

Review

The Evolution of City-as-a-Platform: Smart Urban Development Governance with Collective Knowledge-Based Platform Urbanism

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Abstract: Since the advent of the second digital revolution, the exponential advancement of technology is shaping a world with new social, economic, political, technological, and legal circumstances. The consequential disruptions force governments and societies to seek ways for their cities to become more humane, ethical, inclusive, intelligent, and sustainable. In recent years, the concept of City-as-a-Platform was coined with the hope of providing an innovative approach for addressing the aforementioned disruptions. Today, this concept is rapidly gaining popularity, as more and more platform thinking applications become available to the city context—so-called platform urbanism. These platforms used for identifying and addressing various urbanization problems with the assistance of open data, participatory innovation opportunity, and collective knowledge. With these developments in mind, this study aims to tackle the question of “How can platform urbanism support local governance efforts in the development of smarter cities?” Through an integrative review of journal articles published during the last decade, the evolution of City-as-a-Platform was analyzed. The findings revealed the prospects and constraints for the realization of transformative and disruptive impacts on the government and society through the platform urbanism, along with disclosing the opportunities and challenges for smarter urban development governance with collective knowledge through platform urbanism.

Keywords: city-as-a-platform (CaaP); platformization; platform urbanism; e-governance; knowledge-based urban development; sustainable urban development; smart urbanization; smart city; urban governance; smart governance



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1. Introduction

Since the 1990s, with the beginning of the popularization of internet use, the rapid expansion of technology has changed the social, political, economic, environmental, and legal scenarios of the world in which we live, with repercussions and changes that directly impact cities urban development [1]. This has led many governments focusing on online planning and incorporating online platforms for citizen participation in the local or urban decision-making process [2]. The greater connectivity between people, organizations and governments through the internet—where it is combined with the exponential generation of data, due to Internet-of-Things (IoT), big data, ubiquitous technologies, location-based services, augmented reality (AR), and artificial intelligence (AI) [3]—increases the complexity of cities but also provides new development perspectives, with real possibilities of transforming them into more human, intelligent, and sustainable places [4,5].

In a recent systematic review of the literature on the contributions and risks of AI for building smart cities, it was emphasized how new technologies can support governments in governance and city planning with the participation of society in urban decision-making processes and public policies definition [6]. The current model of thinking about cities simply as physical places governed by a conventional, closed, and bureaucratic administrative structure is under great pressure to evolve [7], as it does not present itself as a compatible option with the necessary response speed for cities' economic development, the society's desire for participation, and the required transparency and accountability for governments [8].

Contemporary models of public governance advocate the creation of public value through articulated initiatives involving governments and society. In these, one of the main roles of the government is to provide information and services online, to allow and encourage popular participation in decision-making and in the definition of public policies. The opening up of data and the mobilization of collective knowledge is becoming more important to enable the co-creation of sustainable solutions for cities. [9]. It is in this context that the concept of City-as-a-Platform (CaaP) emerges, which is associated with the government's opening movement and with the application of digital technologies to expand the possibilities of co-production of public services [7,10]. CaaP is portrayed in the literature as the technological and political infrastructure that allows the society to play a direct and broader role in the life of cities. Digital technologies are applied to promote an open space for the collaboration and democratization of information and knowledge, requiring consensual, transparent, responsive, efficient, effective, equitable, and inclusive governance [11]. Moreover, the development and popularity of CaaP has led to a new urbanism approach: so-called "platform urbanism" [12].

In this work, platformization—platform urbanism in general and CaaP in particular—is conceptualized as a model of sociotechnical governance supported by digital architecture technologies with open and modular standards that provide the connection between government and society for the co-creation of services and policies of high public value.

With the advancement of digital technologies, new models of value production emerge, culminating recently in the perspective of business models based on platforms. This model advocates the feasibility of new flows of value production, bringing actors together in multilateral arrangements, promoting the addition of value through the interaction between these parties. [13]. The discussion of platform-based models received even more attention with the essays on the economic perspective of platforms, and Jean Tirole was awarded the Nobel Memorial Prize in Economic Sciences in 2014 for his work on platformization [14]. In the context of cities, digital platforms are treated as tools for enabling open and participatory urban governance models. The opening of public administration to citizens marks the transition from party politics to representative governance, from centralized management to public and democratic engagement, aiming at promoting the community to participate in the construction of their own cities [4,7,15,16]. As a result, digital platforms support new ways of interacting in communities and through mediated co-creation [17,18].

According to [4], cities are living organisms, and their prosperity is based on their resilience and in their ability to adapt to changes, and emerging technologies can be used as allies in urban planning. In this sense, the more fluid and synergistic interaction between the four assets that make up cities—(a) people, (b) data, (c) infrastructure and (d) technology—is considered essential and desirable [7]. The openness of the government and the engagement of the population in the discussion of local needs and in the co-production of public policies is described in the literature as a promising way to make cities more humane, intelligent, and sustainable and for more inclusive economic and social development [4,7,13,19].

Smart governance is the main challenge for smart city initiatives, which is an emerging field of research and practice [6,20]. In this sense, this paper aims to address the following question: "How can platform urbanism support local governance efforts in the development of smarter cities?" Through an integrative review of articles published in the last

ten years, the evolution of the concept of City-as-a-Platform was analyzed, as well as its relationship with knowledge-based development, making it possible to identify elements that can categorize different levels of cities as platforms. In addition, the main opportunities and challenges identified in the literature for the realization of the transformative and disruptive impact on the government and society of the platform model are presented.

2. Materials and Methods

Integrative reviews provide a comprehensive view on a given research topic, including several theoretical and experimental data sources and types of publications, which contribute to a systemic understanding of the topic of interest [21]. Nowadays, the vast availability of publications in the computerized databases makes the selection of journal articles that have high scientific quality and that are relevant to the research complex and challenging. The application of integrative review methodologies ensures greater rigor in the bibliographic selection and analysis process, enabling the researcher to better understand and clarify the state of the art in relation to the researched topic. In this work, a combination of the methods was used [21,22], which prescribe a set of pre-defined steps for carrying out an integrative literature review.

The research question that guided the definition of terms to compose the Boolean search equation (Table 1) in the databases was: “How can the use of online platforms by local governments support urban governance for the development of smarter cities?” The first literature review was carried out in May 2020, and due to the need to complement the research of the journal articles found in the first survey, a second search was carried out on June 2020, including new terms. Table 1 shows the Boolean equations that guided the searches. Table 2 illustrates the eligibility criteria (inclusion and exclusion) applied in both databases searches. Figure 1 illustrates the increase in publications on the topic in the Scopus database in the first search performed, corroborating the adequacy of the defined investigation period.

Table 1. Boolean search equations.

Search No	Boolean Search Equations
1st search	TITLE-ABS-KEY (“smart cit*” OR “future cit*” OR “intelligent cit*” OR “digital cit*” AND governance OR “e-governance” OR “digital governance” OR “smart governance” AND platform OR “e-platform” OR “online platform*” OR “platformization” OR “mobile platform*”) AND (LIMIT-TO (DOCTYPE , “ar”) OR LIMIT-TO (DOCTYPE , “re”)) AND (LIMIT-TO (LANGUAGE , “English”))
2nd search	TITLE-ABS-KEY (“smart cit*” OR “future cit*” OR “intelligent cit*” OR “digital cit*” AND “collective intelligence” OR “innovation” OR “co-creation” AND “systematic review” OR “review”) AND DOCTYPE (re) AND PUBYEAR > 2009 AND PUBYEAR < 2021

Table 2. Eligibility criteria.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> • Publication date: Published between 2010 and 2020 • Publication type: Journal research and review articles • Publication focus: Topics that align well with the identified research aim 	<ul style="list-style-type: none"> • Language: Other than English language journal articles • Access: Articles not available online and full-text



Figure 1. Number of publications in relation to the Boolean research equation over time.

The bases consulted were Scopus, Web of Science, and Science Direct, and to evaluate the most cited articles and authors, we used the computational tool Publish or Perish, which retrieves and analyzes academic citations from various data sources and presents them by the total number of articles and the number of citations, in addition to other metrics. The research and review articles found by applying the aforementioned Boolean equations were previously selected based on their titles, according to Table 3. We included publications that brought a direct link to the researched topic or that were relevant to the research. The most suitable articles for the research were selected based on the evaluation of the keywords and the abstracts reading. Recent publications were prioritized, with exceptions for the reference literature on the topic.

Table 3. Source and number of articles selected for review.

Criteria for Selection	Researched Database Results					
	Scopus		Science Direct		Web of Science	
	1st Search	2nd Search	1st Search	2nd Search	1st Search	2nd Search
Articles published between 2010 and 2020	118	127	8	8	85	90
Research and review articles only	41	55	7	7	53	58
Pre-selected articles by title, except duplicates	34	36	7	7	37	37
Final selection of articles for review	30					

In total, 30 articles were selected for this integrative review, as shown in Table 4, which included theoretical and experimental studies. Some citations found in the articles read, due to their relevance to the topic, as well as seminal articles, were included in the research. Gray literature produced by research institutions and government, in electronic format not controlled by scientific or commercial editors, due to their connection with the theme or originality, were also incorporated into the study (Table 5).

The data extraction happened from the careful reading of the selected publications. In order to help the understanding of the articles, a matrix was elaborated with the important aspects raised in each theoretical framework, trying to create topics or categories that could compose the research structure. Matrices displays were used to order, summarize, and categorize the information, which allow a more complete interpretation, comparison, as well as evidence synthesis [21]. In the next section, the evolution of the concept of City-as-a-Platform is analyzed, as well as its relationship with knowledge-based development, making it possible to identify elements that can categorize different levels of cities as platforms. To exemplify the proposed categorization, we brought some commercial online engagement platforms that brings together communities and local governments, and also, governments that have developed their own city platforms. On both cases, the objectives are nearly the same: to bring together the public and city leaders to improve and innovate together, making use of available government open data.

Table 4. Selected journal articles for review.

#	Author	Year	Title	Journal
1	Borghys, Van Der Graaf, Walravens, and Van Compernelle	2020	Multi-stakeholder innovation in smart city discourse: quadruple helix thinking in the age of “platforms”	Frontiers in Sustainable Cities
2	Chamoso, González-Briones, De La Prieta, Venyagamoorthy, and Corchado	2020	Smart city as a distributed platform: toward a system for citizen-oriented management	Computer Communications
3	Panori, Kakderi, Komninos, Fellnhöfer, Reid, and Mora	2020	Smart systems of innovation for smart places: challenges in deploying digital platforms for co-creation and data-intelligence	Lan Use Policy
4	Richardson	2020	Coordinating the city: platforms as flexible spatial arrangements	Urban Geography
5	Sabatini-Marques, Yigitcanlar, Schreiner, Wittmann, Sotto, and Inkinen	2020	Strategizing smart, sustainable, and knowledge-based development of cities: insights from Florianópolis, Brazil	Sustainability
6	Stehlin, Hodson and McMeekin	2020	Platform mobilities and the production of urban space: Toward a typology of platformization trajectories	Environment and Planning A: Economy and Space
7	Törnberg and Uitermark	2020	Complex control and the governmentality of digital platforms	Frontiers in Sustainable Cities
8	Van Dijck	2020	Governing digital societies: private platforms, public values	Computer Law & Security Review
9	Yigitcanlar and Cugurullo	2020	The sustainability of artificial intelligence: an urbanistic viewpoint from the lens of smart and sustainable cities	Sustainability
10	Yigitcanlar, Kankanamge, and Vella	2020	How are smart city concepts and technologies perceived and utilized? A systematic geo-twitter analysis of smart cities in Australia	Journal of Urban Technology
11	Bouzguenda, Alalouch, and Fava	2019	Towards smart sustainable cities: A review of the role digital citizen participation could play in advancing social sustainability	Sustainable Cities and Society
12	Gil, Cortés-Cediel and Cantador	2019	Citizen participation and the rise of digital media platforms in smart governance and smart cities	Int. Journal of E-Planning Research (IJEPR)
13	Ismagilova, Hughes, Dwivedi and Raman	2019	Advances in research: an information systems perspective	Int. Journal of Information Management
14	Meijer, Lips and Chen	2019	A new paradigm for understanding urban governance in an information age	Frontiers in Sustainable Cities
15	Park	2019	Strategy for Building Smart City as a Platform of the 4th Industrial Revolution	Journal of Digital Convergence
16	Rotta, Sell, dos Santos Pacheco and Yigitcanlar	2019	Digital commons and citizen coproduction in smart cities: Assessment of Brazilian municipal e-government platforms	Energies
17	Barns	2018	Smart cities and urban data platforms: designing interfaces for smart governance	City, Culture and Society
18	Chang, Sabatini-Marques, Da Costa, Selig and Yigitcanlar	2018	Knowledge-based, smart and sustainable cities: a provocation for a conceptual framework	Journal of Open Innovation: Technology, Market, and Complexity
19	Gil-Garcia, Zhang and Puron-Cid	2016	Conceptualizing smartness in government: An integrative and multi-dimensional view	Government Information Quarterly

Table 4. Cont.

#	Author	Year	Title	Journal
20	Mergel, Kleibrink and Sörvik	2018	Open data outcomes: U.S. cities between product and process innovation	Government Information Quarterly
21	Pereira, Parycek, Falco and Kleinhans	2018	Smart governance in the context of smart cities: a literature review	Information Polity
22	Srivastava and Mostafavi	2018	Challenges and opportunities of crowdsourcing and participatory planning in developing infrastructure systems of smart cities	Infrastructures
23	Brown, Fishenden, Thompson and Venters	2017	Appraising the impact and role of platform models and government as a platform (GaaP) in UK government public service reform: towards a platform assessment framework	Government Information Quarterly
24	De Reuver, Sørensen and Basole	2017	The digital platform: a research agenda	Journal of Information Technology
25	Anttiroiko	2016	City-as-a-platform: towards citizen-centred platform governance	Sustainability
26	Meijer and Bolívar	2016	Governing the smart city: a review of the literature on smart urban governance	International Review of Administrative Sciences
27	Harmaala	2015	The sharing city as a platform for a more sustainable city environment?	International Journal of Environment and Health
28	Yigitcanlar and Dur	2013	Making space and place for knowledge communities: lessons for Australian practice	Australasian Journal of Regional Studies
29	Paskaleva	2011	The smart city: a nexus for open innovation?	Intelligent Buildings Int.
30	O'Reilly	2010	Government as a platform	Innovations

Table 5. Selected documents on gray literature.

#	Author	Year	Title	Source
1	Bollier	2016	The city as platform: how digital networks are changing urban life and governance	The Aspen Institute
2	Ulrich, Marshment-Howell and Van Geest	2016	Open governance in the smart city	ICLEI (Global Network of Local Governments for Sustainability)
3	Chourabi, Nam, Walker, Gil-Garcia, Mellouli, Nahon, Pardo and Scholl	2012	Understanding smart cities: an integrative framework	45th Hawaii International Conference on System Sciences
4	Komninos, Schaffers and Pallot	2011	Developing a policy roadmap for smart cities and the future internet	eChallenges e-2011 Conference
5	Nam and Pardo	2011	Conceptualizing smart city with dimensions of the technology, people, and institutions	12th International Digital Government Research Conference
6	Walravens	2011	The city as a platform	15th International Conference on Intelligence in Next Generation Networks

The main opportunities and challenges identified in the literature for the realization of the transformative and disruptive impact on the government and society of the platform model are presented in the following section.

3. Results

3.1. Knowledge-Based Urban Development and Smart Cities

The relationship between urban development and knowledge emerged for the first time in 1995 [23], when researchers argued about the need for a new approach to the development of cities with a focus on development based on knowledge resources, which would provide the basis and foundation for sustainable development. The four pillars of knowledge-based urban development (KBUD) encompass the domains of economic, socio-cultural, environmental, urban, and institutional development. It is a “new development paradigm of the knowledge era that aims to bring prosperity, to produce cities purposefully designed to encourage the production and circulation of knowledge, in an environmentally conserved, economically safe, socially just and well governed human environment” [24] (p. 11).

In KBUD’s conceptual framework, shown in Figure 2, economic development is associated with the transformation of individuals’ technical knowledge, skills, and creativity into product and service innovations, which generate economic benefits for cities. In the aspect of socio-cultural development, there is an appreciation of social and human capital in the sense of creating a society where knowledge can be generated, distributed, and used for the common good. KBUD’s perspective for environmental and urban development is related to making urban development compatible with environmental preservation, in order to promote and guarantee a better quality of life in cities, now and for the next generations. Finally, institutional development represents the governance to be exercised by governments to lead, unite, and orchestrate the main actors and information that, together, will contribute to the strategic planning and formation of cities [24].

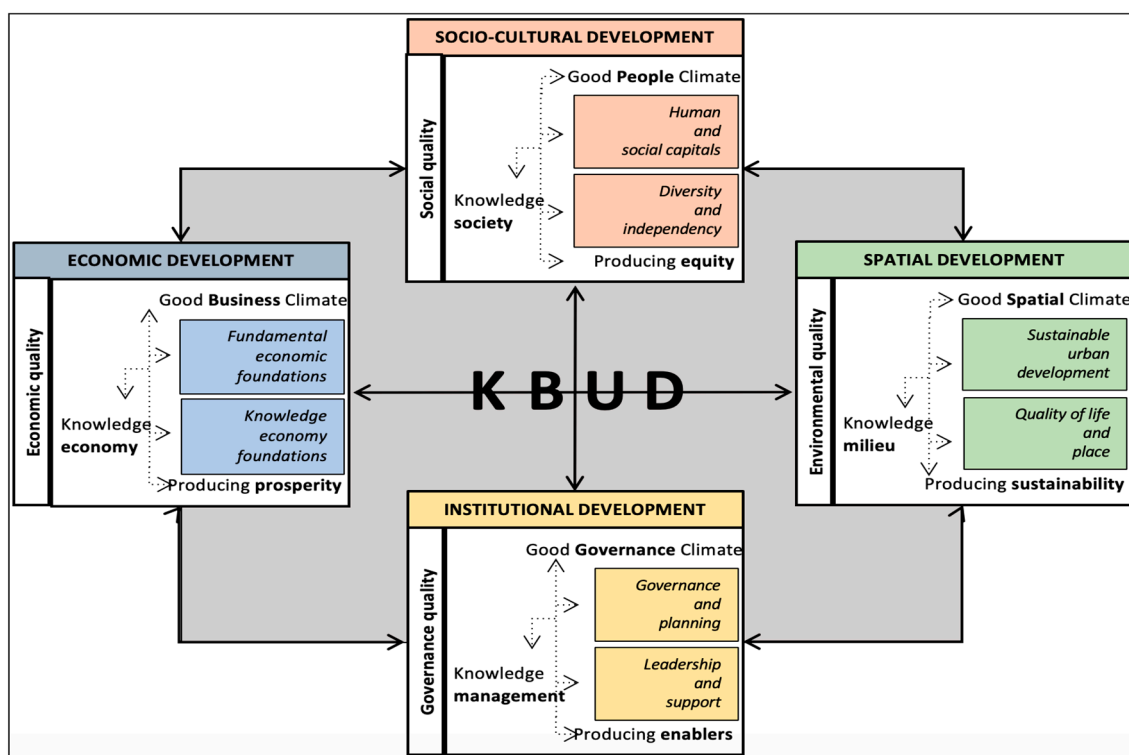


Figure 2. Knowledge-based urban development (KBUD) conceptual framework (adapted from [25]).

Eight interrelated aspects can positively influence the development of cities and make them smarter, namely, governance, people or communities, natural environment, infrastructure, economy, technology, management and politics, with emphasis on the fundamental role of technology for the success of all other aspects [20]. Considering a combination of knowledge and technology, smart cities are a space with knowledge-intensive activities and based on innovation, where there are integrated social cooperation routines that allow knowledge to be acquired and adapted, supported by an information and communication infrastructure capable of managing knowledge in public digital spaces to solve city problems [25,26].

A city is smart when it “invests in its human and social capital in conjunction with the communication and information infrastructure, to fuel sustainable economic growth and improve the population’s quality of life, for example through the proper management of natural resources and participatory governance” [27] (p. 50). Although there is no single meaning for smart cities that is specific and widely recognized in academia, the literature on smart cities has gradually been configured in a balance between social intelligence and digital technologies. Smart cities are not just a network of sensors and data and communication connections [28], but mainly those where citizens are interested in engaging and collaborating to define guidelines for the planning and functioning of cities, in order to add public value to a common good, becoming an essential part of the process [29].

Technology, despite being increasingly evolved, disseminated, and accessible to the population, does not replace human responsibility in the planning and governance process of cities [30]. However, it can assist in solving complex problems, by providing greater interactivity, quality, and efficiency in urban services, reducing costs and improving connections between governments and society [31]. Therefore, smart cities are supported by a combination of technological infrastructure, human skills, knowledge management, and innovation [32].

The main characteristics of smart cities are: (a) Infrastructure network, which allows good connectivity; (b) Strategic vision, to develop the city’s competitiveness through new technologies and the involvement of multiple actors, and; (c) Adoption of a sustainable and inclusive urban development approach that emphasizes social capital in urban development [33]. Open innovation is a new paradigm for building smart cities, where governments and software developers take advantage of the experience, skills, and knowledge of citizens to develop digital services that are relevant to users of the urban environment [32,33]. The technology supports open innovation and eliminates boundaries between companies, society, and government, enabling the transfer of innovation into and out of the urban environment, driving research and the development of partnerships.

Three factors enable the formation of smart cities—technology (hardware and software infrastructures), people (creativity, diversity, and education) and institution (governance and politics) [34]. Technologies are applied in smart cities to boost social interaction and bring society closer in collaborative networks. In the scope of governance, digital platforms enable the creation of ecosystems of urban innovation that make cities increasingly intelligent, human, and sustainable [33,34]. According to [35], investments in human and social capital, added to the adequate technological infrastructure and intelligent governance, can boost the sustainable growth of cities. Good governance to manage and mediate the network of public and private actors, with the definition of responsibilities of the parties involved and the establishment of regulatory policies is the main challenge of smart cities initiatives [20], as will be presented in the next section.

3.2. Smart Urban Governance

The intelligence of a city is related to its ability to attract and mobilize human capital in collaborations through information and communication technology (ICT) tools [36]. Governance is not a purely technological issue but rather a complex process of institutional change of a sociotechnical nature [11]. Based on a systematic review of the literature [11], the authors admit that city governance is a strong collaboration network between government

and stakeholders. In this sense, they understand governance from two perspectives: as a result and also as a process.

As a result, governance focuses on the content of government actions, which should support the research and development of technology and public services that can improve citizens' quality of life. The smart cities governance seen as a process implies stakeholder participation and engagement in the production of the common good, with the exploration of collective intelligence, experiences, and knowledge [11,37]. The governance process involves the creation of rules and the coordination of political decision-making that encompasses different actors, social groups, and institutions in a specific context, to achieve objectives discussed and defined collectively in fragmented and complex environments [38]. Urban governance is a means to achieve integrated urban development, and it can be achieved through an integrated approach that combines: (a) The existence of a multidimensional plan that considers ecological, social, cultural, and organizational aspects = objective; (b) Forms of communication between different levels of structured and continuous governance = communication; (c) Bottom-up participation that produces relevant information = popular engagement; (d) Political agenda that supports integrated urban development at different levels (local, regional, and national) = integration [38].

Assuming the idea of governance as a sociotechnical process, under the social aspect, smart city governance allows citizens to articulate their interests, measure their differences, and exercise their rights and duties in decision-making, in a responsibility shared with the government, with the aim of improving life in cities [31]. From a technical point of view, governance aims to establish an environment with technological and legal infrastructure that allows the connection between government and society. In this sense, the digital transformation is changing governance models in a disruptive way [31]. At the same time that new technologies have increased the complexity of cities, they have provided new ways for actors involved in urban development to organize, demand, and offer solutions [39].

The consolidation of the web gave rise to e-governance and enabled new means of government interaction with citizens and companies and making government internal operations more agile [13,31]. A wide range of electronic services have been offered by the government in an increasing way in recent years for citizens (G2C—"government to citizens"), for companies (G2B—"government to business"), and for governments (G2G—"government to government"). Conversely, it is also allowing access for citizens and companies to the government and among themselves, in technological options for C2G, B2G, and B2C interaction [31].

The introduction of technological tools that enable open and massive collaboration in the urban ecosystem at a low cost with the objective of solving complex problems in cities with the contribution of collective knowledge is known as smart cities open governance [40]. The authors emphasize that traditional governance paradigms, with government as the protagonist, are no longer applicable to collective initiatives enabled by technology, in which complex problems can be more effectively solved by the digitally connected actors in the urban ecosystem, in more horizontal and collaborative partnerships with the government. In this context, the network connections provided by technology can change government's roles as that solely responsible for decisions about the future of cities, transforming citizens into co-creators and co-responsible for urban development, as a third driving force, public and private [7].

Open governance in smart cities should be based on three pillars: (a) Open data—where information is considered a collective asset, which is worth collecting, using, preserving and sharing; (b) Data quality—which must be reliable, and; (c) Open participation—which has in collective knowledge a valuable asset, responsible for improving the effectiveness of public policies and the results of decision-making processes in favor of increasing the quality of life in cities [40]. The city's open government structure is an essential requirement of smart cities, being composed of open data, open governance, open programs and

services, and open involvement, which can be enabled through digital platforms that bring together corporate governance [4].

The idea of CaaP presents itself as the technological and political infrastructure that allows society (citizens, companies, organized groups) to play a direct and larger role in the life of cities, hence realizing platform urbanism. The platforms created by governments are an open space for the collaboration and democratization of information and knowledge that, while providing channels for cooperation and participation, demand governance that is consensus-oriented, transparent, responsive, efficient, effective, equitable, and inclusive [38].

Urban governance through platforms is characterized by being open, collaborative, intelligent, and electronic [41]. This governance can be evolutionary depending on the desire and the need for transformation and government opening. Different levels of governance are directly related to the levels of government opening, which can range from e-government as a simple information channel and online service provision, through enabling social participation via crowdsourcing, reaching a radical public data opening for the development of innovative applications that improve the quality of life in cities [11,40]. This theme will be further discussed in this paper and, below, a brief description of the concept of digital e-government platforms is presented.

3.3. Digital e-Government Platforms

The term ‘Government-as-a-Platform’ (GaaP) was coined for the first time in 2010 by Tim O’Reilly, based on the understanding that government should position itself as a facilitator and manager of its interactions with society, acting as the provider of a platform, where citizens would co-produce innovative solutions for the government derived from their experience, knowledge, and collective intelligence [13].

O’Reilly proposed a change in the government’s view as the sole provider of services to society, with centralized control of proposals and actions, for a government that would allow, through electronic platforms, the involvement of society in proposing services and public policies in an environment of digital commons. The government as a platform is based on seven premises [13]:

- Open platforms: the adoption of open source software platforms and open data structures, allowing the combination of products and services that are oriented to meet the current demands of society;
- Autonomy: offer participants ways to create, generate, implement, or produce new content, without additional help or information from the platform’s original creators;
- Participatory design, with clear rules and interoperable systems architecture, with an emphasis on standardization, modularity, and component reuse, which facilitates the assembly line of new applications;
- Open mind: the best ideas will not necessarily come from the creators of the platform, but from those who break the rules (hackers), combining data in an unexpected and creative way to make useful mashups for users;
- Exploring user behavior: Data mining can be applied to get to know users’ interests and extract from their participation new ways to boost the creation of services that meet their demands;
- Agile development: Reduction of barriers to experimentation, embracing failure, experimentation, and iteration in real time, continuously improving applications, without worrying about having perpetual beta versions. Platform thinking is an antidote to complete specifications, as the cost of experimentation is reduced, and it is possible to discard products and services that do not suit users;
- Leadership by example: building platforms with remarkable resources and making available a set of applications that allow developers to add value to the platform’s ecosystem.

Digital platforms are a new business model driven by ICT. The internet is responsible for connecting people, companies, and governments, and for providing a rich database

on servers and in the clouds, and it has been also providing the development of multilateral networked arrangements that maximize the approximation between producers and consumers and the generation of value through interaction between these parts [14,42]. O'Reilly's idea aligns, to a certain extent, with the performance of large organizations in this fourth era of innovation that, in the face of the inability to innovate quickly due to their rigid and complex organizational structures, seek partnerships with startups, which inject new knowledge, knowledge, and ideas and, through agile methodologies, propose innovations in the market [13].

In city administration, government and society partnership is sought through the configuration of an ecosystem that combines technological infrastructure, made available by the platform owner (government), with a wide range of external participants (individuals and companies), who will have the opportunity to participate or even complement the platform with innovative services and applications, using data provided by the government [43].

Unlike the private sector, the motivating reasons for the adoption of platforms by the government go beyond economic issues, focusing on how to serve citizens well and how to develop public policies for the common good at a time characterized by rapid technological, social, and economical changes. It is not a matter of delegating its competence as a government to third parties but to develop ways of articulating new competences in society that are capable of guaranteeing a dynamic, agile, innovative, and efficient performance in the provision of services and definition of public policies, which meets citizen's expectations. Table 6 summarizes the relationships between stakeholders—government, citizens and companies—derived from the research of thirteen digital media platforms for e-governance and smart city initiatives [31].

Table 6. Electronic governance by platform categories (adapted from [31]).

Government to Citizens (G2C)	Citizens to Government (C2G)
<ul style="list-style-type: none"> Provides information and online services to citizens efficiently and economically. Strengthens the relationship between government and citizens through ICT. G2C services allow citizens to access government documents (laws and regulations), carry out transactions (payment of municipal taxes and fees), and perform bureaucratic tasks (updating registration, changing address, requesting facilities and subsidies). 	<ul style="list-style-type: none"> Share distributed information or collaborate in the formulation of public policies through platforms. Send messages directly to public administrators, conduct remote electronic voting, propose, discuss, and vote on public initiatives.
Government to Business (G2B)	Government to Government (G2G)
<ul style="list-style-type: none"> Facilitates interaction between government and corporate bodies and private sector organizations. Provides business, information, and advice on best e-commerce practices. G2B services allow entrepreneurs to access information online about laws and regulations needed to comply with government regulatory requirements for their business (corporate tax reporting and government procurement). 	<ul style="list-style-type: none"> Facilitates non-commercial online interaction between government organizations, departments, and authorities with the aim of reducing costs, bureaucracy, excessive communication, and human resources.

Themes such as e-government and innovation are being connected to urban governance to develop approaches that can make cities smarter [35,44]. Two Finnish cities adopted open platforms to encourage citizens and stakeholder participation in the construction of urban economic renewal, showing that it is possible to reach economic development through open innovation [4]. The platforms facilitated self-expression and interactive processes among participants, allowing for a more natural connection that evidenced the tendency to democratize innovation and participatory change in public governance [4].

The term platform can be understood as a sociotechnical set that encompasses social elements (participation of stakeholders in the development of services and public policies

that generate value to society) and technical elements (existence of an infrastructure information and communication technology with open, evolving, and adaptable standards architecture) [17]. According to the author, platforms that only broker different groups of users but do not offer an open source base should not be considered digital platforms. An open data platform in smart cities contains semantically enriched databases, application development kits, and reusable application components aimed at web application developers [17]. Therefore, in this work, CaaP is conceptualized as a model of sociotechnical governance supported by digital architecture technologies with open and modular standards that, through government regulation and moderation, provide the connection between government and society for the co-creation of services and policies of high public value.

The mentality of CaaP has profound repercussions for public administration, as it impacts on all aspects of governance, power distribution, and democratic citizenship, enhancing the possibility of obtaining better results in all aspects of urban planning in cities—transport, energy, security, health, economic development, education, and culture, among others [7].

4. City-as-a-Platform

4.1. The Evolution of City-as-a-Platform

The evolution of CaaP presupposes a new form of urban governance that is more open and participatory, with the use of technology in the organization and intermediation of the collaboration of different actors in society. This smart governance refers to the introduction of technological tools that enable open and massive collaboration in the urban ecosystem, with the aim of solving complex problems in cities based on data sharing and contributions from collective knowledge [40]. In CaaP, the government's role in the provision of services and in the definition of public policies is no longer unique or protagonist but becomes the mediator or orchestrator, both in terms of data availability and the participation of actors that enable the cities ecosystem. Table 7 illustrates the evolution of institutional governance paradigms that still coexist and interact, showing open governance as an emerging form of massive and mediated collaboration between individuals and the government [40].

Table 7. Open governance as a new paradigm (adapted from [40]).

Paradigm	Nature of the State	Focus	Emphasis	Resource Allocation Mechanism	Nature of the Service System	Value Base
Old Public Administration (OPA)	Unitary	Political system	Policy development and implementation	Hierarchy	Closed	Public sector ethos
New Public Administration (NPA)	Regulatory	Service organization	Management of organizational resources and performance	Market	Calculated openness	Performance
New Public Governance (NPG)	Plural	Governance network	Negotiation of values, meaning, and relationships	Network	Negotiated openness	Constructed in networks
Open Governance (OG)	Open	Network of individuals	Massive collaborative production of information	Platform	Radical openness	Collaborative around a shared value

Open data are the most valuable opportunities that governments can offer to cities. Internally to the government, data based on open and interoperable standards increases the inter- and trans-departmental cooperation of public administrations by sharing systems and information and, externally, with society, they signal transparency, responsibility, and

trust in the government, in addition to allowing civic participation in the use of data, with the opportunity to innovate and improve the efficiency of the services provided [45,46]. From the literature review, considering a triad composed of government, technology, and people for the formation of smart cities, two aspects are important to classify the evolution of CaaP—the forms of participation and engagement of individuals and the availability of data opened by governments. In our perception, the interaction between government and society in a CaaP can occur in different ways: (a) Simple provision of information and services; (b) Possibility of holding popular consultations; (c) Incorporation of citizens in a more effective participation processes, and; (d) Provision of open data for developers and startups to create new technologies that will impact and transform the way people live in cities.

Based on these levels of interaction, on O'Reilly's premises of government as a platform [13], on the spectrum of popular participation developed by the International Association for Popular Participation [47] and on a large survey developed to analyze municipal Brazilian portals [44], we propose a categorization of CaaP in four levels, as shown in Table 8 [4,31,39]. Some examples of commercial engagement platforms for cities and city platforms developed by governments are presented.

- **Level 1 platform (low G2C–low C2G):** It is characterized by a low level of popular engagement and low government opening. The government's role is restricted to providing information to society and making services available online. The path is unidirectional, from government to society. Technological tools are not available to enable the direct involvement of social actors with the government to propose ideas related to services or public policies. The government does not provide open data via Application Programming Interface (API). The platforms inform and provide digital services to population, such as information about the existence of problems on public roads, and allow online monitoring by the citizen of the registration of their request/information. At this level, the platform's objective is to deliver greater convenience to citizens by reducing the time, effort, and costs of accessing the government, offering information and services in a simplified and organized manner. An example of this type of platform is Cityopen (www.cityopen.com.br) in Brazil.
- **Level 2 platform (average G2C–average C2G):** The purpose of platforms at level 2 is to provide cities and governments with a digital participation platform to consult and include citizens in decision-making, assisting governments in their decisions. To this end, they allow consultation with citizens and minimal crowdsourcing actions, representing an average level of citizen participation and average government openness. There is a higher level of interaction on these platforms in the G2C (e.g., consultations for the approval of projects and referrals) and C2G (e.g., project proposals, ideas, and public policies). These platforms provide society with access to the government through direct, convenient, and interactive participation, in addition to offering the government the possibility to select specific target audiences in certain surveys when necessary. Analytics resources are present with real-time monitoring of data collected in society through panels. These platforms do not offer functionality related to open government data. They contribute to the strengthening of democracy, to the increase of transparency, and the confidence of citizens in governments. Some examples of type 2 platforms are MindMixer (www.mindmixer.com), which is used by cities in the United States and Canada, and Citizenlab (www.citizenlab.co), which is based in Belgium and adopted by several European cities.
- **Level 3 platform (medium G2C–high C2G):** These platforms have all the functionality of level 2 platforms, but additionally, they allow the organization of virtual events with expert panels or government servers, such as virtual workshops, which give participants the opportunity to discuss a topic in small groups before sharing with a larger group of people. They also offer tools for the ideation of new projects, making it possible to gather ideas from as many people as possible, as if they were virtual living labs, that is, iterative ecosystems of open innovation centered on the user. On

these platforms, the level of interaction between government and society is high, but there is no possibility, through the platform, to access open government data to propose new solutions for services and applications. The values of these platforms are centered on the access and reach of opinions and ideas, in addition to manifesting citizens' wishes, with more direct and close involvement of the government through virtual or face-to-face meetings. Examples of this type of platform are Bang the Table (www.bangthetable.com), adopted by cities in the United States, Canada, Australia, the United Kingdom, and New Zealand; YourPriorities (www.yrpri.org), developed in Iceland as an open source platform, being used by cities in the United States, Canada, United Kingdom, Portugal, Spain, Amsterdam, and several other European countries.

- Level 4 platform (high G2C—high C2G): The platforms at this level present the same functionalities as level 3 platforms in terms of public engagement, with the difference of allowing the production of software and applications from a link to the open data made available by governments, via programmable interface applications (API—Application Programming Interface). In addition, some platforms at this level have free code allowing the proposals to be made available to be audited and inspected by anyone with technical knowledge. The amounts delivered by governments that use these platforms go far beyond crowdsourcing or living labs and include hackathons and the possibility of creating software and applications for web or mobile through the combination of data from government and non-government sources, which can lead to services for citizens with high public value. Examples of this type of platform are Consul (www.consulproject.org), an open source and free use platform developed in Spain and currently used by more than 35 countries in Latin America, South America, Africa, and Europe; Decidim (www.decidim.barcelona), created and used in the city of Barcelona, Spain; Opengov (www.opengov.com) and Mysidewalk (www.mysidewalk.com), both developed and used in the United States; vTaiwan (www.vtaiwan.tw), created and applied in Taiwan. Additionally, noteworthy to mention that two city platforms are created through government initiatives: London/UK (www.london.gov.uk) and Singapore (www.gov.sg).

Urban governance through platforms is a stimulus to the development of cities based on collective knowledge, being operationalized through the following: (a) Crowdsourcing: raising the knowledge of people who contribute to decision-making in relation to public policies; (b) Participatory democracy: collective decisions through direct citizen voting; (c) Co-creation: not just listening to citizens' demands and desires, but making them part of the solution, increasing their effectiveness and acceptance, and; (d) Data and information: sharing and inviting the use of open data, aiming at creating applications that contribute to the more human, intelligent, and sustainable development of cities [39].

In Brazil, [44] evaluated 903 municipal eGov platforms, and the results revealed that the majority of them have a low level of digital maturity, with low citizenship co-production and fewer opportunities for city smartness. In the proposed categorization above, almost half of the Brazilian cities analyzed are still in level 1, offering simple information or services in a unidirectional fashion. A significant number of cities analyzed (44.08%) fit in the second level of maturity, and 21.96% of the portals analyzed have some type of functionality that allows the co-production of public services as recommended by level 3. Only 2% of the portals of Brazilian cities analyzed have characteristics of the fourth platform level.

Table 8. The evolution of City-as-a-Platform.


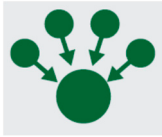
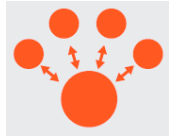
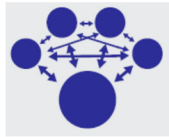
Public Engagement Level (C2G)				
Government openness level (G2C)	Low Low	Medium Medium	High Medium	High High
	Information and Services	Public Consultation	Government and Society Involvement	Collaboration and Application Development
				
Platform rating	1	2	3	4
Government objectives	Provide information and services online.	Obtain feedback, analysis, opinions, or decisions on proposals or actions.	Work directly with the public to ensure that their concerns and aspirations are understood and considered.	Provide open data in machine language, for the development of applications that facilitate and improve the quality of life in cities.
Government deliveries to society	Keep society informed and offer services online.	Keep society informed, listen and acknowledge their concerns and aspirations, provide feedback on how their views influence government's decision.	Ensure that society's concerns and aspirations are reflected in the alternatives developed and provide feedback on how their contributions influence the government's decision.	Provide open data that enable innovation in the formulation of solutions that can be made available to society.
Does it involve open data?	No	No	No	Yes
Does it involve direct popular participation?	No	Yes	Yes	Yes
G2C/C2G benefits	Convenience Reduction of time, effort, and costs, simplification, organization, information.	Access Exposition of opinions and ideas, manifestation of will.	Access and reach Exposure of opinions and ideas with government's counterpart through virtual or face-to-face meetings with specialists.	Public value Provision of open data for the development of web and/or mobile applications by developers.

Table 8. Cont.

Public Engagement Level (C2G)				
Examples of commercial online cities' platforms	Cityopen (Brazil)	Citizenlab (France) Mind Mixer (USA and Canada)	Bang the Table (Australia, Canada, USA, UK, New Zealand) Your Priorities (Europe, Canada and USA)	Consul (International) Decidim (Barcelona) Opengov (USA) Mysidewalk (USA) vTaiwan (Taiwan) Deepint.net (International)
Facilities provided by platforms	Information and availability of digital services.	Crowdsourcing.	Crowdsourcing and virtual or face-to-face living labs.	Crowdsourcing, virtual or face-to-face living labs, hackathons, and the possibility of creating mashups through open data combination.
Brazilian cities eGov platforms [44]	Almost half of the Brazilian cities.	44.08% of the Brazilian cities.	21.96% of the Brazilian cities.	Only 2% of Brazilian cities.

The adoption of some of the platform models presented above represents an economic advantage for local governments, as they have technological infrastructure ready and available for use, sometimes in open source. In addition, they provide data management and analytical resources, with presentation of information on dashboards to support the management of local administrators. The platforms do not replace human importance in the governance of cities and do not exclude the possibility of maintaining face-to-face civic meetings for discussion, ideation, and voting on proposals related to policies for urban development. However, they are important allies for a more open, participatory and intelligent public governance.

Although the model of CaaP provides real opportunities and benefits for better urban governance, rejuvenating civic life and stimulating better government performance, its inclusion in the sphere of city administration poses new challenges in terms of government, political, and civic arrangements. Citizen participation represents changes in the structures of power, wealth, and voice, and the availability of open data creates uncertainties regarding the security, privacy, and reliability of information [7].

In the next section, opportunities and challenges for urban development based on collective knowledge in CaaP are discussed.

4.2. Opportunities and Challenges for the Development Based on Collective Knowledge in City-as-a-Platform

Based on the literature review, the CaaP vision presents promising opportunities, but with several challenges, of a political, economic, technical, and cultural nature in the spheres of government, society, and technology, as summarized in Table 9. From the perspective of the government as an institution, the obstacles will be related to its strongly hierarchical and departmentalized organizational structure, which will hinder the synergy of actions, the resistance to change of teams, the lack of behavioral skills of civil servants for a more direct relationship with the citizen, and low technology training.

CaaP presupposes new governance models focused on communication, interaction, collaboration, and participation in decision-making, facilitating openness and transparency and promoting direct democracy [16]. The governance model will need to be based on rules for participation and content exposure, with the definition of sanctions, in a document available to participants. The government should exercise the mediation power on the platform, ensuring that in all projects, real public value is achieved [48]. Regulations and laws that involve urban planning and the definition of public policies should be revisited, considering a new society that is digital and participatory.

Openness to co-production is an essential requirement in CaaP for the provision of the common good in arrangements involving citizens, government, and organizations. Common goods are conceptualized by [49] as goods for collective use shared by individuals and subject to social conflicts. The principles of common goods can guide the structuring of the governance model in CaaP initiatives, establishing guidelines for the participation of stakeholders in decision-making processes in a given context, delimiting rights, monitoring the behavior of members, defining sanctions, and promoting conflict resolution, with governmental autonomy in multiple layers of participation and responsibility [49].

In this sense, [44] established a model to analyze the level of adherence to the principles of the common good and to identify the potential of digital platforms to promote the common good. The model was applied in digital platforms in Brazilian cities and identified the limitation of the platforms analyzed in the incorporation of the principles of the common good. Only 7% of the analyzed platforms were able to identify elements that refer to civic engagement, inclusion, shared responsibility, accountability, data opening, and co-production of the society for the common good. Most platforms offer information and electronic transactions characteristic of the first 2 levels of our platform categorization.

Table 9. Opportunities and challenges of City-as-a-Platform.

	Opportunities	Challenges
Government	<ul style="list-style-type: none"> • Improvement of services delivered to society. • Harnessing collective intelligence and knowledge. • Improvement in decision-making process quality, with diversified views. • Increased citizens' co-responsibility. • Monitoring of city indicators—transport, health, education, and economic development, among others. • Cost reduction and speed in service provision. • Greater satisfaction of service users—companies and citizens. 	<ul style="list-style-type: none"> • Hierarchical and departmentalized institutional culture. • Development of server behavioral skills. • Training public servants and adapting to change. • Open and participatory governance (leadership and mediation). • Changes in regulations and laws. • Open data as standard (with security, privacy, reliability, and quality guarantee) and systems interoperability. • Financial resources for investments in platform technology. • Ethics in data analysis and use. • Provision of broad and equitable access to technological infrastructure. • Ensuring diversity and representativeness in participation and decisions, preferably involving all stakeholders—citizens, the private sector, and academia.
Society	<ul style="list-style-type: none"> • Possibility of participation and engagement in the proposition and choice of public policies. • Exercise of rights and duties as a citizen. • Feeling of belonging in the contribution to the city's development process. • Monitoring and control of government actions. 	<ul style="list-style-type: none"> • Absence of a culture of participation and engagement. • Lack of knowledge and access to digital technologies (computer, broadband internet). • Lack of motivation or incentive to participate. • Lack of confidence and legitimacy in technological tools. • Lack of confidence or security in online deliberations. • Respect for online participation (digital etiquette). • Lack of face-to-face interaction that can impair bonding and empathy.
Technology	<ul style="list-style-type: none"> • Simpler and easier online interactions. • Use of artificial intelligence to support data and information processing. • Reach a larger number of participants at relatively low cost. 	<ul style="list-style-type: none"> • Ensuring cybersecurity, privacy, and data quality reliability. • Ambiguities and confusions in data analysis, requiring human supervision. • Exponential increase in data collected daily. • Information transparency. • Participant diversity and non-discrimination.

Based on the work analyzed in the literature review, it is possible to understand that CaaP's motivations involve (a) promoting the improvement of public services, making them more adherent to the needs of society; (b) the definition of public policies supported by collective knowledge; (c) the creation of innovative digital applications in partnership with developers and startups, facilitating and improving the quality of life of people in cities. In fact, many of the municipal platforms analyzed in [44] do not provide the information required by law, or provide it in an incomplete, unstructured, or difficult to understand manner, compromising the transparency and publicity of actions taken in the public sector. According to [44], the absence of services and information, or the difficulty in locating and understanding them, distances citizens from public administration and prevents manifestations, requests, criticisms, suggestions, or praise. The lack of inclusion of interested parties and the low understanding of the functioning of public services hamper citizen participation and the co-production of the public good. To achieve the objectives of a networked city, delivering results that effectively meet the wishes of the majority of society, it will be up to the government to carefully analyze the data generated by the platform,

especially due to the ambiguities and confusions that they may eventually present. Human interaction in conjunction with artificial intelligence is essential to evaluate the data in order to recognize its real meaning, since misinterpreted data may lead to incorrect decisions [7]. Still with regard to data, the government's concern should also be focused on protecting citizens' privacy and connected infrastructure against cyber-attacks. Technologies such as blockchain and cryptography can alleviate concerns about data security and contribute to increasing transparency and trust in relation to online systems [6].

In countries with greater social inequalities, another challenge for governments is related to the provision of technological infrastructure for broad and equitable access to popular participation in order to achieve greater diversity and social representativeness in the issues under discussion on the platform. In the case of Brazil, [50] describes the importance of digital inclusion policies to enable community participation in the public consultations required by national legislation. The authors describe that internet access remains a challenge for the expansion of popular participation in Brazilian cities. [50].

From the perspective of society, the engagement of citizens in the processes of defining or choosing public policies and in the design and creation of public services brings the possibility of exercising a direct democracy, without intermediaries, with greater opportunities for monitoring and controlling government actions, increasing the level of confidence in government. The real contribution to the urban development of the place where they live provides people with a sense of belonging, ensuring greater commitment to the solutions chosen and legitimizing the defined public policies.

The platforms, as a link of communication and collaboration between government and citizens, allow people to exercise their role as part of the quadruple innovation helix (society + government + academia + private sector) and have their voices heard, contributing to the construction of proposals that arise from the consensus of the analysis of different perspectives that are capable of building a fairer, more inclusive, and sustainable urban environment [51,52].

Nonetheless, there are obstacles to be overcome in the popular participation aspect. For example, platforms that use crowdsourcing encounter problems related to the human aspect, such as the lack of motivation or incentive for participation, the lack of digital equality between different social strata (in terms of age, gender, income, and skills), as well as the level of knowledge on the themes of the proposals [53]. Allied to this, there are other issues that can prevent people's participation, such as the lack of confidence in the virtual deliberative processes, the feeling of uncertainty regarding the security and privacy of technological tools, and the discomfort related to participating in the platforms due to the lack of knowledge of technology.

From a technology point of view, although platforms create an environment that supports the involvement of multiple actors, there are challenges related to the opacity, complexity, unpredictability, and partially autonomous behavior of digital systems. Such challenges can make it difficult to guarantee the fundamental rights of citizens, such as privacy, security, and non-discrimination [6,54].

Aspects related to transparency, participants' privacy, reliability, and data quality were also identified in relation to crowdsourcing [53]. Technology can have negative impacts on the democratic process if there are no forms of control and punishment. In this sense, although digital platforms seem to provide freedom, in reality, there is a mediation layer in their architecture that guides interaction, allowing certain forms of action and preventing others [55]. It is as if technological control through behavior modeling, incorporated into the interaction rules of the platform, extends to parts of social life, with the power in the subtle adjustment of some technical code. Hence, the importance of adopting platforms that have open and auditable sources.

On the other hand, with the use of new information and communication technologies, it is possible to reach the participation of a large number of people, regardless of their geographical location, in the urban development processes of cities, in a more friendly and interactive way, counting, still, with the ease of compiling the results through strategies

based on AI [56]. In addition, digital tools allow participants to monitor the status of the proposed recommendations and the impact they have had on final decision-making.

In cities organized as platforms, it is possible to take advantage of the creativity, intelligence, and knowledge of a large and indefinite group of people, increasing the likelihood of generating original ideas for urban development [57]. For the authors, the main contribution of digital technologies is the rise and interconnection of various types of intelligence—(a) artificial, (b) human, and (c) collective— supported by good public governance, to build smarter, more human, and more sustainable cities.

The idea here is that no single governance rule or specific platform model is applicable to every city. There is no one size fits all. The choice between the platform models presented in this paper will depend on the technological maturity of the governments, their organizational structure, the available resources and, mainly, the culture of participation of the population.

There is no roadmap or project on how to organize CaaP or a ready recipe for implementing open, participatory and intelligent governance processes [39]. Nevertheless, the authors provide some guidelines, which are listed below:

- Clearly define the objectives to be achieved and seek to solve real problems, with technology being only a tool; if the problems to be solved are not relevant to the city's population, the use of new technologies alone will not motivate them to get involved;
- Configure a new platform and link it to existing systems, which users know; combine online and offline formats for stakeholder access;
- Plan and reserve sufficient resources, as it is not enough to just create the platform, since discussions will need to be moderated, the platform maintained, proposals transferred to decision-makers, requests answered, information prepared, and much more;
- Prepare for change, as the structure of CaaP not only requires different resources and team capacity but also generates changes in internal workflows, organizational culture, and self-conception by local governments;
- Keep governance processes open, accessible, and inclusive;
- Be transparent and follow the defined objectives and goals; initiating a process, creating expectations, and subsequently, disregarding the contribution of citizens and stakeholders must be avoided in all circumstances, as this undermines the trust and credibility of open governance processes;
- Build future innovation through open source codes, which allow greater cooperation with other codes and flexibility for adaptations, helping to avoid technological blockages.

Additionally, analyzing the results of [44] and the good practices of the platforms positioned at levels 3 and 4 identified in Table 8, Table 10 describes complementary principles for CaaP platforms:

Table 10. Principles for the design of City-as-a-Platform.

Principle	Description	Example
Intuitive interface	Use design standards that favor access to services of interest to the user, including service guidelines and recommendations according to user profiles	Organization of services and information adopted by London/UK and Singapore platforms
Responsibilities	Make clear the policies for the use of services, informing interested parties of their rights, responsibilities, and penalties	Decidim's social contract; government terms in Singapore platform

Table 10. Cont.

Principle	Description	Example
Social eGov	Promote the integration of content and services with social media to facilitate the dissemination or incorporation of content on the platform	London/UK Media Centre and social media resources of Singapore platform
Accountability	Provision of services for government transparency	In my area at London/UK platform; Dashboard automation in mySidewalk
Open data	Apply open government practices, making open data available, with the possibility of downloading and reading by machine	Openness and transparency section of London/UK platform and data dissemination strategy of mySidewalk
Interoperability	Enable the integration of platform services or external resources through APIs and interoperability programs	List of API of London/UK and Consul platforms
Communication	Provide channels of interaction with stakeholders	Communication features available in London/UK and Singapore platforms
Knowledge management	Include resources for knowledge management and sharing	KM resources available in London/UK Get involved section
Conflict resolution	Offer quick access channels for complaints of inappropriate use of resources and for mediation of conflicts between different actors on the platform	Terms of service and consultation in get involved sections of London/UK platform
Co-production	Availability of resources that enable the participation of society in the discussion of priorities and in the co-production of public policies	Talk London in London/UK; Debates in Consul platform; participatory budgeting/participative processes in Decidim; open consultation process of vTaiwan

5. Conclusions

In recent years, one of the significant developments was the coining of the concept of City-as-a-Platform (CaaP) as part of the platform urbanism movement [58–61]. The concept is rapidly gaining popularity, as more and more platform thinking applications become available to the city context—where open data and the participatory innovation opportunity of these platforms contribute to identifying and solving critical urban issues [62,63]. Nonetheless, this topic is an understudied area of urban research. Hence, the study attempted to evaluate the use of digital media platforms by local governments (particularly along the notion of CaaP) as a tool to support urban governance for the development of smart cities by answering the aforementioned research question of this study. Through an integrative review of scholarly articles published during the last decade (2010–2020), combined with research on websites of some platforms in existing cities, it was shown how these platforms have been organized and used, classifying them according to the level of involvement citizens and government opening, also presenting the opportunities and challenges arising from its adoption.

Our review has found that CaaP is an emerging field of research and practice and, therefore, more prospective studies are needed to consolidate knowledge on the topic [64]. The complexities of the digital age and the rapid expansion of disruptive technologies are creating the need to better understand the economic, social, environmental, philosophical, and legal implications of their development, adoption, and use for the most human, intelligent, and sustainable development of cities [65,66]. This includes a deeper understanding of the opportunities and risks associated with adopting CaaP.

The use of technology is fundamental and irreversible, but innovation itself is a human undertaking [67,68]. In this sense, the organization of cities in the platform model requires analysis of their transformative and disruptive impact on government and society, since they alter the power structure and the relationship between participants in this ecosystem.

Among the principles identified in the literature to guide the governance strategy in CaaP, we highlight those pointed out by [11,44] linked to the promotion of the common good, such as the following: (a) Training all stakeholders, taking into account their roles and responsibilities; (b) Defining mechanisms for resolving conflicts; (c) Understanding the context for designing sustainable initiatives; (d) Taking co-production and citizen participation as key principles; (e) Considering that public goods are a collective responsibility, and; (f) Establishing rules to govern diffuse and collective interests and monitor the interactions of the actors. Regarding the technological perspective, a number of important aspects will need to be addressed:

- Maximize society's equitable access to digital technologies and relevant urban platforms to form a collective knowledge to tackle issues.
- Promote digital literacy and mitigate the digital divide to prevent the growth of socioeconomic inequalities.
- Design, develop, and deploy technologies that positively affect the behavior of citizens in relation to common goods.
- Promote information security and privacy so that technologies are used with complete confidence.
- Understand the reality of online city governance and establish mechanisms to promote the automation of platform decisions in a secure manner.
- Make open data available and ensure the transparency, security, and privacy of that data.

Lastly, the challenges for the implementation of CaaP are immense for governments and societies [63,69]. Nevertheless, tackling these challenges is critical, and opportunities are already here for researchers, since countless studies and experiments are on the rise in the fields of digital media, urban planning and development, open and big data, public services, sustainable governance, and smart collaboration. Platform urbanism has the potential to contribute to the efforts in expanding the benefits for citizens and their quality of life in cities, where its contribution is also essential for shaping the smarter urban development governance and achieving the smart urbanism goals with collective knowledge [70–72].

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