του σε θέματα Συνδιαλλαγής με τις Υπηρεσίες του Δήμου;

**English Translation**

You are invited to participate in the research conducted by Zoi Patergiannakis, PhD Candidate of the Department of Economics, University of Piraeus, as part of her PhD thesis on "Digital Transformation: The Transition of the Public Sector to the Digital Age" by answering 26 multiple choice and short questions completion. To participate in the questionnaire, you must be over 18 years old.

Your honest contribution to the research is valuable as the research aims to explore the factors that influence citizens' relationship-building with primary local government through the municipality's web portal and their social media pages. In the final part of the survey, you will also be asked for your input on the services and/or information you would like to receive through your municipality's web portal and social media.

Your participation is voluntary and does not require the recording of any data that can identify you so that we can ensure that your answers are as effortless and honest as possible. If the research results are published or presented at conferences, no personally identifiable information will be included.

The average time for the questionnaire completion is 20 minutes.

There are no risks associated with participating in the study, and you can withdraw at any time without any consequences. In addition, you will not receive any financial benefit from your participation in this research.

If you have any questions or concerns, now or later, about your participation, the conduct of the study, the risks or your rights, you can contact researcher Zoi Patergiannaki at zoi.patergiannaki@outlook.com

Part A: Demographic Characteristics

Gender

- [ ] Female
- [ ] Male
- [ ] I prefer not to say

Age

- [ ] 18 - 24
- [ ] 25 – 34
- [ ] 35 – 44
- [ ] 45 – 54

- [ ] 55 – 64
- [ ] 65 - 74
- [ ] 75 +

Educational Level

- [ ] I dropped out of elementary school
- [ ] Primary School graduate
- [ ] High school graduate
- [ ] High school graduate
- [ ] Graduates of Post-Secondary Education (IEK, Colleges, etc.)
- [ ] University graduates (HEI, TEI, etc.)
- [ ] Holder of a Master's Degree
- [ ] Holder of Ph.D

Occupation

- [ ] Employee in the Public Sector
- [ ] Employee in the Private Sector
- [ ] Self Employed – Freelancer
- [ ] Retired
- [ ] Unemployed
- [ ] Household
- [ ] Student
- [ ] Other

Monthly Income

- [ ] Up to 500 euros
- [ ] 501 - 1,000

- [ ] 1,001 - 1,500
- [ ] 1,501 - 2,000
- [ ] 2,001 – 6,000
- [ ] 6,000 and above

Fill in the name of the municipality where you live

| |
|---|
| |

Part B: Internet Use and Digital Skills

How much time per day do you spend on the internet?

- [ ] Not at all
- [ ] Less than 1 hour
- [ ] 1-3 hours
- [ ] 4-6 hours
- [ ] More than 7 hours

Which of the following devices do you use to connect to the internet and social media?

(More than one answer accepted)

- [ ] Desktop Computer
- [ ] Laptop/notebook
- [ ] Mobile phone (smartphone)
- [ ] Other device (e.g. smart TV, smart watch, etc.)

Which of the following tasks have you done in the last quarter?

(More than one answer accepted)

- [ ] Copy or transfer files between folders or to online storage spaces (cloud)
- [ ] Download or install software or applications

- [ ] Modify software, application or device configuration parameters (eg language, colors, font / text size, background, toolbar / menu)

Which of the following software-related tasks have you done in the last quarter?

(More than one answer accepted)

- [ ] Use of word processing software (e.g. word)
- [ ] Create files (eg document, image, video) by embedding text, images, tables, graphs, audio, animation, sound, etc.
- [ ] Use of spreadsheet software (eg excel)
- [ ] Use of software to edit photos, videos or audio files
- [ ] Writing code in a programming language
- [ ] None of the above

Part C: Intention to use the municipalities' web portal

In this section you are asked to evaluate the web portal (website) of your municipality

Evaluate the attractiveness of your municipality's web portal

Please rate the questions below on a scale of 1 to 5 that best describes your opinion. (1-Strongly disagree, 2—disagree, 3—neither agree/neither disagree, 4—agree and 5—strongly agree)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| The online city portal provides relevant information | | | | | |
| The online city portal provides timely information | | | | | |
| The online city portal provides easy to understand information | | | | | |
| The online city portal provides believable information | | | | | |
| All in all, the online city portal provides attractive information | | | | | |

Evaluate the Usefulness of your municipality's web portal

Please rate the questions below on a scale of 1 to 5 that best describes your opinion. (1-Strongly disagree, 2—disagree, 3—neither agree/neither disagree, 4—agree and 5—strongly agree)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| The information on the online city portal is presented in a useful format | | | | | |
| I have generally received sufficient information on the online city portal | | | | | |
| The online city portal can provide the precise information I need for my concern | | | | | |
| The information on the online city portal meets my needs | | | | | |
| All in all, the online city portal provides useful information | | | | | |

Evaluate the Ease of Use of your municipality's web portal

Please rate the questions below on a scale of 1 to 5 that best describes your opinion. (1-Strongly disagree, 2—disagree, 3—neither agree/neither disagree, 4—agree and 5—strongly agree)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Learning to operate the online city portal is easy | | | | | |
| The interaction/dialogue with the online city portal is clear and understandable | | | | | |
| The online city portal is user-friendly | | | | | |
| The online city portal is easy to use | | | | | |

Evaluate your Awareness of your municipality's web portal

Please rate the questions below on a scale of 1 to 5 that best describes your opinion. (1-Strongly disagree, 2—disagree, 3—neither agree/neither disagree, 4—agree and 5—strongly agree)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| All in all, I have good knowledge of the online city portal | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| I know where to find specific information on the online city portal | | | | | |
| I am very familiar with the online city portal | | | | | |
| I have often used the online city portal successfully | | | | | |
| All in all, I have good knowledge of the online city portal | | | | | |

Evaluate your Intention to use of your municipality's web portal

Please rate the questions below on a scale of 1 to 5 that best describes your opinion. (1-Strongly disagree, 2—disagree, 3—neither agree/neither disagree, 4—agree and 5—strongly agree)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| I intend to use the online city portal within the next 3 months | | | | | |
| I predict that I will use the online city portal within the next 3 months | | | | | |
| I plan to use the online city portal within the next 3 months | | | | | |
| I am going to use the online city portal in the future | | | | | |

Have you ever used any online service provided by your municipality's web portal?

Examples of services may include: making an appointment, reporting a problem, requesting services provided by the municipality.

| | |
|---|---|
| | Yes |
| | No |

16. 1. How would you rate your experience of providing these online services?

| | |
|---|---|
| | Very Satisfying |
| | Satisfactory |
| | Neutral |
| | Unpleasant |

☐ Very Unpleasant

Part D: Suggestions regarding your municipality's web portal.

What services and/or information of the municipality would you like to be provided to you through its website in matters of Education, Culture and Sports?

What services and/or information of the municipality would you like to be provided through its website in matters of Environment and Urban Development?

What services and/or information of the municipality would you like to be provided to you through its website in matters of Economy and Labor?

What services and/or information of the municipality would you like to be provided through its website in matters of Social Policy and Public Health?

What services and/or information of the municipality would you like to be provided to you through its website in matters of Administrative Services of the Municipality?

# APPENDIX C – FREQUENCY TABLE OF PARTICIPANTS PER MUNICIPALITY

| | | | Gender | | Age | | | | | Education | | | Economic Activity | | | | | Salary | | | Internet time spent | | | Digital Divide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | 18-34 | 35-44 | 45-54 | 55-64 | 65+ | Primary | Tetriary | Postgraduate | Inactive | Retired | Self-employed | Private employee | Public Servant | 0 -1000 | 1001-1500 | 1500+ | less than 1 hour | 1-3 hours | More than 4 hours | Above Basic | Basic |
| **Municipalities** | Count | Percent | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count |
| Acharnes | 19 | 3.2% | 5 | 14 | 2 | 4 | 5 | 8 | 0 | 5 | 9 | 5 | 3 | 2 | 0 | 9 | 5 | 8 | 8 | 3 | 2 | 10 | 7 | 14 | 5 |
| Agioi Anargyroi-Kamatero | 7 | 1.2% | 4 | 3 | 1 | 1 | 1 | 4 | 0 | 0 | 6 | 1 | 0 | 2 | 1 | 2 | 2 | 4 | 1 | 2 | 1 | 2 | 4 | 6 | 1 |
| Agios Dimitrios | 13 | 2.2% | 5 | 8 | 0 | 2 | 4 | 5 | 2 | 2 | 4 | 7 | 0 | 1 | 2 | 1 | 9 | 2 | 5 | 6 | 2 | 5 | 6 | 10 | 3 |
| Agrinio | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Aigaleo | 4 | 0.7% | 3 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 3 | 1 | 0 | 1 | 2 | 0 | 1 | 2 | 1 | 1 | 0 | 2 | 2 | 3 | 1 |
| Alexandroupoli | 9 | 1.5% | 3 | 6 | 3 | 5 | 0 | 1 | 0 | 0 | 6 | 3 | 4 | 1 | 0 | 2 | 2 | 4 | 3 | 2 | 0 | 4 | 5 | 7 | 2 |
| Amarousion | 17 | 2.9% | 14 | 3 | 2 | 4 | 5 | 2 | 4 | 2 | 8 | 7 | 0 | 4 | 2 | 6 | 5 | 1 | 9 | 7 | 0 | 9 | 8 | 16 | 1 |
| Athens | 78 | 13.2% | 27 | 51 | 10 | 16 | 21 | 22 | 9 | 9 | 42 | 27 | 14 | 18 | 10 | 21 | 15 | 39 | 17 | 22 | 4 | 37 | 37 | 52 | 26 |
| Chalandri | 12 | 2.0% | 4 | 8 | 1 | 7 | 1 | 3 | 0 | 0 | 8 | 4 | 0 | 1 | 4 | 3 | 4 | 5 | 6 | 1 | 0 | 9 | 3 | 7 | 5 |
| Chalcis | 9 | 1.5% | 4 | 5 | 0 | 1 | 6 | 1 | 1 | 0 | 6 | 3 | 0 | 1 | 0 | 2 | 6 | 1 | 4 | 4 | 0 | 5 | 4 | 9 | 0 |
| Chania | 10 | 1.7% | 7 | 3 | 1 | 0 | 2 | 4 | 3 | 2 | 5 | 3 | 0 | 5 | 0 | 1 | 4 | 2 | 4 | 4 | 1 | 8 | 1 | 6 | 4 |
| Corfu | 6 | 1.0% | 2 | 4 | 0 | 2 | 0 | 4 | 0 | 3 | 3 | 0 | 0 | 1 | 2 | 3 | 0 | 4 | 1 | 1 | 1 | 2 | 3 | 4 | 2 |
| Glyfada | 16 | 2.7% | 7 | 9 | 1 | 1 | 6 | 6 | 2 | 2 | 7 | 7 | 2 | 6 | 1 | 2 | 5 | 3 | 4 | 9 | 0 | 6 | 10 | 10 | 6 |
| Heraklion | 5 | 0.8% | 3 | 2 | 1 | 2 | 0 | 2 | 0 | 0 | 3 | 2 | 0 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 4 | 0 | 4 | 1 |
| Ilion | 14 | 2.4% | 2 | 12 | 1 | 2 | 9 | 2 | 0 | 3 | 6 | 5 | 1 | 1 | 4 | 5 | 3 | 6 | 5 | 3 | 1 | 5 | 8 | 13 | 1 |
| Ilioupoli | 10 | 1.7% | 4 | 6 | 0 | 2 | 4 | 2 | 2 | 2 | 8 | 0 | 1 | 3 | 0 | 2 | 4 | 5 | 4 | 1 | 0 | 5 | 5 | 6 | 4 |
| Ioannina | 9 | 1.5% | 5 | 4 | 2 | 1 | 3 | 2 | 1 | 3 | 6 | 0 | 2 | 2 | 1 | 0 | 4 | 4 | 4 | 1 | 1 | 4 | 4 | 5 | 4 |

| | | | Gender | | Age | | | | | Education | | | Economic Activity | | | | | Salary | | | Internet time spent | | | Digital Divide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | 18-34 | 35-44 | 45-54 | 55-64 | 65+ | Primary | Tetriary | Postgraduate | Inactive | Retired | Self-employed | Private employee | Public Servant | 0 -1000 | 1001-1500 | 1500+ | less than 1 hour | 1-3 hours | More than 4 hours | Above Basic | Basic |
| **Municipalities** | Count | Percent | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count |
| Kalamaria | 22 | 3.7% | 11 | 11 | 2 | 3 | 8 | 5 | 4 | 3 | 7 | 12 | 2 | 7 | 2 | 5 | 6 | 7 | 9 | 6 | 0 | 14 | 8 | 20 | 2 |
| Kalamata | 3 | 0.5% | 2 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 1 | 2 | 3 | 0 |
| Kallithea | 8 | 1.4% | 5 | 3 | 0 | 4 | 1 | 2 | 1 | 1 | 6 | 1 | 2 | 1 | 0 | 3 | 2 | 2 | 4 | 2 | 0 | 8 | 0 | 4 | 4 |
| Katerini | 6 | 1.0% | 4 | 2 | 0 | 0 | 4 | 1 | 1 | 0 | 2 | 4 | 0 | 1 | 1 | 1 | 3 | 1 | 3 | 2 | 0 | 2 | 4 | 2 | 4 |
| Kavala | 18 | 3.0% | 9 | 9 | 2 | 2 | 4 | 9 | 1 | 1 | 6 | 11 | 0 | 3 | 2 | 1 | 12 | 3 | 12 | 3 | 2 | 7 | 9 | 13 | 5 |
| Keratsini - Drapetsona | 4 | 0.7% | 2 | 2 | 0 | 0 | 1 | 3 | 0 | 0 | 3 | 1 | 0 | 1 | 0 | 1 | 2 | 2 | 2 | 0 | 0 | 2 | 2 | 2 | 2 |
| Kifissia | 15 | 2.5% | 11 | 4 | 1 | 2 | 4 | 7 | 1 | 1 | 7 | 7 | 5 | 1 | 4 | 3 | 2 | 6 | 1 | 8 | 0 | 11 | 4 | 9 | 6 |
| Komotini | 10 | 1.7% | 3 | 7 | 4 | 3 | 2 | 1 | 0 | 2 | 5 | 3 | 3 | 0 | 2 | 1 | 4 | 4 | 5 | 1 | 0 | 4 | 6 | 9 | 1 |
| Kordelio-Evosmos | 16 | 2.7% | 9 | 7 | 1 | 2 | 6 | 7 | 0 | 3 | 9 | 4 | 6 | 3 | 0 | 3 | 4 | 7 | 4 | 5 | 1 | 9 | 6 | 11 | 5 |
| Korydallos | 4 | 0.7% | 2 | 2 | 0 | 2 | 2 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 3 |
| Kozani | 9 | 1.5% | 4 | 5 | 1 | 2 | 2 | 4 | 0 | 1 | 5 | 3 | 3 | 1 | 1 | 0 | 4 | 6 | 1 | 2 | 0 | 5 | 4 | 7 | 2 |
| Lamia | 13 | 2.2% | 7 | 6 | 2 | 3 | 4 | 3 | 1 | 3 | 7 | 3 | 3 | 2 | 0 | 2 | 6 | 6 | 6 | 1 | 2 | 4 | 7 | 9 | 4 |
| Larissa | 9 | 1.5% | 6 | 3 | 1 | 1 | 5 | 2 | 0 | 1 | 7 | 1 | 2 | 1 | 3 | 2 | 1 | 5 | 1 | 3 | 0 | 6 | 3 | 6 | 3 |
| Mytilene | 4 | 0.7% | 4 | 0 | 0 | 1 | 2 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 3 |
| Nea Ionia | 13 | 2.2% | 7 | 6 | 1 | 3 | 2 | 4 | 3 | 2 | 7 | 4 | 1 | 5 | 1 | 4 | 2 | 5 | 3 | 5 | 1 | 9 | 3 | 8 | 5 |
| Nea Smyrni | 11 | 1.9% | 6 | 5 | 0 | 1 | 1 | 7 | 2 | 2 | 6 | 3 | 0 | 5 | 2 | 3 | 1 | 2 | 6 | 3 | 1 | 5 | 5 | 7 | 4 |
| Neapoli-Sykies | 13 | 2.2% | 9 | 4 | 3 | 0 | 4 | 4 | 2 | 5 | 4 | 4 | 2 | 4 | 0 | 6 | 1 | 5 | 4 | 4 | 1 | 6 | 6 | 8 | 5 |
| Nikaia-Agios Ioannis Rentis | 4 | 0.7% | 2 | 2 | 0 | 1 | 2 | 1 | 0 | 2 | 2 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 3 | 1 |
| Palaio Faliro | 3 | 0.5% | 1 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 0 | 2 | 1 |
| Patras | 13 | 2.2% | 9 | 4 | 2 | 1 | 4 | 5 | 1 | 2 | 6 | 5 | 2 | 2 | 1 | 3 | 5 | 7 | 4 | 2 | 1 | 4 | 8 | 10 | 3 |

| | | | Gender | | Age | | | | | Education | | | Economic Activity | | | | | | Salary | | | Internet time spent | | | Digital Divide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | 18-34 | 35-44 | 45-54 | 55-64 | 65+ | Primary | Tetriary | Postgraduate | Inactive | Retired | Self-employed | Private employee | Public Servant | 0 -1000 | 1001-1500 | 1500+ | less than 1 hour | 1-3 hours | More than 4 hours | Above Basic | Basic |
| **Municipalities** | Count | Percent | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count |
| Pavlos Melas | 12 | 2.0% | 4 | 8 | 1 | 3 | 5 | 2 | 1 | 4 | 3 | 5 | 2 | 2 | 3 | 2 | 3 | 9 | 0 | 3 | 1 | 4 | 7 | 10 | 2 |
| Pella | 16 | 2.7% | 2 | 14 | 0 | 4 | 9 | 3 | 0 | 3 | 10 | 3 | 1 | 0 | 1 | 3 | 11 | 7 | 8 | 1 | 3 | 7 | 6 | 12 | 4 |
| Peristeri | 10 | 1.7% | 4 | 6 | 0 | 1 | 1 | 6 | 2 | 0 | 8 | 2 | 1 | 2 | 0 | 3 | 4 | 3 | 6 | 1 | 1 | 8 | 1 | 7 | 3 |
| Piraeus | 12 | 2.0% | 8 | 4 | 1 | 0 | 2 | 4 | 5 | 1 | 7 | 4 | 0 | 7 | 2 | 3 | 0 | 1 | 7 | 4 | 1 | 6 | 5 | 6 | 6 |
| Pylaia - Chortiatis | 15 | 2.5% | 5 | 10 | 1 | 3 | 7 | 1 | 3 | 2 | 5 | 8 | 1 | 2 | 1 | 4 | 7 | 3 | 5 | 7 | 2 | 8 | 5 | 8 | 7 |
| Rhodes | 3 | 0.5% | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 3 | 1 | 2 |
| Serres | 4 | 0.7% | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 1 | 3 | 1 | 1 | 2 | 1 | 3 | 0 | 3 | 1 |
| Thessaloniki | 51 | 8.6% | 20 | 30 | 7 | 5 | 8 | 28 | 3 | 12 | 22 | 17 | 7 | 8 | 6 | 14 | 16 | 18 | 13 | 20 | 5 | 21 | 25 | 29 | 22 |
| Trikala | 2 | 0.3% | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 0 |
| Veroia | 4 | 0.7% | 3 | 1 | 0 | 0 | 1 | 2 | 1 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 3 | 1 | 0 | 3 | 1 | 4 | 0 |
| Volos | 6 | 1.0% | 1 | 5 | 1 | 1 | 1 | 3 | 0 | 4 | 2 | 0 | 3 | 1 | 0 | 1 | 1 | 3 | 1 | 2 | 0 | 5 | 1 | 3 | 3 |
| Xanthi | 9 | 1.5% | 4 | 5 | 1 | 3 | 1 | 4 | 0 | 4 | 1 | 4 | 3 | 1 | 0 | 1 | 4 | 5 | 1 | 3 | 1 | 4 | 4 | 5 | 4 |
| Zografou | 12 | 2.0% | 5 | 7 | 3 | 2 | 5 | 2 | 0 | 1 | 8 | 3 | 1 | 1 | 2 | 8 | 0 | 4 | 5 | 3 | 2 | 1 | 9 | 8 | 4 |

# APPENDIX D – MUNICIPALITIES SCORES

| | | Objective Quality | | | | Demand Side Quality | | | | | Supply Side Quality | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Municipality** | **Performance** | **Accessibility** | **Best Practices** | **SEO** | **Perceived Awareness** | **Perceived Usefulness** | **Perceived Ease of Use** | **Awareness** | **Behavioral Intention** | **E-Gov Maturity (with criteria)** | **E-Gov Maturity (without criteria)** |
| 1 | Acharnes | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Enhanced Information |
| 2 | Agioi Anargyroi-Kamatero | Medium | Medium | Medium | Medium | Medium | Low | Low | Low | Medium | Enhanced Information | Transactional Services |
| 3 | Agios Dimitrios | Bad | Medium | Medium | Medium | High | Medium | Medium | High | High | Enhanced Information | Connected Services |
| 4 | Agrinio | Bad | Medium | Medium | Medium | | | | | | Emerging Information | Transactional Services |
| 5 | Aigaleo | Bad | Medium | Medium | Good | Low | Low | Medium | Low | Medium | Enhanced Information | Connected Services |
| 6 | Alexandroupoli | Bad | Good | Medium | Good | Low | Low | Low | Low | Low | Emerging Information | Connected Services |
| 7 | Amarousion | Bad | Medium | Good | Good | Low | Low | Low | Medium | Medium | Enhanced Information | Transactional Services |
| 8 | Athens | Medium | Medium | Medium | Medium | Low | Low | Low | Low | Low | Transactional Services | Enhanced Information |
| 9 | Chalandri | Bad | Medium | Medium | Medium | Medium | Medium | Medium | Low | Medium | Transactional Services | Transactional Services |
| 10 | Chalcis | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Enhanced Information |
| 11 | Chania | Bad | Medium | Medium | Medium | High | Medium | Medium | Medium | Low | Enhanced Information | Transactional Services |
| 12 | Corfu | Bad | Medium | Medium | Good | Low | Low | Low | Medium | Low | Enhanced Information | Connected Services |

| | | Objective Quality | | | | Demand Side Quality | | | | | Supply Side Quality | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Municipality** | **Performance** | **Accessibility** | **Best Practices** | **SEO** | **Perceived Awareness** | **Perceived Usefulness** | **Perceived Ease of Use** | **Awareness** | **Behavioral Intention** | **E-Gov Maturity (with criteria)** | **E-Gov Maturity (without criteria)** |
| 13 | Glyfada | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Transactional Services |
| 14 | Heraklion | Medium | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Enhanced Information |
| 15 | Ilion | Bad | Medium | Good | Good | Medium | Low | Medium | Medium | Medium | Enhanced Information | Transactional Services |
| 16 | Ilioupoli | Bad | Good | Medium | Good | Low | Low | Medium | Low | Low | Enhanced Information | Transactional Services |
| 17 | Ioannina | Bad | Good | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Transactional Services |
| 18 | Kalamaria | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Transactional Services | Transactional Services |
| 19 | Kalamata | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Enhanced Information |
| 20 | Kallithea | Medium | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Transactional Services |
| 21 | Katerini | Bad | Medium | Good | Medium | Low | Low | Low | Low | Low | Transactional Services | Transactional Services |
| 22 | Kavala | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Medium | Enhanced Information | Connected Services |
| 23 | Keratsini - Drapetsona | Bad | Good | Medium | Good | Low | Low | Low | Low | Low | Enhanced Information | Connected Services |
| 24 | Kifissia | Bad | Medium | Medium | Medium | Low | Low | Low | Medium | Low | Enhanced Information | Enhanced Information |
| 25 | Komotini | Medium | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Connected Services |
| 26 | Kordelio-Evosmos | Medium | Bad | Medium | Medium | Medium | Medium | Medium | Medium | Medium | Enhanced Information | Transactional Services |
| 27 | Korydallos | Bad | Good | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Transactional Services |

| | | Objective Quality | | | | Demand Side Quality | | | | | Supply Side Quality | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Municipality** | **Performance** | **Accessibility** | **Best Practices** | **SEO** | **Perceived Awareness** | **Perceived Usefulness** | **Perceived Ease of Use** | **Awareness** | **Behavioral Intention** | **E-Gov Maturity (with criteria)** | **E-Gov Maturity (without criteria)** |
| 28 | Kozani | Bad | Medium | Good | Medium | Medium | Low | Medium | High | Medium | Emerging Information | Emerging Information |
| 29 | Lamia | Bad | Good | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Enhanced Information |
| 30 | Larissa | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Transactional Services | Transactional Services |
| 31 | Mytilene | Bad | Good | Medium | Good | Low | Low | Low | Low | Low | Enhanced Information | Connected Services |
| 32 | Nea Ionia | Bad | Good | Medium | Medium | Medium | Low | Medium | Medium | Medium | Enhanced Information | Transactional Services |
| 33 | Nea Smyrni | Bad | Good | Medium | Medium | Medium | Low | Medium | Medium | Medium | Enhanced Information | Transactional Services |
| 34 | Neapoli-Sykies | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Emerging Information | Transactional Services |
| 35 | Nikaia-Agios Ioannis Rentis | Bad | Medium | Good | Good | Low | Low | Low | Low | Low | Transactional Services | Connected Services |
| 36 | Palaio Faliro | Bad | Medium | Medium | Medium | Medium | Medium | Medium | Low | Medium | Enhanced Information | Connected Services |
| 37 | Patras | Bad | Good | Medium | Good | Low | Low | Low | Low | Low | Enhanced Information | Connected Services |
| 38 | Pavlos Melas | Medium | Medium | Good | Medium | Low | Low | Low | Low | Low | Enhanced Information | Transactional Services |
| 39 | Pella | Medium | Good | Bad | Medium | Medium | Low | High | Medium | Low | Enhanced Information | Transactional Services |
| 40 | Peristeri | Bad | Medium | Medium | Medium | Low | Low | Low | Low | Low | Enhanced Information | Connected Services |
| 41 | Piraeus | Medium | Good | Good | Good | Low | Low | Low | Medium | Medium | Enhanced Information | Connected Services |

| | | Objective Quality | | | | Demand Side Quality | | | | | Supply Side Quality | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Municipality** | **Performance** | **Accessibility** | **Best Practices** | **SEO** | **Perceived Awareness** | **Perceived Usefulness** | **Perceived Ease of Use** | **Awareness** | **Behavioral Intention** | **E-Gov Maturity (with criteria)** | **E-Gov Maturity (without criteria)** |
| 42 | Pylaia - Chortiatis | Bad | Medium | Good | Medium | Low | Low | Low | Low | Low | Transactional Services | Transactional Services |
| 43 | Rhodes | Bad | Good | Medium | Good | Low | Low | Low | Low | Low | Enhanced Information | Connected Services |
| 44 | Serres | Bad | Medium | Medium | Medium | Medium | Low | Medium | Medium | Medium | Enhanced Information | Transactional Services |
| 45 | Thessaloniki | Bad | Good | Medium | Medium | Low | Low | Low | Low | Low | Emerging Information | Transactional Services |
| 46 | Trikala | Bad | Good | Medium | Good | Medium | Medium | Medium | Low | Medium | Enhanced Information | Transactional Services |
| 47 | Veroia | Bad | Medium | Medium | Good | Low | Low | Medium | Medium | Medium | Emerging Information | Enhanced Information |
| 48 | Volos | Bad | Medium | Good | Good | Medium | Medium | Medium | Medium | Medium | Enhanced Information | Connected Services |
| 49 | Xanthi | Bad | Medium | Medium | Good | Low | Low | Medium | Low | Low | Enhanced Information | Transactional Services |
| 50 | Zografou | Bad | Good | Medium | Good | Low | Low | Low | Low | Medium | Enhanced Information | Transactional Services |

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