
Smart Cities Inclusiveness in International Rankings: Comparative Analysis, Determinants and Implications for Urban Governance

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Abstract:

Purpose: *The purpose of this article is to conduct a comparative analysis of the dimensions of inclusiveness assessed within two selected international Smart City rankings, and to identify the relationships between these dimensions and the other aspects assessed in those classifications. It addresses two research questions: whether cities considered smart are able to guarantee a better quality of life for all residents, and whether holistic assessments of smart cities examine and analyse their inclusiveness.*

Design/Methodology/Approach: *The study is based on a comparative analysis of the inclusiveness dimensions used in two international Smart City rankings, combined with a correlation analysis between the various evaluation dimensions and a city's final position in a given ranking.*

Findings: *The exclusions identified in the rankings include economic, educational, housing, digital and cultural types, as well as exclusion by gender, race, sexual orientation and the universality of human rights. While the theoretical and methodological dimensions postulate the same quality of life for all residents, the correlation analysis shows only average or weak (insignificant) relationships between inclusiveness and final ranking position — with similar results for the environmental dimension. Inclusiveness is most often correlated with dimensions relating to human capital, economics or management, i.e. factors of a social nature.*

Practical implications: *The results indicate the lower importance attached to social and environmental aspects in the practice of smart city management, suggesting a gap between the declared aim of equal quality of life and its actual weighting in ranking-based assessment and governance.*

Originality/value: *The article offers an original comparative and correlational perspective on inclusiveness in smart city rankings, exposing the discrepancy between the theoretical/methodological postulate of equal quality of life for all residents and the marginal role that inclusiveness and environmental factors play in cities' final evaluation.*

Keywords: *Risk of social exclusion, inclusiveness of smart cities, dimensions of inclusiveness in international Smart City rankings.*

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1. Introduction

Much has been written about the Smart City concept in the contemporary literature on the subject. Initially, it was associated primarily with the digitization of the urban economy and infrastructure (Syväjärvi *et al.*, 2015; Yuan *et al.*, 2021; Neirotti *et al.*, 2014; Dameri, 2014; Rucinska and Knetova, 2014). Over time, social, humanistic and environ-mental themes also began to be recognized (Ahmad *et al.*, 2022; Buttazzoni *et al.*, 2020; Ferraris *et al.*, 2019;).

As a result, the idea of the Smart City is now based on the assumption of sustainability (Nevado Gil *et al.*, 2020) and the cooperation of all urban stakeholders within a fivefold helix (Yamaguchi *et al.*, 2018; Suzic *et al.*, 2020; Paskaleva *et al.*, 2021).

Nevertheless, both in the literature and in practice, Smart City development is still dominated by technicization. It is easier to implement, control and expose as part of the city's image-building than humanization that depends on multiple factors and lives.

It should be clearly noted that researchers' interest in the social dimensions of smart cities has grown significantly in the last decade. Nevertheless, issues related to social exclusion (and, in a more positive context, related to inclusiveness) of smart cities are still on the margins of mainstream research. Meanwhile, as emphasized in the introduction, egalitarianism in the enjoyment of the benefits of smart urban structure lies at the heart of the Smart City concept (Bär *et al.*, 2020; Shelton and Lodato, 2019; Paidakaki *et al.*, 2022; Suárez Ojeda, 2021).

The need for increased interest in the inclusiveness of modern cities is also supported by a number of socio-economic events and trends that are contributing and will continue to contribute in the future to the increasing diversity of urban communities. Among them, the phenomena worth mentioning are globalization (Profiroiou *et al.*, 2020; Szabó, 2021) and population migration for economic (Tariq *et al.*, 2021; Kazantseva and Danenova, 2020) or climatic reasons. The growing aging and declining female fertility rates (Mohapatra, 2021; Abril-Jiménez *et al.*, 2020; Battarra *et al.*, 2018) are also important factors influencing changes in the urban community. Armed conflicts and financial, pandemic or energy crises are also

not insignificant (Hassankhani *et al.*, 2021; Inn, 2020; Yang and Chong, 2021; Jaiswal *et al.*, 2020).

The escalation of the aforementioned events observed in the twenty-first century is causing an increase in the diversity of urban communities in terms of: age, health, nationality, race, religion, income or access to urban infrastructure (energy, logistics, sanitation, etc.). This diversity, in turn, can become a source of tensions and conflicts that pose a serious challenge to urban authorities (Poletti and Michieli, 2018; Krivý, 2018; Martin, 2018; Hollands, 2020).

Given these circumstances, this article seeks answers to the following research questions: Are cities considered smart able to guarantee a better quality of life for all residents? and Do holistic assessments of smart cities examine and analyze their inclusiveness? This is because measures to increase inclusiveness help reduce the risk of exclusion and minimize the dangers of social discontent.

To get answers to the above questions, the article analyzes the dimensions of inclusiveness considered in international Smart City rankings. This is because these rankings are a holistic assessment of the performance of smart cities with a highly opinionated nature. The information they contain is used for image purposes. They are also internationally recognized. Accordingly, the purpose of this article is to conduct a comparative analysis of the dimensions of inclusiveness assessed by the two selected international Smart City rankings, and to identify the relationships between these dimensions and the other aspects assessed by the classifications in question.

The contribution of the present analysis to the development of the Smart City concept includes:

- Identifying the dimensions of inclusiveness considered in international Smart City rankings;
- Defining the gap in the measurement of inclusiveness and areas vulnerable to exclusion that are overlooked in rankings and studies;
- Identifying relationships between the assessed dimensions of inclusiveness and other areas of Smart City assessment;
- Formulating proposals to urban governance oriented towards conducting exclusion risk assessments and strengthening inclusiveness of modern cities.

2. Literature Review

2.1 Research on Urban Inclusivity from a Bibliographic Perspective

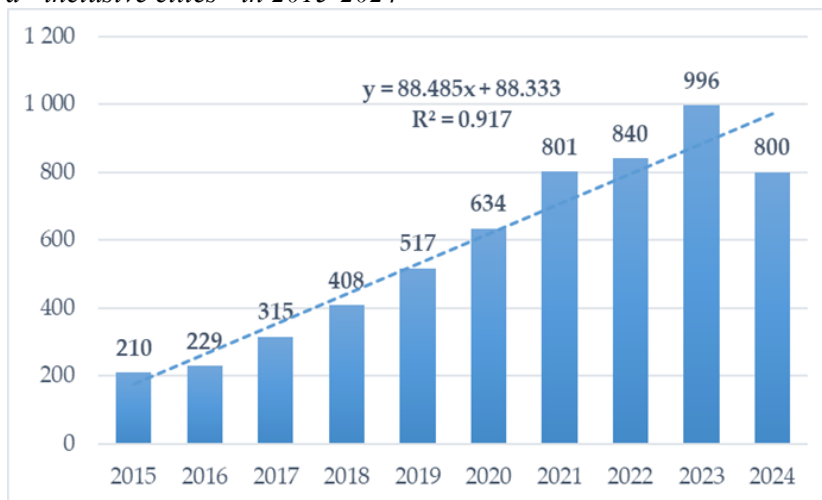
Interest in the inclusiveness of smart cities has steadily increased over the past decade, as illustrated in Figure 1, which shows the number of publications in the Scopus database related to the keyword “inclusive cities”.

Given the well-matched upward trend shown in Figure 1, it is expected that interest in the topic of smart city inclusivity will continue to grow in the near future. As the general statistics show, it appears mainly in articles in the social sciences (Hubl, 2018; Trencher, 2019; Lytras and Visvizi, 2018). It is also present in the fields of environmental sciences, engineering and information technology (Figure 2).

This means that inclusiveness is attributed primarily to the dimension related to the urban community and the environmental setting of that community (Kolesnichenko *et al.*, 2021; Jonek-Kowalska and Wolniak, 2023; Wolniak and Jonek-Kowalska, 2021; Wolniak, 2023). Although the multiplicity and dispersion of other disciplines dealing with this topic indicates the interdisciplinary and multifaceted nature of this concept (Apfelbeck *et al.*, 2020; Lemani & Seleki, 2023; Magidimisha-Chipungu and Chipungu, 2023; Gethe *et al.*, 2023).

Given the main thrust of the considerations carried out in this study, the subsequent literature analysis focuses on research articles embedded in the Scopus classification in the social sciences issues, and therefore anthropocentric in assumption.

Figure 1. Number of publications in the Scopus database associated with the keyword “inclusive cities” in 2015-2024



Source: Own evaluation based on:

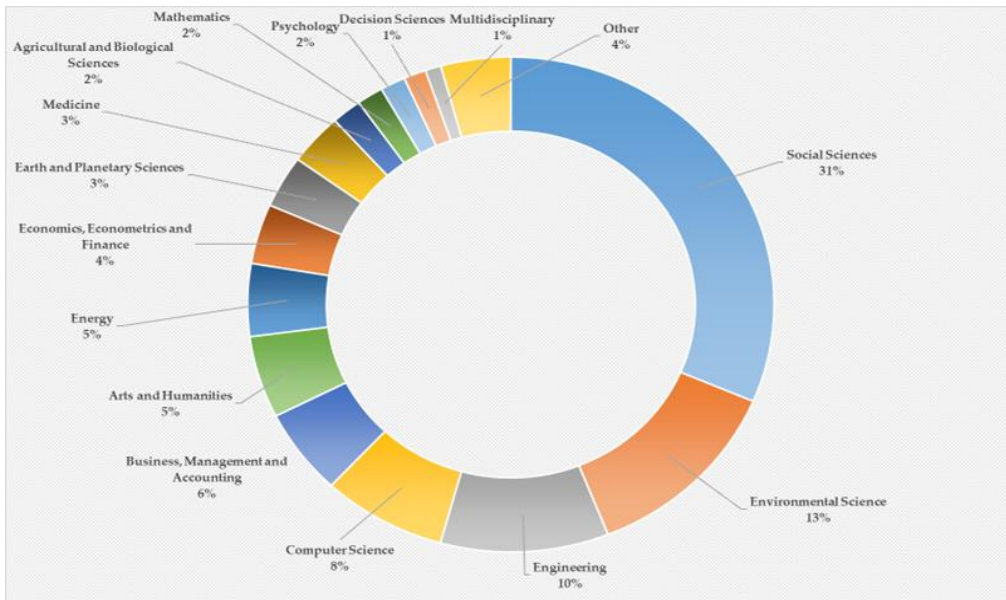
<https://www.scopus.com/search/form.uri?display=basic&zone=header&origin=#basic>.

2.2 Dimensions and Determinants of Inclusiveness in the Light of the Literature on the Subject

Inclusiveness in general social terms means something inclusive, something holistic, meant for everyone. In social terms, the term refers to a situation in which all members of a community – regardless of their characteristics and identity traits – are guaranteed equal access to goods and services. Adapting the term to Smart Cities, it

can therefore be said that inclusiveness means a state in which the quality of life of all residents is the same, as they have egalitarian access to the city's infrastructure and the goods and services offered by the city.

Figure 2. Areas of publications in the Scopus database associated with the keyword “inclusive cities” in 2015-2024



Source: own evaluation based on:

<https://www.scopus.com/search/form.uri?display=basic&zone=header&origin=#basic>

In practice, unfortunately, this is an unattainable state, due to the numerous exclusions that characterize the urban community and are difficult to overcome (Perić *et al.*, 2023; Basu, 2019; Yanjun, 2023). Nevertheless, the very pursuit of inclusiveness is a desirable process, as it reduces social pathologies, prevents conflicts and contributes to the creation of a friendly urban atmosphere, which in turn is of considerable importance for the quality of life in the city (Yadav and Kumari, 2023; Sharma *et al.*, 2020; Giliberto, 2023).

Achieving inclusiveness is difficult because of social fears and prejudices and their magnitude associated with the multiplicity of attitudes and behaviors of residents who make up urban communities. Unfortunately, in practice, this aspect is often marginalized, and the approach of city authorities is instrumental and focused on decentralization and strategic plans, as pointed out by Sissons *et al.* (2019), among others (Sissons *et al.*, 2020).

The literature also criticizes the theoretical-idealistic analysis of inclusivity without taking into account the real inequalities deeply rooted in urban communities (Lee *et*

al., 2020). Meanwhile, without combating the causes of exclusion – both infrastructural and social – measures for the participation of all in the benefits of the Smart City will not be effective.

It seems that combating exclusion and working for inclusivity is particularly difficult in developing and emerging economies (Jonek-Kowalska and Wolniak, 2021; Rivža *et al.*, 2017). This is because the creation of smart cities requires significant financial resources. Meanwhile, existing income disparities significantly impede the development of high-tech urban infrastructure. This phenomenon is described regionally by Waghmare and Singhal (2022) using Indian cities as an example, while postulating urban development planning oriented towards spatial egalitarianism that does not exacerbate the problem of infrastructural and economic exclusion between individual cities and their neighborhoods.

An interesting and rare consideration of inclusiveness is provided by Pratiwi *et al.* (2024). They concern sex education for children with disabilities in Indonesian cities. These children are a group of residents particularly vulnerable to exclusion, including acts of violence. In this context, the researchers point out the lack of a coherent education policy tailored to their needs and to counteract the exclusion of this social group. This exposes problems in the pursuit of inclusivity in emerging economies.

In African countries, where urbanization is currently progressing at the fastest rate in the world, inclusiveness also poses a major challenge. A study by Angelopulo (2021) shows that the rapid population growth observed between 2014 and 2019 has become an additional burden on African cities and is poorly correlated with creating conditions for inclusivity. The author also stresses that inclusiveness is mainly determined by high infrastructure indicators, advanced social and economic development and good governance.

In the management research stream of Colding *et al.* (2024) postulate the creation of a single body in the city administration responsible for building, monitoring and improving the functionality of smart cities. Among its tasks would be to address the most pressing issues of today's cities, such as increasing social inclusion, combating climate change, and empowering citizens and using academic knowledge in formulating smart city policies.

Effective urban governance as a determinant of inclusivity also appears in Samad and Rahim's (2019) study of Malaysian cities. The authors emphasize that measures for inclusiveness must be characterized by comprehensiveness and long-termism. For these reasons, they need to be planned as part of urban building strategies that guarantee equal access to urban infrastructure for all residents, including those with disabilities. Such strategies in Malaysia were developed in 2008 ten years in advance with the key Sustainable Development Goals in mind.
(<https://www.un.org/sustainabledevelopment/>).

Although the Sustainable Development Goals are widely known and accepted, minimizing risks associated with residents' disabilities in the context of Smart City issues has received relatively little attention, as emphasized by Staffort *et al.* (2024) in their study of Australian cities. The authors conduct them bottom-up in the form of survey questions addressed to people with disabilities, a rare but very valuable approach.

The resulting findings imply a need to change the approach to urban planning, including moving away from archaic habits and considering five key elements: (1) Planning for human diversity; (2) All people centered governance; (3) Equity, accessibility, and ease as core foundations; (4) Connectedness to place, people and nature; and (5) Vibrant places and experiences.

Makkonen and Inkinen (2024) reach similar conclusions based on a literature review of inclusivity for people with disabilities. The researchers conclude that currently, the issue appears in publications in the context of improving infrastructural solutions and eliminating technical barriers. What is missing, however, is a broader approach concertedly identifying and mitigating the mental causes of exclusion and adapting existing and new solutions to the previously identified needs and expectations of groups at risk of exclusion.

Moreover, Itair *et al.* (2023) note that the accessibility of smart urban space is limited not only for people with disabilities, but also for those with low incomes and women and children. Thus, these are additional groups at risk of exclusion. To avoid it, the authors call for the introduction of the concept of smart public space, which involves citizens in the management of this space and uses smart technology to monitor, provide real-time information and services to citizens. This will improve the performance of facilities and create an environment that is friendly to the urban community and further protects resources and biodiversity.

One of the fundamental urban benefits of creating a culture of inclusivity is improved image and branding. This has also been pointed out by Zhao *et al.* (2024). The authors note that strengthening inclusivity is served by two key values: altruism or entrepreneurialism. Cities focused on altruism use: iconic architecture buildings, flag-ship projects and long-term policies to combat exclusions. Cities focused on entrepreneurialism, on the other hand, use: media-generated images, narratives and events. The researchers also warn of the façade of inclusivity efforts, which may be undertaken only for image purposes without achieving the desired social goals.

A similar problem is also pointed out by Alsayel *et al.* (2022) analyzing the creativity and inclusivity of Dubai, Amsterdam and Toronto. Their research shows that creativity is not always conducive to inclusion, and in some cases can become a source of new exclusions. Moreover, when faced with a choice between creativity and inclusivity, a city will always prefer creativity because economic interest outweighs social interest.

Altruism is therefore not a true value, despite the fact that the cities studied operate in highly developed economies in which basic subsistence needs are met at a high level. In addition, the results of the studies described above point to a local coloration of inclusiveness, in which only selected – largely dependent on cultural values – aspects of inclusiveness are exposed.

The above-described “hallmarks” of inclusiveness and the image-based approach to shaping it can pose a significant problem for community integration, as Belabas and George (2023) rightly point out when studying the process of integrating migrants into the local community of Rotterdam. The results of their study suggest that a focus on branding inclusiveness will lead to migrants' isolation and may reinforce their attachment to national identity in subsequent generations.

Consequently, such a response will be an additional source of deepening isolation and social tensions. For these reasons, it is important to move away from the narrow, image-based approach to inclusivity represented by many contemporary urban decision-makers.

2.3 Technicization and Digitization versus Smart City Inclusivity

Despite the embedding of the bibliographic search in the social sciences, there are still many technological themes among the selected publications. Their connection to community and classically understood inclusivity is quite remote. This illustrates the aforementioned technicization of research devoted to the Smart City and a certain seeming focus on social problems that are not in the mainstream of the analyses conducted. Although it is worth appreciating that the authors of these publications recognize the role of the human factor in the design, implementation and improvement of digital technologies in smart cities (Hu *et al.*, 2021).

Thus, Cui *et al.* (2024), using Chinese cities as an example, show that expanding the accessibility of IT infrastructure to the community by including residents at risk of digital exclusion increases the use of electronic financial services and improves the eco-efficiency of cities. Inclusivity can therefore be a stimulator of beneficial changes in the quality of urban life, which can certainly be exposed in campaigns to strengthen it.

However, it is important to keep in mind that combining inclusivity with urban digitization is possible with the fulfillment of several key conditions, which are identified by Sha *et al.* (2024).

One is for governments to develop adaptive regulatory frameworks to engage technology companies in both digitization and strengthening inclusivity. The other is to develop digital skills and spur residents to smart, informed citizenship. The authors also stress the need to study other determinants of inclusivity beyond those mentioned above.

On the other hand, Lepore *et al.* (2023) analyze inclusivity in a somewhat broader technological context, that is, in conjunction with innovation. The authors believe that it can be strengthened by implementing Industry 4.0 solutions and research centers established for community digitization.

However, a prerequisite for the effectiveness of such an approach is the use of cooperation on the line: city – business – science – community in accordance with the principles of the quadruple helix. This will allow full identification of residents' needs, including the potential scale of the threat of digital exclusion.

Bin and Qi (2023), on the other hand, use the term inclusive in the context of strengthening the green resilience of cities to pollution associated with greenhouse gas emissions. Research in this context is also conducted by Wu *et al.* (2024) using the example of Chinese Millennials and their commitment to low-carbon future cities.

In a very creative way, inclusivity in the environmental-technological field is also described by Pandyaswargo *et al.* (2024) using the example of adapting the municipal waste collection system to the needs and preferences of Japan's aging and shrinking population. This makes it possible to raise the issue of age-based exclusion and the availability of municipal waste management services.

The use of modern technology to enhance the inclusivity of seniors is also described by Shen *et al.* (2024). The authors recognize the need to activate aging urban communities and create a virtual simulation to motivate seniors to increase physical activity. This is a form of healthy lifestyle promotion to prevent seniors from being excluded from urban life due to deteriorating health. Unfavorable demographic trends will certainly increase the need for such forms of combating exclusion in the future.

The examples of inclusivity analysis presented in this subsection illustrate its complexity and the possibility of analyzing it not only in its social dimension, but also in connection with other aspects of Smart City functioning.

2.4 Research Gap in the Context of a Holistic Assessment of Smart City Inclusiveness

A holistic assessment of smart city inclusivity has thus received little attention in the literature and research. This is largely due to the vague definition of the concept and the incomplete classification of forms of possible exclusion. In the current phase of development of the topic of inclusiveness, mainly selective and fragmented analysis of individual exclusions is observed, which is likely to be the starting point in the near future for the synthesis of existing research results and the sorting out of terminological and methodological issues.

In international Smart City rankings, on the other hand, issues related to inclusiveness are most often included in the assessment of the social dimension of urban infrastructure. There are also emerging rankings that assess cities solely in terms of inclusivity initiatives. Zhao *et al.* (2023) analyze eight of them and reveal their shortcomings. The authors note that the selection of indicators and evaluation dimensions is sometimes biased.

Furthermore, the consistency between ranking systems for the best cities is much higher than for the worst cities. Some rankings lack data, and the methodology used favors cities located in developing economies. The results of this research indicate the need to improve methods of assessing inclusiveness in order to objectify, systematize, generalize and universalize them.

The above circumstances justify undertaking the research presented in this article. In addition, the existing research gap is also due to:

- The lack of analyses relating to the links between inclusiveness and the other dimensions of smart city assessment (using the results of rankings for this purpose makes it possible to perform such studies as a contribution to further in-depth research);
- A lack of identification of the determinants of inclusiveness (the research seeks answers to the question of what inclusiveness influences rather than what influences it);
- The presentation of inclusiveness in the context of urban technicization as the dominant approach to issues of exclusion (a review of the rankings makes it possible to select areas of inclusiveness that relate directly to social aspects).
- In the context of the characterized research gap and the research rationale describing it, the purpose of this article is to conduct a comparative analysis of the dimensions of inclusiveness assessed within the framework of the two selected international Smart City rankings and to identify the relationships between these dimensions and the other aspects assessed in the classifications in question.

3. Research Methodology

As already mentioned, the article seeks answers to two research questions, namely: Are cities considered smart able to guarantee a better quality of life for all residents? and Do holistic assessments of smart cities examine and analyze their inclusiveness? With these research questions in mind, the main purpose of this article is to conduct a comparative analysis of the dimensions of inclusiveness assessed within the framework of two selected international Smart City rankings, and to identify the relationships between these dimensions and the other aspects assessed in the classifications in question.

Two smart city rankings have been selected for further analysis: Smart cities Ranking of European medium-sized cities (Giffinger *et al.*, 2007) and IESE Cities in

Motion Index (Berrone and Ricart, 2022). Their characteristics and the rationale for their selection are given below.

Smart cities Ranking of European medium-sized cities (Giffinger *et al.*, 2007) was developed and published in 2007 and included 70 European cities. It is a report created by scientists and researchers from Centre of Regional Science at the Vienna University of Technology (lead partner), the Department of Geography at University of Ljubljana and the OTB Research Institute for Housing, Urban and Mobility Studies at the Delft University of Technology (authors: Rudolf Giffinger, Christian Fertner, Hans Kramar, Robert Kalasek, Nataša Pichler-Milanović, Evert Meijers).

The cities in this ranking were evaluated in six key areas of Smart City performance:

1. Smart Economy: 6 factors, 12 indicators;
2. Smart People: 7 factors, 15 indicators;
3. Smart Mobility: 3 factors, 9 indicators;
4. Smart Governance: 4 factors, 9 indicators;
5. Smart Environment: 4 factors, 9 indicators;
6. Smart Living: 7 factors, 19 indicators.

This ranking was chosen for the research because of two key circumstances. First, it was created quite a long time ago (17 years). Second, it includes medium-sized cities, rather than large and very large cities, as most rankings do.

Such a selection will allow us to deepen the comparative analysis conducted and obtain information on the course of the evolution of perceptions of inclusiveness in the rankings studied, as well as potential differences in the evaluation of cities depending on their size.

The other ranking – IESE Cities in Motion Index (Berrone and Ricart, 2022) – is published periodically and was developed by academics and researchers (Pascual Berrone; Joan Enric Ricart) from the IESE Business School University of Navarra, one of the world's top business schools. Its subject scope is not limited by the size of the city. The ranking takes into account 9 dimensions:

1. Human Capital: 10 indicators;
2. Social Cohesion: 17 indicators;
3. Economy: 11 indicators;
4. Governance: 16 indicators;
5. Environment: 11 indicators;
6. Mobility and transportation: 13 indicators;
7. Urban Planning Indicators: 8 indicators;
8. International Profile: 5 indicators;
9. Technology: 12 indicators.

The ranking was selected for its timeliness allowing a current look at the exclusion and inclusiveness of smart cities. In addition, it is a comprehensive and holistic study based on 103 indicators, which allows a detailed look at the evaluated categories (the indicators in the ranking are periodically updated and supplemented).

The rankings described in the previous section were analyzed in three research steps:

1. Comparative analysis of areas and indicators taking into account different dimensions of urban exclusion;
 2. Identification of the relationships between the different assessment areas, with a particular focus on those in which the most indicators relating to urban exclusion were identified;
 3. Classification of the cities shown in the rankings, taking into account the relationship between areas considering inclusiveness and the final ranking position.
- In the first stage of the research, an analysis of source documents containing a description of the assessment methods adopted was used. On this basis, areas and indicators relating to various forms of urban exclusion were selected, thereby assessing the extent of inclusiveness.

In the second stage, correlation matrices were developed between the positions of cities in the various areas of assessment, which made it possible to estimate the direction and strength of the impact of these areas on each other and the final ranking of the city. For this purpose, the Spearman rank correlation coefficient was used.

This is a non-parametric measure of the monotonic statistical relationship between variables. This coefficient is used to describe the strength of the correlation of two characteristics, when they are measurable, the studied population is small in number and there is a possibility of ordering the analyzed variables. The values of this coefficient take values from -1 to 1, where -1 means a strong negative correlation, 0 no correlation, and 1 a strong positive correlation (Aczel, 2018; Sobczyk, 2007). The analysis assumed a significance level of $p < 0.05$.

In the third stage of the research, an attempt was made to rank the studied cities taking into account the areas most broadly related to inclusiveness and their final position in the overall ranking. This approach allowed a preliminary assessment of how inclusiveness may be related to Smart City status.

To meet this objective, principal component analysis (PCA) (Frątczak, 2009) was used, which allows for the reduction of the assessed dimensions and enables a better understanding of the nature of the analyzed data.

To ensure comparability of results, 70 cities ranked from 1 to 70 were included in the analysis.

In the remainder of this article, the results are described in the order of the steps outlined above.

4. Empirical Results and Discussion

4.1 Analysis of the Scope of Inclusiveness Assessment in the Rankings Analyzed

In the analysis of the scope of inclusiveness assessment, all areas of a given ranking were taken into account, which then indicated indicators relating to the scale of urban exclusion. The results of this review are included for the two analyzed rankings in Tables 1 and 2, respectively.

Table 1. Indicators relating to exclusion in each area of Smart cities Ranking of European medium-sized cities.

Area	Factor	Index
Smart Economy	Productivity	GDP per employed person
	Flexibility of labor market	Unemployment rate
Smart People	Social and ethnic plurality Cosmopolitanism/ Open-mindedness	Share of foreigners
		Share of nationals born abroad
		Voters turnout at European elections
		Immigration-friendly environment (attitude towards immigration)
Smart Governance	Participation in decision-making	Share of female city representatives
Smart Mobility	Availability of ICT infrastructure	Computers in households
		Broadband internet access in households
Smart Environment	Attractivity of natural conditions	Green space share
Smart Living	Cultural facilities Health conditions Housing quality Education facilities Social cohesion	Cinema attendance per inhabitant
		Theatre attendance per inhabitant
		Museums visits per inhabitant
		Hospital beds per inhabitant
		Doctors per inhabitant
		Share of housing fulfilling minimal standards
		Average living area per inhabitant
		Students per inhabitant
		Poverty rate

Source: Own research based on data in (Giffinger and Fertner, 2007).

According to the information in Table 1, in the ranking analyzed, indicators relating to urban exclusion appear in all areas assessed. This means that issues related to Smart City inclusiveness have been recognized and evaluated in the rather distant past. The concept of a sustainable and inclusive city was therefore reflected in evaluation practice. It is also important that the issue of inclusiveness has also been recognized in the evaluation of medium-sized cities, which, on the one hand, has educational value, and on the other hand, indicates the possibilities for improving

the performance of cities in terms of being smart regardless of their size and international reputation.

Referring to the dimensions of inclusiveness included in the surveyed ranking, it should be noted that the largest number of indicators for assessing it is in the area of Smart Living (5 factors; 9 indicators), (i.e.,) directly related to the quality of life of residents. Inclusiveness in this dimension relates to the accessibility of: cultural and art institutions, health services, housing infrastructure and education.

Also appearing in Smart Living is the factor of social cohesion as measured by the poverty index. Inclusiveness in the context of a foreigner- or migrant-friendly environment, on the other hand, is assessed quite extensively in Smart People (2 factors; 4 indicators). This is an aspect of growing importance due to the increasing processes of income and climate migration. The analysis shows that it was also recognized in the early stages of the development of the Smart City concept.

The studied ranking also touches on issues related to the following exclusions:

- Economic (Smart Economy: per capita income level and unemployment);
- Gender-related (Smart Governance: the presence of women in city government);
- Digital (Smart Mobility: availability of computers and the Internet);
- Environmental (Smart Environment: availability of green spaces).

Thus, it can be concluded that key forms of exclusion appear in the analyzed ranking and are reflected in 19 of the 73 indicators (more than 26%). Indicators of urban inclusiveness in the second of the studied rankings are shown in Table 2.

Table 2. *Indicators on exclusion in each area of the IESE Cities in Motion Index.*

Area	Indicators
Human Capital	Secondary and higher education Museums and art galleries Theaters
Social Cohesion	Female-friendly Hospitals Slavery Index Gini Index Health Care Index LGBT-friendly Female employment rate Unemployment rate Racial tolerance
Economy	GDP Estimated GDP GDP per capita Hourly wage in USD Purchasing power

Governance	Human Capital Index Strength of Legal Rights Index Telecommunication Infrastructure Index Online Service Index Democracy Index
Environment	Percentage of population with access to water supply Renewable water resources Climate vulnerability
Mobility and transportation	-
Urban Planning Indicators	Number of people per household Percentage of the urban population with adequate sanitation services
International Profile	-
Technology	Internet Computers/PCs Mobile phone penetration rate Telephony WiFi hotspots

Source: Own research based on data in (Berrone and Ricart, 2023).

The second ranking analyzed includes more areas and evaluation indicators, indicating both the evolution of the Smart City concept itself and the tools used to compare cities. In this ranking, exclusion issues focus on one of the assessment areas, which is Social Cohesion.

It takes into account the largest number of indicators relating to inclusivity, including those relating to: gender, sexual minorities or ethnicity. It also includes indicators related to economic or health exclusion. Devoting an entire area to issues of inclusiveness allows us to conclude that they are increasingly emphasized and noticed by theoreticians and practitioners, and therefore inclusiveness is becoming one of the key conditions for being smart.

Indicators of exclusion also appear in other areas of the IESE Cities in Motion Index. Thus, educational and cultural inclusivity is identified under Human Capital. The risk of economic exclusion is also analyzed extensively under Economy. Issues related to human rights, democracy and access to public services appear in the Governance area (Czupich and Ignasiak-Szulc, 2016). In the Environment dimension, availability of water and climatic conditions are assessed. Housing and infrastructure exclusion appear under Urban Planning Indicators, and digital exclusion appears under Technology.

It is therefore clear from the above that the rankings take into account different types of exclusion and thus different dimensions of inclusiveness. With the passage of time, the number of indicators included in the evaluation increases.

Nevertheless, none of the rankings analyzed directly address risks due to age and disability, which, in light of the demographic trends described, is a certain shortcoming that needs to be supplemented. The rankings also do not directly address issues related to the availability and price of electricity, which could be of great importance to the quality of life in the city in the future.

4.2 Analysis of Linkages between Different Areas of Ranking Evaluation

The next stage of the research identified the links between the different assessment areas with a focus on those with the most indicators identifying exclusion. In the case of the Smart cities Ranking of European medium-sized cities, these areas were: Smart Living and Smart People. While in the case of the IESE Cities in Motion Index, it was primarily the area of Social Cohesion.

Thus, Table 3 shows the correlation matrix for the areas included in the Smart Cities Ranking of European medium-sized cities.

Table 3. *Spearman's rank correlation matrix for the cities' positions in the Smart cities Ranking of European medium-sized cities.*

Areas	Smart Economy	Smart People	Smart Governance	Smart Mobility	Smart Environment	Smart Living	Total
Smart Economy	1.0000	0.4699*	0.6662*	0.5902*	0.0728	0.6607*	0.7410*
Smart People	0.4699*	1.0000	0.6965*	0.6383*	0.1413	0.6725*	0.7825*
Smart Governance	0.6662*	0.6965*	1.0000	0.7142*	0.3649*	0.8211*	0.9057*
Smart Mobility	0.5902*	0.6383*	0.7142*	1.0000	0.1837	0.8068*	0.8535*
Smart Environment	0.0728	0.1413	0.3649*	0.1837	1.0000	0.2345	0.3767*
Smart Living	0.6607*	0.6725*	0.8211*	0.8068*	0.2345	1.0000	0.9231*
Total	0.7410*	0.7825*	0.9057*	0.8535*	0.3767*	0.9231*	1.0000

Note: * significance level $p < 0.05$,

Source: Own research.

The overall ranking score is most strongly correlated with the Smart Living area (correlation coefficient of 0.9231), which emphasizes the role of quality of life (conditions: housing, education, health, culture, tourism, public safety) in claiming the status of being smart. Given that this area also had the highest number of indicators identifying inclusiveness, it can also be concluded that reducing exclusion in various forms has a positive, strong and significant impact on the city's ranking.

The Smart People area, which included indicators related to acceptance of national minorities, among others, is no longer as strongly correlated with the final ranking

position (correlation coefficient 0.7825). Nevertheless, it is still a fairly strong, positive and statistically significant correlation, which indirectly indicates a link between cosmopolitanism and being smart. Table 4 shows the correlation matrix for the areas included in the second of the IESE Cities in Motion Index rankings analyzed.

Table 4. *Spearman's rank correlation matrix for the cities' positions in the IESE Cities in Motion Index.*

Area	Economy	Human capital	Social cohesion	Environment	Governance	Urban planning	International profile	Technology	Mobility and transportation	Total
Economy	1.0000	0.3508*	-0.3669*	-0.3750*	0.2611*	-0.0349*	0.2899*	0.5628*	-0.1916	0.4136*
Human capital	0.3508*	1.0000	-0.1678	-0.1992	0.3809*	0.0927	0.4296*	0.3521*	0.1341	0.4680*
Social cohesion	-0.3669*	-0.1678	1.0000	0.6552*	0.0038	-0.2592*	-0.3154*	-0.3279*	-0.0606	-0.0028
Environment	-0.3750*	-0.1992	0.6552*	1.0000	-0.0196	-0.1320	-0.3081*	-0.3382*	0.1612	0.1391
Governance	0.2611*	0.3809*	0.0038	-0.0196	1.0000	0.1637	0.3933*	0.3833*	0.0849	0.5267*
Urban planning	-0.0349	0.0927	-0.2592*	-0.1320	0.1637	1.0000	0.2884*	0.3000*	0.2355*	0.4508*
International profile	0.2899*	0.4296*	-0.3154*	-0.3081*	0.3933*	0.2884*	1.0000	0.4809*	0.1555	0.5803*
Technology	0.5628*	0.3521*	-0.3279*	-0.3382*	0.3833*	0.3000*	0.4809*	1.0000	-0.0371	0.5098*
Mobility and transportation	-0.1916	0.1341	-0.0606	0.1612	0.0849	0.2355*	0.1555	-0.0371	1.0000	0.3147*
Total	0.4136*	0.4680*	-0.0028	0.1391	0.5267*	0.4508*	0.5803*	0.5098*	0.3147*	1.0000

Note: *significance level $p < 0.05$

Source: Own research.

It is also worth mentioning that the area of Smart Living is most strongly correlated with the area of Smart Governance (correlation coefficient 0.8211), which highlights the importance of the city's efforts to improve the quality of life, including increasing the scope of inclusiveness. This dimension of evaluation is also significantly determined by Smart Mobility, Smart People and Smart Economy.

Thus, it can be concluded that inclusive cities are well-managed, have efficient transportation infra-structure, are open to others and are characterized by good economic health. This is confirmed by an analysis of the correlation coefficients for Smart People, the second of the areas most widely identifying exclusion risks.

The data in Table 4 shows that the various dimensions of the assessment are less correlated with each other than they were in the previous ranking analyzed. This is because more statistically insignificant, low-value and negative correlations appear in the table, indicating the differential nature of the assessment carried out. This illustrates the differentiation of cities and clearly indicates area imbalance.

The overall ranking score is most strongly correlated with International profile and Governance and Technology, indicating that the smartness of cities and their ranking are most strongly influenced by the primary, traditional Smart City differentiators. Social cohesion directly related to inclusiveness is negatively correlated with final ranking.

Admittedly, this is a statistically insignificant correlation, but it draws attention to the unfavorable association of this area with the resultant rating. So, cities with high technological and international potential and good governance do not necessarily pay attention to inclusiveness as a social value. In this context, the methodological guidelines for assessing inclusiveness are appropriate and comprehensive, but the empirical results document the lack of a clear commitment of leading cities to levelling exclusion.

The area of social cohesion that takes into account the most indicators related to inclusiveness is the most strongly associated with Environment. Nevertheless, it can be assumed that this is a coincidental correlation, as environmental issues are also very weakly correlated with the final Smart City ranking.

The analysis also shows that various forms of exclusion are more strongly associated with economic and technological factors than management factors. This could indicate both a city's low interest in social issues and great difficulty in pursuing inclusivity.

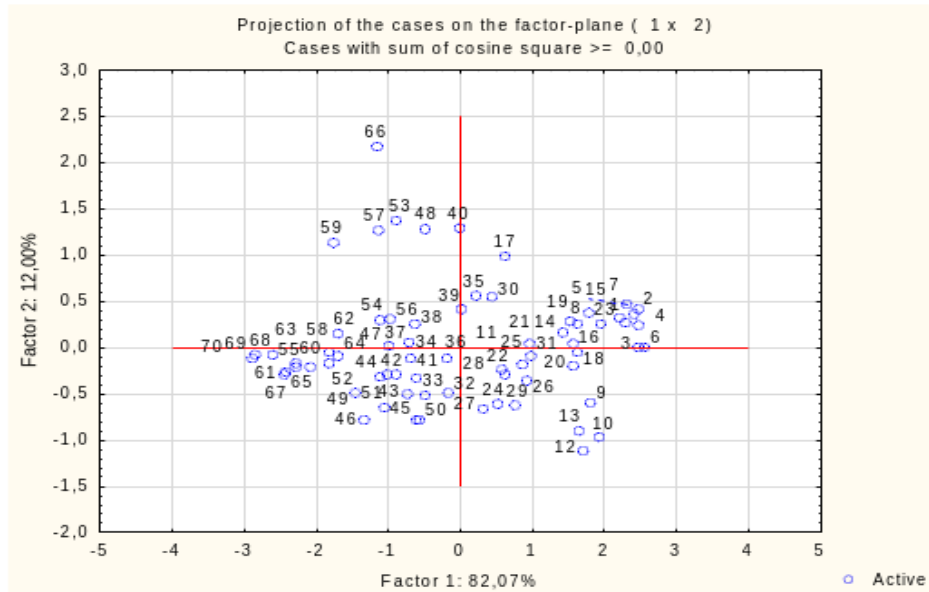
4.3 Classification of Cities with Regard to Inclusiveness and Overall Smartness

In the final stage of the research, the cities included in the rankings were subjected to a classification taking into account the following areas: (1) Related to inclusiveness, and (2) The final rating in the Smart City ranking studied. Principal component analysis was used to divide the cities, and the results of the research are shown in Figures 3 and 4.

Thus, in the case of the Smart cities Ranking of European medium-sized cities within the PCE, the following dimensions were included: Smart People, Smart Living and Smart Governance. According to the data in Figure 1, cities ranked high in the overall ranking are also cities with high positions in Smart Living, Smart Governance and Smart People. They are located in Quadrant I of the coordinate system. This proves the mutually beneficial impact of these areas on being smart.

Quadrant IV, on the other hand, includes cities with high Smart City and Smart Governance rankings, but less openness and cosmopolitanism than those placed in Quadrant I. Notably, the two quadrants described here mainly include cities in the top 30 of the ranking. So, being smart is also largely associated with being inclusive.

Figure 3. Principal component analysis, PCA for cities with the Smart Cities Ranking of European medium-sized cities (dimensions: Smart People, Smart Living, Smart Governance).



Source: Own evaluation.

Quadrants III and IV include cities ranked more distantly in the Smart cities Ranking of European medium-sized cities. With Quadrant II including cities with medium to low scores in Smart Living and Smart Governance, but quite high in Smart People (e.g., Liepaja – No. 66 or Tartu – No. 40). On the other hand, Quadrant III includes cities with average or low ranking in all three areas.

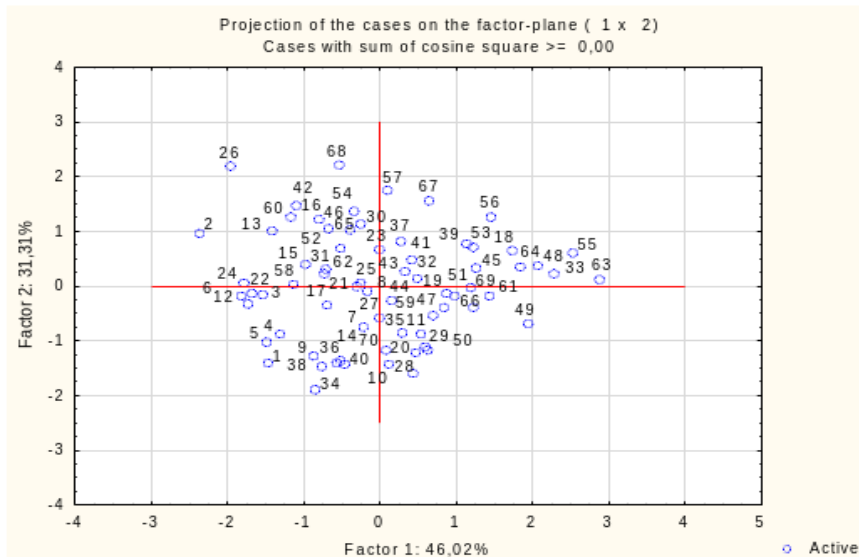
The above observations allow us to conclude that being inclusive is closely related to being smart. However, among cities rated well in terms of inclusiveness, a certain dichotomy relating to openness to others can be observed, for not in all entities does a high rating in Smart Living (relating to more classic forms of exclusion) correspond with a rating in Smart People (taking into account, among other things, attitudes to-ward migrants or foreigners). Inclusivity must therefore be analyzed and evaluated, and thus shaped from different perspectives.

In the case of the IESE Cities in Motion Index, the PCA analysis took into account the following: Human Capital, Social Cohesion and Governance. The results are presented in Figure 4.

Quadrant I includes cities performing very well and well in terms of Social Cohesion and less well in terms of governance and human capital. Quadrant II, on the other hand, includes those with the most balanced ratings in all three areas. These

are not the leaders of the ranking, but the cities ranking in the top half of the seventy in all dimensions taken into account. Thus, it can be said that these are entities committed to being smart in social areas as well.

Figure 4. Principal component analysis, PCA for cities in the IESE Cities in Motion Index (dimensions: Human Capital, Social Cohesion, Governance)



Source: Own evaluation.

Quadrant III includes most of the cities that are characterized by poor places in Governance and much better places in Human Capital and/or Social Cohesion. These are cities more clearly committed to community. Quadrant IV represents cities performing very well in Governance, but doing less well in the inclusivity issues identified in Social Cohesion.

The above observations show that a ranking that takes into account cities with high geographic, social or demographic diversity is characterized by less inter-area cohesion. This illustrates the very high diversity of the cities studied. In addition, it draws attention to the lack of close links between the traditional, primary characteristics of smart cities and the inclusiveness (but also, environmentalism) exhibited in the further development of the Smart City concept.

The more socially sustainable cities are in the middle of the ranking, which may indicate that the distribution of efforts and material resources across the various dimensions of being smart does not allow for top positions in the Smart City rankings.

4.4 Discussion

The literature studies presented show that the risks of exclusion in smart cities can be a serious problem for their further development, so it is worth identifying, monitoring and taking measures to combat them. Then all residents can become beneficiaries of a better quality of life (Yadav and Kumari, 2023; Sharma *et al.*, 2020; Giliberto, 2023).

The results of the conducted analyses show that in the rankings of smart cities the problem of urban exclusion is not downplayed. It has been analyzed in a multifaceted, though not holistic, way since the beginning of the intensive development of the Smart City concept. Thus, there is a methodological basis for assessing inclusiveness, or threats of exclusion.

Nevertheless, the links between inclusiveness and the final position of cities in the rankings studied are not strong and/or significant. Therefore, it is not a determinant of Smart City status as much as classic distinctions such as technology, mobility or urban economics and governance. This may support the conclusions of Sissons *et al.* (2019) of an instrumental and generic approach to mitigating exclusionary risks in smart cities. It may also draw attention to the image-based rather than actual approach to inclusivity, as has been already written about by Zhao *et al.* (2024) and Alsayel *et al.* (2022).

A fairly similar catalog of exclusion risks appears in the two rankings studied, but also in the literature analyzed. This catalog includes economic, digital, cultural, educational or infrastructural exclusion. However, direct references to exclusion affecting seniors and people with disabilities are missing. This issue is described in a broader context by Staffort *et al.* (2024) and Makkonen and Inkinen (2024) noting the need to include people with disabilities in Smart City communities. On the other hand, Pandyaswargo *et al.* (2024) and Shen *et al.* (2024) describe measures to help seniors adapt to using the city's digital infrastructure.

Indicators identifying inclusiveness are correlated with urban governance, highlighting the role of city government in combating exclusion. They are also associated with urban economics, which may indicate that cities located in developed economies are better able to deal with exclusion problems. Inclusivity is also linked to human capital, which illustrates the interplay of the social differentiators of smart cities.

It is also a new research observation that areas of inclusivity score moderately or low in determining a city's final place in the Smart City ranking. Interestingly, a group of environmental factors has an even lower correlation with this place. This clearly indicates the lesser role of these determinants in Smart City development. Thus the five-fold helix effect – widely emphasized in the literature – is not common and fully appreciated in the reality of modern cities.

Based on the results, it can also be concluded that medium-sized European cities are less differentiated in terms of the inclusiveness-management-ranking relationship than large cities with a wide geographic diversity. This indicates the need to balance the potential of cities regionally and globally (Kudelko *et al.*, 2022; Bal-Domańska *et al.*, 2020).

It is worth noting, however, that the two rankings analyzed find leaders in inclusiveness who also perform very well in other areas of Smart City assessment. Being inclusive and smart at the same time is therefore not an impossible challenge to achieve in practice. These cities can exemplify good practices and inspire emulation.

Based on the analysis, two groups of recommendations can be made. The first concerns the methodology for assessing inclusiveness and will include the need for issues like:

- A holistic approach to inclusiveness assessment that takes into account different forms of exclusion;
- Inclusion in the assessment of inclusiveness of issues related to aging populations and problems of people with disabilities.

The other relates to the city's efforts to strengthen inclusivity and thus resilience to exclusions, and includes the need to:

- Move away from an image-based treatment of inclusiveness;
- Focus on bottom-up real analysis of the risks of exclusion;
- Ongoing identification and monitoring of various forms of exclusion, and taking action to mitigate those of greatest magnitude;
- Guaranteeing coherence and sustainability between all areas of Smart City operations, with a particular focus on the social and environmental areas.

5. Conclusion

The considerations presented in the article entitle us to conclude that the literature and smart city rankings pay attention to inclusivity and identify various dimensions and types of possible exclusions. With the development of the Smart City concept, the scope of interest in inclusivity is also growing. The scale of its assessment (both in terms of area and indicators) is also increasing.

Exclusions identified in the rankings include the following types: economic, educational, housing, digital, cultural, but also by gender, race, sexual orientation or universality of human rights. Accordingly, it can be concluded that the theoretical and methodological dimensions postulate the same quality of life for all residents of smart cities.

Nevertheless, an analysis of the correlations between the various dimensions of smart cities' evaluation and their position in a given ranking indicates average or weak (insignificant) relationships between invisibility and final ranking (similar relationships apply to the environmental dimension). This indicates the lower importance of social and environmental aspects in the practice of smart city management. Inclusive-ness itself, on the other hand, is most often correlated with dimensions relating to human capital, economics or management, (i.e.) factors of a social nature.

In addition, in the ranking for medium-sized cities located in the same geographic area, the inter-area consistency is greater than in the global ranking that takes into account cities with high multidimensional variation, indicating the different paths of aspiration to be smart and the area imbalance of these aspirations.

The analyses presented in the article are characterized by three main research limitations:

- Restriction to only 2 rankings;
- Calculating correlations on the basis of areas taking into account individual indicators, but also measuring other aspects of being smart;
- Using processed secondary data of a quantitative nature, without qualitative research.

Despite these shortcomings, the conclusions of the article can be the basis for improving both the methodology for assessing inclusiveness and efforts to mitigate the risks of exclusion in practice. This is because they are new and important observations relating to both theory and practice related to Smart City.

Two threads of thought can be considered for further research. The first relates to the development of a holistic proposal for measuring and evaluating inclusivity, which is lacking in both theoretical and instrumental terms. The other relates to a detailed bottom-up assessment of individual risks of exclusion, which will in turn allow us to look at issues of inclusivity from the perspective of residents, (i.e.) key Smart City stakeholders. This is because currently the study of exclusion and urban inclusiveness is done on the basis of theoretical considerations or statistical data analysis, which is a rather limited approach in the case of social phenomena.

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