

Smart urban development and quality of life: A sustainability perspective on Iași, Romania

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Abstract: This study explores whether citizens in Iași, Romania, use smart initiatives and perceive them as improving their quality of life. We conducted a city-scale semi-structured survey to assess participants' views on the sustainability of the implemented smart initiatives and their impact on their quality of life. The results show perceptions of smart initiatives and their usefulness differ substantially by age, indicating an emerging generational shift with medium- and long-term consequences. More than 80% of respondents are satisfied with their quality of life, and nearly 60% consider that their quality of life has improved as a result of the implementation of smart initiatives in the city. However, only 50% consider that Iași is developing sustainably, and more than 70% report that the expansion of green areas, eco-friendly transportation, improved recycling methods, and better air quality are important to them.

1. Introduction

The increasing degree of urbanisation worldwide increases the pressure on infrastructure, resources, and governance systems. To tackle these challenges, it is necessary to organise the urban space and to prioritise residents' quality of life and the sustainable development of cities. Many studies addressing the impact of environmental factors examine how our way of life affects the environment (Chen et al., 2022; Shivanna, 2022; Soni et al., 2025), how these factors can improve health and well-being (Mensah et al., 2016), or how they can have negative implications (Orzu et al., 2016). In recent years, they have also emphasized the need for a more sustainable environment (Helne, 2021). Therefore, environmental factors are essential in shaping our overall well-being. The quality of our surroundings can significantly impact our lives in numerous ways, including the quality of our living spaces, air, water, and recreational facilities. For example, pollution is a frequently addressed topic, mentioned in multiple contexts as a key factor in understanding variations in quality of life, well-being, and overall health status. This has gained momentum both in public discourse (BBC News, 2021; Mathiesen, 2025) and in scientific research (Ajibade et al., 2021; Papazotos, 2021), where it is debated, argued, and, most importantly, solutions are sought to reduce the pollution levels (Arora et al., 2018; Rhodes, 2018).

The constant development of society, population growth, and, implicitly, urban development have generated, in recent years, many debates and discussions, especially from the perspective of sustainability. Its absence and the need for sustainable

community development to achieve a good quality of life today and for future generations are often highlighted (Arora, 2018).

As urban living spaces become more complex due to increasing population density, reduced living space, the need for more green space, more parking, office and commercial space, among others, they require greater attention and in-depth strategic approaches. The concept of a smart city emerged as a useful tool to tackle the aforementioned issues; initiatives can help facilitate coexistence in an increasingly complex environment and improve quality of life (Gracias et al., 2023; Paskaleva and Cooper, 2022; Toli and Murtagh, 2020).

The concept of the smart city has been introduced in development plans and strategies over the past few decades as a solution to current urban problems (Yigitcanlar, 2015). The concept emerged in the early 21st century as a technology-driven solution, initially emphasising the deployment of information and communication technologies (ICT), Internet of Things (IoT) sensors, and big data analytics to optimise urban operations (Albino et al., 2015). It has also become a frequently studied topic in correlation with the fields or subfields in which it has implications, such as urban planning and sustainability (Haarstad, 2017; Shamsuzzoha et al., 2021; Toli and Murtagh, 2020), city development (Kumar et al., 2020), and economy (Li et al., 2016; Vinod Kumar and Dahiya, 2017). The political field also frequently uses the concept in public discourse and policies for urban development, promising sustainable solutions and improved quality of life (Joss et al., 2019; Varró and Szalai, 2022).

Quality of life is among the most common indicators used to evaluate the outcomes and the success of implementing a smart initiative for community development (Albino et al., 2015). The main justification used is that the success of any smart city effort must be measured by how it affects residents' lived experience. How effectively smart interventions translate into tangible, citizen-perceived improvements in urban liveability, inclusivity, and daily well-being has become the defining question of contemporary smart city scholarship (Caragliu et al., 2011). Therefore, the concept of quality of life — including well-being, health, satisfaction, and access to amenities — holds a central place in smart city frameworks. It is widely recognised as the main objective and key measure of urban digitalisation (Příbyl and Horák, 2015). Although, it must be acknowledged that a few existing studies that analyse the degree of connection between quality of life and smart cities fail to quantify the strength of this connection, arguing that it is largely subjective (Vázquez et al., 2018; Wang and Zhou, 2023).

In practice, smart initiatives are structured around six key dimensions: smart governance, economy, mobility, environment, people, and living. The last most directly reflects residents' well-being and urban satisfaction, and therefore the quality of life (Smith et al., 2024; Albino et al., 2015). This multidimensional structure recognises that urban quality of life results from the interaction of institutional, technological, environmental, and social factors across the city.

Measuring the quality of life in smart urban contexts is complex. Well-being is subjective, so identical technological interventions may prompt different perceptions across demographic groups. A general index cannot capture the full lived experience (Příbyl and Horák, 2015; Vázquez et al., 2018). Access to and use of smart services are key factors: residents with higher digital skills and human capital report greater life satisfaction and broader access to jobs, healthcare, and mobility. Those excluded from digital participation face compounding disadvantage (Alfaro-Navarro et al., 2024).

Objective indicators from sensors, administrative data, and technical audits provide essential but insufficient evidence for evaluating smart city performance. Recent studies argue that subjective, survey-based methodologies are indispensable and that surveys reveal demographic nuances invisible to aggregate technical metrics (Stanković et al., 2021). This includes variations in smart city awareness, service utilisation, and satisfaction across age groups, education, and geographic areas. Survey-based instruments help better understand how citizens experience and evaluate smart urban interventions.

Survey instruments, such as Likert scales, multi-criteria decision analysis techniques like BTOPSIS (Best-Worst Method combined with TOPSIS), and DEMATEL (Decision-Making Trial and Evaluation Laboratory), enable researchers to quantify perceptions, prioritise citizen concerns, and identify gaps between policy intentions and lived realities (Roszkowska and Wachowicz, 2024). Guazzo et al. (2026) emphasise that surveys can capture trust in data governance, concerns about privacy and surveillance, and perceptions of institutional transparency, while Santos et al. (2025) document that citizen surveys highlight digital exclusion as a barrier to equitable smart city benefits, especially for the elderly and lower-income communities. In participatory approaches, Dhenge and Nimbarte (2024) demonstrate how participatory surveys can empower marginalised groups by enabling them to voice their priorities and grievances, while other studies argue that iterative, community-engaged surveying fosters co-creation of smart city strategies (Kumar et al., 2020).

According to Cârstea (2024), subjective well-being is often analysed alongside objective indicators. There are many factors that can influence it, for example, physical and mental health, income, physical environment, poverty, and perception can be different from one person to another, depending on gender and age. There are also differences in perception influenced by education, culture, and religion, which are evident across countries and regions.

At the national level, the sustainable perspective is often addressed alongside other concepts, such as the smart city. If we refer to the national context, the subject addressed in this paper is analysed directly or in adjacent contexts, both at the national level (Ciucu, 2024; Ioan, 2024) and at the local-to-regional scale (Moise, 2023; Bogdea, 2026). Overall, we can say that it requires more attention from a subjective analysis perspective to validate the implementation of concepts, initiatives, decisions, and projects and to show how they integrate at the community level.

This study aims to address the gap in understanding how residents of Iași Municipality, a post-industrial Central and Eastern European city from Romania, experience and evaluate smart urban initiatives. The main goal is to evaluate to what extent residents of Iași perceive smart city initiatives as helpful and citizen-oriented for their needs and how these initiatives contribute to their quality of life. The research aims to evaluate citizens' perceptions, with particular attention to the role of demographic factors and to awareness of sustainable development. Specific research objectives include: (1) how the citizens perceive the sustainable development of the city; (2) to quantify perceived contributions of these initiatives to quality of life and identify priority areas for improvement; and (3) to analyse how perceptions vary by age and gender.

2. Study area

Iași Municipality is located in the north-eastern part of Romania (Figure 1), and is the third-largest city in Romania, according to the last Census results. In 2022, the city ranked second nationally in the Vegacomp Smart City Index¹, maintaining its status as a smart city through projects and initiatives that improve residents' quality of life and the efficiency of public services. Iași has implemented a wide range of major initiatives and projects in smart mobility (traffic management systems, intelligent public transport), digital infrastructure (broadband expansion, public Wi-Fi), smart environment (energy-efficient street lighting, air quality monitoring), and smart governance (inter-institutional digital platforms) (Ibănescu et al., 2022). Ivan et al. (2020) document the municipality's focus on technological deployment and the number of initiatives, and argue for a positive trend. However, Misinciuc (2023) identify a critical gap: despite the extent of Iași's smart city portfolio, the systematic evaluation of the impact on citizens is limited.

¹ <https://vegacomp.ro/smart-city-scan-for-romania-snapshot-860-projects-in-124-cities/>

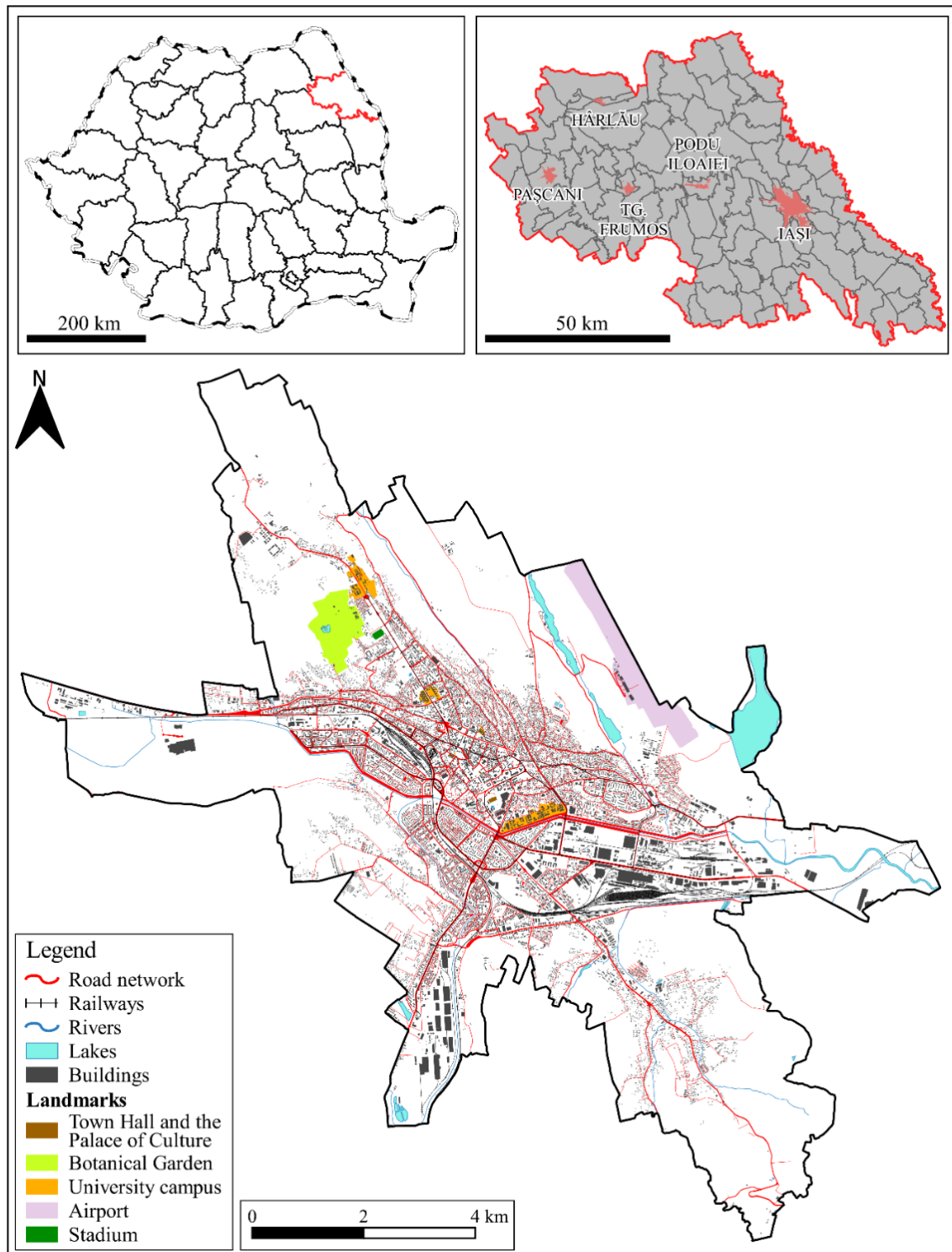


Figure 1. Location of Iași Municipality with its main landmarks.

As the city evolves, more and more built-up space replaces natural areas, consisting of large industrial sites and dense apartment blocks built in the communist era (Figure 2). Moreover, many developers continue to build chaotically and poorly, prioritising residential and commercial buildings over green areas, services, and transport infrastructure. This leads to dysfunction and creates imbalances in how neighbourhoods are developed, particularly in underserved peripheral areas, where new residential developments are often built without adequate infrastructure (roads, schools, green spaces, public transport), creating inequality in living standards between central and

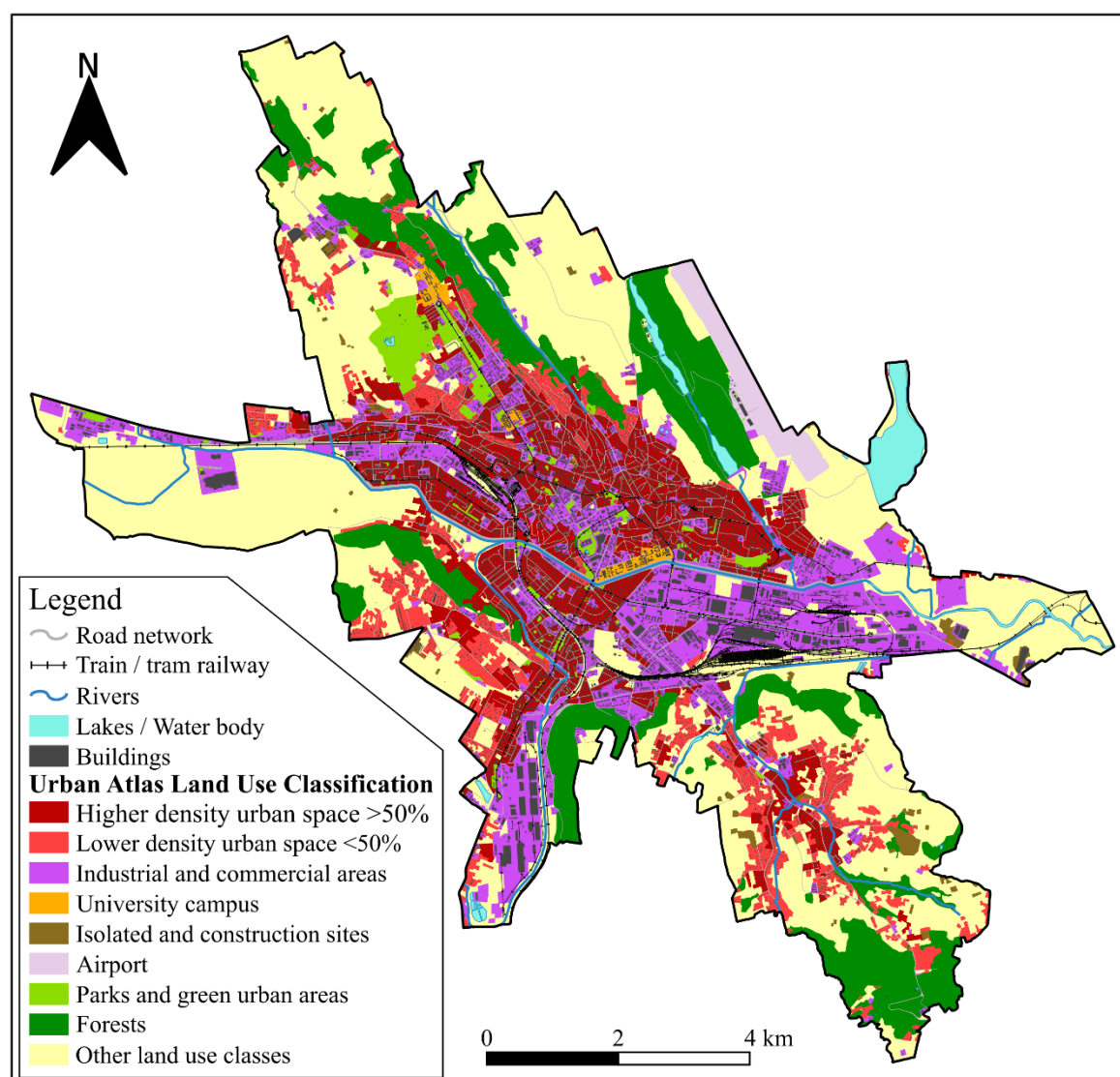


Figure 2. Land use classification for Iași territory based on the Copernicus Urban Atlas products.

peripheral neighbourhoods. This urban sprawl requires the implementation of a smart city model that meets the community's objectives for sustainability, inclusion, and quality of life. For example, a fully smart neighbourhood near the regional hospital is proposed for development as part of a smart city project².

At the 2021 census, the city had a population of more than 270,000, and the overall city density was around 2.890 inhabitants/km², which varied significantly across the city (Figure 3). The uneven distribution of population density directly determines which residents benefit from smart city initiatives. Some neighbourhoods often have lower access to services, worse air quality, less green space, and older infrastructure.

The city's continuous dynamism, oriented towards development, needs all the elements that shape and guide it in this direction, and the smart city concept comes to its aid, as it aligns well with the directions of development, modernisation, and digitisation. Through its diverse initiatives, it contributes to and impacts several areas, including the

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<https://apix.ro/foto-schite-tot-ce-trebuie-sa-stii-despre-primul-cartier-smart-al-iasului-zeci-de-cladiri-pentru-care-sunt-necesare-35-000-de-locuri-de-parcare/>, <https://arsc.ro/smart-city-district-iasi/>

economy, education, public administration, environmental protection, health, and tourism. It is necessary to analyse the current status of smart projects and

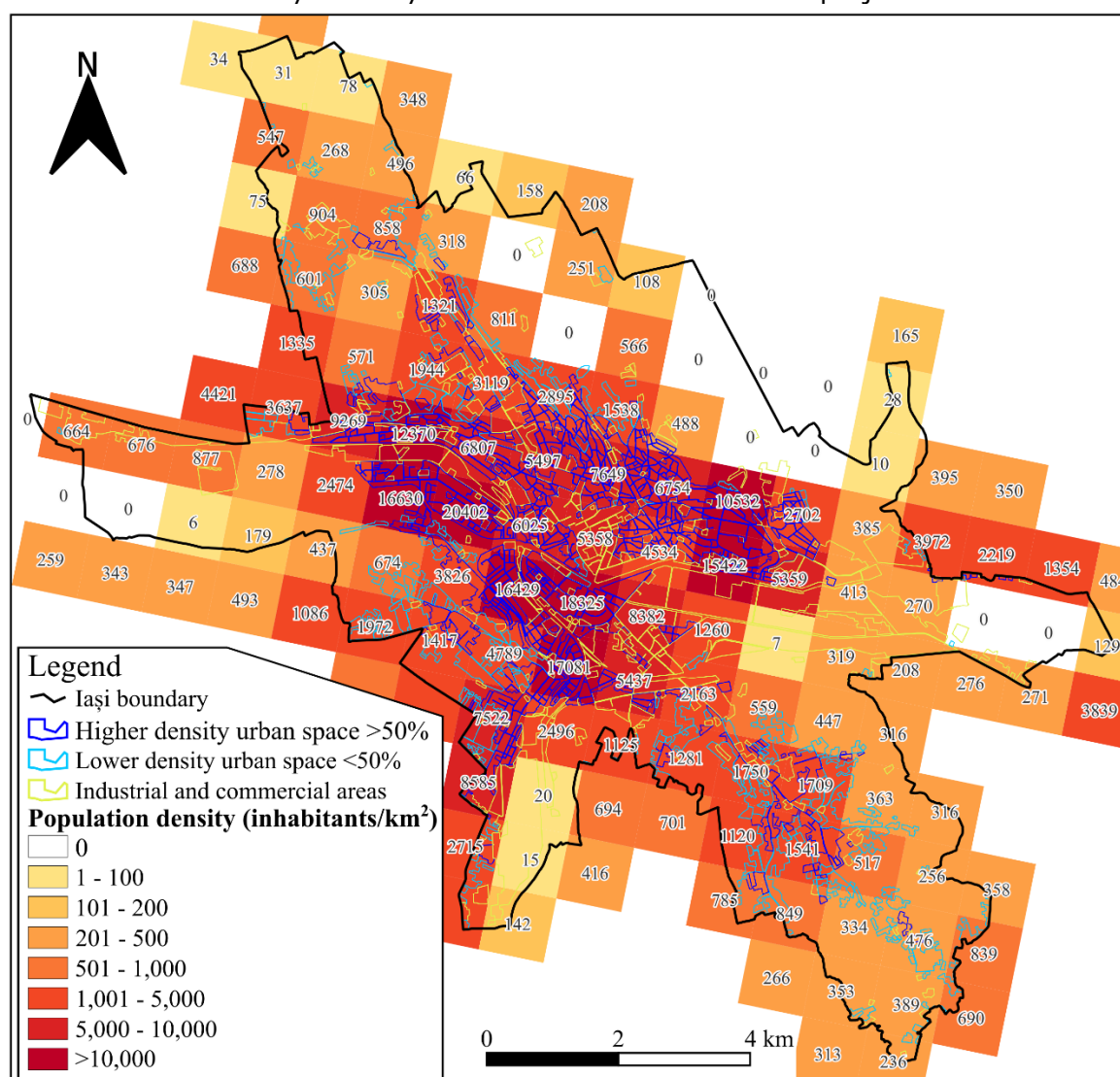


Figure 3. Population density within Iași Municipality (data source: Eurostat³).

initiatives in the city by reviewing official documents prepared by the public administration, assessing their impact on the community, and outlining future development directions to transform the city into a modern, efficient urban environment adapted to the needs of its inhabitants. This is also outlined by Misinciuc (2023), who identifies a critical gap: despite the extent of Iași's smart city portfolio, the systematic evaluation of the impact on citizens is limited.

Although numerous local official documents address the smart concept (BRCT, 2021; SIDU, 2015-2030; SIDU, 2021-2030), in practice, some projects are ultimately implemented, while other proposals are only partially implemented or not yet finalised (Vegacomp, 2021). The fundamental document for the development of the concept is a digital development strategy, as we can see on the official site (<https://iasismartcity.ro/>), which may be problematic compared to what defines the smart concept: namely, that, in addition to the important digital component, there is also a social one. A truly smart city should seek to align these two components to improve citizens' quality of life.

³ <https://ec.europa.eu/eurostat/web/gisco>

Regarding official information about initiatives and their distribution across the six smart axes (iasismartcity.ro), it is not up to date and does not exactly match the smart definitions. They can mislead users, creating a false image for the community, which should be the main beneficiary. The official website lists many past initiatives, but not all qualify as smart city initiatives under the six main smart axes. In addition to the challenges related to official information and definition, there is the issue of balance among the types of smart city initiatives. Currently, smart mobility initiatives dominate.

To address this, city officials must further develop initiatives in other categories. These steps will reduce the gap, create a unified environment, support a more rigorous development process, and establish a framework that improves quality of life.

To improve communication between the public administration and citizens, attention must also be paid to participatory administration. Real-time communication from both sides can lead to rapid resolution of potential problems. Thus, through effective communication, notifications, possible solutions, and even the shaping of a favourable environment for both parties are brought to their attention.

3. Materials and Methods

The research employs a quantitative design, supplemented by qualitative interpretation of responses. To examine the complex relationship between smart city implementation and quality of life, primary data from a citizen survey are integrated with secondary spatial datasets. A structured questionnaire was our main tool for data collection, capturing citizens' perceptions of smart city initiatives and their impact on daily quality of life. The questionnaire included sections on awareness of smart city concepts and local initiatives, perceived quality of life, attitudes toward sustainability and environmental development, and socio-demographic characteristics such as age, gender, educational level, and occupation.

The questionnaire has multiple sections of various formats, including Likert-scale items (1–5) to measure attitudes and perceptions, as well as predefined choices for categorical responses. Sustainability-related questions were intentionally included to assess whether citizens associate smart city development with environmental progress and to determine whether demand for sustainability-oriented services differs across demographic groups, particularly by age. For this study, we used only the sections on quality of life perception, the importance of services to citizens, and home-facility access that may improve their quality of life.

3.1 Data collection

To increase the number of respondents, data collection used both online and paper questionnaires. Participation was anonymous and voluntary. The online survey was conducted through Google Forms. Physical questionnaires were also distributed at various city locations to diversify the respondents' age and occupational groups with limited digital access. Cochran's formula (Cochran, 1977) was used to determine the sample size during the design phase. This approach ensured strong representation of citizens' perceptions across different demographic groups, rather than statistical representativeness of the total population. We analysed 385 answers that reflected the population's distribution by age, gender, education level, and occupation.

3.2 Spatial and auxiliary data

To complement the survey data, several spatial datasets were used to support the territorial and thematic analysis of Iași. Gridded population density data from the GISCO-Eurostat repository were used to map population distribution across the municipality, thereby identifying the unequal density patterns. Land-use and land-cover data from the Urban Atlas products of the Copernicus Land Monitoring Service described Iași's urban space, including residential areas, green spaces, commercial zones, and

infrastructure. OpenStreetMap (OSM) provided a base for thematic and analytical maps. It included street networks, points of interest, and urban features to enhance the study's spatial context. All spatial datasets were managed, processed, and visualised using QGIS, the primary GIS tool for cartographic production and spatial analysis.

3.3 Data analysis

Survey results were analysed using Microsoft Excel, which facilitated the production of descriptive statistics and graphical representations (charts and plots) to summarise respondents' perceptions. To examine differences between demographic groups and assess relationships between variables, statistical tests were applied. We used the t-test to compare responses between two groups (e.g., by gender) and the ANOVA (Field, 2018) to identify statistically significant differences across multiple groups (e.g., by age category).

Where ANOVA revealed statistically significant differences across groups, Tukey's Honestly Significant Difference (HSD) post hoc test (Field, 2018) was subsequently applied to identify which specific group pairs differed significantly from one another. Unlike ANOVA, which only indicates that at least one group differs, the Tukey HSD test shows which pairs of groups differ, making it appropriate for our study, which compares age groups. Since Excel does not have a built-in tool for the Tukey HSD test, we used the Real Statistics⁴ add-in to run it. These tests enable rigorous comparison of perceptions and support the study's main analytical objectives.

4. Results

The study's results include gender and age distributions, the current evaluation of the smart environment axis, satisfaction with specific services, city layout, the effect of proximity to certain services, and which environmental factors are targeted for future development.

The gender distribution (Figure 1) reflects parity, with nearly equal numbers of male and female respondents. The age distribution is also balanced, except for the 20-22 and 57 age groups, which have twice as many respondents as the other age groups (Figure 1). The remaining age groups exhibit minor fluctuations that level out when all four are considered together. Younger respondents were more likely to access the online form, while most 65+ participants completed the survey in person.

Iași Municipality has implemented several smart environment initiatives, including (i) Electric buses and charging stations; (ii) air quality monitoring system (three permanent stations, part of the National Air Quality Monitoring Network: IS-1 Stone Bridge, IS-2 Decebal Cantemir, IS-3 Oancea); (iii) digitized ecological islands that have

⁴ <https://real-statistics.com/free-download/real-statistics-resource-pack/>

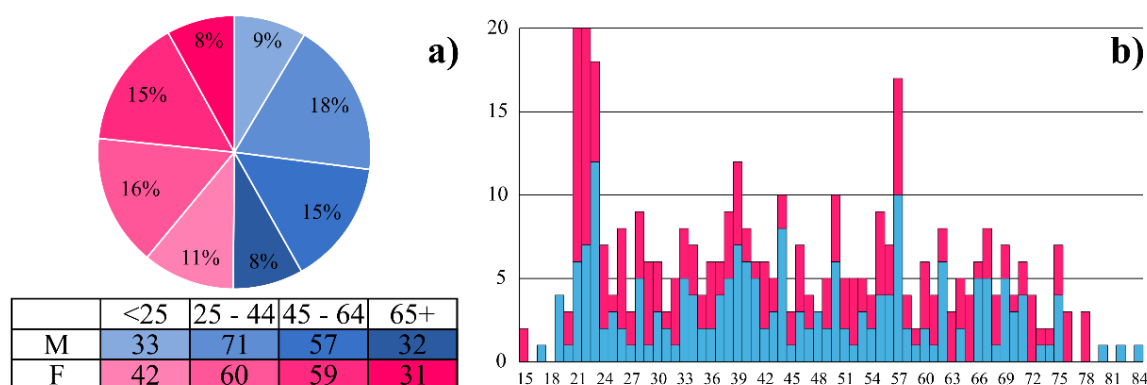


Figure 4. Gender and age distribution of respondents. a) Pie chart distribution of respondents by age group, including the number of respondents for each category in the table; b) Age respondents histogram separated by males and females.

sensor-driven waste collection points designed to optimize recycling and minimize pollution; (iv) public charging stations for electric vehicles; and (v) real-time location updates for waste-disposal SALUBRIS vehicles. These solutions are designed to enhance the quality of life and reduce environmental impact, and are accessible on the Iasi digital website (<https://iasi.digital/>), where citizens can view real-time updates from air quality stations and track SALUBRIS vehicles. Their presence advances sustainable development goals, further supported by projects such as the NetZero City Coalition, the Green Cities Sustainable Urban Development Programme (Green Cities, BERT), Green Oasis in Our Neighbourhood, CHESS - Cities Hub for Environmental Sustainability Strategies, and the Urban Regeneration Zone - Depou CTP.

Questionnaire responses reveal varied opinions about the city's quality of life. The question: How do you evaluate the following statements? was designed to assess perceptions of quality of life, safety, and sustainability, with answers ranging from strongly disagree to strongly agree. Overall, respondents' answers indicate general agreement on safety, cleanliness, and quality of life (Figure 5). By contrast, disagreement is higher regarding sustainability, administrative impact, and the solution's effect on pollution levels in Iași Municipality. Social activity received mainly neutral ratings, suggesting either a lack of tradition or limited community engagement, as indicated by the statement: I am satisfied with my involvement in the social life of the city, for which more than 50% of respondents responded neutrally. The impact evaluation measures whether individuals perceive improvements in quality of life resulting from effective implementation. One key statement was rated neutral by 30.4%, agree by 31.4%, and strongly agree by 26.4%, indicating that most respondents are beginning to note positive effects. Neutral responses may indicate a lack of familiarity or difficulty connecting with the concept. These results underscore the need for improved communication on the benefits for daily life and for enhanced digital interfaces to ensure usability for all abilities.

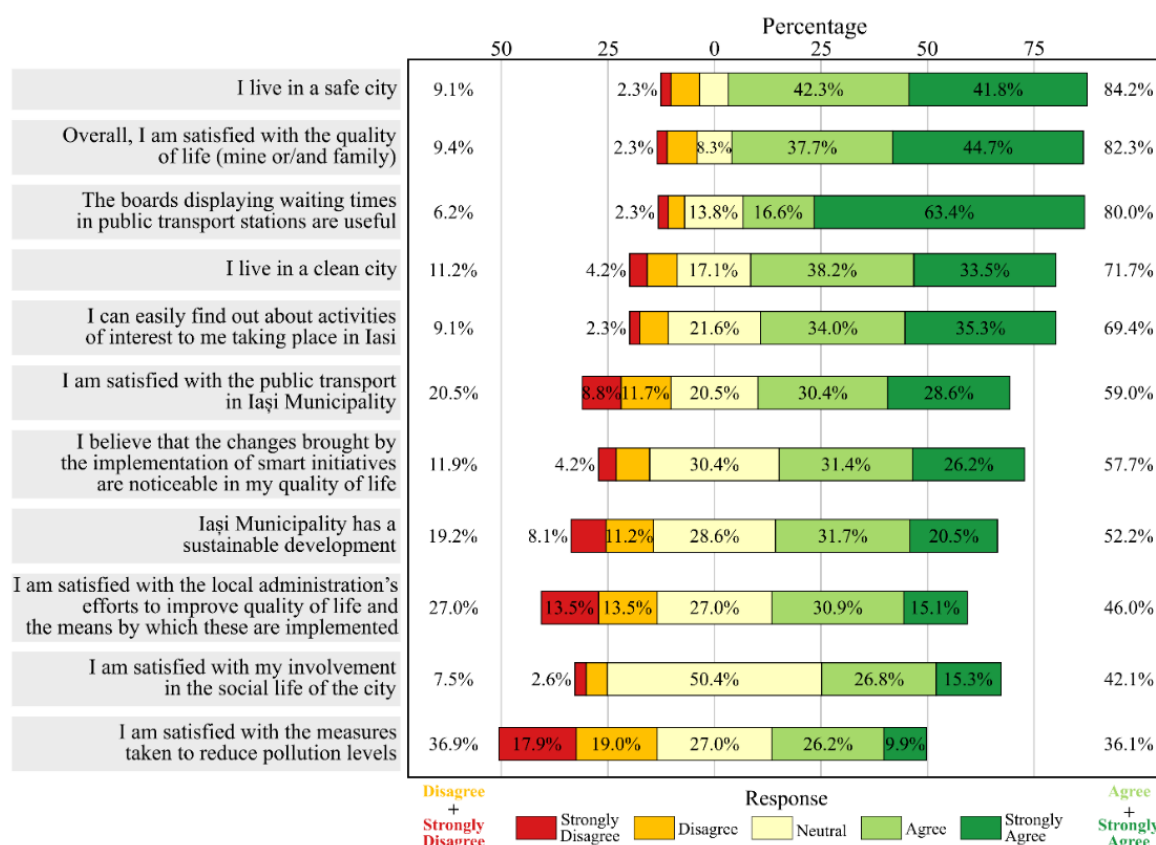


Figure 5. Citizens' perception of their quality of life in Iași Municipality.

Quality of life extends beyond smart initiatives; it is closely tied to urban efficiency, which directly drives sustainable processes. Figure 6 illustrates how individuals judge the distances to various facilities from their homes and the degree to which these distances affect their quality of life. Most responses reflect moderate to strong positive influence, while only a few report no effect. For certain facilities, such as cultural spaces, restaurants, parking lots, train stations, and bus stations, fewer respondents cite a notable impact (Figure 6). This trend may point to a more sedentary or less socially engaged lifestyle. Notably, 29.2% selected 'slightly' for parking lots, possibly indicating reliance on public transportation, ease of parking access, or a belief that parking availability does not greatly affect quality of life.

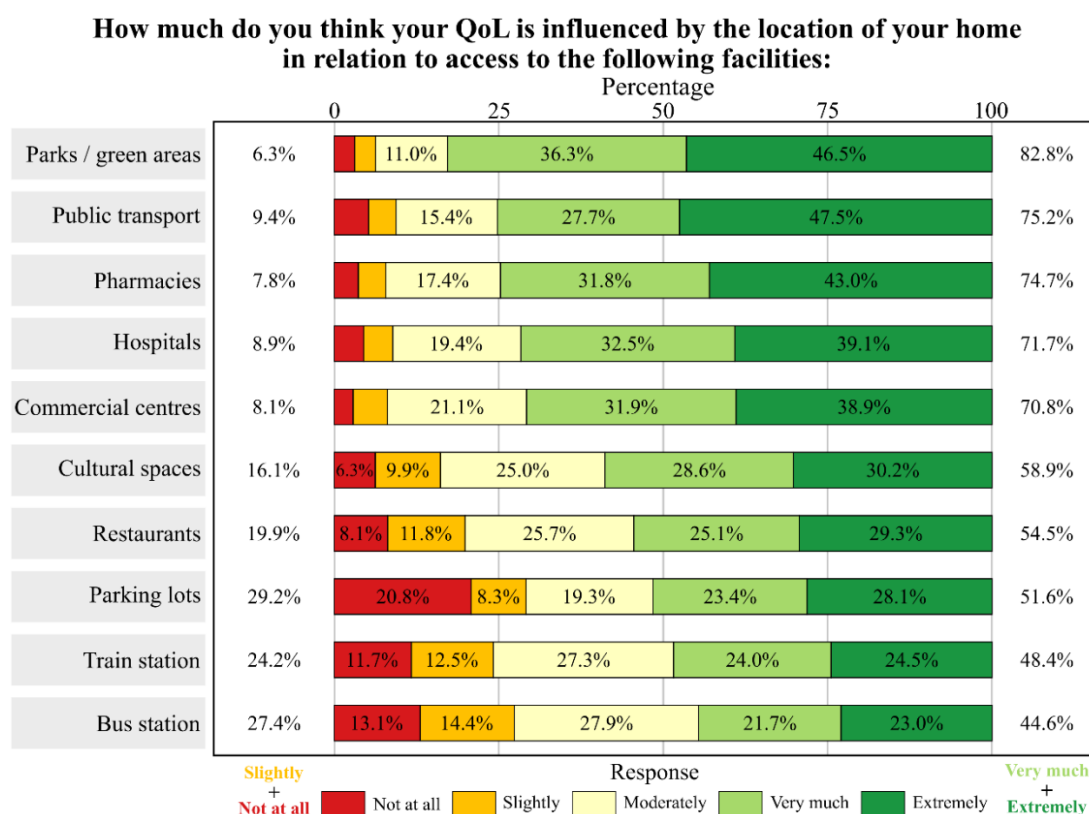


Figure 6. Influence of home proximity to urban facilities.

In addition to citizens' perceptions of various facilities (Figure 7), we incorporated quality-of-life claims into our analysis, assessing how important certain services are to

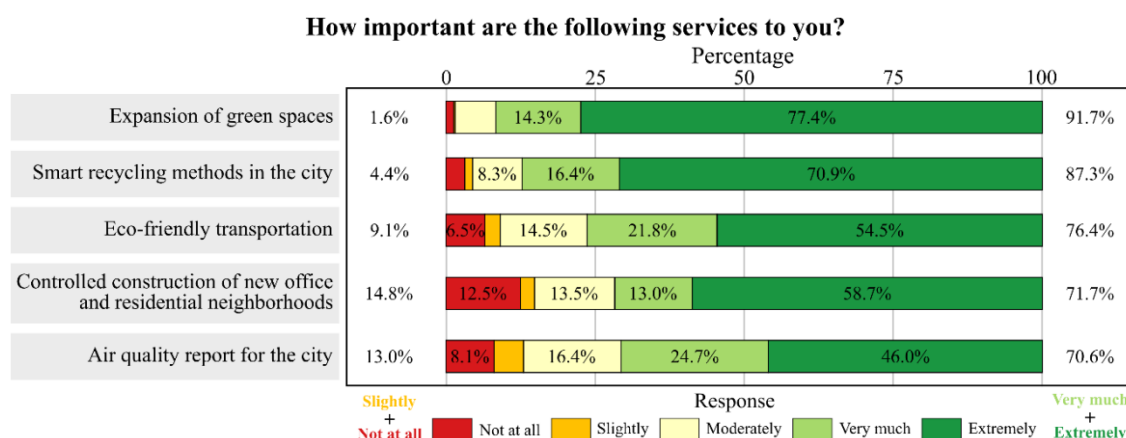


Figure 7. Main directions regarding environmental development.

respondents and their roles in the community's development and environmental interactions. The expansion of green spaces, as shown in Figure 7 with 91.7% positive responses (including 'very much' and 'extremely important'), clearly signals residents' desire for more green space and greater proximity to it. Considering responses on facility proximity, green space emerged as the most favoured component.

T-test results (Table 1) for three questions on quality of life and city sustainability show no statistically significant differences between male and female respondents. Specifically: (Q1) Overall, I am satisfied with the quality of life (mine and/or family); (Q2) I believe the changes from smart initiatives are evident in my quality of life; (Q3) Iași

Municipality pursues sustainable development. Thus, gender does not affect perceptions of these statements, with similar responses across both groups.

Table 1. T-test results for the perception of quality of life and sustainability related by gender.

Question	Mean (M)	Mean (F)	p-value	Significant?
Q1	4.24	4.07	0.0941	No
Q2	3.65	3.70	0.6463	No
Q3	3.40	3.51	0.3506	No

Table 2 details the ANOVA and Tukey HSD post-hoc results for age groups regarding satisfaction *with quality of life (mine and/or family)*. The results identify statistically significant differences between age groups, such as <25 and 25-44, and 45-64 and 65+ (p-values of 0.0204 and 0.0293, respectively). The most significant difference arises between <25 and 45-64, with a p-value of 0.00003. Other comparisons show no statistically significant differences. Young people under 25 exhibit distinct perceptions of quality of life from the middle-aged group, likely reflecting differences in lifestyle, priorities, and expectations. These groups represent separate generations, each assessing quality of life through their individual experiences.

Table 2. Results of the ANOVA test and the Tukey HSD post-hoc test on quality of life perception by age group.

Analysis of Variance			p-value = 0.00006
Tukey HSD test			
Group 1	Group 2	p-value	Significant?
<25	25-44	0.0204	Yes, significant
<25	45-64	0.00003	Yes, highly significant
<25	65+	0.4657	No
25-44	45-64	0.1673	No
25-44	65+	0.6779	No
45-64	65+	0.0293	Yes, significant

Table 3 presents the ANOVA and Tukey HSD post-hoc findings for the statement: *I notice that smart initiatives make a difference in my quality of life*, by age group. The results show statistically significant differences between <25 and 25-44 (p-value 0.0111), and pronounced differences between <25 and 45-64 (p-value 0.0027). Remaining comparisons lack statistically significant p-values. Young people perceive the impact of smart cities on their quality of life differently from the 25-44 and 45-64 groups. This may indicate that young respondents, who are generally familiar with digital interfaces, have distinct expectations for these services.

Table 3. Results of the ANOVA test and the Tukey HSD post-hoc test on the perception of the impact of the concept of smart city on the quality of life by age group.

Analysis of Variance			p-value = 0.0015
Tukey HSD test			
Group 1	Group 2	p-value	Significant?
<25	25-44	0.0111	Yes, significant

<25	45-64	0.0027	Yes, very significant
<25	65+	0.7250	No
25-44	45-64	0.9408	No
25-44	65+	0.2910	No
45-64	65+	0.1262	No

Table 4 presents the ANOVA and Tukey HSD post hoc analyses for the question: Does Iași Municipality have sustainable development, by age group? The results indicate no statistical differences, suggesting that the answers are consistent and reflect a unified perception, with age not serving as a variable for differing views.

Table 4. Results of the ANOVA test and the Tukey HSD post-hoc test on the perception of sustainable development by age group.

Analysis of Variance		p-value = 0.19844	
Tukey HSD test			
Group 1	Group 2	p-value	Significant?
<25	25-44	0.9193	No
<25	45-64	0.8765	No
<25	65+	0.6333	No
25-44	45-64	0.3811	No
25-44	65+	0.2171	No
45-64	65+	0.9352	No

The spatial distribution of forests, parks and green areas (Figure 8) shows the reality of this component in Iași and thus allows identification of deficient areas, as well as areas where existing green spaces are concentrated. Also, to better understand the connection with the population, the population density variable was used to determine whether the values are within normal limits or below the national and European standards.

Green space per capita indicates that areas with high population density also have fewer green spaces nearby. This is also confirmed by the BERD project (2023), which highlights the need to address this problem and the lack of compliance with standards.

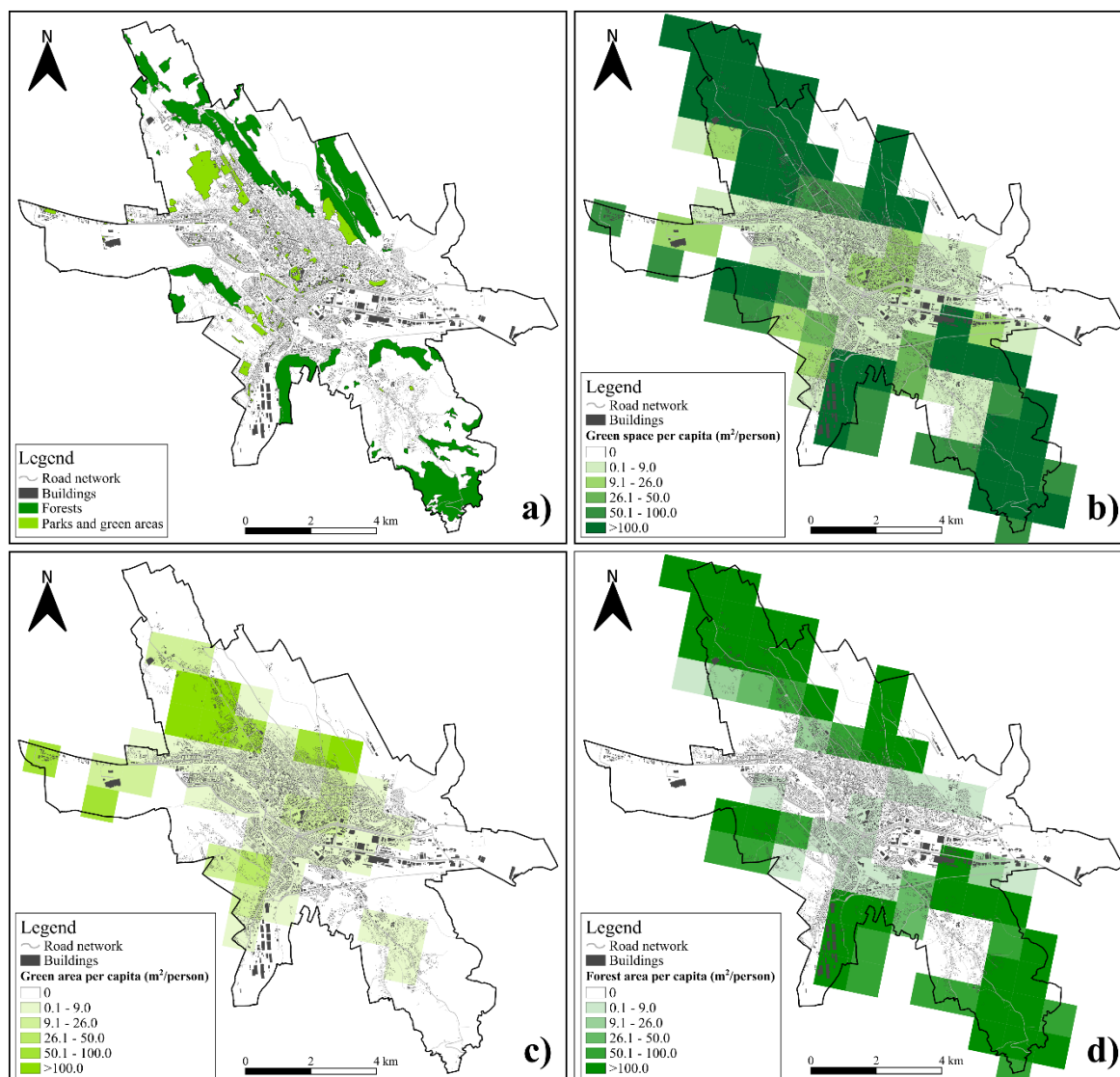


Figure 8. Distribution of green areas per capita within Iași Municipality. a) Location of green areas, parks and forests; b) Green space area per capita including forests, parks and green areas; c) Green area per capita only for parks and green spaces; d) Forest area per capita only for the forested areas.

5. Discussion

Iași represents a highly relevant case study for analysing the role of the smart city in improving quality of life within the broader framework of sustainable development. The city records a high number of projects and initiatives, as confirmed by its position in national rankings, while the EBRD Project (2023) also highlights its orientation towards sustainable development. Nevertheless, our study adds a grassroots perspective by incorporating citizens' views into the analysis, thereby offering a clearer understanding of the extent to which smart initiatives translate into improvements in the quality of life of urban inhabitants.

The survey data temper this optimistic image by revealing certain discrepancies between the city's leading position in terms of smart initiatives and projects, on the one hand, and their actual contribution to inhabitants' quality of life, on the other. Citizens acknowledge that important steps are being taken, but they also indicate that the direct and indirect effects of these initiatives on quality-of-life indicators should be strengthened.

One of the most important findings, with relevance for both academic and non-academic stakeholders, is the significance of age as a factor in the analysis. The slightly higher share of young respondents may be explained by the demographic profile of Iași, which includes a large young population, many of whom are students, reinforcing the city's status as a major university centre. However, this pattern is reflected not only in the city's demographic structure, but also in the higher levels of awareness, use, and familiarity with smart initiatives among younger people. This raises two major issues. First, the smart city appears to be more closely connected to younger populations, which suggests that older generations do not benefit from smart initiatives to the same extent and may even experience disadvantages because of their weaker connection to the smart environment. Second, smart initiatives seem not only to be adopted more widely by younger generations, but also to be designed with younger or more digitally connected users in mind. This indicates that the smart city is oriented more towards highly digitally skilled populations and less towards digitally vulnerable groups or those with only basic digital competences. Taken together, these findings point to a rather pessimistic scenario in which smart projects may contribute to a generational divide between younger and older populations, and in which their impact on quality of life may vary considerably according to age. Such an outcome appears counterintuitive to the inclusive logic that underpins smart initiatives.

These findings may suggest the need for differentiated or tailored development approaches that nevertheless pursue a common objective, namely the improvement of quality of life. When initiatives are designed with quality of life as their primary goal, rather than novelty or access alone, they are more likely to reflect the needs of diverse population groups and to acknowledge age-related differences in a meaningful and practical manner.

Gender, by contrast, did not prove to be a significant factor influencing perceptions in this case, as the differences observed were not statistically significant. Citizens therefore evaluate the analysed issues in broadly similar ways regardless of gender. This is not unusual in relation to digital behaviours. In states where equal gender rights were institutionally promoted during the socialist period, gender differences tend to be less pronounced in areas associated with education-related behaviours, including the use of digital tools, platforms, and technologies.

Green development and green infrastructure remain among the dimensions that lag most behind inhabitants' expectations, indicating that current efforts still leave considerable room for improvement. This finding also reinforces the already existing shortage of green spaces, especially in the central area, as highlighted in Figure 8. It is also important to note that, in relation to the minimum green space per capita established at both national and European levels, the municipality of Iași does not meet the required threshold. This is further confirmed by residents, who expressed a clear preference for the expansion of green spaces (Figure 7), suggesting either a perceived shortage or a desire for improved access. The EBRD (2023) report supports this interpretation, underlining the need for more green space, alongside several other aspects requiring improvement from a sustainability perspective.

With regard to sustainable development and its relationship to smart initiatives, Figure 7 also suggests that citizens are aware of the need for the municipality to develop sustainably and recognise that this can be pursued through multiple directions of action. The main challenge, however, is to connect the city's smart-driven strategy more effectively with inhabitants' needs in relation to green and blue infrastructure, as well as transport services.

Based on these findings, at least two major policy directions should be pursued by local and metropolitan actors. First, future measures in this field should include stronger awareness-raising efforts and increased visibility of smart initiatives among all age groups. The limited recognition of some initiatives points to existing communication gaps, and greater efforts are needed to ensure that citizens of all ages are aware of both their existence and their utility. Second, smart applications and related initiatives should

incorporate functions tailored to the specific needs of different age groups, particularly older people, who may benefit from simpler interfaces and more intuitive forms of design, including visual guidance where appropriate.

A third complementary measure would be to involve citizens more directly in the development and improvement of smart initiatives through concrete participatory mechanisms, potentially adapted to the characteristics of different urban areas, since needs vary depending on the level of development of each zone. Discussion groups prior to implementation, along with consultations on design, utility, and scope of application, could help ensure that the broader strategy receives feedback from inhabitants not only after implementation, but also during the design stage. Such an approach would allow input from end users to reduce later costs associated with adjustment or redesign, while also improving the alignment of smart initiatives with population needs, quality of life priorities, and the specific characteristics of different groups, neighbourhoods, age categories, and types of application.

From a theoretical point of view, the study reinforces findings similar to those of Lange (2022), who argues that, although digitalisation was expected to support sustainability and economic growth, these objectives were not achieved to the anticipated extent. Moreover, Santarius et al. (2020) and Santarius et al. (2023) conclude that, for ICT to contribute to sustainability, stronger political involvement is needed through more effective policies, while society must also be more actively engaged in sustaining this process and in relating to digital risks and benefits in a sustainable manner. At the same time, they argue that technological potential does exist to improve resource use in support of a sustainable transformation.

6. Conclusions

Based on the results, the Municipality of Iași can be evaluated as an area in development, with many diverse actions related to smart city sustainable initiatives. The results of the study indicate that Iași is among the cities with high access to the implementation and optimisation of smart resources. This has also led to the creation of dynamic and attractive environments that encourage the development of new ideas. Therefore, the concept of smart urban development should not be treated superficially, as the numerous initiatives and their social impact are evident and widely perceived. However, the lack of alignment between the needs of different social groups and the availability of services leads to dissatisfaction, as do poorly developed areas, such as environmental problems associated with pollution.

A clearly defined pattern emerges in the differing interests of age groups in relation to specific initiatives. Young people make greater use of transport-related facilities and are generally more open to the digital dimension, although their interests do not yet appear to extend to services such as tax payment. Middle-aged people display the highest level of dynamism in the use of applications, a pattern that can be explained by their need for and interest in a wider range of services. By contrast, older people are the group most likely to refuse interaction with the digital environment, often invoking age and social status associated with economic difficulties as explanatory factors.

The statistical analysis shows that differences between age groups are significant for the question related to the smart city and for that related to quality of life. However, no statistically significant differences emerge for the question related to sustainability. At the same time, there is a clear demand for development and for strengthening the environmental dimension, which suggests that awareness of the need for sustainable development is relatively high. This indicates the need for a development approach that is also tailored to different groups of citizens and different areas of the city, so that the benefits of this development are perceived by a wider range of residents, regardless of whether they live in central or peripheral areas, or belong to different age groups.

Two main limitations of the study should, nevertheless, be acknowledged. The first relates to the type of data, as survey-collected data may be influenced by subjective

perceptions shaped by everyday or punctual events. The second concerns the context of data collection, since some of the data were gathered in local administrative centres where people come to resolve various issues. As a result, it may be assumed that the survey was not administered in a fully neutral environment.

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