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ANALYZING THE IMPACT OF E-GOVERNMENT QUALITY DIMENSIONS ON CITIZEN SATISFACTION THROUGH PLS-SEM: A CASE STUDY OF THE "NA MINHA RUA LX" APP IN THE LISBON METROPOLITAN AREA

Foazul Islam

Master Thesis

presented as partial requirement for obtaining a Master's Degree in Data Science and Advanced Analytics

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by

Foazul Islam

Master Thesis presented as a partial requirement for obtaining the Master's degree in Data Science and Advanced Analytics, with a specialization in Data Science.

Supervised by

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Lisbon, 15th July 2025

Foazul Islam

DEDICATION

To my wife, Ayesha Akther, for her unwavering love, patience, and constant encouragement throughout this entire journey. Your belief in me gave me the strength to keep going.

To my family, whose support and prayers have been a pillar of strength during every step of this academic path.

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ABSTRACT

Urbanization continues to challenge city governance, demanding innovative and citizen-centered solutions. In Lisbon, Portugal's capital, the *"Na Minha Rua LX"* app was introduced in 2017 as a digital platform for residents to report local urban issues and promote civic engagement. Despite its early promise, the app has faced criticisms regarding usability, responsiveness, and service quality—issues reflected in user feedback and low ratings on app platforms. This thesis aims to evaluate the key determinants that influence citizen satisfaction with the "Na Minha Rua LX" app by applying Partial Least Squares Structural Equation Modeling (PLS-SEM)**.** The study investigates five core e-government quality dimensions: system**,** information, service, trust**,** and privacy/security. A survey of 202 participants from the Lisbon Metropolitan Area, collected via convenience sampling, forms the basis of the quantitative analysis. The findings reveal that system**,** information quality, and trust significantly impact user satisfaction, while service quality and privacy/security do not show a statistically significant effect. These insights are vital for municipal decision-makers seeking to improve digital platforms and align them more closely with citizen expectations. By highlighting the role of system performance, transparent communication, and reliable information in fostering satisfaction, this study contributes to the broader literature on smart cities and urban digital governance**.** The results offer practical recommendations for improving the app's effectiveness and advancing Lisbon's strategic goals for citizen engagement and sustainable urban development by 2030.

KEYWORDS

E-Government; Citizen Satisfaction; System Quality; Service Quality; Information Quality; Trust; PLS-SEM; Na Minha Rua LX;

Sustainable Development Goals (SDG):

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LIST OF ABBREVIATIONS AND ACRONYMS

CS	Citizen Satisfaction
DV	Dependent Variable
GDPR	General Data Protection Regulation
H	Hypothesis
HTMT	Heterotrait-Monotrait ratio
ICTs	Information and Communication Technologies
IFQ	Information Quality
IVs	Independent Variables
NLP	Natural Language Processing
PLS-SEM	Partial Least Squares Structural Equation Modeling
PS	Privacy and Security
SEQ	Service Quality
SYQ	System Quality
TR	Trust
VIF	Variance Inflation Facto

1. INTRODUCTION

1.1. BACKGROUND OF STUDY

E-government offers several advantages for governments in enhancing the delivery of public services to citizens (Maktub, Handayani, & Sunarso, 2025). As observed by Idzi, & Gomes (2022), it represents a significant evolution in public administration, especially in terms of service delivery. E-government refers to the use of digital processes over computer networks to facilitate interactions between government entities, the public, and regulated private sector organizations (Idzi, & Gomes, 2022). It is characterized by citizen-centric services, public access to information, the role of technology in shaping public administration, and the need for skilled public service managers and workers (Idzi, & Gomes, 2022). Additionally, e-government fosters increased citizen participation in co-producing public services (Lee, 2024). As such, effective e-government implementation can greatly enhance the quality of public services at the local level (Widodo & Kusnan, 2023).

Understanding how e-government services influence citizen satisfaction is essential for improving these services and increasing public participation (Abdulkareem et al., 2022). Many countries have adopted mandatory e-government services, making access to public services reliant on digital portals (Alkraiji, 2021). As a result, governments are required to allocate more resources and develop new strategies to boost citizen satisfaction with these mandatory online services (Alkraiji, 2020).

Given the current stage of e-government development, it is crucial to identify relevant performance metrics to assess improvements following the implementation of digital government systems (Heeks, 2008). The success of e-government has been widely explored in research, although there is ongoing debate about which factors most accurately measure e-government users' satisfaction. Alawneh et al., (2013) considered the influence of five key factors: security and privacy, trust, accessibility, awareness of public services, and quality of public services. Wang and Liao (2008) showed that information quality, system quality, service quality, use, user satisfaction, and perceived net benefit are valid measures of e-Government system success. The adoption of e-government technologies depends on how well these systems address citizens' needs (Santa, et al., 2019).

Lisbon has strategically embraced technology as one important tool to enhance citizen engagement and proactively address urban questions. One important example is the "Na Minha Rua" app, an initiative that has played a pioneering role in providing residents with a mobile platform for reporting, communicating, and monitoring urban concerns. This innovation establishes a direct and transparent line of communication between the city administration and the citizens (Moutinho, 2024).

This study evaluates the five influential factors such as —trust, service quality, information quality, system quality, privacy and security—on citizen satisfaction (Alawneh et al., 2013; Santa et al., 2019) with the "Na Minha Rua" app e-government service through Partial Least Squares Structural Equation Modeling (PLS-SEM) in the Lisbon Metropolitan Area.

1.2. PROBLEM STATEMENT

The development and implementation of e-government systems present both opportunities and challenges for public administrations globally (Drew, 2011) While several studies have addressed technological implementation (Lee, 2010), information systems (Wang & Teo, 2020), and technology adoption (Hujran et al., 2023), limited research has examined how these components translate into meaningful citizen engagement and satisfaction, particularly at the municipal level. Local governments, such as those in Lisbon, must contend with unique variables like digital literacy, localized service needs, trust in public institutions, and citizen empowerment (Tejedo-Romero et al., 2022).

Dombrowski et al. (2014) argue that cultivating trust in e-government systems may be more important than merely achieving technical efficiency. Building on this, Almaiah and Nasereddin (2020) highlight that perceived website quality and institutional trust significantly affect the adoption of e-government services. Similarly, Chan et al. (2021) stress the importance of citizens' holistic perceptions—including core, facilitating, and supporting services—on their overall evaluation of service quality and satisfaction.

Despite identifying key success factors such as trust, usability, information accuracy, and system efficiency (Gupta et al., 2024; Alkraiji & Ameen, 2022; Li & Shang, 2020), integrative studies examining how these dimensions interact to shape citizen satisfaction remain scarce. Ilieva et al.

(2024) observe the ongoing difficulty in developing standardized metrics to assess user satisfaction and engagement, signaling a persistent gap in comprehensive, multidimensional research.

In Portugal, particularly in the Lisbon metropolitan area, there is still insufficient incorporation of citizen perspectives in the design and evaluation of e-government platforms (Chamusca, 2025). Ferreira et al. (2015) highlight technical and strategic limitations in local platforms such as the ALO Digital Project, despite a generally positive user outlook. Likewise, Gomes (2019) underscores the challenge of digital exclusion among vulnerable populations, emphasizing the need for more inclusive, citizen-oriented approaches to e-governance.

One digital initiative addressing these needs is Lisbon's "Na Minha Rua" application, which allows residents to report and track urban issues in real-time. While the platform promotes civic engagement and municipal responsiveness (Moutinho, 2024), its effectiveness remains underexplored in academic research. Specifically, there is a lack of studies analyzing how citizens evaluate the application across key quality dimensions such as trust, information, service responsiveness, usability, and data security.

Given this context, a comprehensive analysis of the impact of these factors on citizen satisfaction with the "Na Minha Rua" app is timely and essential. Such a study will contribute valuable insights to both academic discourse and policy development, supporting the optimization of e-government services in Lisbon and beyond.

1.3. RESEARCH QUESTION

Given the increasing use of e-participation platforms like "Na Minha Rua LX" in the Lisbon municipality (Jardim, 2022) and their potential impacts on citizen satisfaction, it is important to examine different factors such as trust, service quality, information quality, system quality, and security influence satisfaction. We developed this research question.

How do trust, service quality, information quality, system quality, and security influence citizen satisfaction with the "Na Minha Rua LX" e-government app in the Lisbon municipality?

E-government platforms, such as "Na Minha Rua LX," have been associated with increased citizen engagement and satisfaction. However, various factors like trust, information quality, and security

play crucial roles in determining how citizens perceive and interact with these platforms. Previous studies have shown that citizens' trust in government services and the perceived quality of the information and services significantly influence their overall satisfaction (Alruwaie et al., 2020). Trust, in particular, is essential in shaping citizens' willingness to use e-government services, as it affects how users perceive the responsiveness and reliability of the platform (Hariguna et al., 2019). Similarly, the quality of service and security measures can either enhance or diminish the public's engagement with digital platforms, especially when dealing with sensitive personal data (Wang & Teo, 2020).

1.4. SIGNIFICANCE OF THE STUDY

E-government has become a central pillar of modern urban governance, enabling more transparent, efficient, and citizen-centered service delivery (Alkraiji, 2020; Nookhao & Kiattisin, 2023). In the Lisbon Municipality, the *Na Minha Rua LX* application exemplifies this shift by offering citizens a direct platform to report and monitor local urban issues, such as infrastructure damage, sanitation, and public space concerns (Soares, 2024). This digital tool reflects Lisbon's broader commitment to smart city initiatives by fostering civic engagement and enhancing municipal responsiveness (Lisbon Council, 2022).

By assessing the impact of key e-government quality dimensions—trust, service quality, system quality, information quality, and security—on citizen satisfaction, this study contributes essential insights into how public digital services can be optimized to meet user needs. These dimensions are recognized as critical success factors in digital governance frameworks globally (Alkraiji, 2020; Mechant & Walravens, 2018).

The findings hold practical value for Lisbon's municipal policymakers by offering empirical data to refine digital service strategies, promote transparency, and enhance trust in public administration (UserCentriCities, 2022). For developers and civic technology designers, the study highlights user experience elements that most directly influence public satisfaction and continued engagement (Nookhao & Kiattisin, 2023). From an academic perspective, this research adds to the growing literature on local e-government applications and citizen-centered digital services (Mechant & Walravens, 2018).

Ultimately, the study supports Lisbon's transition toward smarter, more inclusive governance by promoting user-informed improvements in service delivery and encouraging greater citizen participation in municipal affairs (Lisbon Council, 2022; Soares, 2024).

1.5. LIMITATIONS OF THE STUDY

This study focuses exclusively on citizens residing and working in the Lisbon Metropolitan Area and examines their experiences with the *Na Minha Rua LX* application. While this localized scope enables a deep understanding of user satisfaction within Lisbon, the findings may not be directly generalizable to other municipalities or regions with different governance structures, digital maturity levels, or demographic profiles (Li & Shang, 2020).

The research primarily relies on survey responses, which may introduce response bias, such as overrepresentation of digitally literate or more civically engaged individuals. Additionally, technological advancements—such as the integration of AI-driven chatbots in government services—and policy changes, including new data privacy regulations like the General Data Protection Regulation (GDPR), may influence citizen satisfaction during the study period. These evolving factors could affect the stability and consistency of the findings, thereby limiting the generalizability of the conclusions to other timeframes or administrative contexts (FXMedia, 2024; European Commission, 2025).

Although factors like digital literacy, socioeconomic status, and accessibility are likely to influence satisfaction with e-government services, they are not the central focus of this study. Furthermore, the study emphasizes individual citizens as primary users of the app, potentially overlooking the perspectives of other stakeholder groups such as businesses, NGOs, and public service employees who may also interact with municipal digital platforms (Li & Shang, 2020)

2. LITERATURE REVIEW

2.1. E-GOVERNMENT AT THE MUNICIPAL LEVEL

E-Government refers to the use of information and communication technologies (ICTs) to deliver public services more efficiently and transparently. At the municipal level, this involves digital tools and platforms designed to improve local governance, enhance service delivery, and increase civic engagement (Rana et al., 2013). Municipal e-government systems often include applications for reporting infrastructure issues, waste management (Majerova et al., 2022) parking services (Rachmawati, & Fitriyanti, 2021), online permitting (Abdel Wahed, & Ismail, 2022), and citizen feedback platforms (Rotta et al., 2019).

As highlighted by Savoldelli et al., (2014), technological innovation in the public sector can create new public value when implemented through digital services, local policies, and regulatory reforms. In cities, e-government allows local governments to digitally store data, streamline administrative processes, and engage with citizens in real time (Al Dhaheri, & Hudin, 2021).

A practical example is the “Na Minha Rua Lx” mobile application developed by the Lisbon City Council, which allows residents to report urban issues such as potholes, broken streetlights, or garbage overflow. This app fosters greater transparency and direct interaction between local authorities and citizens, thus embodying the essence of municipal e-government (Soares, 2024).

Furthermore, municipal e-government not only supports more efficient operations but also strengthens democratic participation by facilitating two-way communication between local government and the public (Santa et al., 2019).

At the municipal level, the adoption of e-government systems is critical for improving local public services such as permitting, infrastructure management, and citizen outreach. These technologies enable local governments to operate with greater speed, efficiency, and accountability (Ruano, 2014). However, realizing their full benefits depends heavily on citizen participation and behavioral factors (Choi, & Song, 2020).

Municipalities must consider factors beyond just technical infrastructure — including trust in local authorities, ease of use, relevance to daily life, and digital literacy — when implementing e-government services (Ilieva et al., 2024). In Lisbon, for example, while apps like “Na Minha Rua Lx”

are available, their widespread adoption still relies on user awareness, trust in the system, and perceived effectiveness.

A key barrier at the municipal level remains low user adoption, often caused by limited public outreach, lack of training, or mistrust in digital platforms. This issue curtails the efficiency gains that e-government tools can offer (Ilieva et al., 2024).

To overcome these challenges, municipalities must develop inclusive strategies that combine digital transformation with community engagement, training programs, and ongoing feedback mechanisms. Doing so can significantly enhance adoption and maximize the value of local e-government initiatives.

2.2. CITIZEN SATISFACTION IN MUNICIPAL E-GOVERNMENT SERVICES

At the municipal level, citizen satisfaction with e-government services is crucial for promoting long-term engagement and fostering broader adoption. Local government digital platforms, such as Lisbon's "Na Minha Rua Lx", which enables citizens to report and track urban issues, demonstrate how user-centric services can encourage citizens to trust and continuously engage with municipal platforms (Moutinho, 2024).

The Expectation Confirmation Theory (ECT) explains that satisfaction occurs when the service experience matches or exceeds the expectations of the users. If citizens' experiences with e-government services are positive, they are more likely to continue using them, leading to increased trust and public participation (Luo et al., 2024).

Recent studies have emphasized the critical role of system usability, response time, and transparency in shaping user satisfaction with local e-government services. For example, Patergiannaki, (2023), found that Greek citizens were more likely to engage with municipal e-services when they were satisfied with the convenience and efficiency of the platforms. Similarly, Tejedo-Romero et al. (2022) highlighted that positive user experiences in Portugal led to higher rates of e-government adoption and increased willingness to use other digital public services at, municipalities.

Therefore, municipalities must prioritize continuous improvements to the user experience by ensuring their e-government platforms are user-friendly, efficient, and aligned with citizens' needs, fostering long-term trust and satisfaction.

2.3. QUALITY OF SERVICE IN E-GOVERNMENT

Service quality is measured by the quality of support provided by the app's developer, including technical support, network infrastructure, and system reliability (Wang, 2008).

The "Na Minha Rua Lx" application serves as a pivotal tool for enhancing citizen engagement and streamlining municipal services in Lisbon. By allowing residents to report issues such as waste management, public lighting, and infrastructure problems, the app fosters a collaborative environment between the city's administration and its inhabitants (Moutinho, 2024).

Recent studies have emphasized the importance of service quality dimensions—such as reliability, responsiveness, and user-friendliness—in determining the success of e-government platforms. For instance, a study by Sá et al. (2016) highlights the necessity of adapting traditional service quality frameworks to the digital context of local e-government services, ensuring they meet the evolving expectations of citizens.

Moreover, the integration of feedback mechanisms within the "Na Minha Rua Lx" app has been instrumental in building trust and ensuring transparency. By providing timely updates on reported issues, the application not only resolves problems efficiently but also reinforces citizens' confidence in municipal governance (Soares, 2024).

However, challenges remain. A study by Soares (2024) indicates that while the app has improved service delivery, there is a need for continuous evaluation and enhancement to address user concerns effectively. This includes refining the user interface, ensuring accessibility for all demographics, and maintaining prompt response times to reported issues.

2.4. QUALITY OF INFORMATION IN E-GOVERNMENT

Information quality refers to the accuracy, reliability, timeliness, and relevance of the data provided through digital government platforms. It is a key determinant of citizen satisfaction, influencing not only how users perceive e-government services but also their continued usage

intentions. High-quality information must be complete, understandable, secure, and tailored to user needs (Hariguna, et al., 2019).

Recent empirical studies confirm that information quality significantly affects user satisfaction in e-government contexts. For example, Hariguna et al., (2019) found that citizens' trust and satisfaction in public digital services in Indonesia increased significantly when information was perceived as timely, accurate, and relevant. Similarly, Pham et al., (2023) demonstrated that in Vietnam, information quality had a direct effect on perceived value, satisfaction, and loyalty toward e-government platforms.

Moreover, technological innovations like the Internet of Things (IoT) have been found to enhance the quality of information shared by public platforms, leading to greater engagement and trust. Chatterjee et al., (2018) observed that integrating IoT into public service delivery improved data transparency and responsiveness, which in turn enhanced user satisfaction and intention to reuse services.

In the context of municipalities, platforms like Lisbon's "Na Minha Rua Lx" illustrate the value of high-quality information. By enabling residents to report local issues and receive real-time feedback, the app ensures that the information shared is relevant, up-to-date, and actionable, reinforcing citizen trust in local governance (Soares, 2024).

Thus, the quality of information is not just a technical concern but a strategic priority for e-government success. Local administrations must regularly assess the information they provide, ensuring it meets citizen expectations and supports effective civic engagement.

2.5. QUALITY OF SYSTEM IN E-GOVERNMENT

System quality pertains to the overall performance of an information system, encompassing attributes such as reliability, availability, response time, usability, and adaptability. These characteristics are pivotal in determining user satisfaction and the continued use of e-government services. A system that is consistently available, responds promptly, and is user-friendly significantly enhances the user experience and encourages ongoing engagement.

Empirical studies have reinforced the importance of system quality in e-government adoption. For instance, Veeramootoo et al., (2018) validated an integrative model of e-filing continuance usage, finding that system quality significantly influences user satisfaction and the intention to continue using the platform. Similarly, Wang and Teo (2020) developed a mobile government success model, demonstrating that online service quality, which includes system quality, is positively associated with citizen satisfaction.

Further supporting these findings, a study by Li and Shang (2020) examined e-government service quality and its impact on citizens' continuous-use intention. The research identified system quality as one of the eight contributing dimensions of e-government service quality, highlighting its significant role in influencing perceived service value and citizens' intention to reuse e-government services.

In the context of municipal services, platforms like Lisbon's "Na Minha Rua Lx" exemplify the importance of high system quality. By providing a reliable and user-friendly interface for citizens to report and track local issues, the platform enhances user satisfaction and fosters trust in local governance (Soares, 2024).

In conclusion, ensuring high system quality is essential for the success of e-government initiatives. Governments must prioritize the continuous assessment and improvement of system attributes to meet user expectations and promote sustained engagement with digital public services.

2.6. TRUST IN E-GOVERNMENT

Trust is a pivotal factor in the adoption and continued use of e-government services, particularly at the municipal level, where the relationship between citizens and local authorities is more immediate and service-specific. In digital local governance, trust reflects the citizen's belief that their municipality will deliver services fairly, securely, and reliably, using digital tools to support—not exploit—public needs.

At the municipal level, trust encompasses multiple dimensions: trust in the technology (e.g., its security and usability), trust in the local government's intentions, and trust in the institution's competence to deliver effective services (Naranjo-Zolotov et al., 2019). This trust significantly

impacts the perceived usefulness and ease of use of digital platforms, which are central to user satisfaction and long-term adoption (Wirtz & Kurtz, 2017).

A lack of trust can deter residents from engaging with municipal e-services, such as complaint-reporting platforms, digital permits, or community portals. For instance, in Lisbon's "Na Minha Rua Lx" app, citizens' willingness to report issues like broken infrastructure or sanitation problems relies heavily on their belief that their inputs will be received, respected, and resolved transparently. Research by Soares (2024) found that citizen engagement with the app correlates strongly with perceptions of trust in both the responsiveness of municipal institutions and the reliability of the platform itself.

Studies also show that transparency, data privacy, and responsiveness are core trust-building mechanisms. When local governments clearly communicate service status and updates—e.g., through automated responses, progress tracking, or completion confirmations—citizen trust improves (Patergiannaki, 2023). Moreover, trust is reinforced when users feel that the system protects their privacy and handles their information responsibly (Qatawneh, et al., 2024).

In summary, for e-government initiatives at the municipal level to succeed, local authorities must foster trust through clear communication, prompt responsiveness, secure platforms, and consistent service delivery. Without these, even the most well-designed digital systems may see limited adoption and engagement from the very citizens they aim to serve.

2.7. PRIVACY AND SECURITY IN E-GOVERNMENT

Privacy and security are central to the success and sustainability of e-government initiatives, particularly because public agencies manage highly sensitive citizen data, including personal identification, financial records, and service usage history (United Nations Department of Economic and Social Affairs, 2022). At the municipal level, where digital platforms are increasingly used to provide services such as permit applications, infrastructure reporting, and social support, safeguarding this information is critical to building and maintaining citizen trust (Gil-Garcia, et al., 2016).

Privacy and security are identified as essential pillars in ensuring user satisfaction with mobile government (m-Government) services, as they directly influence users' trust and their willingness

to engage in online transactions. This study also emphasizes that users are unlikely to conduct transactions through m-Government services if privacy and security measures are weak, particularly when sensitive data such as financial information is involved (Desmal et al., 2022)

Modern e-government systems must address a range of cyber risks, including data breaches, ransomware, unauthorized surveillance, and denial-of-service attacks. These threats not only compromise service availability but also erode public confidence. Recent studies have consistently found that concerns over data protection and digital surveillance are major deterrents to the adoption of public digital services (Gupta et al., 2024).

From a user behavior perspective, the perception of strong security mechanisms—such as, confidential and private type information, data minimization, and transparent privacy policies—can significantly enhance satisfaction and encourage continued use of e-government platforms. For example, a study by Malik et al. (2016) on local e-government systems in Pakistan found that security and privacy have direct and positive impact on citizen satisfaction.

Additionally, privacy concerns are particularly significant in the context of mandatory digital services, where users may have limited alternatives. Citizens expect not only protection against breaches but also ethical use of their data, including transparency in data collection and informed consent. Failure to meet these expectations can lead to resistance, distrust, and underutilization of digital services, particularly among vulnerable or digitally fewer literate groups.

In summary, the effectiveness of municipal e-government platforms hinges not only on functionality but also on the perceived and actual protection of user data. Strong cybersecurity frameworks and transparent privacy practices are essential in establishing the trust required for long-term engagement and the successful digital transformation of local governance.

Table 1 – Literature review of Quality of service, Quality of Information, Quality of System, Trust, privacy and security.

Source	Main Findings
Wang (2008)	Service quality in e-government depends on technical support availability, network infrastructure robustness, and system reliability, which together ensure smooth and continuous service delivery to citizens.
Moutinho (2024)	The "Na Minha Rua Lx" app enhances citizen participation by enabling users to report local infrastructure issues directly, improving municipal responsiveness and fostering stronger collaboration between citizens and government agencies.
Sá et al. (2023)	Highlights the importance of tailoring traditional service quality models to the digital context of local e-government, stressing responsiveness, reliability, and user-centered design to meet modern citizen expectations.
Soares (2024)	Found that integrating real-time feedback mechanisms in municipal apps like "Na Minha Rua Lx" increases transparency and trust among users, but also identifies ongoing challenges related to user interface complexity, accessibility barriers, and the need for faster government response times.
Hariguna, et al., (2019)	Demonstrated that information quality dimensions—accuracy, relevance, timeliness, completeness—significantly boost citizen trust and satisfaction in Indonesia's e-government platforms, encouraging more frequent and sustained use.

Changchit et al. (2023)	Found that in Vietnam, high-quality information directly enhances perceived value, user satisfaction, and loyalty towards e-government services, suggesting information quality is a key factor for citizen retention and service success.
Chatterjee, Kar, & Gupta (2018)	Showing that incorporating IoT technologies in public service delivery improves data transparency and real-time responsiveness, leading to higher user satisfaction, greater trust in government processes, and stronger intentions to reuse e-government services.
Veeramootoo, Nunkoo, & Dwivedi (2018)	Confirmed that system quality attributes such as ease of use, reliability, and system flexibility play a critical role in user satisfaction and are essential for encouraging continuous use of e-government platforms, particularly in contexts like electronic tax filing.
Wang & Teo (2020)	Developed a model showing that mobile government platforms with high system quality—marked by stability, speed, and user-friendliness—positively influence citizen satisfaction, leading to broader acceptance and adoption of online public services.
Li & Shang (2020)	Identified system quality, including system reliability, ease of navigation, and speed, as a key dimension influencing citizens' perceived service value and their intention to continue using e-government services in the future.
Naranjo-Zolotov, Oliveira, & Casteleyn (2019)	Emphasized that trust in technology and government institutions (competence and goodwill) is a decisive factor in the success of municipal e-government platforms, directly affecting citizens' willingness to adopt and engage with digital government services.

Wirtz & Kurtz (2017)	Found that citizen trust acts as a strong predictor of satisfaction and continued use of municipal e-government platforms, with transparent practices and reliable services reinforcing positive user perceptions.
Patergiannaki (2023)	Highlighting that transparency, privacy protection, and prompt responsiveness are essential in building and sustaining citizen trust in local e-government services, which in turn affects service adoption rates and user loyalty in the context of the Greek Local Government.
Santa, et al., 2019	Reported that privacy and data protection concerns are major barriers to the adoption of digital public services in Saudi Arabia; however, citizen trust improves substantially when users perceive that their personal data is handled securely and ethically.
Malik et al**. (**2016)	Found that citizens' perceptions of confidential and private type information, data minimization, and transparent privacy policies, have a direct and positive effect on have direct and positive impact on citizen satisfaction with local e-government platforms in Pakistan.
United Nations DESA (2022)	Emphasized that robust cybersecurity frameworks and transparent privacy practices are critical for building sustainable and trusted e-government services globally, especially as governments manage increasingly sensitive and diverse citizen data through digital platforms.
(Desmal et al., 2022)	Privacy and security are identified as essential pillars in ensuring user satisfaction with mobile government (m-Government) services, as they directly influence users' trust and willingness to engage in online transactions, with this study emphasizing that users are unlikely to conduct such transactions if privacy and security measures are weak, particularly when sensitive data such as financial information is involved.

Gil-Garcia et al. (2016)	Noted that at the municipal level, safeguarding citizen data privacy and security is essential to maintain trust and engagement, as breaches or misuse of data can rapidly erode public confidence and hinder the success of digital government initiatives.

2.8. THE USE OF E-GOVERNMENT AND ITS IMPACT ON CITIZEN SATISFACTION (MUNICIPAL CONTEXT)

At the municipal level, e-government platforms serve as essential tools for enhancing public service delivery, streamlining administrative processes, and fostering greater civic engagement. Applications such as Lisbon's "Na Minha Rua Lx" exemplify how digital systems can facilitate direct communication between citizens and local authorities—allowing residents to report issues, track service responses, and receive updates on urban concerns (Soares, 2024). These types of services play a central role in shaping public perceptions of government responsiveness and efficiency.

Citizen satisfaction in municipal e-government is largely driven by how well the services meet local needs. Recent research confirms that system usability, information relevance, and service responsiveness are key determinants of satisfaction at the local level (Bernhard et al., 2018). When residents find local digital platforms intuitive and responsive—such as receiving prompt action on a reported pothole or streetlight malfunction—they are more likely to trust and continue using such services.

Moreover, citizen satisfaction acts as a feedback mechanism for municipal performance. A study by Trung (2024) found that local governments that actively maintain and improve their digital interfaces tend to experience higher levels of public satisfaction and engagement. In Lisbon's case, Soares (2024) notes that consistent updates, transparent workflows, and user-oriented design in the "Na Minha Rua Lx" platform contribute to increased citizen confidence in the municipality's capacity to act.

However, disparities in digital access and quality between neighborhoods can affect overall satisfaction levels. Municipalities must therefore not only maintain functional platforms but also

ensure that digital services are inclusive, accessible, and relevant to all citizens—especially marginalized groups who may be underrepresented in digital participation (Pontones-Rosa et al., 2021).

In conclusion, municipal e-government services have a measurable impact on citizen satisfaction. By focusing on platform usability, service reliability, and meaningful feedback loops, local governments can improve perceptions of public value and strengthen democratic accountability.

3. METHODOLOGY

3.1. CONCEPTUAL FRAMEWORK

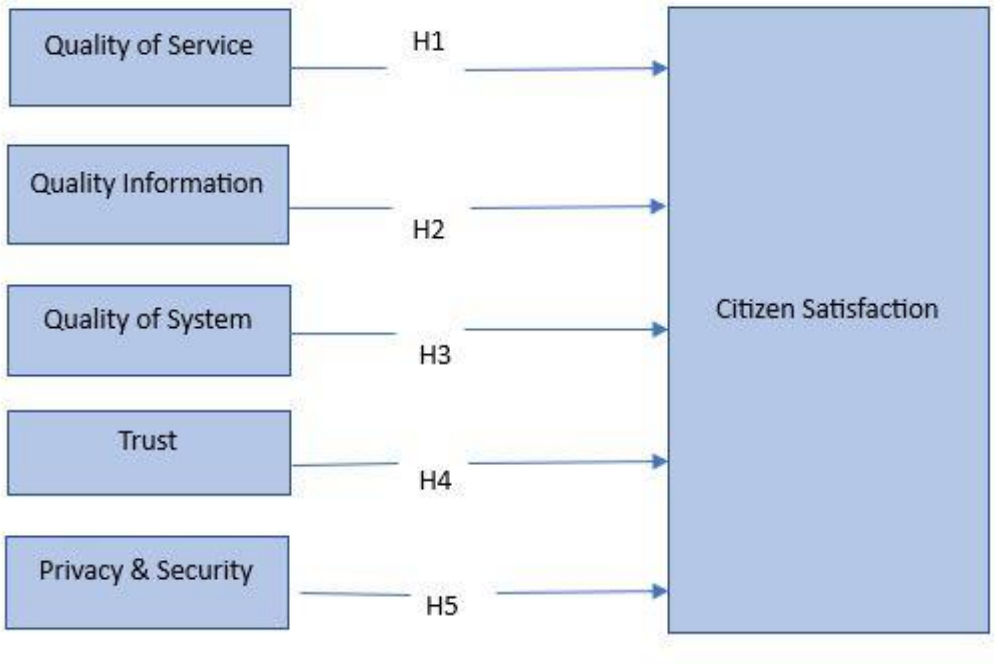

Figure 1 – Conceptual Framework

This research model investigates the impact of five influential factors such as trust, service quality, information quality, system quality, privacy and security on citizen satisfaction with the "Na Minha Rua LX" app in the Lisbon Metropolitan Area. The research framework was supported by the study of Alawneh et al. (2013) and Santa et al., (2019). Specifically, it hypothesizes that Quality of Service (H1), Quality Information (H2), Quality of System (H3), Trust (H4), and Privacy & Security (H5) each have a positive and direct effect on citizen satisfaction. Quality of Service refers to the responsiveness and efficiency of the app's services; Quality Information assesses the relevance, accuracy, and timeliness of information provided; Quality of System measures usability, interface design, and technical performance; Trust reflects citizens' perceptions of the app's reliability; and Privacy & Security concerns the protection of users' personal data. Using Partial Least Squares Structural Equation Modelling (PLS-SEM), the model aims to evaluate and quantify these

relationships to understand which dimensions most significantly influence overall citizen satisfaction with the app.

3.2. HYPOTHESIS

A hypothesis serves as a predictive statement that defines a potential relationship between variables or explains specific phenomena based on existing theories and empirical evidence (Mann, 2013). In the context of this study, which investigates citizen satisfaction with the *Na Minha Rua Lx* e-government portal in the Lisbon Metropolitan Area, five hypotheses are developed to explore the core determinants of satisfaction: service quality, information quality, system quality, trust, Privacy and security.

Service quality is widely recognized as a critical driver of user satisfaction in e-government platforms. For citizens using the *Na Minha Rua Lx* portal to report infrastructure issues, the responsiveness, efficiency, and reliability of the services provided play a vital role in shaping their overall satisfaction. Prior studies confirm that high service quality fosters greater trust and encourages continued usage of e-government portals (Alawneh et al., 2013; Hariguna et al., 2019; Veeramootoo et al., 2018; Moutinho, 2024). When municipal authorities promptly respond to citizens' reports and offer clear feedback, users perceive the platform as effective and valuable. Therefore, this study posits that improved service quality on *Na Minha Rua Lx* will result in higher citizen satisfaction.

H1: ***The quality of service provided by the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.***

The quality of information disseminated through e-government portals is a pivotal determinant of user satisfaction. For *Na Minha Rua Lx* users, the relevance, accuracy, timeliness, and clarity of information — such as status updates on reported issues or public service announcements — directly affect their perceptions of the platform's reliability. High-quality information reduces user uncertainty, builds trust, and enhances satisfaction (Wang & Teo, 2020; Veeramootoo et al., 2018; Chatterjee, et al., 2018). Poor or delayed information, in contrast, can lead to frustration and disengagement. Hence, this study proposes that providing accurate, timely, and user-relevant information through *Na Minha Rua Lx* will positively influence citizen satisfaction.

H2: ***The quality of information provided by the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.***

System quality refers to the technical soundness of the portal, including its usability, availability, reliability, and response speed. For users of *Na Minha Rua Lx*, an intuitive interface, quick load times, and consistent system uptime are essential to delivering a smooth user experience. Studies have shown that users are more likely to be satisfied and continue using an e-government service when the system operates efficiently and without technical errors (Upadhya et al., 2022; Santa, et al., 2019; Chatterjee, et al., 2018). Given the increasing digital literacy among Lisbon's citizens, expectations for system performance are high. Therefore, the present study hypothesizes that system quality is a significant predictor of citizen satisfaction with *Na Minha Rua Lx*.

H3: ***The quality of the system of the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.***

Trust is a foundational element in the adoption and sustained use of e-government services. It encompasses citizens' beliefs that the platform is secure, that their personal data is handled ethically, and that the government will act on their input (Malik et al., 2016; Santa et al., 2019; Chatterjee et al., 2018). For *Na Minha Rua Lx*, where citizens report sensitive municipal issues, trust in the platform's responsiveness and in the municipal authorities' commitment to resolving concerns is crucial. A lack of trust may deter citizens from using the portal, whereas high trust levels can lead to greater satisfaction and continued engagement. This study thus hypothesizes a positive relationship between trust and citizen satisfaction with *Na Minha Rua Lx*.

H4: ***Trust in the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.***

Security and privacy protection are paramount in fostering citizen confidence and satisfaction in digital government platforms. Given that *Na Minha Rua Lx* involves the exchange of personal and location data, users are particularly sensitive to the platform's ability to safeguard their privacy and protect against security breaches. Research indicates that strong privacy policies, data encryption, and transparent security measures positively influence citizens' perceptions and their willingness to engage with e-government services (Malik et al., 2016; Alawneh et al., 2013). Privacy

and Security positively influence user satisfaction and encourage greater adoption of mobile government services (Desmal et al., 2022). Therefore, this study posits that robust security and privacy features will enhance citizen satisfaction with *Na Minha Rua Lx*.

H5: ***Privacy and Security measures of the Na Minha Rua Lx portal are positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.***

4. EMPIRICAL STUDY

4.1. RESEARCH DESIGN

This study adopts a structured research framework aimed at analyzing the impact of E-Government quality dimensions on citizen satisfaction, using the *'Na Minha Rua LX'* app as a case study within the Lisbon Metropolitan Area. The primary objective is to evaluate how distinct quality dimensions—namely Trust, Service Quality, Information Quality, System Quality, Privacy and Security—influence user satisfaction with the app. Given the considerable population of Lisbon, a representative but limited sample was surveyed due to time and resource constraints.

The research employs a quantitative approach, enabling statistical assessment of the relationships between variables. As emphasized by Creswell and Creswell (2018), quantitative research is designed to measure and analyze the strength and direction of relationships between independent variables (IVs) and a dependent variable (DV) using structured instruments and statistical techniques. In this context, the selected E-Government quality dimensions serve as IVs, while citizen satisfaction functions as the DV. To model these relationships effectively, the study utilizes Partial Least Squares Structural Equation Modeling (PLS-SEM), which is particularly well-suited for predictive analysis and handling complex models with multiple constructs (Hair et al., 2019).

4.2. POPULATION

Lisbon, the capital and most densely populated city in Portugal, serves as the focal area for this research on citizen satisfaction with E-Government services, specifically through the *'Na Minha Rua LX'* mobile application. Despite its prominence, Lisbon has experienced a gradual population decline over recent decades (Leston, Bandeira et al., 2014). The broader Lisbon Metropolitan Area, however, remains significant, hosting nearly 3 million inhabitants—about 27% of the national population. As of 2021, Lisbon's resident population represented 5.2% of Portugal's total, with women accounting for 53.4% and men 46.6%, resulting in a sex ratio of 0.87 males per female, largely due to women's higher life expectancy (Garha & Azevedo, 2025). While the natural birth sex ratio tends to remain stable at approximately 1.05 males per female globally (Caselli et al., 2006), Lisbon's current demographic structure reflects broader aging and migration trends.

Importantly, the city has seen a marked rise in foreign residents over the past decade, with individuals of non-Portuguese origin now making up 10.1% of the population (Garha & Azevedo, 2025). This demographic diversity is relevant, as the *'Na Minha Rua LX'* app is designed to serve all city residents, regardless of gender, age, or nationality, by facilitating direct communication with municipal authorities.

For the purpose of this study, the target population encompasses all individuals currently residing in the Lisbon Metropolitan Area who have access to and are potential users of the *'Na Minha Rua LX'* app. This inclusive definition ensures that the research captures a representative perspective on citizen satisfaction with the city's E-Government services.

4.3. SAMPLING METHOD

This study employed a convenience sampling technique, a type of non-probability sampling, to recruit participants for the survey (Etikan, et al.,2016). This method was selected for its practicality, as it allowed for the collection of a substantial number of responses efficiently and at a relatively low cost — an important consideration given the exploratory nature of this case study on the *'Na Minha Rua LX'* app. However, it is important to acknowledge that convenience sampling can introduce selection bias, as the sample may not perfectly represent the broader target population, which could affect the generalizability of the findings (Hair et al., 2019).

According to demographic data from 2021, the average age of residents in the Lisbon Metropolitan Area was 44.8 years, slightly below the national average of 45.4 years (Garha & Azevedo, 2025). The population was distributed across three primary age groups: 15.8% were children (0–17 years), 60.8% were working-age adults (18–64 years), and 23.4% were seniors (65 years and older) (Garha & Azevedo, 2025). For the purposes of this research, only adults aged between 18 and 64 years were included in the sample. Individuals under 18 and those aged 65 and older were excluded, as the app primarily targets active residents who are more likely to engage with digital municipal services.

4.4. DATA COLLECTION TECHNIQUE

For this study, data were collected using a convenience sampling approach targeted at users and potential users of the *'Na Minha Rua LX'* app in the Lisbon Metropolitan Area. An online

questionnaire was distributed via email to university students and further expanded through social media platforms using a snowball sampling method, which allowed participants to share the survey within their personal and professional networks, thereby broadening the sample reach (Baltar & Brunet, 2012).

As noted by Creswell & Creswell, (2017), quantitative research seeks to explain relationships among variables by collecting and analyzing numerical data using statistical techniques. Among the available methods, surveys remain the most popular for gathering quantitative data due to their cost-effectiveness and efficiency when targeting larger and dispersed populations (Bryman, 2016). While surveys often involve modest sample sizes, they can yield significant insights, particularly when analyzed using robust statistical models such as Partial Least Squares Structural Equation Modeling (PLS-SEM), which is suitable even for small to medium sample sizes (Hair 2019).

The questionnaire was specifically designed et al., to measure the relationships between independent variables (Trust, Service Quality, Information Quality, System Quality, and Security) and the dependent variable (citizen satisfaction) in line with the study's hypotheses. Participation in the survey was strictly voluntary, and all respondents provided informed consent in accordance with the ethical standards set by the overseeing university's ethics board.

Before the official launch, a pilot study was conducted with a smaller group to assess the reliability of the measurement scales. This preliminary phase confirmed the internal consistency of the constructs and ensured that the wording of each item was clear and understandable. Minor language adjustments were made based on participant feedback, which enhanced the overall clarity of the questionnaire. The final round of data collection was carried out over a one-month period across Portugal, with a focus on capturing responses from individuals residing in the Lisbon Metropolitan Area.

4.5. MEASUREMENT

To capture participant responses, this study utilized a Likert scale format, which remains a widely accepted tool in quantitative research for measuring attitudes and perceptions. Scholars such as Joshi et al. (2015) have advocated for the use of seven-point Likert scales, citing their improved sensitivity and ability to capture nuanced respondent views compared to five-point scales. Nevertheless, the choice between five-point and seven-point scales largely depends on research

context, as there is no universally fixed rule (de Winter & Dodou, 2010). Given the exploratory nature of this study and its use of PLS-SEM, a seven-point scale was adopted for its greater variance and reliability in structural modeling.

The measurement items for each construct were adapted from well-established scales in prior e-government and information systems research:

- Information Quality (IFQ) was measured using items adapted from Santa et al., (2019), who examined its influence on user satisfaction in digital platforms.

- System Quality (SYQ) was assessed using validated indicators adapted from Nookhao & Kiattisin, (2023)., who examined system performance, usability, and reliability as key determinants of behavioral intention to use e-government services from the perspective of Thai citizens.

- Service Quality (SEQ) items were drawn from Veeramootoo et al., (2018), whose study analyzed the success factors in citizen-centric e-government services.

- For Citizen Satisfaction (CS), measurement items were adapted from Alruwaie, et al., (2020), with emphasis on sustained user engagement and satisfaction with government platforms.

- Trust (TR) was measured using items sourced from Alawneh et al. (2013) who investigated the role of trust as a critical factor influencing user satisfaction and adoption of e-government services in Jordan.

- Finally, Privacy and Security (PS) was measured using items sourced from Alawneh et al. (2013) who investigated the role of trust as a critical factor influencing user satisfaction and adoption of e-government services in Jordan.

Each of these measurement scales was carefully modified to fit the specific context of the *'Na Minha Rua LX'* app and validated through a pilot study to ensure clarity and contextual relevance for respondents in the Lisbon Metropolitan Area.

4.6. RELIABILITY TEST

Reliability pertains to the consistency of a measurement instrument, indicating the extent to which individual responses align with the true value of the underlying construct (McTavish & Loether, 2002). A common method to assess reliability is through internal consistency, typically measured using Cronbach's alpha (Rubin & Babbie, 2005). In this study, reliability analyses were conducted for each construct—such as usability, information quality, privacy and security, and citizen satisfaction—to evaluate the consistency of the measurement model in the context of the *'Na Minha Rua LX'* app, following the recommendations of Nunnally (1978), who suggested 0.50 as the minimum threshold in exploratory research. Cronbach's alpha served as the primary indicator of reliability, where values above 0.70 are considered acceptable and those above 0.80 are regarded as good (Bougie & Sekaran, 2019). Recent e-government studies have also confirmed the utility of Cronbach's alpha and composite reliability (CR), with values exceeding 0.70 indicating strong internal consistency (Rodríguez-Correa et al., 2025; Ayhan et al., 2025).

4.7. DATA ANALYSIS TECHNIQUES

This study employs multivariate analysis to simultaneously examine the relationships among the multiple quality dimensions of e-government services and their impact on citizen satisfaction (Leguina, 2015). To analyze the data collected from users of the *'Na Minha Rua LX'* app in the Lisbon Metropolitan Area, Partial Least Squares Structural Equation Modeling (PLS-SEM) is applied. PLS-SEM is particularly well-suited for this research, as it effectively handles complex models involving multiple constructs and paths, even with moderate sample sizes and non-normal data distributions (Hair et al., 2019). This method has gained wide acceptance in recent e-government and public administration studies for modeling citizen satisfaction and adoption behavior.

The structural model estimation and hypothesis testing using PLS-SEM will be conducted with Smart-PLS software, providing path coefficients, reliability, and validity measures essential for evaluating the impact of e-government quality dimensions on citizen satisfaction.

5. RESULTS AND DISCUSSION

5.1. DATA COLLECTION AND SAMPLE DESCRIPTION

To test the proposed models, data were collected from 202 respondents through an online survey hosted on the Qualtrics platform, conducted between 20th May and 24th June in 2025. The survey targeted users residing in the Lisbon Metropolitan Area, focusing on both college students and local residents. Participants were specifically recruited based on their use of the Na Minha Rua LX mobile application, a popular platform for reporting urban maintenance issues and communicating with local authorities.

The majority of respondents identified as male (128 individuals), while 71 were female, and 3 identified as non-binary or preferred not to disclose their gender. The survey sample was composed entirely of active users of the Na Minha Rua LX app, reflecting the app's growing adoption and relevance within urban engagement and digital governance in Lisbon.

5.2. DEMOGRAPHIC PROFILE OF RESPONDENTS

The demographic factors in the questionnaire consist of respondents' personal data such as gender, age (years), education, occupation, computer and digital technology skill level, daily internet usage, and frequency of Na Minha Rua LX app usage. The results are summarized in Table 2.

5.2.1. GENDER

Table 4.1 shows that a majority of the respondents were male (63.37%), followed by females (35.15%). A small number of participants identified as non-binary (0.50%) or preferred not to disclose (0.99%) their gender.

5.2.2. AGE (YEARS)

Most respondents were in the 18–30 years age group (57.92%), followed by 31–40 years (23.27%), and 41–50 years (11.88%). A smaller portion were aged 51–60 years (5.45%) and 61–65 years (1.49%).

5.2.3. EDUCATION

In terms of education level, 38.12% of respondents were graduates, 54.95% held postgraduate degrees, and 6.93% were at the undergraduate level.

5.2.4. OCCUPATION

The largest group of respondents were private sector employees (38.61%), followed by students (34.65%). Others included freelancers (9.41%), self-employed individuals (7.43%), and public sector employees (6.44%). Only 0.50% reported being unemployed, while 3.47% selected "Other."

5.2.5. COMPUTER & DIGITAL TECHNOLOGY SKILL LEVEL

Half of the respondents (50.00%) rated their digital skills as medium, while 35.64% considered themselves highly skilled. The remaining 14.36% identified their skill level as low.

5.2.6. DAILY INTERNET USAGE

A significant portion of respondents (34.65%) used the internet for 3–5 hours daily, while 31.19% reported using it for more than 8 hours. 30.20% used it for 5–8 hours, and only 3.96% used the internet for less than 1 hour.

5.2.7. NA MINHA RUA LX APP USAGE (PER WEEK)

Most respondents (76.24%) used the Na Minha Rua LX app 1–3 times per week, followed by 14.36% using it 4–6 times, and 6.44% using it 7–9 times. Only 0.99% used the app more than 9 times per week, while 1.98% reported no usage during the week.

Table 2 – Demographic Profile of Respondents (n=202)

Factors	Frequency	Percentage
Gender		
• Male	128	63.37
• Female	71	35.15
• Preferred not to disclose	2	0.99
• Non-binary	1	0.50

Age		
• 18-30 years	117	57.92
• 31-40 years	63	31.19
• 41-50 years	14	6.93
• 51-60 years	4	1.98
• 61-65 years	4	1.98
Education		
• Graduate	77	38.12
• Undergraduate	71	35.15
• Postgraduate	54	26.73
Occupation		
• Student	78	38.61
• Employee - private sector	74	36.63
• Self-employed	15	7.43
• Employee - public sector	15	7.43
• Others	11	5.45
• Unemployed	8	3.96
• Freelance	1	0.50
Computer & digital technology skill level		
• Medium	101	50.00
• High	70	34.65
• Low	31	15.35
Daily internet usage		
• 5-8 hours	69	34.16
• 1-4 hours	60	29.70
• More than 8 hours	42	20.79
• Less than 1 hours	31	15.35

Na Minha Rua LX service usage (Week)		
• 1-3 times	154	76.24
• 4-6 times	37	18.32
• 7-9 times	9	4.46
• More than 9 times	2	0.99

5.3. RELIABILITY AND VALIDITY ANALYSIS

Reliability analysis (RA) is a crucial statistical procedure used to evaluate the consistency, stability, and dependability of datasets and measurement methods (Izah, et al., 2024) RA plays a vital role in fields where precision in measurements and data is essential, such as psychology, education, healthcare, and market research (Izah, et al., 2023). Before running PLS-SEM analysis, the data collected were screened to ensure error free from missing value, suspicious response patterns, and outliers. Results from the statistical analysis were reviewed and evaluated in terms of the relation among items in the measurement model. In current research, the internal consistency reliability, convergent validity, and discriminant validity for each individual item of the instruments were being assessed. Internal consistency reliability for each subscale was determined by the composite reliability and Cronbach's alpha coefficient (Chan, & Lay, 2018).

5.3.1. CRONBACH'S ALPHA (CA) & COMPOSITE RELIABILITY

Cronbach's alpha (CA), a widely employed measure of internal consistency, assesses the degree of interrelatedness among items in a scale or questionnaire. This coefficient falls within the range of 0 to 1, with higher values (usually above 0.75) signifying a strong internal consistency, indicating that the items within the measurement instrument reliably measure the same underlying construct (Izah, et al., 2023). However, Cronbach alpha value 0.50, which is the just acceptable value as suggested by Nunnally (1978). The assessments of composite reliability, affirming that the collection of items represent their respective latent constructs, evaluations of convergent validity, substantiating the high correlation of indicators with their intended constructs (Pontes et al., 2024). Composite reliability value is less than 0.60 is poor, in the 0.70 is acceptable (Chan, & Lay, 2018). The table 3 presents reliability measures for six constructs: Information Quality (IFQ), System Quality (SYQ), Service Quality (SEQ), Trust in Government (TR), Perceived Security (PS), and Citizen Satisfaction (CS). Each construct is assessed using multiple items.

Information Quality (IFQ) shows a lower Cronbach's alpha of 0.742, but has high composite reliability values with rho_a at 0.753 and rho_c at 0.853. System Quality (SYQ) demonstrates strong reliability, with a Cronbach's alpha of 0.828, rho_a of 0.832, and rho_c of 0.886. Service Quality (SEQ) has consistently high values across all three measures, with a Cronbach's alpha of 0.853, rho_a at 0.859, and rho_c at 0.910. Trust in Government (TR) has a Cronbach's alpha of 0.747 and composite reliability values of 0.749 for rho_a and 0.855 for rho_c, indicating good internal consistency. Perceived Security (PS) reports a Cronbach's alpha of 0.880, with rho_a at 0.900 and rho_c at 0.926, reflecting strong reliability. Citizen Satisfaction (CS) also shows good reliability, with a Cronbach's alpha of 0.764 and composite reliability values of 0.767 for rho_a and 0.864 for rho_c.

Table 3 – Cronbach's Alpha (CA) and Composite Reliability (rho_a, rho_b)

Construct	Item	Mean	Std	Cronbach's alpha	Composite Reliability(rho_a)	Composite Reliability(rho_c)
IFQ	IFQ1	3.307	1.208	0.742	0.753	0.853
	IFQ2	3.243	1.299			
	IFQ3	3.515	1.105			
SYQ	SYQ1	3.455	1.227	0.828	0.832	0.886
	SYQ2	3.460	1.247			
	SYQ3	3.322	1.231			
	SYQ4	3.317	1.226			

SEQ	SEQ1	3.381	1.181	0.853	0.859	0.910
	SEQ2	3.302	1.183			
	SEQ3	3.351	1.211			
TR	TR1	3.703	1.174	0.747	0.749	0.855
	TR2	3.614	1.227			
	TR3	3.287	1.225			
PS	PS1	3.223	1.303	0.880	0.900	0.926
	PS2	3.248	1.293			
	PS3	3.277	1.306			
CS	CS1	3.738	1.163	0.764	0.767	0.864
	CS2	3.564	1.076			
	CS3	3.297	1.251			

5.3.2. CORRELATION MATRIX

The correlation matrix was utilized to examine the relationships of all variables, and the severity of the effect of correlation with numbers between +1 to − 1, was determined such that +1 indicates a strong relationship, and − 1 indicates a strong relationship in the opposite direction. Also, 0 indicates no relationship (Nazari et al., 2021)

Table 4 – Correlation Matrix

	CS	IFQ	PS	SEQ	SYQ	TR
CS	1.000	0.748	0.698	0.660	0.791	0.750
IFQ	0.748	1.000	0.838	0.821	0.783	0.705
PS	0.698	0.838	1.000	0.734	0.747	0.708
SEQ	0.660	0.821	0.734	1.000	0.669	0.745
SYQ	0.791	0.783	0.747	0.669	1.000	0.712
TR	0.750	0.705	0.708	0.745	0.712	1.000

5.3.3. DISCRIMINANT VALIDITY

To evaluate discriminant validity in this study, we use the Heterotrait-Monotrait ratio (HTMT). For the HTMT ratio, presented in Table 5, its values should be below the value of 0.9, which is also verified. Therefore, since all measures satisfy each one of the criteria, we can conclude that discriminant validity is supported (Pontes, et al., 2024)

Table 5 – Heterotrait-monotrait ratio (HTMT) – Matrix

	CS	IFQ	PS	SEQ	SYQ	TR
CS						
IFQ	0.980					
PS	0.840	1.017				
SEQ	0.805	1.050	0.847			
SYQ	0.986	0.984	0.867	0.785		
TR	0.974	0.966	0.888	0.937	0.912	

5.3.4. COLLINEARITY STATISTICS (VIF)

Variance inflation factor (VIF) is used to measure how much the variance of the estimated regression coefficient is inflated if the independent variables are correlated. The value of VIF is 1< VIF < 5; it specifies that the variables are moderately correlated to each other. The small values of VIF corresponding to the variables show that there is no problem of collinearity (Shrestha, 2020).

Table 6 – Collinearity Test

	VIF
IFQ -> CS	5.590
PS -> CS	3.826
SEQ -> CS	3.722
SYQ -> CS	3.097
TR -> CS	2.865

Information Quality (IFQ) shows a VIF value of 5.590 when predicting Citizen Satisfaction (CS), indicating potential multicollinearity concerns as it slightly exceeds the common threshold of 5. Perceived Security (PS) reports a VIF value of 3.826 towards CS, reflecting acceptable multicollinearity. Service Quality (SEQ) has a VIF value of 3.722 in relation to CS, which is within acceptable limits. System Quality (SYQ) demonstrates a VIF value of 3.097 when predicting CS, indicating low multicollinearity risk. Trust in Government (TR) shows the lowest VIF value among the constructs towards CS at 2.865, reflecting minimal multicollinearity concern.

5.4. HYPOTHESIS TESTING

The hypothesis is a critical component of scientific exploration, representing the researcher's expectations from the study (Vaidyanathan, 2023). In this research, hypothesis testing was conducted based on the results of the inner model (structural model) analysis, which includes outputs such as R-square values, parameter coefficients, and t-statistics. To determine whether a hypothesis can be accepted or rejected, the significance values between constructs, along with their t-statistics and p-values, were examined. The hypothesis testing for this study was performed using Smart-PLS 4.0 software (Luthfi et al., 2022). The p-value denotes the probability of occurrence of statistical significance in measuring the outcome of the research, based on the proposed hypothesis. According to Vaidyanathan (2023), a hypothesis is accepted when $p < 0.05$. These significance values were obtained from the bootstrapping results generated in SmartPLS (Luthfi et al., 2022). The results of the hypothesis testing for this research are presented in Table 8.

Table 7 – Path Coefficients

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
IFQ -> CS	0.254	0.248	0.128	1.995	0.046
PS -> CS	-0.004	-0.009	0.095	0.041	0.967
SEQ -> CS	-0.063	-0.062	0.083	0.761	0.446
SYQ -> CS	0.396	0.406	0.086	4.616	0.000
TR -> CS	0.338	0.340	0.072	4.664	0.000

According to the table, there were five relationships tested using Smart-PLS structural model analysis. These relationships were examined between Information Quality (IFQ) and Citizen Satisfaction (CS), Privacy and Security (PS) and CS, Service Quality (SEQ) and CS, System Quality (SYQ) and CS, and Trust in Government (TR) and CS.

The table shows the significance value of each relationship. The significance value of the relationship between IFQ and CS is 0.046, between PS (Privacy and Security) and CS is 0.967, between SEQ and CS is 0.446, between SYQ and CS is 0.000, and between TR and CS is 0.000. Therefore, according to the significance values, the relationships between PS and CS (p = 0.967) and SEQ and CS (p = 0.446) are rejected because their p-values are higher than 0.05, while the other models are significant.

Based on the analysis results, the beta value (original sample coefficient) of IFQ is 0.254, PS is -0.004, SEQ is -0.063, SYQ is 0.396, and TR is 0.338. Therefore, according to the beta values obtained from the structural model analysis, SYQ has the highest beta value, indicating the strongest positive effect on CS, while PS has the lowest beta value, showing no effect on CS.

Table 8 – Hypothesis Test Result

Hypothesis	Description	Result
H1	The quality of service provided by the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.	Rejected
H2	The quality of information provided by the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.	Accepted
H3	The quality of the system of the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.	Accepted

H4	Trust in the Na Minha Rua Lx portal is positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.	Accepted
H5	Privacy and Security measures of the Na Minha Rua Lx portal are positively associated with citizen satisfaction among residents of the Lisbon Metropolitan Area.	Rejected

6. CONCLUSIONS AND FUTURE WORKS

As mentioned this study examine the five influential factors such as —trust, service quality, information quality, system quality, privacy and security—on citizen satisfaction (Alawneh et al., 2013; Santa et al., 2019) with the "Na Minha Rua" app e-government service through Partial Least Squares Structural Equation Modeling (PLS-SEM) in the Lisbon Metropolitan Area. The results revealed that system quality, trust, and information quality are statistically significant predictors of user satisfaction, while service quality and privacy/security did not show a direct significant effect within the tested model.

From a practical and managerial standpoint, these findings emphasize the importance of investing in a reliable, efficient, and user-friendly system (Moutinho, 2024). As Moragudi (2024) notes, when system performance deteriorates, users are more likely to abandon the platform altogether. Furthermore, building trust in municipal responsiveness and digital platforms remains vital for citizen engagement (Porumbescu, 2015). Trust becomes even more essential in the era of interoperable data-driven governance, where both public authorities and citizens depend on secure and ethical data management (Esteves, 2022). Meanwhile, the quality of information—defined by its accuracy, timeliness, and relevance—plays a key role in shaping users' perceptions of usefulness and satisfaction (Abd Aziz et al., 2024).

The rejection of service quality and privacy/security as significant predictors suggests that users may take these elements for granted or see them as secondary to functional performance and transparency. This may reflect a lack of visible responsiveness or simply an assumption that baseline security measures are already in place. However, these aspects remain essential in practice, particularly as data sensitivity, privacy concerns, and digital literacy continue to evolve across different user groups.

Despite its insights, the study has several limitations. The use of a convenience sampling approach limits the generalizability of findings across Lisbon’s broader population. The sample size, while adequate for exploratory modeling, may restrict the robustness of detecting more nuanced relationships or mediation effects. Furthermore, user feedback often included informal or

ambiguous language, and the translation process from Portuguese to English may have introduced semantic bias, affecting the reliability of sentiment interpretation.

To address these limitations, future research should prioritize broader and more representative sampling, ideally stratified across age, socio-economic background, and digital literacy levels. Integrating advanced Natural Language Processing (NLP) techniques (Rodriguez et al., 2022) could also improve sentiment classification and feedback interpretation, especially for informal, multilingual content. Additionally, longitudinal studies could track satisfaction trends over time, especially in response to system upgrades or policy interventions.

Finally, exploring moderating factors such as user age, previous experience with e-government platforms, or neighborhood-level responsiveness could provide deeper insights into citizen expectations and behaviors. Examining behavioral intentions—including continued use, advocacy, or service avoidance—would also enhance understanding of long-term engagement patterns. Such analyses are essential for supporting the evolution of municipal digital tools like “Na Minha Rua LX,” especially as Lisbon advances toward more inclusive, responsive, and innovative urban governance.

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APPENDIX A

Part 1: General information and Citizen Satisfaction to use e-government services (*'Na Minha Rua LX'* app) of the respondents.

Instruction: Please tick ✓ in the answer that represents the fact.

1. Gender:

☐ Male
☐ Female

2. Age (years):

☐ 21-30
☐ 31-39
☐ 40-49
☐ 50-59
☐ 60-65

3. Education:

☐ Undergraduate
☐ Graduate
☐ Postgraduate

4. Occupation:

☐ Employee - private sector
☐ Employee - public sector
☐ Self-employed
☐ Freelance
☐ Student
☐ Unemployed
☐ Other.....

7. Computer & digital technology skill level

- ☐ High
- ☐ Medium
- ☐ Low

8. Daily internet usage

- ☐ < 1 hour
- ☐ 1-4 hours
- ☐ 5-8 hours
- ☐ >8 hours

9. Na Minha Rua LX service usage (Week)

- ☐ 1-3 times
- ☐ 4-6 times
- ☐ 7-9 times
- ☐ >9 times

Part 2: Opinions on factors affecting Citizen Satisfaction to use e-government services (*'Na Minha Rua LX'* app) of the respondents.

Instruction: Please tick ✓in the column that corresponds to your level of opinion based on the following criteria

Level of Agreement				
5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Factors affecting Citizen Satisfaction to use e-government services (*'Na Minha Rua LX'* app)	Level of Agreement				
Information Quality	**5**	**4**	**3**	**2**	**1**
1. The information I get from the *'Na Minha Rua LX'* app is complete					
2. The quality of the information I get from the *'Na Minha Rua LX'* app is on time.					
3. Local authorities can make decisions based on the information provided by the *'Na Minha Rua LX'* app?					
System Quality					
1. The *'Na Minha Rua LX'* app is user-friendly.					
2. The 'Na Minha Rua LX' app is easy to navigate and use.					
3. I can use the *'Na Minha Rua LX'* app at any time I need.					
4. The *'Na Minha Rua LX'* app performs reliably during my usage.					
Service Quality					
1. The *'Na Minha Rua LX'* app simplifies and standardizes how I					

report issues to the municipality					
2. The *'Na Minha Rua LX'* app contributes to modernizing municipal service processes.					
3. The *'Na Minha Rua LX'* app reduces the time needed to report and resolve urban issues					

Trust					
1. I trust that the *'Na Minha Rua LX'* app delivers public services in a trustworthy manner					
2. I expect my use of the *'Na Minha Rua LX'* app will increase in the future.					
3. I trust that my personal information will remain secure within the *'Na Minha Rua LX'* system.					
Privacy and Security					
1. The *'Na Minha Rua LX'* app complies with Portugal's personal data protection laws (e.g., GDPR).					
2. The *'Na Minha Rua LX'* app ensures the confidentiality of my personal information.					
3. The *'Na Minha Rua LX'* app does not share my personal information with others without my consent.					
Citizen Satisfaction					
1. I am satisfied with the information quality provided by the *'Na Minha Rua LX'* app					
2. I am satisfied with the service quality offered through the *'Na Minha Rua LX'* app.					
3. Overall, I am satisfied with my experience using the *'Na Minha Rua LX'* app.					

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