A SYSTEMATIC REVIEW ON THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) FOR CITIZEN PARTICIPATION IN URBAN MANAGEMENT

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Abstract

Discussions on intelligent cities and technology-based urban solutions have gained importance in the field of city planning and management. In the context of technological development, it is necessary to update citizen participation, inserting it in contemporary advances and building new strategies to traditional methodologies. This study explores the possibilities offered to urban management from the insertion of Information and Communication Technologies (ICT) and aims, therefore, to analyze the scientific production to understand how ICT contribute to the improvement of this participation. The methodology is based on a systematic review of the literature with explicit and systematic search methods in the *Scopus and Web of Sciencedatabases*, in addition to content analysis through word clouds. The results indicate a more prominent scientific production of case studies pertaining to public administration and the evaluation of e-government and e-services. The studies point to an increase in the use of social media,

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apps and other platforms both *top-down andbottom-up*, and indicates some caveats and opportunities for new research.

Keywords: Urban Management, ICT, E-government, E-participation, Smart Cities.

INTRODUCTION

According to the United Nations (UN, 2019), in 2007 more than half of the world's population came to live in cities. By 2050, the UN (2019) projects that approximately 70% of the 10 billion inhabitants the planet may have will live in urban agglomerations. This growth of cities entails economic, social, and environmental impacts, which constitutes one of the great contemporary challenges for urban managers and planners, especially when considering the goals of sustainable development.

In this context, discussions about *smart cities* and new innovative urban solutions based on Information and Communication Technologies (ICT) have gained increasing importance in the field of urban planning and management (Neirotti et al., 2014). The term reflects the concept that a smart city is characterized by good resource management and social participation; that is, it invests in human and social capital in order to create technological infrastructures that support sustainable economic development and improve the population's quality of life (Caragliu, Del Bo, & Nijkamp, 2011).

Among the various challenges of city management, the promotion of greater dialogue among different sectors of society stands out. Capturing opinions, debating, dialoguing, consulting, and, as a consequence, achieving greater citizen participation in public management are matters of utmost relevance in the current context. For Lazzaretti et al. (2019), ICT are important allies of public governance, making it more effective through responsiveness, integrity, reliability, regulatory improvement, accountability, responsibility, and transparency.

With technological development, participatory processes must be updated by integrating them into contemporary developments and developing new strategies alongside traditionally applied methodologies (Bugs & Reis, 2014). Given this need, which seeks democratization and horizontality in decision-making

processes, and in parallel with technological advances, this study starts from the premise that available technologies are diverse and that their adoption by governments can affect citizen participation. In other words, the variety of technologies and the strategies implemented configure different modes of adoption and different outcomes. Thus, the central question of this study is: *in what way can ICT contribute to the improvement of citizen participation in urban management?*

To answer this question, recent studies on the use of ICT for citizen participation were analyzed, specifically the new alternatives for management, by structuring the literature on the subject according to the existing fields and approaches, in order to deepen the concept of e-participation, identify new fields of study, and identify research possibilities.

This article is structured into five parts. The first presents a contextualization, the problem, and the objective of the study; next comes a theoretical framework with the conceptual bases on the subject; the third part addresses the methodological procedures used in the review; the fourth analyzes the results; and, finally, the article discusses the findings and presents final considerations and recommendations for subsequent studies.

SMART CITIES: CONCEPTS AND POLYSEMIES

The concept of smart cities is broad and may vary according to the field of knowledge to which it is applied; therefore, it still lacks a consensual definition, which may lead to imprecision (Hollands, 2008; Caragliu et al., 2011). Gibson, Kozmetsky, and Smilor (1992) argue that the emergence of the term dates back to the early 1990s, due to the need to understand the urban development process associated with the phenomenon of globalization and new technologies. Consequently, in the early 2000s, Smart City projects and initiatives were already being reported, and their objective was to improve urban quality of life and the relationship between public management and citizens (Odendaal, 2003).

However, only more than a decade after the term emerged was a Smart City model proposed by Giffinger et al. (2007), based mainly on self-management activities and civic awareness. In the model, the

city should encompass six sectors and achieve excellent performance in them: smart economy; smart people; smart governance; smart mobility; smart environment; and smart living.

Thus, amid various definitions, Meijer and Bolívar (2016) observed that the concept usually has three focal points: the technological focus, referring to cities that employ smart technologies; the people-centered focus, with emphasis on citizen intelligence; and governance, which highlights collaboration.

In the literature, the term Smart Cities is usually associated with the quality of public services, the administrative efficiency of cities, resource management, environmental preservation, urban sustainability, and, as adopted in this paper, ICT and citizen participation in urban management.

CITIZEN PARTICIPATION AND ICT

From the late 1990s onward, there has been a growing number of studies on investment in digital information technology in public management with the aim of fostering citizen participation (Zheng, Schachter, & Holzer, 2014; Wang & Bryer, 2013; Thomas & Streib, 2003 apud Lee & Kim, 2017). The lack of population participation in the planning and management of public policies undermines democracy and contributes to increasing inequality. Many public managers have offered various forms of electronic participation, ranging from simple online requests to interactive platforms and social media services.

The study by Lee and Kim (2017), conducted in South Korea, developed and tested a model proposing three dimensions of electronic participation in the effectiveness of local governance. The result points to a direct relationship between citizen participation in local management through digital tools and the perception of public managers' responsiveness. The explanation provided by the studies varies according to their focus, concentrating on demographic issues (citizen profile) and satisfaction with public management (Gramberger, 2001).

Although an infinite number of citizen participation tools are being developed, as found in the studies by Ergazakis, Metaxiotis, and Tsitsanis (2011) and by Kamateri et al. (2015), it is still not clear in

which contexts public managers incorporate such participation into their decision-making (Steinbach, Wilker, & Schottle, 2020).

Factors external to governments' own technological capacity hinder the effectiveness of full adherence to participatory management. This is the case of South Africa, according to the study by Piderit and Jojozi (2017), which points to low participation in electronic governance due to political reasons, despite the country having adequate technological conditions. In Brazil, the city government of Belo Horizonte, in the state of Minas Gerais, launched the Digital Participatory Budget (OPD) in 2006, a modern version of the participatory budgeting process created in 1989 and already implemented in Porto Alegre, Rio Grande do Sul. However, this tool has shown a decline in use due, according to the study by Barros and Sampaio (2017), to the loss of citizens' trust in the participatory budgeting instrument.

METHODOLOGY

To achieve the intended objective of the investigation, a Systematic Literature Review (SLR) was chosen, as it was considered appropriate for highlighting scientific production and making the procedures used explicit. In this sense, according to Sampaio and Mancini (2007), the systematic review is defined as a study that uses the scientific literature as a source of data in order to investigate a given topic. The review may summarize, synthesize, and relate a set of evidence through the application of explicit methods for searching, analyzing, and synthesizing the selected information. The steps proposed by the authors were adopted **(Table 1)**.

Table 1

Steps for the Systematic Review.

Steps	Description
Step 1: Definition of the question	Establishes what is to be investigated.
Step 2: Search for evidence	Search in indexed electronic databases (through the selection of descriptors, also known as terms, built from keywords and Boolean operators AND, NOT, OR, etc.).
Step 3: Review and selection of studies	With the selected studies, establish criteria to determine their validity and whether the results may be biased.
Step 4: Analysis of the quality of the studies	Based on similarities among articles, the data will be grouped in order to obtain the final conclusions.
Step 4: Presentation of the results	The writing of the results should take into account the guiding question established in the first step.

Source: Adapted from Sampaio and Mancini (2007).

REVIEW PROCEDURES

Thus, recent studies (2017–2021) on the use of ICT for citizen participation were sought in order to understand how ICT may contribute to improving such participation in urban management. The scientific production considered relevant to the study was collected through explicit and systematized search methods in the *Scopus* (Elsevier) and *Web of Science* databases, as they contain an immense quantity and variety of indexed journals, articles, and abstracts and are relevant in the fields of applied social sciences and technologies.

However, in order to access the databases, it was first necessary to access the CAPES Journal Portal and log in through the Federated Academic Community (CAFe), which is a federation that brings together Brazilian teaching and research institutions. Through CAFe, it is possible to access services offered by the institutions participating in the federation, such as database access. It therefore constitutes an initiative of the Brazilian National Research Network (RNP) that makes it possible to conduct research and access materials restricted to institutional subscriptions. In addition, for the search and subsequent

analysis of the articles, the following review protocol was previously adopted to guide the research **(Table 2)**.

Table 2

Search and review analysis protocol.

1. Definition of search terms and synonyms and their relationships through Boolean operators
2. Search restricted to the field “Titles, Abstracts and keywords”
3. Inclusion criteria (filters): - Languages: English, Portuguese, and Spanish. - Text type: Article. - Publication stage (Stage: final). - Time interval: Published in 2017, 2018, 2019, 2020, and 2021.
4. Exclusion criteria: - Belonging to fields of study unrelated to the research topic. - Other text types (e.g., essays and books). - Literature review articles.
5.Exclusion of duplicate articles between the databases.
6. Screening of titles
7. Screening of abstracts
8. Categorization of studies
9. Full reading of the selected articles

Source: Author (2021).

Furthermore, as shown in **Table 3**, search terms (strings) and related synonyms were defined according to the recurrence identified in the texts of the theoretical framework. Quotation marks (“ ”) were used for compound terms, that is, terms consisting of more than one word, and an asterisk (*) was used as a truncation resource to find words in singular or plural forms and spelling variations. In addition, the advanced search feature available in the databases was used to establish relationships between search terms in order to narrow or broaden the research. For this purpose, the Boolean operators, which may be and, or, and and not, were employed.

Table 3

Terms used in the review and search code.

<table>
<tr><td></td><td></td><td colspan="3">Combinations among synonyms</td><td>Other</td><td></td><td></td></tr>
<tr><td rowspan="6">"e-participat*"</td><td rowspan="6">OR</td><td>“public participation”</td><td>“public engagement”</td><td>“public involvement”</td><td rowspan="6">“participat* democracy” “participat* govern*” “collaborative govern*” “citizen centri*”</td><td rowspan="6">AND</td><td rowspan="6">"ICT*"</td></tr>
<tr><td>“popular participation”</td><td>“popular engagement”</td><td>“popular involvement”</td></tr>
<tr><td>“civic participation</td><td>“civic engagement”</td><td>“civic involvement”</td></tr>
<tr><td>“citizen participation”</td><td>“citizen engagement”</td><td>“citizen involvement”</td></tr>
<tr><td>“social participation”</td><td>“social engagement”</td><td>“social involvement”</td></tr>
<tr><td>“community participation”</td><td>“community engagement”</td><td>“community involvement”</td></tr>
</table>

Script: *("e-participat*") OR (("public participation" OR "popular participation" OR "civic participation" OR "citizen participation" OR "social participation" OR "community participation" OR "public engagement" OR "popular engagement" OR "civic engagement" OR "citizen engagement" OR "social engagement" OR "community engagement" OR "public involvement" OR "popular involvement" OR "civic involvement" "citizen involvement" OR "social involvement" OR "community involvement" OR "participat* democracy" OR "participat* govern*" OR "citizen centri*" OR "collaborative govern*") AND ("ICT*"))". Source: Author (2021).*

The search began with terms related to citizen participation combined with the operator “OR” in order to retrieve studies containing any of the terms in their titles, abstracts, or keywords. Subsequently, in order to narrow the search, the operator “AND” was used to find the terms only when combined with “ICT”, also present in the titles, abstracts, or keywords.

Consequently, after an initial sample had been obtained, filtering tools available within the databases themselves were adopted regarding language, year of publication, type of publication, and subject area. This made it possible to direct the search toward more recent articles published in more than one language, thus restricting the search to peer-reviewed scientific production and avoiding other text types such as essays and books. The new sample then underwent a methodological selection procedure according to the following stages: (1st) Reading of titles, (2nd) Reading of abstracts, (3rd) Processing and categorization, (4th) Full reading of the selected articles.

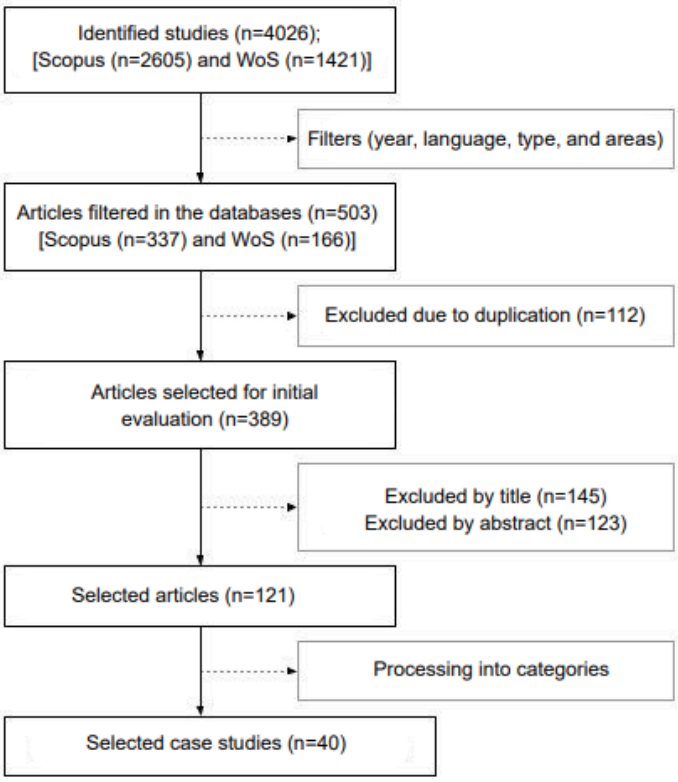
The *Pandas* library for data manipulation and analysis, written in Python, was used to process the abstracts of the selected articles. Stopwords were removed and, finally, through the Wordcloud library, a word cloud was generated from the abstracts. By means of the *Matplotlib* library, also in Python, the image was generated as a heuristic model for data visualization and for constructing an overall panorama of the works.

RESULTS

The results presented here stem from the search carried out in the *Scopus* and *Web of Science* databases on May 8, 2021. With the search script **(Table 3)** in hand and as previously established in the review protocol **(Table 2)**, the search, procedures, and analyses were initiated according to the following sequence **(Figure 1)**:

Figure 1

Review stages.



Source: Author (2021).

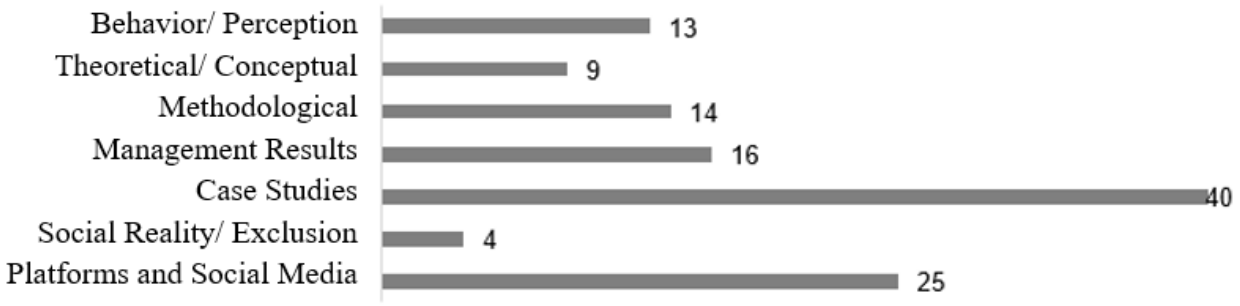
An initial sample of 4,026 studies was obtained, 2,605 in Scopus and 1,421 in *Web of Science*. However, when the predefined inclusion and exclusion criteria **(Table 2)** were applied, the sample was reduced to a total of 503 articles. Next, by cross-checking the databases, a significant number of articles present in both databases—that is, duplicates—was identified. After the duplicates were excluded, a new sample of 389 articles was obtained.

Once the search stages had been completed, a qualitative analysis was conducted by reading the titles and abstracts of the partial sample, with the aim of eliminating articles considered unrelated to the topic or the field. Through title reading, it was identified that 145 articles did not contribute to the research question; by reading the abstracts of the remaining articles, it was identified that 123 articles were outside the scope of the research, resulting in a final sample of 121 articles to be categorized. In sum, those eliminated in this analysis corresponded to articles that had not been filtered out by the databases' own tools based on the established restrictions, as well as studies from other thematic areas unrelated to the research, or literature review articles.

Furthermore, also through abstract reading, the 121 selected articles were processed into different categories **(Figure 2)**, based on the theme of each study, namely:

Figure 2

Categorization of the articles.



Source: Author (2021).

The *Behavior/Perception* category addresses themes that are very common in Economics, Psychology, and Administration, such as "Decision Theory" and "Behavior Theory." Such works aim to identify which factors (economic, social, psychological) are more or less decisive for the user in choosing whether or not to participate voluntarily in government decision-making through electronic governance mechanisms.

The articles in the *Theoretical/Conceptual* category are responsible for theorizing and providing definitions, even etymologically, since their content is centered on theoretical debate. They were selected and analyzed for the theoretical foundation and exploration of definitions on the subject.

In the *Methodological* category, one observes articles whose focus lies on the development of methods and systems for evaluating big data. Although this is not the scope of the present article, the analysis made it possible to identify technologies that enable the identification, collection, processing, systematization, and secure management of such data. Another issue widely discussed in this category of articles is the inclusion of offline data in addition to online data, which are already widely used.

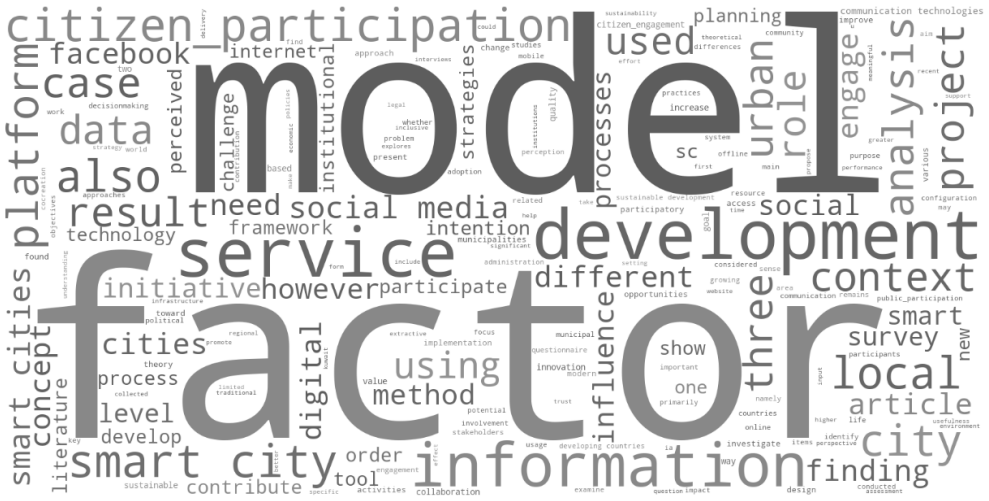
The *Management Results* category presents data from various countries whose governance instruments already test and use online participation mechanisms in practice. Terms such as "collaborative governance," "electronic governance," and "e-governance" appear here. In general, these works have two focal points: the first group analyzes how smart city governments use new technologies with the aim of improving citizen participation. The second group actually evaluates whether participation increases due to the availability of platforms that facilitate interaction.

The third and most numerous category, *Case Studies*, comprises a series of examples of cities, whether pioneering or not, that have embraced ICT and use them in planning management. These cities, as can be observed in the analyzed articles, receive various denominations *(wired cities; cyber cities; digital cities; self-aware cities; smart cities)*. All these terms, in turn, focus on the effects of ICT on the form, processes, and ways of life of cities. In order to outline a general panorama of the contents, albeit a visual and imperfect one, the textual processing of the abstracts of these categorized articles was chosen.

This method consisted of a heuristic procedure in which the following word clouds corresponding to each category were generated **(Figure 3)**:

Figure 3

Word cloud generated from the abstracts of the articles in the "Case Studies" category.



Source: Author (2021).

The category called *Social Reality/Exclusion* encompasses some works related to the difficulty of access to information in certain poor and emerging countries and how this factor is responsible for generating even greater social inequality. They also emphasize the potential of big data to favor the analysis of such realities, as well as its use as an instrument for strengthening democracies.

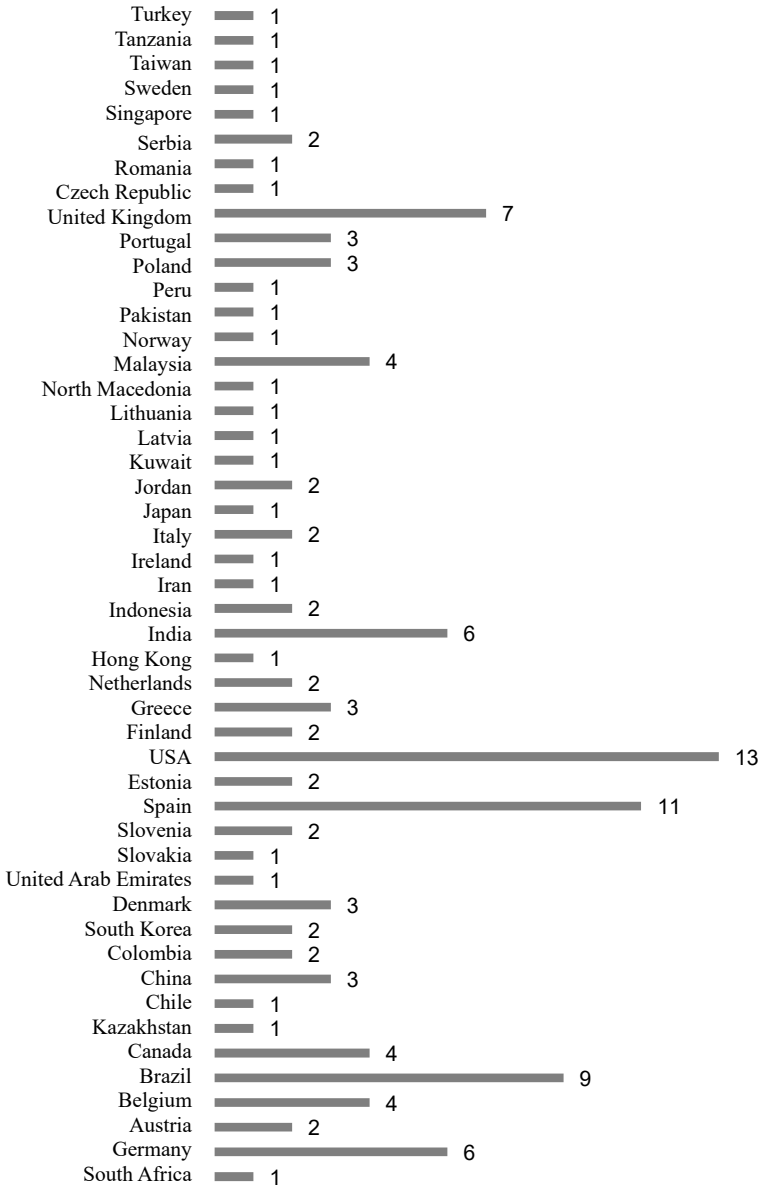
The *Platforms and Social Media* category refers to those articles whose focus lies on online interaction platforms and social media. In this case, social networks such as *Twitter*, *Facebook*, and *Instagram* can be highlighted, as they are widely used as a source of data for studies involving smart cities. Most of the articles focus on user-generated data derived from location-based platforms in a specialized manner. Such platforms expand the concept of connectivity and make it possible, within the demands and needs of each city, to optimize public management.

The search yielded results from scientific production distributed across several countries, though with a larger number of articles in more technologically developed countries, such as the United States,

Spain, the United Kingdom, and Germany, and a significant number in Brazil and India, which are emerging countries **(Figure 4)**

Figure 4

Countries of origin of the corresponding authors of the articles.



Source: Author (2021).

Furthermore, it was observed that the *Case Studies* category had the largest number of articles and was also the most expressive in bringing evidence to the research question. Therefore, as a final analysis, all the articles included in this category were read in full and exploratorily.

DISCUSSION

The Case Studies analyzed in full, as well as the information extracted from them, generally demonstrated a strong questioning of the concept of smart cities and its various approaches, with strong criticism of the lack of inclusion of e-participation as one of its pillars. In addition, a substantial academic production related to public administration and the evaluation of e-government and its electronic services was noted. However, for a better understanding of the relationships between citizen participation and ICT, some examples are highlighted here.

From the late 1990s onward, there has been a growing number of studies on investment in digital information technology in public management with the aim of fostering citizen participation (Wang & Bryer, 2013; Thomas & Kim, 2017; Zheng et al., 2014).

Napitupulu (2019) addresses Presidential Instruction No. 3 of 2003 in Indonesia and discusses public policies and e-gov development strategies, showing that there are two main public demands that must be met by the government in order to achieve quality governance: public services and public participation. The government should not only provide quality public services, but should also facilitate public participation in the formulation of public policies. The author also argues that e-participation would be the evolution of e-government, emphasizing public participation as the main priority in the organization of government. This new form of government is called Transformational Government (T-government) or Open Government, which would be a new concept of electronic government management, more “open” to citizens’ involvement in the design of public content and services.

Moreover, it is argued that when the benefits of public participation meet citizens’ needs, there is an improvement in the quality of public services provided by the government and, consequently, an

enhancement in cost and time control. Thus, with ICT, public participation could be more easily captured in the decision-making process or in government policies.

However, the mere use of technology does not guarantee that the public will be willing to participate in decision-making or in policy formulation (Utomo, 2011). The author concludes that citizens are not significantly involved in online participation because society has not yet perceived the importance of the practice. Appropriate conditions and incentives are necessary to engage citizens, in addition to overcoming factors that hinder the continuation of community participation, such as bureaucracy, time, high costs, among others, all of which result in community skepticism (Utomo, 2011). Thus, the implementation of e-participation is not an easy task, as it requires a new fundamental process in the relationship between government and citizen, in which the latter first perceives the usefulness (benefit) and also the ease of use of the technology offered, in accordance with Davis's (1989) technology acceptance model.

Szarek-Iwaniuk and Senetra (2020) reinforce the importance of strong legislation, agreements, and public documents focused on social participation, such as, for example, in Poland, the "Strategy for Responsible Development," which presents the main prerequisites, objectives, and directions of national development in the social, economic, regional, and spatial dimensions, and proposes a new model of development driven by responsible people, socially oriented toward sustainable growth.

Another Polish strategic document entitled "National Strategy for Regional Development 2030" aims to promote regional development up to 2030, emphasizing the importance of sustainable development on a national scale, including the reduction of disparities in the socioeconomic development of Polish regions. Therefore, policy should build a culture of social participation and cooperation, and the implementation of the smart city is advocated as a concept geared toward innovation, ICT development, and social engagement in urban management and planning.

There is also the "National Urban Policy 2023," whose main objective is to empower cities and urban areas in the process of promoting sustainable development, creating jobs, and improving local

quality of life, by improving the quality of urban policies at the national and territorial levels. Public participation is one of the topics addressed in this document, which states that the quality of urban management should be improved.

It is also argued that the growing availability of ICT offers new opportunities to increase social participation and encourage citizens toward innovative co-design solutions in city management, because e-participation would allow the government to reach more citizens than traditional methods of social participation, relying on modern technologies to increase active social participation in decision-making. Examples of electronic participation tools include social media, electronic petitions, chat rooms, discussion forums, videoconferencing, consultation platforms, online questionnaires, geo-questionnaires, geo-discussions, and mobile applications.

In addition, the Public Participation Geographic Information System (PPGIS), which consists of a series of electronic participation methods and techniques combining cartography with social research, aims to involve community members in decision-making processes. These methods are increasingly used to gather the opinions of local communities and to increase social participation in online interactive urban planning, whose maps allow respondents to submit ideas, identify problems, and propose solutions based on specific locations in space.

As a result, the research tool and data collection methods can be adapted to a specific problem: PPGIS tools support extensive public consultations anytime and anywhere, and they can be accessed through any device that supports web browsing without leaving home, saving time and money. This is also considered a disadvantage, after all, tools that require Internet access face the challenge of including socially and digitally excluded groups.

Ma and Zheng (2017) seek to study why the general public's use of e-government functions has not increased along with the development of e-government. In studying e-government performance in European countries, the authors point to the rapid development of information and communication technologies (ICT) and the fact that many e-government resources have been increasingly adopted by

governments around the world over the last two decades (UN, 2012). The point is that if these costly, capital-intensive electronic services are not used as much as they could be, then the intended benefits of e-government cannot be properly achieved, making it important, according to the authors, to examine what drives citizens' demand for and use of government services.

Moreover, e-government has been widely accepted as a platform for public administration reform (Kassen, 2014), and this brings several benefits to the government itself. For Osman et al. (2014), the benefits brought by electronic services can be grouped into two categories: tangible and intangible benefits. Tangible benefits would involve savings of time and money, while intangible benefits would include the quality of the information and services provided, as well as the system that provides them. The question they intend to answer is therefore more related to what makes an advanced and high-quality e-government system attract more citizens to use it, given that although e-government has become more popular in general, its use still falls short of expectations.

This is because, although e-government—the supply-side factor—is a global phenomenon, research on the actual use of e-government—the demand-side factor—remains relatively underdeveloped (Fakhoury & Aubert, 2015). In addition, evidence of a link between the supply and demand of e-government is scarce; thus, the use of e-government is a complex process that depends on several factors.

Consequently, Zheng and Schachter (2017) reinforce that a citizen's perception of the advantages of electronic participation significantly influences its use: trust is seen as the gateway to the adoption of e-government, so people will likely use e-government services only if they trust the technology and their government (Venkatesh et al., 2016). Furthermore, Kurfalı et al. (2017) indicate that social influence also affects individuals' adoption of e-government, because citizens care about the opinions of other users and tend to use government services when they are disseminated within the community and requested by it.

Other conclusions of the study were that a citizen with good Internet access is more likely to use online services, and that types of Internet access may influence such use; moreover, if government services provided by conventional means are still of good quality, citizens may have fewer incentives to

use e-government. There is a hypothesis that national e-government performance is positively related to citizens' use of various e-government resources: the main finding is that the mere provision of e-government does not automatically lead to use and adherence.

As future avenues for research, the authors indicate the analysis of new models to understand whether the relationship between e-government performance and citizen use is linear or not. Second, they point out that the effect of national e-government performance may differ among various social groups (gender, age, formal education, economic income, and political attitudes), as well as through the moderating effects of variable demographic and socioeconomic factors. In addition, social media (for example, *Facebook*, *Twitter*), as stated, have been increasingly adopted by governments as a tool for providing information and engaging citizens; therefore, their inclusion in future research is considered essential.

The study by Lee and Kim (2017), in South Korea, developed and tested a model proposing three dimensions of electronic participation in the effectiveness of local governance. The result points to a direct relationship between citizen participation in local management through digital tools and the perception of public managers' responsiveness. The explanation provided by the studies varies according to their focus, which concentrates on demographic issues (citizen profile) and satisfaction with public management (Gramberger, 2001).

Although an infinite number of citizen participation tools are being developed through the use of ICT, as observed in the studies by Ergazakis et al. (2011) and Kamateri et al. (2015), it is still not clear in which contexts public managers incorporate this participation into their decision-making (Steinbach et al., 2019).

Factors external to governments' own technological capacity hinder effectiveness through full adherence to participatory management. This is the case of South Africa, according to the study by Piderit and Jojozi (2017), which points to low participation in electronic governance due to political reasons, even though the country has adequate technological conditions.

In Brazil, the city government of Belo Horizonte, in Minas Gerais, launched the Digital Participatory Budget (OPD) in 2006, in an attempt to optimize citizen participation, as a modern version of the participatory budget created in 1989. However, this tool has shown a decline in use due, according to the study by Barros and Sampaio (2017), probably to the loss of citizens' trust in the participatory budgeting instrument.

In this sense, ICT are important allies of public governance, making it more effective through responsiveness, integrity, reliability, regulatory improvement, accountability, responsibility, and transparency.

CONCLUSION

The adoption of the systematic review and its methodological stages, as well as the construction of word clouds, contributes to understanding the general panorama of the research and therefore enables and opens space for more in-depth studies on the subject. As general contributions, it is noted that the increased use of social media, smartphones, portals, crowdsourcing platforms, and planning support systems has generally promoted smarter, more participatory, and more collaborative governments, both top-down and bottom-up. This trend shows gradual changes in governmental organizations, new relationships between governments, the private sector, and citizens, and improvements in cities (Lin, 2018; Napitupulu, 2019).

Added to this, greater participation using different forms of online expression and interaction is associated with greater offline citizen participation (Tai, Porumbescu, & Shon, 2020). It is also identified that this relationship may be stronger among the poorest, which suggests that e-participation is capable of playing an important social role in mobilizing and engaging citizens.

In addition, there is still a wide range of studies based on different technological tools, with associations between two or more digital tools in order to achieve the desired results for city development and citizen participation. The versatility of technology stands out in view of the variety of tools, options,

and ways of combining them for each objective, namely: social media, websites, collaborative clouds, applications, online forums, living labs, crowdsourcing tools, and operations centers.

One of the current strategies most used by municipal governments is social media, which enjoys high adherence among the population, with Facebook being the most recurrent platform in the studies (Svidroňová, Kaščáková, & Vrbičanová, 2018; Huffman, 2017; Metallo et al., 2020). The identified methods suggest everything from the use of existing resources on the platform, such as groups and interaction features, to the use of textual data mining for clustering and analyzing user expressions. It is also noteworthy that social media, although they are environments of potential participation, are often used only as communication channels and are therefore little incorporated as a data source for validation and decision-making by municipal administrations.

The approach by Szarek-Iwaniuk and Senetra (2020) shows that tools based on Public Participation Geographic Information Systems (PPGIS) can mobilize social participation in land-use planning and achieve significant results in participation and in locating urban demands due to the advantages of system geolocation. Digital platforms with PPGIS resources demonstrate promising potential as technologies to be incorporated into Smart City environments that aim for greater precision and community collaboration.

Another frequent aspect in the studies is the importance of initiatives to expand wi-fi Internet coverage in municipalities, since this is an essential action for democratizing access and participation and for boosting other technologies. Furthermore, there is a low number of studies on social issues and inequality of access to ICT, as well as on accessibility and usability of tools. Therefore, these are characterized as fields to be further explored in subsequent studies.

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