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From Technology to Social Inclusion: Citizens' Perceptions and Priorities About Smart Cities in the District of Porto, Portugal

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Abstract

As cities strive to become smarter and more sustainable, it becomes crucial to understand how residents perceive and engage with smart city initiatives. This study intends to ascertain citizens' perceptions and priorities regarding smart city initiatives in the district of Porto (Portugal). To achieve this objective, a quantitative methodology was employed. The population's understanding of the "smart city" concept and their satisfaction with smart urban services' availability, were analyzed through an online questionnaire answered by 171 inhabitants of the region. The results reveal that 61.4% of participants identified theirs as a smart city, with significant differences in perception between men and women and different age groups. Services related to environment and sustainability were the most frequently recognized (77.8%), while those related to "Economy and Innovation" received less recognition (53.2%). In a hierarchy of priorities for improvements, participants highlighted "Quality of Life", "Security and Privacy" and "Environment and Sustainability" as fundamental axes. This study suggests the need for greater alignment between municipal initiatives and citizen expectations, highlighting the importance of citizen participation in the development of strategies for smart cities.



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1. Introduction

Contemporary cities face growing challenges related to accelerated urbanization, environmental sustainability, mobility, security and social inclusion. In this context, the smart cities paradigm emerged as an innovative response, integrating digital technologies, data and citizen participation, to improve urban management and quality of life [1,2].

The evolution of smart cities reflects a significant transformation in the approach to urban planning, moving from a purely technological vision to a more holistic perspective, which places the citizen at the center of initiatives [3]. According to Guerra et al. [4], this movement represents a paradigm shift in city management, with technology becoming a tool to achieve broader social, economic and environmental objectives, instead of an end in itself.

Portugal has made significant progress in implementing smart city initiatives, with several cities in the north of the country, such as Porto, Maia and Matosinhos, who adopted smart solutions in various domains. However, there is a significant gap in the literature

regarding citizens' perception of these initiatives and the alignment between the priorities established by municipal managers and the real needs of the populations.

However, despite technological advances and public policies aimed at urban innovation, the way citizens perceive and evaluate these transformations in their daily lives remains underexplored.

Numerous studies have explored the technological infrastructures of smart cities, but fewer have centered their attention on the lived experiences and priorities of residents, particularly in mid-sized urban regions [5]. Simultaneously, different perspectives exist regarding the role and the expectations of citizens. If some studies emphasize co-creation and participatory governance [6], others critique smart city agendas for favoring top-down technocratic models that may neglect equity and inclusiveness [4,7].

The core motivation lies in the conviction that citizen participation, public perception, and social inclusion are fundamental—yet often overlooked—components for the success of any smart city strategy.

To address these issues, this study adopts a citizen-centered lens, assessing how smart city developments are perceived and whether they align with local expectations and values.

This study aims to fill this gap, investigating the perceptions and priorities of the Porto district inhabitants, regarding the concept of smart cities and the smart urban services available in their locations. Our comprehensive questionnaire seeks to ascertain whether the implemented initiatives are recognized by the population, if they meet their needs, and which areas are considered priorities for intervention.

The relevance of this investigation is based on the premise that the success of smart cities depends not only on the implementation of advanced technologies, but also on the inclusion and active participation of citizens in the urban transformation process. As highlighted by Meijer and Bolívar [8], smart city governance is a complex process that requires a political understanding of technology and an approach centered on public values, going beyond economic gains.

In order to enhance the clarity of the theoretical framework, and drawing on the literature review, a set of categories was established. These categories generally align with the indicators most frequently employed in smart city evaluation rankings, which, in turn, reflect core concepts that are intrinsically linked to the smart city paradigm itself.

Although the limitations inherent to the exploratory nature of the study and the use of convenience sampling are acknowledged, it is anticipated that the results will provide a preliminary understanding of citizens' perceptions regarding the implementation of the principles and services associated with the smart city concept. In particular, the study aims to identify domains perceived as more developed and effective, as well as areas with lower visibility or recognition among participants, highlighting potential perceptual asymmetries based on sociodemographic variables such as gender and age group.

The data obtained should also serve as a relevant starting point for critical reflection on the relationship between citizenship, technology, and urban governance, enabling the formulation of guidelines for future research. The analysis of the results will further seek to generate insights that support the development of a subsequent, more in-depth study, employing a more robust and representative methodology to validate and expand upon the trends identified herein.

2. Background

Studies on place branding and public diplomacy have evolved significantly over time, with a greater concentration of analyses focused on European and Asian locations. Although the term “public diplomacy” dates back to 1965 (coined by Edmund Gullion, see Cull [9]), Anholt in 1998 (cited by Barreto et al. [10]) helped to formalize the idea of

managing a place's reputation using branding principles. Since then, these two fields have intertwined in theory and in practice.

The concept of smart cities emerged in recent decades as a creative response to the challenges that increase with urbanization, sustainability and urban governance. These smart cities combine technology, data and social innovation, with the aim of raising citizens' quality of life, increasing the efficiency of urban services and encouraging sustainable practices [1,2].

Studies for the development of smart cities, therefore, consider the challenges imposed by increasingly accelerated globalization and the competition between countries, regions and cities, which more and more seek to promote the development of their territories, by attracting investments, technology, tourism, as well as financial and human resources [11].

Also known as computerized cities, or digital cities, the term "smart cities" emerged in 1997 from discussions for the Kyoto Protocol, with the aim of thinking about solutions to make cities more sustainable. One of the submissions was to make cities more intelligent, that is, to use technology in a massive way to be smarter about proposed urban solutions. However, despite the term "smart city", these are not directly linked to artificial intelligence [12].

According to Guerra et al. [4], in an in-depth analysis of the challenges and opportunities of implementing smart cities in different urban contexts, the transition requires a multidimensional approach that integrates technological, social, economic and environmental aspects. In their study, they highlight the importance of citizen participation and the co-creation of solutions, proposing a framework that facilitates the population's involvement in the development of smart urban initiatives. According to the study, the success of smart cities depends on a balance between the implementation of advanced technologies and the ability to respond to the real needs of the inhabitants, suggesting that top-down strategies often fail because they do not adequately consider the perspective of residents, workers or visitors, to urban solutions.

Caragliu et al. [2] state that urban development depends on the availability and quality of the communication grid, the knowledge and social network (human and social capital) and not just the physical infrastructure (the physical capital) of a city. In this context, the concept of "smart city" was introduced as a strategic device that encompasses modern urban production factors in a common framework and, in particular, to highlight the importance of Information and Communication Technologies (ICTs) to strengthen a city's competitive profile.

In smart cities [1], ICT merges with traditional infrastructures, coordinated and integrated through new digital technologies. The authors point out seven main objectives: understanding urban problems; coming up with effective and viable ways to coordinate urban technologies; establishing models and methods for using urban data across spatial and temporal scales; developing new communication and dissemination technologies; instituting new forms of urban governance and organization; defining critical problems related to cities, transport and energy; and, identifying risks, uncertainties and dangers in the smart city.

As stated by Harrison et al. [13], a smart city is one that integrates information and technology into the structures of urban systems, such as security, transport, energy, public services and health, with the aim of optimizing operations and improving the lives of citizens. Therefore, the concept goes far beyond the isolated use of technology, encompassing social, economic and environmental aspects.

Also, according to the authors [13], smart cities are urban areas where the prioritized analysis sources are those generated by the city's own development, such as traffic congestion, electricity use, security, time dynamization, transportation, among others. The mobilized foundational concepts are classified as instrumented, in reference to near real-time sources of data about the real world from physical or virtual sensors; intercon-

nected, referring to redistributed data in an enterprise computing platform; and intelligent, referring to the analysis of citizens' behavior to make economic decisions.

Alawadhi et al. [14] associates the need for a smart city with rapid urbanization, which creates an imperative urgency for cities to find more intelligent ways of managing the challenges that growth imposes, such as traffic congestion, pollution, increased crime, forms of waste management, excessive energy consumption, and so on.

Studies carried out by Meijer and Bolívar [8] present smart city models based on three pillars: cities that use smart technologies (technological focus); cities with smart people (focus on human resources); and cities with smart collaboration (focus on governance). Of course, it is also possible for smart cities to combine these three elements.

Regarding the priority axes in defining what a smart city is, there is no consensus in the literature. While for Washburn et al. [15] smart cities have as their identity feature their connection to smart computing technologies, capable of boosting fundamental services, such as education, health and security; authors such as Nam and Pardo [3] place the well-being and quality of life of its citizens as central axes of smart cities.

Studies by Fonseca and Ferraresi [16] state that from the goals established in the United Nations Agenda for 2030, the 11th Sustainable Development Goal warns of the need to make cities and urban settlements more inclusive, safe, resilient and sustainable.

However, far from a single definition, the authors analyze the complexity of the concept, which is reflected in the existence of different models and rankings of smart cities, whose ordering naturally follows from the indicators chosen to measure them [16].

The same authors also emphasize that a smart city nowadays is not just the green city, in the sense of a sustainable city; the safe city, in the sense of a city designed to be safe, where the infrastructure must be planned in light of security and crime prevention purposes; the nearby city, in the sense of a city built giving priority to the mobility of people and things; the accessible city, emphasizing participation, as a smart city must be inclusive and guarantee the accessibility of services to all citizens.

In an attempt to create parameters to be measured and translated into smart cities' rankings, different authors have identified a multiplicity of "intelligence indicators" for a city, which we consider here:

2.1. Digital Infrastructures and Connectivity

Digital infrastructures are often considered the backbone of a smart city. The availability of high-speed internet, free Wi-Fi in public spaces, devices connected via IoT (Internet of Things) and urban sensors make it possible to collect, analyze and use data in real time for more effective decision-making. These technologies enable a more efficient and personalized urban management aligned with the three main dimensions (technology, people and institutions) of the smart city: integration of infrastructures and services mediated by technology, social learning to strengthen human infrastructure and governance for institutional improvement and citizen engagement [3].

According to Zanella et al. [17] the Internet of Things (IoT) provides open access to selected subsets of data for the development of various digital services. Building a general architecture for IoT is therefore a complex task, mainly due to the huge variety of devices and the link layer of technologies and services that can be involved in such a system. Urban IoT must support the smart city vision, which aims to exploit the most advanced communication technologies to offer value-added services for city administration and its citizens.

2.2. Mobility, Transport and Accessibility

Mobility, transport and accessibility are central elements in smart cities. Smart mobility is one of the most evident aspects. This involves the use of intelligent transport systems (ITS), integrated traffic management, traffic lights that adapt to the flow, smart parking platforms and public transport that works effectively.

For Giffinger et al. [18], smart mobility is one of the six pillars of smart cities, and it plays a crucial role in social inclusion and the strengthening of the local economy. The objective of accessibility and smart mobility in urban areas is to create transport systems that are more efficient, sustainable and inclusive, capable of improving urban traffic and the mobility of inhabitants.

Docherty et al. [19] point out that most contemporary conceptions of smart mobility resemble “automobility”, with an emphasis on various changes in the way we move, and a vision of the future in which mobility will be framed as a personalized service available on demand, with individuals having instant access to an integrated clean, green, efficient and flexible transport system to meet all their needs.

According to Karlsson et al. [20], smart urban mobility has progressed with the implementation of integrated systems, such as Mobility as a Service (MaaS), an innovative approach that combines sustainability, digitalization and social inclusion, facilitating access to different modes of transport through digital platforms. This helps reduce dependence on individual vehicles and improves accessibility in cities. A multiple case study in Finland and Sweden, developed by the authors, demonstrates that relevant transport legislation, regulations and policies, such as transport-related subsidies, tax policies, innovation, attitudes and habits of people and public administration, planning of urban projects and transport infrastructure to support service-based travel, as well as participation of private actors are factors that converge for a shared vision of the MaaS ecosystem.

2.3. Energy

Energy, in association with the concept of sustainability, is a fundamental component in smart cities, which must seek truly sustainable energy, such as renewable energy sources; and monitor energy consumption—factors that are related to reducing the impacts of climate change. In smart cities, energy saving, environmental protection and the search for a greener city must be aligned [14].

Wesz et al. [21] highlights the growing attention to the energy performance of buildings, considered the most important criterion in sustainability rating systems and the least achieved in sustainability assessments, when compared to other building performance ratings, such as water efficiency or indoor air quality.

2.4. Governance and Public Services

Governing a smart city requires thinking about creating new forms of human collaboration using information and communication technologies, as technology alone will not make a city smarter. Thus, for the city manager to build a smart city, he must have a political understanding of the technology, a process approach to managing the emerging smart city, and a focus on both economic gains and other public values. The governance of smart cities is characterized as a complex process of institutional change and must respect the political nature of attractive visions of socio-technical governance [8].

Furthermore, the active participation of the population is crucial to giving legitimacy to public decisions. Smart governance, therefore, uses digital tools to improve the delivery of public services, fostering transparency and encouragement for citizen participation.

Fonseca and Ferraresi [16] point out that “new information and communication technologies (ICT) place smart cities and local governance as a horizon for the (re)organization

of democratic urban spaces that are inclusive, sustainable, resilient, safe and intelligent". The authors classify as the materialization of citizenship the participation of the city's inhabitants in decision-making processes on issues of local interest, capable of transforming the passive citizen into a participating actor and creator of urban space. The use of ICT enables digital participatory democracy and the implementation of an e-governance model [16].

In Governance Management, Alawadhi et al. [14] highlight that interdepartmental collaboration is fundamental, since initiatives change the organizational culture and vice versa, solidifying the role of senior management as strategic. However, the authors emphasize that limited budgets often present a major challenge for the government. Therefore, governance must be based on programmatic guidelines, budgetary and resource allocations, interactions and partnerships with external actors, seeking to better understand the desires and needs of stakeholders, involving citizens, companies and other interested parties and improving the relationship between citizens and government.

2.5. Quality of Life

A study by Cardullo and Kitchin [22] finds that most of the smart city initiatives that claim to be citizen-centered are in fact based on public administration, civic paternalism and a neoliberal conception of citizenship that places consumption choice and individual autonomy within a structure of restrictions defined by the State or by organizations that present market-oriented solutions to urban issues, instead of being based on the logic of citizenship, this is, civil, social, political and social rights. In order for a change in this process to be possible, the authors indicate the need to create standards to rethink "smart citizens" and "smart citizenship" in a logic that is, in fact, "citizen-centered".

Mora et al. [23], based on a bibliometric analysis, indicates that studies on smart cities represent a significant volume of scientific research; however, much of the resulting knowledge about them is purely of a technological nature, lacking the social intelligence, cultural artifacts and environmental attributes necessary for urban innovation related to ICT, aspects defended by the authors.

Thus, when referring to the quality of life of populations, which is crucial to the advancement of smart cities, should be a point of concern for governments to think about a city for everyone, with quality of life for all, a focus on the digital inclusion of vulnerable populations and data privacy issues.

2.6. Security, Privacy and Civic Participation

In smart cities, urban security is strengthened through advanced surveillance, immediate emergency responses and automated street lighting. However, the implementation of these technologies raises concerns about privacy issues and excessive surveillance.

Security, privacy and civic participation are central themes in the discussion about the use of technologies in urban areas. The implementation of solutions such as surveillance cameras, smart lighting systems and rapid responses in emergency situations needs to be performed in a way that respects citizens' privacy and the protection of their personal data. Initiatives to implement smart cities and urban science must follow three directives: reorientation in the way cities are designed; reconfiguring the underlying epistemology to openly recognize the contingent and relational nature of urban systems, processes, and science; adoption of ethical principles designed to derive benefits from smart cities and urban science while reducing negative effects [24].

As an example of civic participation, urban planner and technology analyst Anthony Townsend [25] investigates the historic collision of two global trends: rapid urbanization and the spread of ubiquitous computing. The author studies how the humble cell phone

became the best-selling consumer electronic device in history and how it is bringing new economic and social opportunities to the growing slums of the developing world [25].

2.7. Culture and Leisure

The presence of a creative class, the quality and attention dedicated to the urban environment, the level of education and accessibility, in addition to the use of ICT for public administration, are positively correlated with urban wealth and the development of a smart city [13].

Research carried out by Barroso and Baracho [26] points out that, in studies on smart cities, culture constitutes a subtopic, and cultural heritage is a subtopic of that culture. The authors recall that the term “smart heritage”, in reference to heritage preservation, began to appear in the literature in the early 2010s, with the first attempts to define the term dating back to 2013 [26].

The term “smart cultural heritage” refers to the possibility of digital connection between institutions, visitors and objects, in a dialog. Smart heritage adopts more participatory and collaborative approaches, making cultural data freely available, so-called open data, which increases opportunities for interpretation, digital curation and innovation [27].

Neirotti et al. [28] state that in cultural aspects public involvement aims to improve the exploration and attractiveness of a city’s cultural heritage. The authors divide the constituent items of a smart city into hard and soft domains, placing cultural issues in the soft domains block. In the case of culture, the authors highlight that public involvement aims to improve the exploration and attractiveness of a city’s cultural heritage, through the promotion of cultural events and the encouragement of people’s participation. It is up to the city to manage entertainment, tourism and everything it involves, such as hospitality, for example.

Neirotti et al. [28] also highlight the need for communication about cultural activities and ways to motivate people to get involved in them as well as information about the main places to visit in a city. Finally, they remind us of the importance of care, maintenance and active management of public spaces by city managers to improve the attractiveness of a city.

2.8. Environment and Sustainability

Smart city initiatives help create desirable conditions for a livable and sustainable city, preserving and protecting the natural environment, which, in turn, increases the attractiveness and livability of the city [14], placing the environmental issue as fundamental in the design of smart cities.

The response to contemporary urban challenges has materialized in the emergence of the paradigm of green and smart cities. This urban model combines technological innovations with ecological principles, aiming to transform the city experience in multiple dimensions.

By harmonizing advanced technology with environmental sustainability, these urban centers seek to improve population well-being, minimize ecological damage and stimulate an economy that benefits all social segments. Its strategy involves implementing sophisticated technologies to manage essential resources such as energy, mobility, waste and water resources, while simultaneously valuing natural areas and biological diversity in the urban environment. This design represents a creative and indispensable solution to the obstacles imposed by the accelerated urbanization of the current century. In the Portuguese context, examples such as Bragança, Lisboa, Porto and Oeiras demonstrate encouraging results, showing that the transition to ecologically responsible and technologically advanced urban centers is viable and advantageous for society [29].

2.9. Economy and Innovation

Smart cities are not just technology hubs; they also function as vibrant innovation ecosystems. The creation of environments that support startups, incubators, technology clusters and research centers is essential to strengthen competitiveness in urban areas.

For Giffinger and Gudrun [30], smart cities are those that are characterized by a future vision focused on the economy, people and the quality of life of their populations.

According to Komninos [31], cities seek smart solutions in several areas: innovative economy, infrastructure and citizen governance. Although there are around 20 fields of application for smart cities with thousands of possibilities, their real impact is still restricted. A European survey identified three urban priorities: competitiveness based on knowledge and innovation; active labor markets to reduce poverty; and environmental sustainability with a focus on energy savings and reducing the carbon footprint. The economic aspect of these cities is closely linked to technological innovation and the promotion of entrepreneurial ecosystems, forming what some experts call “smart territories”—where knowledge, creativity and technology converge to drive regional development.

Intelligence in the context of the urban economy provides for overcoming economic challenges with the creation of new jobs and businesses, increasing regional attractiveness and competitiveness [14].

2.10. Social Inclusion

Social inclusion in smart cities depends on tools that guarantee equal access to technology, encourage population participation and digital empowerment of more vulnerable groups.

Ahirrao et al. [32] states that human issues and social inclusion in smart cities must be concerned with the ability to integrate, understand, add value to their citizens, to not exclude anyone, treat everyone with dignity and equality and protect individual and collective rights in order to improve the quality of life of the city’s inhabitants. Also, Gomyde et al. [33] and Martinelli et al. [34], defend the need for smart cities to be more focused on human and inclusive aspects than on technology.

In this context, it is essential to understand that action, especially in highly anthropic areas, must take into account economic, social and environmental inequalities that characterize an urban ecosystem. Those actions must assume as a priority the need to encourage both economic growth and the protection of existing natural resources, but also the protection of the citizens’ general well-being [35].

3. Materials and Methods

The sample in this study was selected using non-probability convenience sampling, deemed suitable for the exploratory nature of the investigation.

The inclusion criteria for participation required respondents to be permanent residents of the district of Porto, Portugal, to actively work in it and be 17 years of age or older. 171 responses were obtained and the sociodemographic characterization of the participants is shown in Table 1. As the Porto district has approximately 1.8 million residents, a sample of 171 respondents, with a 95% confidence level, corresponds to a margin of error of 7.5% (acceptable given that it is an exploratory study).

Table 1. Sociodemographic characterization of the participants.

Participants		<i>n</i>	%	Mean ± DP
Sex	masculine	75	43.9	35.8 ± 15.3
	feminine	94	55.0	
	other	1	0.6	
	missing	1	0.6	
Age (years)	17–20	48	28.1	
	21–30	34	19.9	
	31–40	10	5.8	
	41–50	37	21.6	
	51–60	41	24.0	
	missing	1	0.6	
Marital status	single	89	52.0	
	married	64	37.4	
	separated/divorced	17	9.9	
	missing	1	0.6	
Level of education	elementary school (6th grade)	2	1.2	
	middle school (9th grade)	3	1.8	
	high school (12th grade)	70	40.9	
	vocational training	16	9.4	
	bachelor’s degree	18	10.5	
	undergraduate degree	50	29.2	
	master’s degree	8	4.7	
	PhD	3	1.8	
	missing	1	0.6	
Type of employment	contractor	12	7.0	
	fixed term contract	29	17.0	
	permanent employment contract	104	60.8	
	other	25	14.6	
	missing	1	0.6	
Total		171	100.0	

3.1. Questionnaire Design

The questionnaire was designed based on the literature review [11,18–20,30]. It has two sections: the first is related to the socio-demographic characterization of the participants (gender, age, marital status, level of education, type of employment, place of residence and work, and mode of transportation used); the second is composed by 10 questions related to the concept of “smart city”. The answers to these questions were dichotomous (yes/no), multiple choice, Likert scale and order of preference.

3.2. Procedure

The questionnaire was designed in LimeSurvey, made available through a link, and disseminated via email by University of Maia’s students, as well as in social networks, specifically Facebook and Instagram. Before starting the questionnaire, respondents were informed—through an Informed Consent Form—about the concept of “smart city”, as well as the main associated aspects, such as the incorporation of digital technologies in urban management, the promotion of sustainability, innovation in public services, and citizen participation. The goals of the study were also explained, along with the voluntary nature of participation, the possibility of withdrawing up until the submission of the questionnaire, and the assurance of anonymity and confidentiality of the data provided.

To ensure the ethical protection of participants, no personally identifiable data was requested. Additionally, the informed consent included the contact details of the responsible researchers for any further clarification or questions, promoting transparency and respect for participants’ rights. Participants were also informed that the collected data would be accessible only to the research team, stored electronically, protected by an access

code/password, and kept for a period of five years, in accordance with appropriate ethical procedures. Data was collected between November and December 2024.

3.3. Data Analysis

For statistical data analysis, the Statistical Package for Social Sciences software, IBM SPSS, version 28.0, was used. Initially, the sample was characterized through descriptive analysis of the data collected (response frequencies, percentages, means, standard deviations, minimum and maximum). For statistical inference, the parametric independent samples t test and the non-parametric Chi-Square test of homogeneity and Chi-Square test of independence were used.

4. Results

Table 1 shows us that 55% of respondents (the majority) are female, 48% are aged 30 or younger, 52% are single, 46.2% have a higher education degree, and the majority (60.8%) have a permanent employment contract at their workplace. Regarding the means of transportation used to get to work, the majority (65.5%) use their own car, followed by public transportation (21.1%). Only 7% walk to their workplace. Regarding questions 10 and 11 (on perception and satisfaction with the city respondents live in), the answers given are shown in Table 2.

Table 2. Respondents' answers to questions 10 and 11.

Questions	Yes		No	
	<i>n</i>	%	<i>n</i>	%
Q10. Do you consider the city you live in to be a smart city?	105	61.4	66	38.6
Q11. Are you aware if the following services are available in your area				
- DIGITAL INFRASTRUCTURE (widespread access to high-speed internet, free public Wi-Fi, IoT networks and smart devices, etc.)	110	64.3	61	35.7
- TRANSPORTATION, MOBILITY, AND ACCESSIBILITY (intelligent transport systems, traffic management—smart traffic lights, parking solutions, reduced mobility accessible services, public transportation and autonomous vehicles, etc.)	118	69.0	53	31.0
- ENERGY (smart grids, integration of renewable energy sources, and energy efficiency, etc.)	108	63.2	63	36.8
- GOVERNANCE AND PUBLIC SERVICES (e-services such as online bill payments, public safety, emergency response systems, crime prevention technologies, telemedicine, etc.)	123	71.9	48	28.1
- ENVIRONMENT AND SUSTAINABILITY (drinking water treatment, recycling, air quality, pollution control, maintenance of green spaces, sustainable buildings, energy-saving and carbon footprint reduction initiatives, investment in renewable energy)	133	77.8	38	22.2
- ECONOMY AND INNOVATION (startups support, technology centers, innovation clusters, technology's impact on employment, research, and development)	91	53.2	80	46.8
- QUALITY OF LIFE (housing—availability of smart and affordable housing solutions; education—digital learning platforms, smart classrooms; social services—programs for social inclusion, social assistance and community services, access to telemedicine services, healthcare facilities equipped with technology)	106	62.0	65	38.0

Table 2. *Cont.*

Questions	Yes		No	
	<i>n</i>	%	<i>n</i>	%
- SOCIAL INCLUSION (platforms for resident feedback, civic engagement, participatory governance apps, public forums, initiatives to promote digital skills, open and transparent data availability)	98	57.3	73	42.7
- SECURITY AND PRIVACY (protection of personal data, cybersecurity, confidentiality and privacy safeguards in the deployment of surveillance and data collection technologies, surveillance cameras on the street and public service spaces, smart public lighting, emergency response systems)	110	64.3	61	35.7
- CULTURE AND LEISURE (integration of technology in the preservation and promotion of cultural heritage, smart solutions for tourism and entertainment)	119	69.6	52	30.4

Table 3 presents the results to the question ‘How do you rate your satisfaction with the services provided by your local government (smart services)’, which was answered using a Likert scale (1: Very dissatisfied to 5: Very satisfied), through the mean, standard deviation and minimum, and maximum values.

Table 3. Results to question 12.

Q12. How Do You Rate Your Satisfaction with the Services Provided by Your Local Government (Smart Services) as It Regards to:	Mean	Standard Devia- tion	Median	Min	Max
Digital infrastructure	3.35	0.94	4	1	5
Transportation, mobility, and accessibility	3.29	1.05	3	1	5
Energy	3.33	0.91	3	1	5
Governance and public services	3.28	0.94	3	1	5
Environment and sustainability	3.41	0.92	4	1	5
Economy and innovation	3.17	0.83	3	1	5
Quality of life	3.27	1.01	3	1	5
Social inclusion	3.27	0.80	3	1	5
Security and privacy	3.34	0.92	3	1	5
Culture and leisure	3.54	0.88	4	1	5

Question 13, which asked respondents to rank ‘the 10 areas of intervention or priority services the local government should improve’, was analyzed in two ways: (i) by assigning a decreasing score from 10 to 1, from the first to the last choice; and (ii) by counting the frequency of responses for the top 3 choices. The results were similar, with a variation only in the lower-ranked items (Public Governance and Services alternating with Digital Infrastructure, and Economy and Innovation alternating with Transport, Mobility, and Accessibility) (Table 4).

Table 4. Answers to question 13.

Priorities for Areas of Intervention	Total
Quality of life	731
Security and privacy	687
Environment and sustainability	620
Energy	596
Transportation, mobility, and accessibility	574
Economy and innovation	529
Digital infrastructure	518
Culture and leisure	506
Governance and public services	492
Social inclusion	466

Tables 5–7 show the answers to questions 14 to 19.

Table 5. Answers to question 14 to 16.

Questions	Yes (%)	No (%)
Q14. Do you consider these types of services to be easy to use?	80.5	19.5
Q15. Are there any services that you think should be reviewed and reconsidered?	50.3	49.7
Q16. Do you believe these services to be known and accessible to everyone, including minority groups?	38.5	61.5

Table 6. Answers to question 17.

Question	Low (%)	Medium (%)	High (%)
Q17. How do you rate the level of impact these services have had in the city’s quality of life?	7.9	45.7	46.4

Table 7. Answers to question 18 and 19.

Questions:	Yes (%)	No (%)	Don’t Know (%)
Q18. Are there platforms that allow citizens to give suggestions or express their opinions on this matter?	25.4	17.2	57.4
Q19. Would you like to have a more active participation?	55.0	45.0	
If so, how could this collaboration be encouraged:			Didn’t answer (%)
-Through questionnaires	25.7	28.7	45.6
-Through interviews	6.4	48.0	45.6
-Through focus groups	4.7	49.7	45.6
-Through regular public consultations	16.0	38.0	45.6
-Through the creation of platforms for digital participation	28.6	25.7	45.6
-Through transparent and accessible information (including performance indicators and progress reports)	23.4	31.0	45.6

To test whether the responses were independent of gender (F/M) for nominal response questions—Questions 10, 11, 14, 15, 16, 17, 18, and 19—the non-parametric Chi-Square

test of homogeneity was applied to compare the proportion of responses between both sexes. Table 8 presents the questions where statistically significant differences in responses between the two genders were found.

Table 8. Answers' proportions for female and male participants, Chi-square and *p*-value.

Question	Proportion (SIM)		χ^2	<i>p</i>
	Female	Male		
Q10. Do you consider the city you live in to be a smart city?	0.76	0.43	19.610	< 0.001 ***
Q11.1 Are you aware if the DIGITAL INFRASTRUCTURE service is available in your area.	0.76	0.52	11.959	0.003 **
Q11.2 Are you aware if the TRANSPORTATION, MOBILITY, AND ACCESSIBILITY service is available in your area.	0.80	0.55	12.724	0.002 **

** $p < 0.01$; *** $p < 0.001$.

For the Likert scale question (Q12), the parametric independent two-sample t-test was applied to test whether the responses of the two genders showed statistically significant differences. The services where there are statistically significant differences between female and male participants are shown in Table 9.

Table 9. Mean and standard deviation in participants' answers divided by gender, t value and *p*-value.

Q12. How Do You Rate Your Satisfaction with the Services Provided by Your Local Government (Smart Services) as It Regards to:	Female		Male		t	<i>p</i>
	Mean	Standard Deviation	Mean	Standard Deviation		
Digital infrastructure	3.51	0.95	3.15	0.90	2.54	0.012 *
Transportation, mobility, and accessibility	3.45	1.02	3.08	1.06	2.23	0.024 *
Governance and public services	3.48	0.83	3.05	1.00	3.05	0.003 **
Environment and sustainability	3.53	0.77	3.23	1.05	2.18	0.031 *
Economy and innovation	3.30	0.76	3.01	0.89	2.24	0.027 *

* $p < 0.05$; ** $p < 0.01$.

Having divided the participants into 2 groups according to their level of education (Respondents without higher education and Respondents with graduate degrees and above), differences were found only for question 16 (nominal response). Participants without higher education showed a higher proportion of affirmative responses than those with graduate degrees, with statistical significance (Table 10). There were no differences for question 13 on the Likert scale.

Table 10. Answers' proportions for participants with and without higher education, Chi-square and *p*-value.

Question	Proportion of Yes		χ^2	<i>p</i>
	Without Higher Education	With Higher Education		
Q16. Do you believe these services to be known and accessible to everyone, including minority groups?	0.64	0.36	4.575	0.032 *

* $p < 0.05$.

Having divided the participants into 2 groups according to age (30 or younger and over 30), differences were found for questions Q11.1, Q11.2, Q11.9 and Q16 (Table 11).

Table 11. Answers' proportions for participants divided into 2 groups (30 or younger and over 30), Chi-square and *p*-value.

Question	Proportion of Yes		χ^2	<i>p</i>
	30 or Younger	Over 30		
Q11.1 Are you aware if the DIGITAL INFRASTRUCTURE service is available in your area.	0.73	0.56	5.369	0.020 *
Q11.2 Are you aware if the TRANSPORTATION, MOBILITY, AND ACCESSIBILITY service is available in your area.	0.78	0.61	6.024	0.014 *
Q11.9 Are you aware if the SECURITY AND PRIVACY service is available in your area.	0.73	0.56	5.369	0.020 *
Q16. Do you believe these services to be known and accessible to everyone, including minority groups?	0.49	0.29	7.166	0.007 **

* $p < 0.05$; ** $p < 0.01$.

The proportion of affirmative responses from younger respondents (aged 30 or younger) is statistically significantly higher than with older subjects for questions Q11.1, Q11.2, Q11.9, and Q16.

Regarding question 13, which uses a Likert scale, statistically significant differences were found regarding to: Transport and Mobility; Quality of Life; Social Inclusion; and Culture and Leisure—where younger participants (aged 30 or younger) reported a higher average (greater satisfaction) than older participants (Table 12).

Table 12. Mean and standard deviation of participants' responses divided into two groups (30 or younger and over 30), *t*-value and *p*-value.

Q13. How Do You Rate Your Satisfaction with the Services Provided by Your Local Government as It Regards to:	30 or Younger		Over 30		<i>t</i>	<i>p</i>
	Mean	Standard Deviation	Mean	Standard Deviation		
Energy	3.49	0.93	3.18	0.86	2.25	0.026 *
Quality of life	3.46	1.02	3.10	0.98	2.37	0.019 *
Social inclusion	3.45	0.77	3.10	0.78	2.94	0.004 **
Culture and leisure	3.68	0.93	3.40	0.82	2.08	0.039 *

* $p < 0.05$; ** $p < 0.01$.

5. Discussion

5.1. Perceptions of Smart Cities and Service Availability

When asked whether their city constitutes a smart city, the majority of residents (61.4%) have a positive view of the presence of smart technologies in their city. However, there is still a significant number (almost 40%) who do not see their city as such. This may suggest that although the technology is present its integration or visibility may not be clear to everyone.

Regarding the perception of availability of these same services, it is possible to conclude that Environment and Sustainability (such as recycling initiatives, waste management

and pollution control) is the most recognized service, with 77.8% of participants stating that these services are available. This can be considered a positive reflection of environmental policies and practices adopted by local government. Governance and Public Services (71.9%) and Culture and Leisure (69.6%) are also well evaluated, with the majority of participants considering these services to be available.

5.2. Areas with Lower Perceived Availability

At the opposite extreme we find Economy and Innovation, as the item that presents the lowest perception of service availability, with 53.2% of participants indicating that these services exist and 46.8% not recognizing them. In the second and third-to-last places in terms availability perception we find Social Inclusion and Quality of Life with 57.3% and 62%, respectively.

5.3. Inclusion and Contradictions in Perception

Although social inclusion ranked lowest among the perceived priorities of a smart city, a significant portion of respondents (61.5%) reported that urban services are not accessible to minority groups. This apparent contradiction suggests a disconnect between the recognition of social exclusion and the urgency attributed to addressing it. While citizens acknowledge the existence of accessibility gaps, they may not perceive them as directly impacting their daily lives, which diminishes the perceived priority of inclusion compared to more tangible or immediate concerns such as safety or infrastructure. This underscores the need to raise awareness about the systemic implications of exclusion and to promote a more integrated understanding of inclusion as a core component of equitable and sustainable urban development.

To make these recommendations more concrete, several strategies may be proposed: the creation of multilingual communication channels accessible to individuals with different types of disabilities; the training of community agents to act as facilitators in accessing public services; the implementation of inclusive digital platforms with simplified interfaces and technical support; and the establishment of regular forums that promote the direct participation of minority groups in the formulation and evaluation of public policies, ensuring that their specific needs are effectively addressed.

4. Urban Competitiveness and Key Challenges

The results of participants' perception of theirs as a smart city (61.4% say their city is smart) reflect the growing challenge that cities face to stand out in an increasingly competitive global context. To achieve this, as pointed out by Filipe et al. [11], cities need to attract investment, technology, tourism and talent. The positive perception of many participants regarding digital infrastructures and urban sustainability, as highly valued areas (with approval percentages of 64.3% to 77.8%), demonstrates an effort to position the city competitively by adopting technologies that benefit sustainable development and the efficiency of urban services.

In turn, areas such as Economy and Innovation or Security and Privacy have a lower perception and satisfaction, reflecting a continuous challenge for cities to integrate new technologies in an efficient and visible way for everyone, and also to ensure that privacy and security are not compromised with increasing digitalization.

5.4. Satisfaction Levels by Service Area

Regarding satisfaction with the services offered by the council (Question 12), Culture and Leisure present the highest average satisfaction (3.54), which indicates that participants are, in general, relatively satisfied with the services in this area, although there is still some dispersion in opinions (standard deviation of 0.88).

In second place comes Environment and Sustainability with an average of 3.41, which also suggests a positive assessment, but not without some criticism.

The areas with the lowest satisfaction averages are Economy and Innovation (average of 3.17) and Governance and Public Services (average of 3.28). These results indicate that, despite the existence of services in these areas, residents' expectations may not be fully met, possibly due to perceived limitations in the implementation and/or visibility of services, or, inclusively, a gap between City Council strategies and the communities' needs.

It should be noted that the standard deviation of responses reflects significant variability in opinions. The areas with the highest standard deviations, such as Transport, Mobility and Accessibility (1.05) and Quality of Life (1.01), indicate that opinions about these services are more polarized, that is, there are both very satisfied and very dissatisfied people.

Despite this, the median for all areas is between 3 and 4, which means that the center of the response distribution is between "neutral" and "satisfied", without major divergences between extremely negative or positive responses. This suggests moderate satisfaction, without great praise or criticism.

5.5. Thematic Priorities and the Role of Sustainability

The concept of smart city, which emerged from discussions on the Kyoto Protocol, can justify that environmental issues and sustainability, in particular, are seen as a priority for many cities, with 77.8% of participants recognizing that there are efforts in this area, such as recycling initiatives, pollution control and energy efficiency.

This focus on sustainability, through the use of smart technologies, is also aligned with the global objectives of the UN 2030 Agenda, as mentioned by Fonseca and Ferraresi [16]. The responses on the environment and energy demonstrate that the cities are, in general terms, advancing in the implementation of ecological and efficient solutions, which are central characteristics of smart cities.

5.6. Differences in Priority vs. Satisfaction

Regarding question 13, which asked participants to rank areas of intervention/services in their council according to those they most value, the results unequivocally point to Quality of Life as the priority axis, followed by Security and Privacy, Environment and sustainability and Energy. We would highlight that Social Inclusion appears last.

If, at first glance, it seems contradictory that social inclusion has a low evaluation in Question 12, but appears as one of the least valued as a priority in Question 13, there may be an explanation for these results. Although citizens are only relatively satisfied with social inclusion services (Q12), this does not necessarily reflect a perception of urgency or future priority (Q13).

This gap is not necessarily a contradiction, but rather a difference between current assessment and projection of future needs. Furthermore, many people may not directly perceive the impact of social inclusion on their daily lives, especially if they do not belong to vulnerable groups.

5.7. Usability, Accessibility and Participation

Regarding ease in the use of services (Question 14), 80.5% of respondents consider the services easy to use, so we can say that there is a widespread positive perception regarding the usability of public services, which suggests good organization and basic accessibility.

This does not mean that it is not perceived that some of these services may be outdated or ineffective, as 50.3% consider that some services should be reviewed or rethought.

As it regards to Inclusion and Access for All (Question 16), only 38.5% consider services accessible to everyone, including minorities, which should be seen as a warning sign. Although services are considered easy to use in general, there is a strong perception

of exclusion or access barriers for certain groups, which points to social inequalities or failures in communication and adaptation.

Regarding to Civic Participation mechanisms (Questions 18 and 19) the results should also lead to reflection, as only 25.4% say there are platforms to give suggestions/opinions, while 57.4% do not know. Despite the interest in participating more actively (which is mentioned by 55% of the sample), a lack of visible and effective civic participation channels becomes evident. It would be possible to consider, for example, the creation of digital participation platforms (28.6%) and questionnaires (25.7%), and promoting greater transparency of information (23.4%).

5.8. Impact and Sociodemographic Differences

In terms of the impact of Services on Quality of Life (Question 17), almost half (46.4%) of respondents see a high impact, and 45.7% a medium impact, which reinforces the importance of these services in the daily life of a city.

When we analyze and interpret the results according to gender, a pattern stands out where women seem to have a more positive or affirmative perception regarding the themes of questions 10, 11_1 and 11_2. On the level of satisfaction with services, women demonstrated higher levels of satisfaction than men in all items and, in 5 of these items, this difference is statistically significant ($p < 0.05$).

Given this data, it is essential to consider gender as a relevant variable in the evaluation and planning of urban services and in the formulation of public policies.

5.9. Differences by Age Group

Although these findings are limited by the non-random nature of the sample, they offer valuable indications and initial insights into generational differences in perceptions of public services

Also at the age group level, the results point to differences with statistical significance. It is the case that young people (≤ 30 years old, 48% of participants) have a more favorable perception of the council's public services, both in terms of the functioning and accessibility of services (Questions 11 and 16), and in general satisfaction with areas such as Energy, Quality of Life, Social Inclusion, and Culture and Leisure. However, it should be noted that social inclusion and accessibility (Questions 13 and 16) are the topics where the difference between generations is clearest, pointing to a more positive and integrated vision on the part of young people.

The results then lead to two important lessons: the need to involve young people and the need to better communicate and adapt services to older age groups.

5.10. Insights into Smart City Dimensions

It is important to highlight that the research results also reflect some of the key objectives for a smart city [1]:

- Understanding urban problems: The research reveals that, while areas such as Culture and Leisure (69.6%) and Environment and Sustainability (77.8%) have good perceptions, other areas, such as Economy and Innovation (53.2%), still face challenges in understanding and implementing efficient technological solutions.
- Coordination of urban technologies and governance: The results regarding participants' perception of smart services, such as Governance and Public Services (71.9%) and Security and Privacy (64.3%), demonstrate progress in terms of digital governance and public services, but also the need for improvements in areas such as digital security.
- Use of urban data and management models: The research on satisfaction with services reflects cities that already integrate urban data but also points to the need to develop

better management models and analysis of this data, especially in the area of Transport, Mobility and Accessibility.

- The quality of communication infrastructure: The results of Question 11 on Digital Infrastructure (64.3%) and Transport, Mobility and Accessibility (69%) show that the city is making progress in digital infrastructure and the use of technology to improve mobility. However, satisfaction with areas such as Economy and Innovation and Quality of Life, which depend heavily on human capital and intelligent collaboration, still present important challenges. This suggests that, although infrastructure is being developed, the quality of human capital and collaboration between citizens and public administration still needs to be strengthened.

Batty et al. [1] describe the fusion of Information and Communication Technologies (ICT) with traditional infrastructures. The results of Question 11 show that the areas with the highest satisfaction in terms of integrated digital technologies include Environment and Sustainability (77.8%) and Culture and Leisure (69.6%), reflecting an efficient integration of ICTs to optimize services in these areas. However, in Economy and Innovation, the integration of ICTs is not so evident, which suggests a possible gap in the way technology is being applied to foster innovation or the creation of new business models.

5.11. Alignment with Smart City Models

Studies by Nam and Pardo [3] highlight well-being and quality of life as central axes of smart cities. Although there is a positive evaluation in areas such as Culture and Leisure and Environment and Sustainability, areas directly related to quality of life, such as Transport, Mobility and Accessibility (average of 3.29) and Quality of Life (average of 3.27) itself, present a more moderate satisfaction. This suggests that, despite technological solutions to improve the way people live, challenges remain to be overcome to ensure that all citizens benefit equally from these advances.

The model of cities with smart people and smart governance proposed by Meijer and Bolívar [8] can be related to the area of Social Inclusion. Although the perception of services related to social inclusion (57.3%) is reasonable, the results on satisfaction with governance services indicate that, despite the presence of technologies, citizens may not feel sufficiently involved and heard in decisions or city governance.

At the same time, policymakers must understand the importance of prioritizing digital inclusion, robust data governance, and institutional innovation as a strategy to build more inclusive, secure, and resilient smart cities [36]. Analysis of research results in relation to the smart city concept also reveals that the cities are taking important steps in key areas such as digital infrastructure, smart mobility, sustainability and public governance [36,37]. However, there is room for improvement in aspects such as social inclusion, security and privacy, quality of life and innovative economy. It is important to highlight that the construction of a smart city requires not only the implementation of technologies, but also a continuous effort to integrate all citizens, improve their quality of life and ensure that the benefits of technological innovation reach everyone in a fair and accessible way.

It is important to acknowledge that the absence of random sampling procedures limits the statistical representativeness of the sample, which consequently restricts the generalizability of the findings to the broader target population. Nonetheless, the data collected provide valuable insights into initial trends, perceptions, and patterns concerning smart cities. These findings offer a foundational basis for guiding more comprehensive and extensive future investigations.

The results of this exploratory study highlight that, despite an overall positive perception regarding the presence of smart technologies and urban services, significant gaps persist in key areas, namely Social Inclusion, Economy and Innovation, Security and Privacy,

as well as civic participation and accessibility for minority groups. These findings allow for the formulation of practical implications and recommendations aimed at developing more effective and inclusive public policies.

First, the low perception of service accessibility among minority groups (only 38.5% consider the services accessible to all) underscores the need to implement targeted strategies that promote social inclusion. For example, it is recommended to develop multilingual communication channels and adapt services for various disabilities, such as subtitles in institutional videos, braille versions of digital content, and accessible interfaces on online platforms. Concurrently, training community agents to act as mediators between public services and vulnerable groups could facilitate access to and effective use of urban services.

Second, the relatively low perception of services related to Economy and Innovation (53.2%) suggests that the integration of digital technologies is not yet sufficiently visible or tangible to the population. Therefore, investment in technological infrastructure that fosters local entrepreneurship and social innovation is recommended, such as startup incubators, innovation hubs, and digital skills training programs for small business owners. Alongside these investments, awareness campaigns should be developed to inform the public about existing initiatives and encourage their use, while reinforcing trust in data security and privacy.

Regarding civic participation, the results indicate a deficit of effective channels for citizen engagement, with only 25.4% of respondents acknowledging the existence of platforms for suggestions and opinions. To address this gap, the creation and implementation of accessible, user-friendly interactive digital platforms that enable active citizen participation in municipal decision-making processes is suggested. Practical examples include mobile applications for reporting urban issues, online public consultations, and virtual thematic forums. The promotion of these tools should be accompanied by educational actions encouraging participation, especially among young people, who show greater willingness to engage civically.

Finally, statistically significant differences observed between genders and age groups indicate the need for a differentiated approach in the planning and communication of public services. The adoption of strategies that consider the specificities of these groups is recommended, such as targeted campaigns using communication channels appropriate to each age bracket, and the creation of specific programs promoting digital and social inclusion for groups with lower levels of satisfaction and participation.

In summary, this study reinforces the importance of integrated public policies that combine technological innovation, social equity, and citizen participation, aligned with the principles of smart cities and the objectives of the UN's 2030 Agenda for sustainable and inclusive development. In this regard, Ulya [38] emphasizes the significance of research on smart cities as essential to envisioning solutions to the challenges posed by global urbanization.

Future implications of this research include the need for longitudinal studies to monitor the evolution of citizen perceptions as smart city initiatives mature and expand as well as to incorporate larger and more representative samples to enhance the generalizability of findings. Investigating the role of emerging technologies such as artificial intelligence, blockchain, and the Internet of Things in addressing identified gaps could also be useful to provide further insights. Almiyat et al. [39], for instance, refers that the process of converting society to using electricity as its principal energy source, is essential to the long-term health of the energy sector.

Moreover, exploring participatory governance models that actively involve diverse citizen groups in co-creating smart city solutions will be a condition to ensure equitable and sustainable urban development. Finally, policymakers should consider adaptive frame-

works that respond dynamically to shifting social needs and technological advancements, fostering resilient and inclusive smart cities.

6. Conclusions

This study provides relevant data on citizens' perceptions and priorities regarding smart city initiatives in the Porto district. The results reveal a moderate recognition (61.4%) of the locations studied as smart cities, with significant differences between demographic groups. Women and younger participants showed a greater tendency to recognize their cities as smart and greater satisfaction with the services available, suggesting a possible relationship between digital literacy, familiarity with technologies and recognition of smart city initiatives.

Participants' stated priorities reveal a clear appreciation of Quality of Life, Security and Privacy, and Environment and Sustainability, pointing them as fundamental axes for the development of smart cities. The ordering also suggests that, from the perspective of citizens, the value of smart cities lies primarily in their ability to improve concrete aspects of everyday well-being, rather than in abstract technological advances.

Feedback on digital inclusion and accessibility raise some worries: 61.5% of participants do not consider that smart services are accessible to all people, including minority groups. This perception aligns with the concerns raised by Cardullo and Kitchin [22] about the need to rethink smart citizenship in a more inclusive and citizen-centered way.

The interest in more active participation in the development of smart city initiatives, expressed by 55% of respondents, points to a potential for citizen involvement that has not yet been fully explored.

These results thus suggest the need for greater alignment between council's strategies and citizens' expectations in the development of smart cities. It is recommended that public managers consider: (1) strengthening communication mechanisms about existing initiatives; (2) prioritizing interventions in areas of greatest citizen interest; (3) developing specific strategies for digital inclusion of vulnerable groups; and (4) implementing effective citizen participation platforms.

The limitations of this study include the sample concentrated in the Porto district and possible selection biases related to the questionnaire dissemination methodology. Future research could expand the analysis to other regions of Portugal, implement mixed methodologies that combine quantitative and qualitative data, and deepen the understanding of differences in perception between demographic groups.

Finally, despite the limitations inherent to the exploratory nature of the study, the results offer valuable insights into what should be considered to enhance a successful development of smart cities in the Portuguese context, namely that not only investments in technological infrastructures are necessary, but also an inclusive and participatory approach that places citizens and their needs at the center of urban transformation strategies.

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