

# Gendering the Smart Cities:

Addressing gender inequalities in urban spaces

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## ABSTRACT

This article aims to advance the debate on gender and smart cities. Smart cities, with technology as a basic component in urban management, are initiatives seen as a path towards sustainability and inclusiveness. Discussed by academics and practitioners to promote better living in urban spaces, gender issues have been neglected when studying and designing smart cities. Gender (in)equalities affect women's and men's lives in many ways, which include the different experiences and unequal situations in cities. By failing to address gender issues, urban spaces can potentially exacerbate inequalities. Additionally, disregarding gender issues through gender-blind policies does not make cities neutral but rather gendered only for a universal Subject. Based on a systematic and integrative literature review, we sought to answer the research question: Why gender should be considered when studying and designing smart cities? In addition to addressing the question, the intersectionality approach is presented as a means to promote gendered smart cities.

## CCS CONCEPTS

• **Applied computing** → Computers in other domains; Computing in government; E-government.

## KEYWORDS

Smart city, Gendering smart cities, Gender, Gender-sensitive, Gender inequalities, Intersectionality, Inclusiveness, urban spaces

### ACM Reference Format:

Javiera F. M. Macaya, Soumaya B. Dhaou, and Maria Alexandra Cunha. 2021. Gendering the Smart Cities: Addressing gender inequalities in urban spaces. In *14th International Conference on Theory and Practice of Electronic Governance (ICEGOV 2021)*, October 06–08, 2021, Athens, Greece. ACM, New York, NY, USA, 8 pages. <https://doi.org/10.1145/3494193.3494308>

## 1 INTRODUCTION

Smart cities have been increasingly discussed by academia, international organizations and practitioners. Anchored on the argument of growing urban population and the promise of a more sustainable and efficient city, smart cities are based on the use of information and communication technologies (ICT) to promote better living

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*ICEGOV 2021, October 06–08, 2021, Athens, Greece*

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ACM ISBN 978-1-4503-9011-8/21/10...\$15.00  
<https://doi.org/10.1145/3494193.3494308>

in urban spaces. Inclusiveness is one of the goals of smart cities, and if it is not addressed, it may exacerbate existing inequalities or create new forms of exclusion [1, 11, 23]. However, discussions on smart cities have not addressed the exclusion linked to gender issues, neglecting the debate on gender inequality and exclusion [38].

There is nothing new in the fact that knowledge production is mainly linked to the male being as the reference. Anything that differs from this, it is characterized as the “Other.” [6, 15] Indeed, knowledge adopts mainly a male perspective to explain the world, its vision and expression. Consequently, it is producing and reproducing the phenomenon of androcentric explanations [15]. From this androcentric view, the idea of Man or masculine subject – the “universal subject” – is created, serving as a reference to everything. This reference does not exclude women in the production of knowledge, but they are considered as “minorities” or “deviant group” – that is, that diverges from the standard (masculine), making them invisible [13] or exception.

Although there are already gendered approaches to think about cities in the field of urbanism and urban planning [41], the debates about smart cities have not addressed themes related to gender [38]. Based on the debates on the “universal subject,” we begin to understand that, by not addressing gender discussions, smart cities reproduce a masculine vision of the city. By not including gender issues, they do not stop being gendered: they are, but for a universal subject.

Despite there is nothing that naturally unites women [2, 21], it is critical to identify dimensions to consider “women” as subjects in smart cities, as well as the gender issues that feminist researchers address. Thinking about gender means reflecting on social relationships [29]. These considerations guided the formulation of our research question: Why gender should be considered when studying and designing smart cities?

Based on the relevance of considering gender in smart city design, this paper aims to advance the debate on gender in smart cities in order to explore the diversity of citizens and to promote inclusiveness. For this purpose, firstly, a review of the literature on these topics is presented. Secondly, the methodology and the approach are described. Then, the results are discussed. We conclude this paper by addressing the limitation and proposing new avenue of research in the field.

## 2 SMART CITIES AND GENDER

The smart city debate originates from multinational technology companies [58, 70] and mobilizes several areas of knowledge [5]. We found clear evidence of lack of agreement on the meaning of the key terminology, and a lack of consensus on the definition

and objectives of the advocacy effort [68, 70]. Initially closely tied to the use of technologies, more current visions also include the perspectives and demands of citizens and communities in a broad sense [20, 35]. It is worth noting that the understanding of the smart city is crossed by different interpretations and visions, susceptible to the contextual issues of different parts of the world [34, 70]. This is an aspect that bases the lack of a universal definition, since the elements that comprise a smart city are specific to each context and culture [64, 68]. Among the various definitions and elements that characterize them, Vanolo [70] states that the different visions of smart cities are representations of visions of society.

Seen as 'cities of tomorrow' and/or as urban utopias [70], smart cities are understood as a holistic approach to sustainable urban development [27, 69]. Among some of the definitions, there are elements such as technology, data and innovation, with the aim of improving life and well-being in cities, as well as the delivery of urban services [57, 58, 68]. Thus, there are definitions that focus on the role of technology [7, 18, 26, 40] the human capital of cities and involvement of citizens and interest groups [8, 20, 34, 40, 71] and sustainability [40]. Other articles bring sets of elements as a basis – such as the “three Ts”: technology, tolerance and talent, associated with investment in technology, the socio-cultural diversity of cities and the human capital of the city, respectively [32]. Those understand technology as an enabler for smart cities and highlight the role of human capital for environmental, social and economic sustainability [20]. Other studies understand technology, community and policies [8], issues concerning technology, people and systems [28] or technology, people and institutions [44] as driving elements of smart cities. Singh [44] also includes e-participation and citizen involvement elements as fundamental concepts in the definition of smart cities.

Along with the definitions, another aspect that stands out is the purpose of smart cities. In this aspect, authors highlight the improvement in communication and public service delivery [18, 19], the improvement of life in cities [9, 19, 27, 38, 44] addressing local problems [38], and city transformation through innovation [8].

Citizens are the ones who most observe and use cities [8, 20]. Therefore, people-centered approaches for smart cities stand out. In those approaches, participation and stakeholder engagement at different levels of government (municipal, regional, national) are key to include the diverse perspectives and ensure that cultural factors and ways of life are integrated into smart city projects [60, 62, 63, 68].

Besides the challenge of participation and the engagement of people and stakeholders, inclusion is another aspect that is posed for smart cities [68] that, together with diversity, are elements for sustainability and innovation [27]. It is critical to consider how technologies, open data initiatives and capacity building make it possible to address urban challenges and promote smart city initiatives, promoting sustainability, inclusion, and prosperity [60, 62, 63, 68].

An inclusive smart city is one in which people do not need to move over long distances. These cities are sustainable, healthy, safe and accessible [63]. By drawing from the diversity of urban people and groups – this includes vulnerable groups, including representatives of youth, women, people with disabilities, older people, and residents of uneven areas and informal sectors [57, 68] –, smart city visions become relevant to the local context, addressing

the needs of each locality [63, 68]. However, smart city debates have not addressed one important aspect of sustainability, and inclusion namely gender issues [38], despite the fact that this approach is already present in urbanism and urban planning studies [41].

Social norms and gender stereotypes mark the role that women and girls – as well as men and boys – can play in societies, places them at a disadvantage and constitutes obstacles to gender equality [46, 59]. Gender and the way people identify themselves define their position and power in society [58]. Deeply anchored in societies, gender norms also reverberate by institutionalizing gender-based inequalities – with discriminatory effects that fall even more heavily on least advantaged women. They therefore need to be addressed in policy and action planning [58].

Gender (in)equality affects women and men lives in diverse ways and has been addressed from different approaches that recognize that women and men experience different and unequal situations in cities [56]. The design of gender-sensitive policies that integrate gender equality perspectives are linked to different areas: poverty reduction, economic growth, disaster management and mitigation, housing, and urban development [46, 55, 65]. Gender equality would enable women and girls' access to productive resources, essential services, and their participation in decision-making processes that affect their daily lives, reducing the situations of disadvantage they experience [46, 55, 56, 65].

Discussions on the incorporation of gender perspectives into policies are anchored in what is known as gender blindness, referring to the lack of acknowledgement that “roles and responsibilities of women/girls and men/boys are ascribed to, or imposed upon, them in specific social, cultural, economic and political contexts.” [17] Rooted in the intention of treating all people in the same way, gender-blind approaches disregard specificities and ignore that this supposed neutrality does not exist, since policies, projects and actions are based on values and priorities of those who formulate them [58, 59]. They overlook issues of experience of “others” – this category includes “women and individuals with non-conforming gender identity,” [33] – as if public policies and legislation affect all people in the same way. Additionally, they ignore that, by default, the world was and is designed by and for men, which applies to dimensions beyond digital issues [72], and can result in inefficient service design and delivery and the exacerbation of gender inequalities [31, 55, 59]. Furthermore, gender-blind policies disregard the complexity of power relations present in society [42], and construct a discourse about a 'universal we' [70], hiding injustices present in the city (in mobility, leisure, access to housing, violence – and even in studies conducted) [12, 30, 33, 42, 70]. However, it is worth noting the insufficiency of creating 'sections' in programs or policies with measures for women: gender issues must be cross-cutting [33]. In this regard, Marathe and Jacob [33] highlight the role of spoken and written language, which shapes and can reinforce notions of gender: “It is not enough to say or write that gender-specific terms 'apply to women as well.' In the long term, this reinforces gender roles.” One example is gendered poverty, women's poverty or feminization of poverty in cities. Mainly linked to urban policies and analysis, this debate considers that there are various situations that accentuate poverty, mainly affecting women due, for example, to unpaid care work [56]. It is on the basis of unpaid care work (rarely recognized and/or valued) that the urban economy works.

Looking at the feminization of poverty can mean advances in the prosperity of cities, their resilience and the reduction of natural disasters [46, 55, 56]. However, feminizing poverty cannot be only limited to the income of female household heads: “Female heads are not only likely to continue to have disproportionate responsibility for unpaid and care work, which are especially onerous in urban contexts characterised by limited access to basic services and difficult environmental circumstances,” [56] they also need paid work, reinforcing women’s triple role<sup>1</sup>. Finally, another aspect related to gendered poverty is the search for opportunities in cities; both new migrants and women consider urban areas to be places with more opportunities for paid work and independence than rural areas [58], endorsing the importance of looking at gender issues when analyzing poverty dynamics.

Thus, gender-sensitive approaches – which consider “societal and cultural factors involved in gender-based exclusion and discrimination in the most diverse spheres of public and private life” [16] – are important tools to make cities more equitable and safe spaces [17, 48], for instance, by taking into account such issues in both the analysis and design of responses to urban issues. Gender-sensitive approaches allow for questioning *one-size-fits-all* policies [32] – that is, a policy that seeks to serve all people in the same way, without considering possible specificities. In this sense, such approaches should be present in the various stages of public policies for urban spaces – including budgets, monitoring and evaluation parameters and indicators, for instance –, taking into account the context in which they are inserted [17, 24, 27, 38]. Especially about the latter, Nesti [38] states that gender-sensitive indicators allow analyzing the effects of smart city policies on women and men, as well as understanding whether such policies reduce or increase gender inequalities. At the same time, it is necessary to consider other aspects and factors of inequality that can generate biases beyond gender issues [22].

Despite the difficulties in addressing gender issues, considering them when assessing the governance of smart cities can be useful to track their contribution to inclusion, legitimacy and public value creation [38]. This is even more relevant when it comes to urban development, especially planning and designing, as these areas are marked by “the limited understanding of a culturally privileged and male dominated profession.” [33] Beyond a specific knowledge area, it is important to note that ideas regarding governance are not neutral, but rather the product of a “model accepted by the powerful class, which is (or has been, at least until recently) a male-only group.” [43] In this sense, Wajcman et al. [72] state that, when considering technologies embedded in a given context, it is necessary to understand the intersection of gender with other factors of inequality, since such technologies can have different and negative impacts: “For instance, women who are poor or belong to racial minorities experience the negative effects of digitalization and automation more acutely.” [72]

<sup>1</sup>Women’s triple role refers to the reproductive (domestic and care work), the productive (formal and informal work for income and subsistence) and the community managing roles [16].

### 3 METHODOLOGY

This article is based on systematic and integrative literature reviews conducted with the aim of understanding how gender and smart cities have been addressed by academic and empirical work. Despite the paths already taken regarding gender and urban planning and gender-sensitive analyses, gender debate has been neglected in studies regarding smart cities [38]. After the review, it is possible to say that gender-sensitive approaches in regards with smart cities are still very incipient.

While conducting a systematic review on gender and smart cities within the field of public administration/public policy, Nesti [38] identified only three papers specifically addressing these topics. We identified a similar scenario. Webster and Watson [73] point out that a review of the knowledge already produced regarding a topic or issue is an important step to create a solid foundation for the development of future research. In the scope of this research, we see it as an initial effort to investigate in greater depth the joining of these major themes, largely addressed separately.

The systematic literature review process was conducted from December 2019 to June 2020. Starting from the databases Web of Science, Ebsco Host, Scopus, Scielo, Association for Information Systems eLibrary (AISEL), the review was conducted by searching for the terms “smart city OR smart cities AND gender” and “smart city OR smart cities AND wom?n”<sup>2</sup> in all search fields. To ensure that articles from the Information Systems (IS) field were included in the literature review, its eight most important journals, known as basket of eight [3] were included and the searches were conducted in the databases of the following journals: European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, and MIS Quarterly.

After conducting the searches for these terms, seven filtering steps were applied: (i) type of document, restricting the results to “Articles,” “Proceedings Paper” and “Early Access,” if applicable; (ii) knowledge areas, including only articles from “Information Systems,” “Management and Business,” “Public Administration,” “Women’s Studies,” “Urban Studies,” and “Regional Urban Planning”; (iii) language, selecting articles written in English, Portuguese or Spanish;<sup>3</sup> reading of (iv) the title; (v) the abstract; (vi) the introduction and the conclusion, evaluating the pertinence with the theme; and (vii) a complete reading of each article – 73 articles were read completely and, of these, 56 were considered to compose the systematic literature review.

The integrative review aims to review empirical works, using at the same time the theoretical and empirical literature, synthesizing several studies already published on a particular area of knowledge or theme [36, 74]. Based on these understandings, the integrative review was carried out during the months of August and September 2020, in the publication repositories of the United Nations Entity for Gender Equality and the Empowerment of Women (UN

<sup>2</sup>The use of wildcards is useful for representing unknown characters. For instance, the question mark (?) represents any single character. Thus, searching for “wom?n” matches “woman” and “women” results.

<sup>3</sup>These three filters were applied directly to the database where the searches were conducted. A file with the resulting list of articles was downloaded and the results were consolidated in an Excel spreadsheet, where the next filters were directly applied.

Women) and the United Nations Human Settlements Programme (UN-Habitat). These two UN agencies were chosen considering their areas of expertise: gender equality and sustainable urban development. The databases are global repositories of the publications of these two agencies, and English is the main language used for the searches.

In the UN-Women publications repository, the selection process started from the filter by topic addressed in the publications. Out of more than 150 possibilities for filtering by topic, 17 were applied: “Gender equality and women’s empowerment,” “Ending violence against women and girls,” “Human rights,” “Governance and national planning,” “Sustainable Development Goals (SDGs),” “Gender equality and inequality,” “Women’s rights,” “Gender mainstreaming,” “Gender, culture and society,” “Safe Cities and Safe Public Spaces,” “Innovation and technology,” “Gender power relations,” “Local development,” “Gender stereotypes,” “Information and communications technology (ICT),” “Urban development,” and “Planning and monitoring.” In the UN-Habitat publications repository, the selection also started from the filter by topic of the publications. In this case, three topics were used: “Gender,” “Women,” and “Smart city.” The second filtering step consisted in reading the titles of each publication, followed by the verification of adherence to the researched topics (smart cities, gender, and women). Steps four and five excluded documents that were repeated or in languages other than English, Portuguese or Spanish. After the complete reading of the documents, 32 were selected to compose the integrative review.

All articles and documents were read in full using the ATLAS.ti@software, where the in-vivo coding of the texts was performed. After finalizing the reading and coding of all documents, all codes were grouped under the category “systematic review” or “integrative review,” and quotations were grouped around the recurring themes as the coded text excerpts were reread. Fourteen codes referring to systematic and integrative review were identified. After this separation by major themes, the quotations that composed each theme were read again and grouped into subthemes, which resulted in subcodes. In this article, we present the cut of the literature that discusses gender and smart cities.

## 4 RESULTS AND DISCUSSION

Although the discussion on smart cities is complex, since it involves social, economic, environmental, technological and behavioral aspects, research that considers addressing gender inequalities remains scarce [30, 38]. Based on the papers and documents reviewed, considering gender issues when studying and designing smart cities is imperative to promote inclusive urban spaces. Additionally, the reviews bring that gender-blind smart cities may exacerbate inequalities, then gender-sensitive policies are means to consider gender since the beginning of decision-making. Lastly, intersectionality is presented as an approach to gendering smart cities. This section will explore these three aspects.

Firstly, inclusion is an important aspect of smart cities. As part of the New Urban Agenda and to achieve the Sustainable Development Goals of the 2030 Agenda, countries have committed to take advantage of the opportunities arising from smart cities and technologies in order to enable cities to improve their service delivery and promote a sustainable growth [60–63, 68]. Therefore, inclusion,

resilience, sustainability, interoperability, flexibility, security and risk mitigation are key issues that should underpin smart cities [68]. Cities with the smartness should become safer and more livable, responding quickly to new urban challenges [37, 47, 49], developing strategies that include people – considering skills development, digital citizenship, data literacy, and affordability –, respecting privacy and human rights, and developing capacities at the institutional and regulatory levels [64, 66, 68]. To this end, it is important that these strategies target mainly people who are already socially and economically excluded; furthermore, these strategies should harness and make use of the innovation infrastructure already in place in cities among other critical problems such as climate issues and sustainability-related problems [62, 64, 68]. All these aspects reveal the role that social and environmental issues play in smart city initiatives, since by including them as objectives, they recognize that the prosperity of cities will not automatically result in the reduction of urban inequalities [56].

While technologies are seen as major drivers of inclusion in smart cities (especially of vulnerable groups), it is essential to recognize and understand their limitations, noting which groups may not benefit or be disproportionately affected [68]. To this end, promoting digital inclusion and access to information and communication technologies, as well as skills development and digital literacy, is an important issue to enable the smart city to be truly inclusive and to avoid increasing the digital divide in the society [57, 68]. By doing so, they move towards sustainability and enable all people to benefit from the knowledge-based economy [57, 63].

The possibilities of exacerbating inequalities should be considered when implementing technology-based policies [32, 38]. Thus, inclusion should be embedded in equality aspects in policy implementation, considering that smart cities can play an important role in reducing discriminations [27, 38]. Specifically on gender, Nesti [38] states that elements that compose widely known definitions of smart cities ([10], for example) can negatively impact gender equality. Therefore, smart cities should consider gender issues and integrate perspectives of marginalized groups – including children, youth, the elderly, women in vulnerable situations and people with disabilities – in planning [47, 62, 67, 68]. This would ensure that cities are safer and more responsive to their needs, and especially women and girls, while reducing inequalities between women and men [47, 68]. Cities can only be considered smart if they are safe, gender-responsive and gender-equitable spaces [56, 60, 67]. However, there are still few documents and policies that detail ways to ensure that these issues are addressed [67].

Secondly, gender-blind approaches in urban public policies are evidenced in the universal Man for whom cities are designed. However, the way cities are lived, experienced and perceived is related to each individual’s identity factors. For this reason, policies based on gender-sensitive approaches potentially address urban problems based on the diversity of its population. It is from those approaches that policies designed for a universal Man gain different nuances and shapes, taking into account multiplicity and diversity of experiences on urban spaces and challenging the existence of a “universal” experience in the city [42, 70]. Although the debate on gender-blind approaches was mainly addressed by authors who were concerned with urban spaces, a few were particularly interested in discussing gender and smart cities.

Gender issues may be considered since the beginning of decision-making based on gender-sensitive policies. Considering that the city planning influences, shapes and impacts the daily lives of women and men differently, it is necessary that urban infrastructure be developed based on gender parameters in order to enhance gender-friendly cities [17, 33, 39]. In smart cities, gender sensitivity should be present in the logic of public policy formulation and decision-making about urban spaces, with budgetary provisions that guarantee resource allocation [38, 39]. In her research about smart cities and gender, Nesti [38] noticed that researchers have identified gender inequalities in local social, political and economic contexts, as well as in ICT policies, reproducing gender-based discriminations in cities. Therefore, gender planning or gender-aware urban planning – i.e., the development of organizational, financial, official, and information-based tools applicable to gender-sensitive policies and projects of diverse contexts [17, 24, 38] – is a means to address gender equality in smart cities and is applicable in different areas and levels.

The failure to look at the infrastructure of everyday life in cities from a gender perspective results in negative consequences for people at the margins [24, 33]. Its effects can be felt in mobility and transport, leisure, and safety/violence – especially sexual violence – [17, 33, 42, 45]. This results from the position that women or people with non-conforming gender identities occupy in society, by gender roles, the gendered hierarchy of power [33, 45]. Considering gendered and racialized spaces, it is relevant to understand what it means to live, occupy, and move around the city for women and people with non-conforming gender identities, challenging stereotypes and biases present in various discourses [25, 33, 42]. Nevertheless, this discussion is mainly focused on physical infrastructure, disregarding the impacts of gender blindness in digital infrastructure, critical in smart cities. For instance, we can mention the gender inequalities in the access to ICT. Due to digital gender inequalities, women are prevented from benefiting from the use of technologies and the public online services [31]. These inequalities can have implications, for example, in the data that are generated from the use of technologies. Consequently, women and other digitally excluded groups will not be represented in databases used to inform decision-making processes – and therefore potentially not represented in policies.

Additionally, gendered approaches applied to the city that consider both women's and men's needs for investment in urban public infrastructure contribute to better housing and living standards and sustainable urbanization [52, 55, 56]. These approaches enable them to enjoy “their right to public space including public transportation, and [promote] gender equality, including equal access to income, education, health care, justice, and political participation and influence.” [50] However, such approaches should be understood as the first step towards equal rights in urban areas, and in order to consider the diversity of women's needs and experiences [4, 53].

Therefore, urban planning should no longer be gender-blind and respond adequately to the diversity of demands and realities [55, 58] and this may include policies on digital infrastructure. Women need to be included in decision-making processes – breaking the logic of cities designed *by men and for men* –, providing budget resources and forms of measurement for monitoring [4, 55]. Also, it is necessary to generate data and information disaggregated by gender

to support public policies [4, 54, 55]. Monitoring and evaluation of policies also need to use gender lens, fully integrating planning practices: “For example, if it is known that women have less access to cars and make more use of public transport than men, then policies favouring car use or public transport use will have gender-based impacts” [58] that should be considered by decision-makers. This is particularly important when designing smart cities, since the data produced by the use of technologies can fail to represent digitally excluded groups, biases that might be considered in decision-making processes.

It is important to note that aiming only at the efficiency of public policies will not necessarily change the relational gender aspects that mark differences and inequalities [56]. To this end, it is relevant that public policies, especially those related to smart cities, include gender and diversity issues and perspectives from the beginning, since gender inequalities hinder the development of these initiatives [38, 47]. These inequalities should be considered as they “they hamper women's access to resources, technologies, services, policies and decision-making processes but also because they have a strong negative impact on economic growth, unemployment rate, diffusion of digital services, and sustainability.” [38]

Lastly, a possible way forward to include social factors as gender and race in decision-making is the intersectionality approach. Highlighted by documents from the integrative literature review, this approach has the potential to include diverse perspectives [14]. Intersectionality considers the combination and interaction between various forms of inequality, which shape women's experiences of vulnerability and discrimination [49, 50]. In this way “the intersection of a number of simultaneous oppressions including (but not limited to) race, class, caste, gender, ethnicity, sexuality, disability, nationality, immigration status, geographical location, and/or religion,” [53] as well as structural inequality such as legal barriers, gender identity, language, refugee status, HIV/AIDS status, low income and age [50, 52, 53, 72]. Treating all people equally can mean reproducing and exacerbating existing inequalities [50]. It is therefore necessary to understand that women's experiences are not universal, being shaped by the intersection of characteristics that portray a diverse population [58, 72]: “Being female, after all, is not synonymous with being poor. It is the intersection of gender with other forms of discrimination that pushes women and girls from poor and marginalized groups behind.” [51] Intersectionality allows characterizing the situation of “women and girls living at the intersection of inequalities and discrimination,” [51] identifying possible distinct effects of policies between men and women, as well as designing and implementing targeted policies considering specificities of each audience [51, 53]. Beyond identifying discriminations, disadvantages and vulnerabilities, it is worth noting that this approach gives prominence to the unique knowledge of women and girls as agents of change [53].

Intersectional analyses can play an important role in designing and implementing initiatives for safe cities and public spaces, preventing violence and sexual harassment in these spaces [53], “addressing the spatial, social and symbolic exclusion generated by neutral planning.” Using intersectional perspectives, contemplating the diversity of views and identities, collaborates with the understanding about the barriers to opportunities that a city can offer, as well as with the construction of safer cities with less discrimination

for women and girls [50, 52, 53], taking into account their specificities: “For example, women with disabilities mentioned the lack of physical access to key public spaces such as public transportation and pedestrian bridges.” [52]

Although the interesting role of intersectionality approach in the design and implementation of urban spaces, it has not been discussed in the scope of smart city initiatives. This approach can play an important role in addressing the various forms of inequality in smart city initiatives, including (but not limited to) gender, race, sexuality and disability. Since smart cities aim at being inclusive and a path for sustainable development [27, 68], intersectionality is a tool for achieving those objectives.

## 5 CONCLUSION

This paper aimed to explore why gender should be considered in the study and design of smart cities. While there are few papers and documents that address the question of gender and smart cities together, other knowledge areas – such as urbanism and related fields– have advanced the debate that incorporates gender-sensitive analysis when thinking about urban spaces.

Considering gender in the debate of smart cities is important because power relations present in societies integrate gender as one of the social factors. Both technology and cities in the urban are circumscribed in relation to gender, adopting and representing them since their design [58, 72]. Thus, gender-blind approaches have been widely implemented, which disregard how gender characterizes the experiences and lived experiences of women, girls, and men, boys. By being gender-blind, smart cities can potentially exacerbate inequalities and negatively impact inclusiveness – one of the goals of such initiatives. So smart cities that take into account gender-sensitive approaches might be better prepared to be inclusive and to face inequalities.

Gender-sensitive approaches can help build cities as equal status, opportunities and rights, as well as safe spaces [17, 48], taking into account the diversity that composes the urban context and the specificities experienced by different social groups – especially those most vulnerable. Gender-sensitive approaches, such as gender mainstreaming or intersectionality, for example, should be integrated in the different stages of smart city initiatives, particularly when considering the context in which they are inserted [17, 24, 27, 38], allowing to analyze their effects on women’s and men’s experiences of urban spaces and their impacts in relation to gender inequalities [38]. It is also urgent to consider other aspects and factors of inequality that can generate biases beyond gender issues [22].

Given the progress of other knowledge areas in including social factors, studies on smart cities should move in this direction as well. Future studies can advance both the theoretical development – by including gender as a component of smart cities –, and the empirical debate – by analyzing whether gender and other social factors should integrate the design, implementation and monitoring of the smart city initiatives.

## ACKNOWLEDGMENTS

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001

## REFERENCES

- [1] Margarita Angelidou. 2014. Smart city policies: A spatial approach. *Cities*, 41, pp. S3-S11. <https://doi.org/10.1016/j.cities.2014.06.007>
- [2] Angela Arruda. 2019. Feminismo, gênero e representações sociais. In H. B. Holanda, *Pensamento feminista brasileiro: formação e contexto* (pp. 334-355). Rio de Janeiro, BR: Bazar do Tempo.
- [3] Association of Information Systems (AIS). (n.d.). Senior Scholars’ Basket of Journals. <https://aisnet.org/page/SeniorScholarBasket>
- [4] Ginette Azcona, Antra Bhatt, Sara Duerto Valero, and Tanu Priya Uteng. 2020. Harsh Realities: Marginalized Women in Cities of the Developing World. New York, EUA: UN Women & UN-Habitat. <https://www.unwomen.org/en/digital-library/publications/2020/02/harsh-realities-marginalized-women-in-cities-of-the-developing-world>
- [5] Patricia Baudier, Chantal Ammi, and Matthieu Deboeuf-Rouchon. 2020. Smart home: Highly-educated students’ acceptance. *Technological Forecasting & Social Change*, 153, 1–19. <https://doi.org/10.1016/j.techfore.2018.06.043>
- [6] Simone de Beauvoir. 2019. *O segundo sexo* (5 ed., Vols. 1 - Fatos e Mitos). (S. Milliet, Trans.) Rio de Janeiro, BR: Editora Nova Fronteira.
- [7] Jelena Bleja, Henrike Langer, Uwe Grossmann, and Elisabetta Mörz. 2020. Smart cities for everyone – age and gender as potential exclusion factors. 2020 IEEE European Technology and Engineering Management Summit (E-TEMS), 1–5. Dortmund, DE. <https://doi.org/10.1109/E-TEMS46250.2020.9111741>
- [8] Djida Bounazef, and Nathalie Crutzen. 2018. Exploring the ability of tomorrow’s leaders to support smart city projects. 7th International Conference Innovation Management, Entrepreneurship and Sustainability (IMES 2019), 1–25. Prague, CZ.
- [9] Patrici Calvo. 2019. The ethics of Smart City (EoS): moral implications of hyperconnectivity, algorithmization and the datafication of urban digital society. *Ethics and Information Technology*, 22, 141–149. <https://doi.org/10.1007/s10676-019-09523-0>
- [10] Andrea Caragliu, Chiara Del Bo, and Peter Nijkamp. 2011. Smart cities in Europe. *Journal of Urban Technology*, 18(2), 65–82. <https://doi.org/10.1080/10630732.2011.601117>
- [11] Hafeedh Chourabi, Taewoo Nam, Shawn Walker, J. Ramon Gil-Garcia, Sehl Mellouli, Karine Nahon, Theresa A. Pardo, and Hans Jochen Scholl. 2012. Understanding Smart Cities: An Integrative Framework. Hawaii International Conference on System Sciences, 45, 2289–2297. Hawaii, US. <https://doi.org/10.1109/HICSS.2012.615>
- [12] Hilda Römer Christensen. 2019. Smart Biking as Gendered Innovations? The Case of Mobike in China. International Conference on Human-Computer Interaction. 11596, 368–377. Orlando, USA: Krömker, H. (Eds.). [https://doi.org/10.1007/978-3-030-22666-4\\_27](https://doi.org/10.1007/978-3-030-22666-4_27)
- [13] Albertina de Oliveira Costa, Carmen Barroso, and Cynthia A. Sarti. 2019. Pesquisa sobre mulher no Brasil: do limbo ao gueto? In H. B. Holanda, *Pensamento feminista brasileiro: formação e contextp* (1 ed., 109–134). Rio de Janeiro, BR: Bazar do Tempo.
- [14] Kimberle Crenshaw. 1989. Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *The University of Chicago Legal Forum*, 140, 139–167.
- [15] Eichler, M. 1991. *Nonsexist research methods – A Practical Guide*. New York, US: Routledge.
- [16] European Institute for Gender Equality – EIGE. (n. d.). Glossary & Thesaurus. <https://eige.europa.eu/thesaurus?lang=en>
- [17] Tetiana Fesenko, Galya Fesenko, and Natalya Bibik. 2017. The safe city: developing of GIS tools for gender-oriented monitoring (on the example of Kharkiv city, Ukraine). *Eastern-European Journal of Enterprise Technologies*, 3(2), 25–32. <https://doi.org/10.15587/1729-4061.2017.103054>
- [18] Fernando Fonseca, Paulo Ribeiro, Mona Jabbari, Elena Petrova, George Pappageorgiou, Elisa Conticelli, Simona Tondelli, and Rui Ramos. 2020. Smart Pedestrian Network: an integrated conceptual model for improving walkability. International Conference on Society with Future: Smart and Liveable Cities . 318, 125–142. Cham: Pereira, P., Ribeiro, R., Oliveira, L., & Novais, P. (Eds.). [https://doi.org/10.1007/978-3-030-45293-3\\_10](https://doi.org/10.1007/978-3-030-45293-3_10)
- [19] Amanda Gopeni, Ntombovuyo Wayi, and Stephen Flowerday. 2016. A feedback loop model to facilitate communication between citizens and local government in Buffalo City. International Conference on Information Resources Management (CONF-IRM) Proceedings. 73. Cape Town: Association for Information Systems (AIS). <https://aisel.laisnet.org/confirm2016/73/>
- [20] Parul Gupta, Sumedha Chauhan, and M. P. Jaiswal. 2019. Classification of Smart City Research - a Descriptive Literature Review and Future Research Agenda. *Information Systems Frontiers*, 21, 661–685. <https://doi.org/10.1007/s10796-019-09911-3>
- [21] Donna Haraway. (2019). Manifesto ciborgue: ciência, tecnologia e feminismo-socialista no final do século XX. In H. B. Holanda, *Pensamento feminista: conceitos fundamentais* (pp. 157-212). Rio de Janeiro, BR: Bazar do Tempo.

- [22] Mariann Hardey. 2019. Women’s leadership and gendered experiences in tech cities. *Gender in Management*, 34(3), 188–199. <https://doi.org/10.1108/GM-05-2018-0048>
- [23] Robert G. Hollands. 2008. Will the real smart city please stand up? *City*, 12(3), 303–320. <https://doi.org/10.1080/136004810802479126>
- [24] Liisa Horelli. 2017. Engendering urban planning in different contexts – successes, constraints and consequence. *European Planning Studies*, 25(10), 1779–1796. <https://doi.org/10.1080/09654313.2017.1339781>
- [25] Mehdi Jalili, Farshad Hakimipour, and Stefan Christiaan Van der Spek. 2018. Extraction of Usage Patterns for Land-Use Types by Pedestrian Trajectory Analysis. *International Symposium on Web and Wireless Geographical Information Systems (W2GIS 2018)*, 10819, 61–76. A Coruna, ES: R. Luaces M., Karimipour F. (Eds.). [https://doi.org/10.1007/978-3-319-90053-7\\_7](https://doi.org/10.1007/978-3-319-90053-7_7)
- [26] Mohammed-Issa Riad Mousa Jaradat, Akram A. Moustafa, and Abedallah Mohammed Al-Mashaqba. 2018. Exploring Perceived Risk, Perceived Trust, Perceived Quality and the Innovative Characteristics in the Adoption of Smart Government Services in Jordan. *International Journal of Mobile Communications*, 16(4), 399–439. <https://doi.org/10.1504/IJMC.2018.092669>
- [27] Payyazhi Jayashree, Feras Hamza, May El Barachi, and Ghazaleh Gholami. 2019. Inclusion as an Enabler to Sustainable Innovations in Smart Cities: A Multi-Level Framework. *th International Conference on Smart and Sustainable Technologies (SpliTech)*, 1–9. Split. <https://doi.org/10.23919/SpliTech.2019.8783013>
- [28] Balasubramanian Krishnan, Seetharaman Arumugam, and KoilaKuntla Madulety. 2020. Critical success factors for the digitalization of smart cities. *International Journal of Technology Management & Sustainable Development*, 19(1), 69–86. [https://doi.org/10.1386/tmsd\\_00016\\_1](https://doi.org/10.1386/tmsd_00016_1)
- [29] Teresa de Lauretis. 2019. A tecnologia de gênero. In H. B. Hollanda, *Pensamento feminista: conceitos fundamentais* (120–155). Rio de Janeiro, BR: Bazar do Tempo.
- [30] Lena Levin. 2019. How to Integrate Gender Equality in the Future of “Smart” Mobility: A Matter for a Changing Planning Practice. *HCI in Mobility, Transport, and Automotive Systems. HCII 2019. Lecture Notes in Computer Science*. 11596, 393–412. Orlando: Heidi Krömer. [https://doi.org/10.1007/978-3-030-22666-4\\_29](https://doi.org/10.1007/978-3-030-22666-4_29)
- [31] Javiera Fernanda Medina Macaya, Manuella Maia Ribeiro, Tatiana Jereissati, Camila dos Reis Lima, and Maria Alexandra Cunha. 2021. Gendering the digital divide: The use of electronic government services and implications for the digital gender gap. *Information Polity*, 26, 131–146. <https://doi.org/10.3233/IP-200307>
- [32] Dorem N. Manitiu, and Giulio Pedrini. 2016. Urban smartness and sustainability in Europe. An ex ante assessment of environmental, social and cultural domains. *European Planning Studies*, 24(10), 1766–1787. <https://doi.org/10.1080/09654313.2016.1193127>
- [33] Rewa Marathe, and Suzana Jacob. 2016. Does the domestic space belong to women? An Assessment of the Housing in the New Indian Urban Agenda through the lens of gender. *TRIA-TERRITORIO DELLA RICERCA SU INSEDIAMENTI E AMBIENTE*, 16(1), 119–134.
- [34] Mauricio Marrone, and Mara Hammerle. 2018. Smart Cities: A Review and Analysis of Stakeholders’ Literature. *Business & Information Systems Engineering*, 60, <https://doi.org/10.1007/s12599-018-0535-3> 197–213.
- [35] H. Patricia McKenna. 2019. Getting Smarter About Data and Access in Smart Cities. *HCII 2019: Universal Access in Human-Computer Interaction. Theory, Methods and Tools*. 11572, 146–158. Cham: Antona M., Stephanidis C. [https://doi.org/10.1007/978-3-030-23560-4\\_11](https://doi.org/10.1007/978-3-030-23560-4_11)
- [36] Karina Dal Sasso Mendes, Renata Cristina C. P. Silveira, and Cristina Maria Galvão. 2008. Revisão integrativa: método de pesquisa para a incorporação de evidências na saúde e na enfermagem. *Texto & Contexto - Enfermagem*, 17(4), 758–764. <https://doi.org/10.1590/S0104-07072008000400018>
- [37] Ministry of Municipal and Rural Affairs, UN-Habitat. (2019). *Future Saudi Cities Programme: Saudi Cities Report 2019*. Ministry of Municipal and Rural Affairs, UN-Habitat. <https://unhabitat.org/saudi-cities-report-2019>
- [38] Giorgia Nesti. 2019. Mainstreaming gender equality in smart cities: Theoretical, methodological and empirical challenges. *Information Polity*, 24, 289–304. <https://doi.org/10.3233/IP-190134>
- [39] Vibhuti Patel. 2017. Safe cities and gendering budgeting. *Research Horizon - International Peer-Reviewed Journal*, 7, 22–28
- [40] Maria Isabel Ribeiro, Antonio Fernandes, and Isabel Maria Lopes. 2019. Importância das tecnologias de informação na procura de um destino turístico: o caso de uma Smart City portuguesa. *Revista Iberica de Sistemas e Tecnologias de Informação*(24), 349–362. <http://hdl.handle.net/10198/20467>
- [41] Marion Roberts. 2016. Introduction: concepts, themes and issues in a gendered approach to planning. In I. S. Madariaga, & M. Roberts, *Fair shared cities: the impact of gender planning in Europe*. New York, US: Madariaga, Inés Sánchez de; Roberts, Marion.
- [42] Sheila Scraton, and Beccy Watson. 1998. Gendered cities: women and public leisure space in the ‘postmodern city’. *Leisure Studies*, 17(2), 123–37. <https://doi.org/10.1080/026143698375196>
- [43] Anna Simonati. 2016. Gendered Citizenship in Italian Administrative Law: A Work in Progress Toward a New Public Ethics. *Public Integrity*, 18(1), 59–82. <https://doi.org/10.1080/10999922.2015.1093396>
- [44] Bhopendra Singh. 2015. Smart city-smart life - Dubai Expo 2020. *Middle East Journal of Business*, 10(4), 49–52. <https://platform.almanhal.com/Files/Articles/74070>
- [45] Yamini J. Singh. 2019. Is smart mobility also gender-smart? *Journal of Gender Studies*, 29(7), 832–846. <https://doi.org/10.1080/09589236.2019.1650728>
- [46] UN Women. 2012. *The Future Women Want – A vision of sustainable development for all*. United Nations Entity for Gender Equality and the Empowerment of Women (UN Women). New York: UN Women. <https://www.unwomen.org/en/digital-library/publications/2012/6/the-future-women-want-a-vision-of-sustainable-development-for-all>
- [47] UN Women. 2015. *Proceedings report: UN Women Safe Cities Global Leaders’ Forum*. New Delhi. <https://www.unwomen.org/en/digital-library/publications/2015/9/proceedings-report-un-womens-safe-cities-global-leaders-forum-2015>
- [48] UN Women. 2016. *Gender equality and the New Urban Agenda*. New York: UN Women. <https://www.unwomen.org/en/digital-library/publications/2016/10/gender-equality-and-the-new-urban-agenda>
- [49] UN Women. 2017. *Safe Cities and Safe Public Spaces: Global results report*. United Nations Entity for Gender Equality and the Empowerment of Women (UN Women). New York: UN Women. <https://www.unwomen.org/en/digital-library/publications/2017/10/safe-cities-and-safe-public-spaces-global-results-report>
- [50] UN Women. 2018a. *Fourth UN Women Safe Cities and Safe Public Spaces Global Leaders’ Forum: Proceedings report*. United Nations Entity for Gender Equality and the Empowerment of Women (UN Women). New York: UN Women. <https://www.unwomen.org/en/digital-library/publications/2018/12/fourth-un-women-safe-cities-and-safe-public-spaces-global-leaders-forum>
- [51] UN Women. 2018b. *Turning Promises into Action: Gender equality in the 2030 Agenda for Sustainable Development*. New York (EUA): UN Women. <https://www.unwomen.org/en/digital-library/publications/2018/2/gender-equality-in-the-2030-agenda-for-sustainable-development-2018>
- [52] UN Women. 2019. *Safe cities and safe public spaces for women and girls global flagship initiative: International compendium of practices*. New York, EUA: UN Women. <https://www.unwomen.org/en/digital-library/publications/2019/01/safe-cities-and-safe-public-spaces-international-compendium-of-practices>
- [53] UN Women. 2020. *Safe Cities and Safe Public Spaces for Women and Girls Global Flagship Initiative: Second International Compendium of Practice*. New York, EUA: UN Women. <https://www.unwomen.org/en/digital-library/publications/2020/02/safe-cities-and-safe-public-spaces-international-compendium-of-practices-2>
- [54] UN Women, UN Environment, UN Habitat. 2018. *Expert Group Meeting on “Building sustainable and resilient societies through the gender-responsive implementation of the 2030 Agenda for Sustainable Development”*. Nairobi, Kenya. <https://www.unwomen.org/en/digital-library/publications/2018/7/egm-on-building-sustainable-and-resilient-societies>
- [55] UN-Habitat. 2010. *Gender equality for smarter cities – Challenges and Progress*. United Nations Human Settlements Programme (UN-HABITAT). <https://unhabitat.org/gender-equality-for-smarter-cities-challenges-and-progress>
- [56] UN-Habitat. 2013. *State of women in cities 2012-2013 – Gender and prosperity of cities*. Nairobi: UN-Habitat. <https://unhabitat.org/sites/default/files/download-manager-files/Gender%20and%20Prosperity%20of%20Cities.pdf>
- [57] UN-Habitat. 2017. *Smart city Rwanda Masterplan*. UN-Habitat. <https://unhabitat.org/smart-city-rwanda-master-plan>
- [58] UN-Habitat. 2018a. *Leading change: Delivering the New Urban Agenda through Urban and Territorial Planning*. Kuala Lumpur: UN-Habitat. <https://unhabitat.org/leading-change-delivering-the-new-urban-agenda-through-urban-and-territorial-planning>
- [59] UN-Habitat. 2018b. *Gender Equality Enhancer*. Barcelona, Espanha: UN-Habitat. <https://unhabitat.org/gender-equality-enhancer>
- [60] UN-Habitat. 2019a. *Urban Impact 4th Quarter 2019*. New York: UN-Habitat. <https://unhabitat.org/urban-impact-4th-quarter-2019>
- [61] UN-Habitat. 2019b. *A/RES/71/256 - Nova Agenda Urbana*. New York, US: ONU. <https://uploads.habitat3.org/hb3/NUA-Portuguese-Brazil.pdf?fbclid=IwAR2koIM7MtGbh6i57G4fxWeWpbK52jr7sXrGdBhJf81bF2GSzY527FWdAY>
- [62] UN-Habitat. 2019c. *People-focused Smart Cities*. Nairobi: UN-Habitat. <https://unhabitat.org/people-focused-smart-cities>
- [63] UN-Habitat. 2019d. *Mixed reality for public participation in urban and public space design - Towards a new way of crowdsourcing more inclusive smart cities*. Nairobi: UN-Habitat. <https://unhabitat.org/mixed-reality-for-public-participation-in-urban-and-public-space-design-towards-a-new-way-of>
- [64] UN-Habitat. 2020a. *Future Cities, New Economy, and Shared City Prosperity Driven by Technological Innovations*. Nairobi: UN-Habitat. <https://unhabitat.org/future-cities-new-economy-and-shared-city-prosperity-driven-by-technological-innovations>
- [65] UN-Habitat. 2020b. *Human Rights, Rule of Law and the New Urban Agenda*. Nairobi: UN-Habitat. <https://unhabitat.org/human-rights-rule-of-law-and-the-new-urban-agenda>
- [66] UN-Habitat. 2020c. *The State of Arab Cities 2020: Financing Sustainable Urbanization in the Arab Region – Executive Summary*. UN-Habitat. <https://unhabitat.org/state-of-arab-cities-report-2020-financing-sustainable-urban-development-in-the-arab-region>

- [67] UN-Habitat. 2020d. 2020 Future cities Advisory outlook – Urban technologies in China. Beijing, CN: UN-Habitat. <https://unhabitat.org/future-cities-advisory-outlook-2020-urban-technologies-in-china>
- [68] United Nations [UN]. 2016. Smart cities and infrastructure: report of the Secretary-General. Economic and Social Council, Commission on Science and Technology for Development. Geneva: United Nations [UN]. [https://unctad.org/system/files/official-document/ecn162016d2\\_en.pdf](https://unctad.org/system/files/official-document/ecn162016d2_en.pdf)
- [69] Julia van Heek, Katrin Arning, and Martina Ziefle. 2015. Safety and Privacy Perceptions in Public Spaces: An Empirical Study on User Requirements for City Mobility. In R. Giaffreda, D. Caganova, Y. Li, R. Riggio, & A. Voisard (Ed.), *International Internet of Things Summit* (pp. 97-103). Rome: Springer, Cham. [https://doi.org/10.1007/978-3-319-19743-2\\_15](https://doi.org/10.1007/978-3-319-19743-2_15)
- [70] Alberto Vanolo. 2016. Is there anybody out there? The place and role of citizens in tomorrow's smart cities. *Futures*, 82, 26–36. <https://doi.org/10.1016/j.futures.2016.05.010>
- [71] Ana Iolanda Voda, and Laura-Diana Radu. 2018. Artificial Intelligence and the Future of Smart Cities. 17th International Conference on Informatics in Economy (ie2018), 110–127). Iasi, RO.
- [72] Judy Wajcman, Erin Young, and Anna FitzMaurice. 2020. The Digital Revolution: Implications for Gender Equality and Women's Rights 25 Years after Beijing. UN-Women. New York, US: UN-Women. <https://www.unwomen.org/en/digital-library/publications/2020/08/discussion-paper-the-digital-revolution-implications-for-gender-equality-and-womens-rights>
- [73] Jane Webster, and Richard T. Watson. 2002. Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, 26(2), xiii–xxiii. <https://www.jstor.org/stable/4132319>
- [74] Robin Whittlemore, and Kathleen Knafel. 2005. The integrative review: updated methodology. *Journal of Advanced Nursing*, 52(5), 546–553. <https://doi.org/10.1111/j.1365-2648.2005.03621.x>