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Citizen Engagement and Participation in Smart Cities: Scope and Definition of Concept

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Abstract

Smart city initiatives increasingly claim to be citizen-centric, yet governance frameworks persistently conflate two analytically distinct concepts, citizen participation and citizen engagement, in ways that undermine the design and evaluation of civic involvement mechanisms. This conceptual ambiguity represents a structural problem in the field, not a transitional oversight, and carries direct consequences for how urban managers design governance instruments and measure their effectiveness. This study systematically examines the scope, definition, and operationalization of both concepts in smart city research through a Systematic Literature Review (SLR) following the SPAR-4-SLR protocol. A corpus of 43 peer-reviewed articles published between 2011 and 2025, retrieved from Scopus and Web of Science, was subjected to qualitative content analysis using a structured coding framework. Findings reveal that 53% of reviewed studies use participation and engagement interchangeably, a pattern that remains stable across all publication periods, confirming the structural rather than incidental nature of the ambiguity. Only 26% of articles establish a rigorous conceptual distinction and operationalize both terms through distinct analytical frameworks. The review further identifies a critical mechanism design gap: 30% of articles report no engagement mechanism whatsoever, and only 23% report outcomes with verifiable indicators. Based on these findings, this study proposes a conceptual framework that explicitly distinguishes participation, as a behavioral, often episodic act, from engagement, as a sustained, intrinsically motivated process characterized by genuine influence over governance outcomes. The framework offers researchers a theoretically grounded basis for construct differentiation and provides urban managers with actionable criteria for designing governance mechanisms that move beyond symbolic consultation toward authentic co-creation. Implications for digital governance research and smart city policy are discussed, with particular attention to underrepresented contexts in the Global South.

Keywords: smart cities; citizen engagement; citizen participation; urban governance; digital governance; sustainable urban development; SPAR-4-SLR; conceptual framework

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Academic Editor: Izabela Jonek-Kowalska

Received: 5 May 2026
Revised: 29 May 2026
Accepted: 3 June 2026
Published: 21 August 2026

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1. Introduction

Cities are gradually establishing a fruitful conversation with their citizens to better capture their needs and create mechanisms to stimulate co-creation processes with the

government through their engagement, with the ultimate goal of increasing quality of life and well-being [1,2]. Smart city initiatives are a way of increasing citizen engagement and empowerment [3,4], fostering collaborative approaches between government, citizens, and other stakeholders in addressing urban challenges [5].

Although smart city initiatives around the world claim to be citizen-centric, studies have shown that these claims are still based on a neoliberal and post-political conception of citizenship. Sometimes, citizens, their needs, and their experiences are not considered within the repertoire of public agents. Therefore, the challenge is to create truly citizen-centered smart cities, reshaping their political economy and the role citizens play in the design, development, and governance of projects [3]. This challenge has become increasingly urgent as smart city initiatives proliferate globally. Recent evidence suggests that while participatory mechanisms are widely implemented, questions persist about whether they generate genuine engagement or merely symbolic participation [6]. Understanding this distinction is essential as cities worldwide invest heavily in citizen-centric technologies and processes.

In the smart cities discourse, key topics include concepts of citizen involvement and engagement for the creation of smart city plans and project implementation [7,8]. This requires open participation, collaboration, and partnership between public authorities, the private sector, non-governmental institutions, schools, and citizens. The involvement of different actors in decision-making and public services, especially citizens, is essential for the development of a prosperous smart city [9]. Despite the recognized importance of engagement, there remains a limited understanding of the specific mechanisms, whether financial incentives, gamification, participatory processes, or technological platforms, that effectively foster sustained citizen involvement. Contemporary research reveals diverse approaches ranging from reward-based systems [10] to process-oriented strategies emphasizing intrinsic motivation [2,4], yet systematic comparison of their effectiveness remains scarce.

Studies on engagement are extensive and encompass various fields, such as sociology, marketing, political science, psychology, and organizational behavior [11]. However, the multiplicity of approaches makes it challenging for researchers and managers to access relevant content [12]. This is particularly significant in smart cities, where engagement is an essential element for development [13]. Although the concepts of citizen participation and engagement have been widely examined [14], they are still often used interchangeably, despite presenting significant differences [15]. Recent scholarship suggests that engagement encompasses deeper dimensions, including intrinsic motivation and genuine influence, differentiating it from the more behavioral act of participation [5,16].

Despite this growing recognition, the literature has yet to systematically examine the extent and structural consequences of this conceptual ambiguity. Existing reviews have analyzed ICT-enabled participation [17], mapped smart city governance mechanisms [18], and explored co-creation frameworks [19], but none have directly investigated how the conflation of participation and engagement shapes the design and evaluation of citizen involvement strategies across the field as a whole. This gap is not merely academic: urban managers who do not operationally distinguish between creating participatory channels and fostering genuine engagement risk investing in governance instruments that maximize visible metrics—platform registrations, consultation responses, event attendance, while failing to generate the sustained civic ownership that smart city initiatives require. Following Benbasat and Zmud's [20] critique of nominal approaches in IS research, this study argues that conceptual precision is a prerequisite for cumulative knowledge-building and evidence-based governance design.

This study addresses these gaps through a systematic literature review (SLR) of 43 peer-reviewed articles published between 2011 and 2025, a period that captures the full consolidation trajectory of smart city governance research, from its foundational frameworks to its current empirical maturation [21] following the SPAR-4-SLR protocol [22]. The objectives of this study are: (1) to examine the theoretical and practical relationship between citizen participation and engagement in smart city research; (2) to analyze the mechanisms employed to foster engagement and assess the evidence base for their effectiveness; and (3) to provide a conceptual framework that supports evidence-based governance design. Consequently, this study addresses the following research questions:

- RQ1: What are the conceptual and practical differences between citizen participation and engagement in smart cities?
- RQ2: What mechanisms have been employed to foster citizen engagement in smart city initiatives, and what patterns emerge regarding their implementation and effectiveness?

2. Materials and Methods

This study conducts a Systematic Literature Review (SLR) to examine the conceptual boundaries between citizen participation and engagement in smart cities. To ensure a rigorous, transparent, and replicable synthesis, we followed the SPAR-4-SLR (Scientific Procedures and Rationales for Systematic Literature Reviews) protocol, as proposed by Paul et al. [22]. Unlike traditional clinical protocols such as PRISMA, SPAR-4-SLR is specifically designed for social science and management research, offering a structured framework for qualitative conceptual analysis that accommodates interpretive coding and theory-building objectives.

The methodology was organized into three main stages: (1) Collection, (2) Purification, and (3) Evaluation.

2.1. Collection and Search Strategy

The search was performed in Scopus and Web of Science (WoS). These databases were selected because they represent the two primary global indexers of high-impact peer-reviewed research in urban governance, information systems, and public administration, the three disciplinary domains most relevant to this study. Together, they provide complementary coverage: Scopus offers a broader multidisciplinary reach, while WoS prioritizes journals with established impact metrics and longitudinal indexing. Both databases apply rigorous quality controls for journal inclusion, which justified their selection over grey literature repositories or single-discipline databases. It is acknowledged, however, that this choice may introduce a geographic bias toward Global North scholarship, as journals from Latin America, Africa, and Southeast Asia remain underrepresented in both indexers, a limitation explicitly discussed in the findings. The search string was designed to capture the intersection of smart cities with the constructs of participation and engagement:

Search String: (“smart city” OR “smart cities”) AND (“citizen engagement” OR “citizen participation”).

Timeframe: 2011 to 2025. This period was selected because 2011 marks the consolidation of smart city research as a distinct field, anchored by foundational contributions such as Nam and Pardo’s [21] multidimensional framework integrating technology, people, and institutions, and the formal launch of major smart city programs in Europe and North America. Examining this full 14-year window allows the study to trace structural patterns of conceptual treatment across distinct phases of the field’s development, from its exploratory origins to its current empirical maturation.

Language: English (to ensure international comparability).

Document Type: Peer-reviewed journal articles (Books, conference papers, and editorials were excluded to maintain the highest level of peer-reviewed evidence).

2.2. Purification and Selection Criteria

Following the initial collection, the results underwent a purification process based on specific inclusion (IC) and exclusion (EC) criteria:

IC1: Articles focusing on the role of citizens in smart city governance.

IC2: Studies discussing theoretical or practical dimensions of engagement or participation.

EC1: Articles that mention the terms only tangentially (e.g., technical papers on sensors without human-centric analysis).

EC2: Duplicate studies between databases.

Screening was performed by the lead author (K.E.B.). To ensure coding consistency, a 20% random sample of the screened records (n = 22) was independently reviewed by co-author E.M.L., with disagreements resolved by consensus.

2.3. Evaluation and Data Analysis

The final corpus of 43 articles was subjected to qualitative content analysis [17,23], focusing on how each study defined, operationalized, and distinguished, or failed to distinguish, "participation" and "engagement." Data extraction followed a standardized coding sheet including: (a) geographic focus; (b) conceptual definitions; (c) mechanisms of involvement; and (d) governance models. To ensure coding transparency and reproducibility, a structured codebook was developed prior to analysis, defining the criteria for each conceptual category as follows: (1) Interchangeable use: the article employs "participation" and "engagement" as synonyms without acknowledging conceptual differences or providing distinct operationalizations; (2) Participation framed as engagement: the article labels its object as "participation," yet the phenomena described sustained involvement, intrinsic motivation, co-creation, emotional investment—align with the theoretical definition of engagement; (3) Conceptual inversion: the article employs engagement-oriented terminology to describe phenomena that are episodic, behavioral, and externally motivated, characteristics of participation rather than engagement; (4) Rigorous distinction: the article explicitly defines both constructs, operationalizes them through separate analytical frameworks, and maintains this distinction consistently throughout. Coding was conducted by the lead author and subsequently reviewed by co-author Edimara Mezzomo Luciano, who assessed a random sample of 20% of the corpus (9 articles) in her capacity as doctoral supervisor, mitigating interpretive bias and strengthening reproducibility through consensus-based resolution of disagreements [17]. While a corpus of 43 articles may appear modest, it reflects the precision of the inclusion criteria: the search was designed to capture studies that substantively address both constructs as analytical objects, consistent with SPAR-4-SLR guidelines prioritizing analytical depth over corpus size [22,24].

The comprehensive execution of this systematic review, including the specific transitions between each phase of the SPAR-4-SLR framework, is synthesized in Figure 1. The diagram details the flow from the initial **Assembly** of research questions and sources through the **Acquisition** phase, where the initial 157 records were refined to the final 43 articles. Furthermore, it illustrates the **Purification** criteria applied, the **Organization** and **Validation** strategies used for content analysis, and the final **Communication** of findings, including identified limitations regarding conceptual confusion and geographic bias.

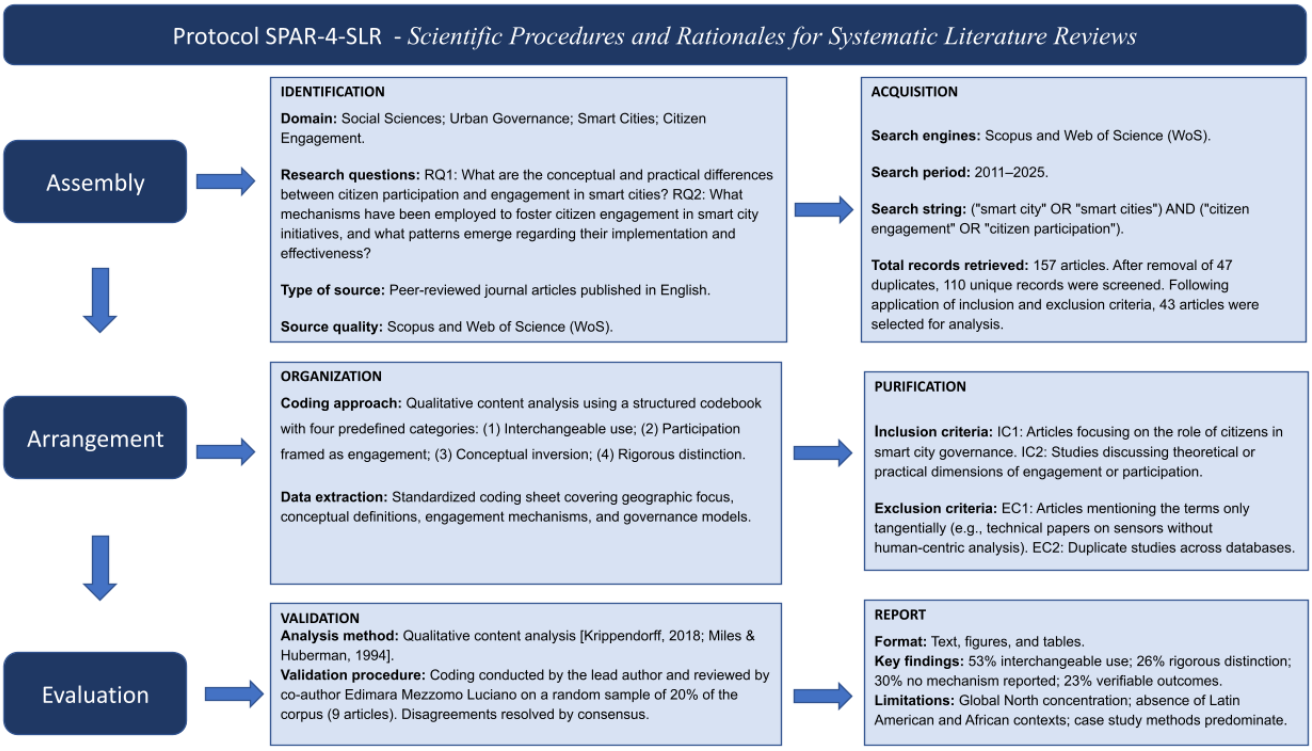


Figure 1. Systematic Literature Review flowchart based on the SPAR-4-SLR protocol [17,23] detailing the selection of articles on citizen engagement in smart cities.

3. Results

In addition to the SPAR-4-SLR protocol, this review adheres to the PRISMA 2020 reporting guidelines [25]. No protocol was formally registered prior to the review. The PRISMA 2020 flow diagram illustrating the selection process is presented in Figure 2. The completed PRISMA 2020 checklist is provided as Supplementary Materials.

The database search retrieved 157 records from Scopus and Web of Science combined. After removal of 47 duplicates, 110 unique records were screened by title and abstract. Following application of the inclusion and exclusion criteria (IC1, IC2, EC1, EC2), 43 articles were retained for full-text analysis and included in the final synthesis. The complete selection process is illustrated in Figure 2.

The 43 articles reviewed in this study were drawn from diverse geographic contexts spanning Europe, North America, Asia, the Middle East, and Oceania, demonstrating that citizen engagement in smart cities has attracted scholarly attention across a wide range of cultural, institutional, and political settings. Studies from the Global North predominate in the corpus, while Latin America remains largely underrepresented: Brazil appears as one of the contexts analyzed in Przeybilovicz et al. [1], a multiple case study covering Curitiba alongside other international settings, but no other Latin American country features as a primary study context. African contexts are entirely absent. This geographic concentration underscores both a limitation of the existing literature and a significant opportunity for future research in regions with distinct governance structures, cultural contexts, and smart city development trajectories.

The corpus also reveals a marked temporal concentration: the majority of reviewed articles were published between 2020 and 2025, reflecting the acceleration of the global smart city agenda and the governance challenges brought by the COVID-19 pandemic. Table 1 presents the details of each article, including authorship, research goal, methodology, and conceptual focus. Tables 2–6 provide an analytical synthesis across four dimensions: geographic and temporal distribution, research methods, thematic focus, and conceptual

treatment of engagement and participation, offering a structural overview of the field before the detailed findings are discussed in the subsequent section.

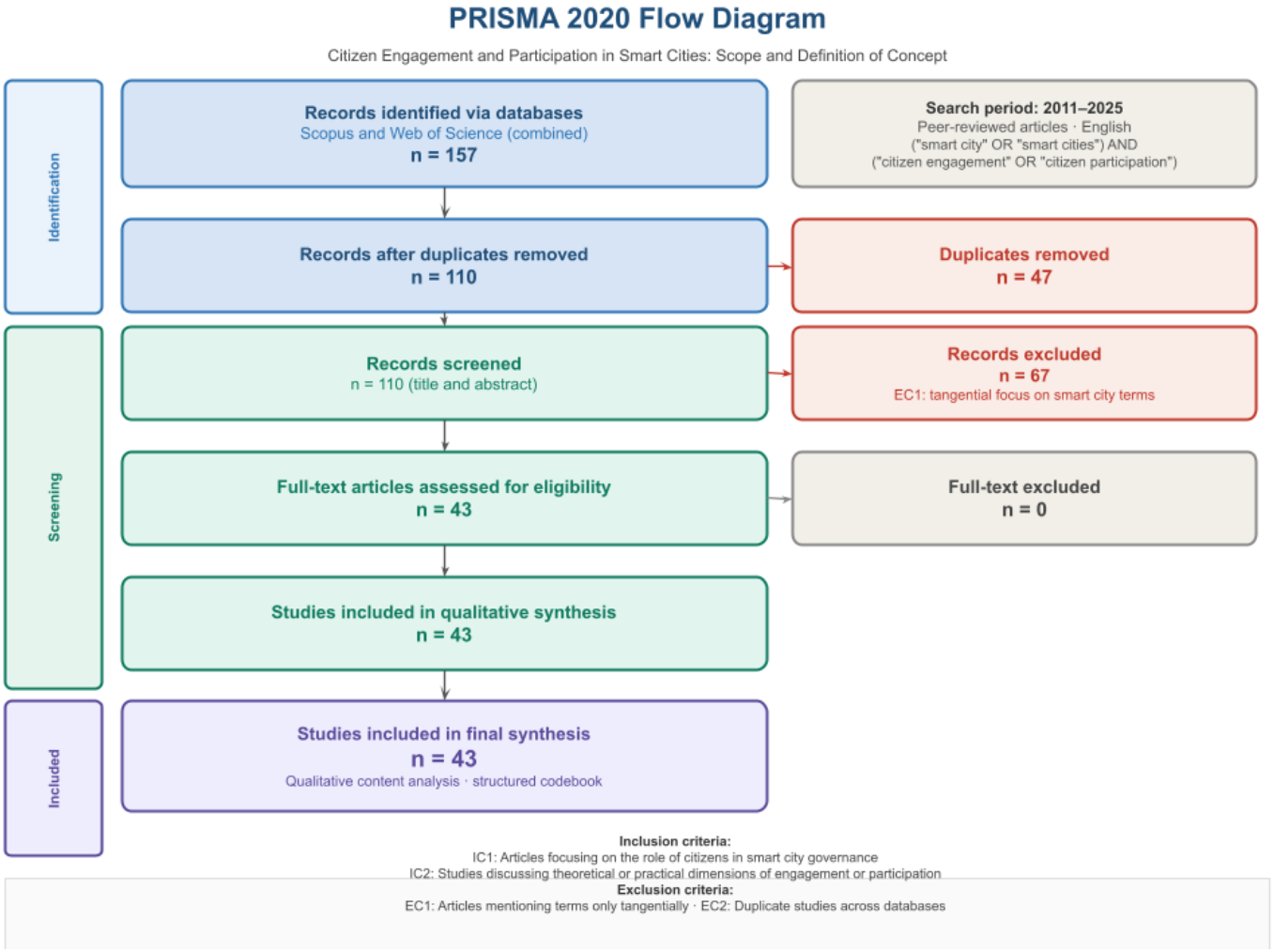


Figure 2. PRISMA 2020 [25] flow diagram illustrating the systematic literature review selection process. Source: Prepared by the authors following Page et al. (2021) [25].

Table 1. Article data.

No.	Author (Year)	Goal	Method	Conceptual Focus of the Paper
1	**Blasi et al. [1]**	To investigate the social media platform Twitter through data mining, to get insights into various aspects of citizen engagement.	Multiple case studies	City Size (higher engagement in smaller cities). Engagement associated with Tolerance Levels. Engagement associated with Technology Level.
2	**Chantry [14]**	To enhance empirical and theoretical advances in assessing citizens' participation in Quayside, by using the framework proposed by Cardullo and Kitchin [3].	Case study	Engagement as occupation of Multiple Political Spaces. Post-Political Areas of Engagement. New Heuristic for comparing initiatives.
3	**Przeybilovicz et al. [26]**	To understand how citizens participate in Smart City initiatives, especially in cases where collaboration with local government is facilitated by ICTs.	Multiple case study	Governance Mode and Social/Institutional Context. Formation of Participation Patterns. Smart City initiatives facilitated by ICTs.

Table 1. *Cont.*

No.	Author (Year)	Goal	Method	Conceptual Focus of the Paper
4	**Cavalheiro et al. [27]**	To investigate whether the implementation of a smart city initiative in a tourist destination has helped change it into a smart tourist destination.	SLR	Implementation of ICTs vs. Citizen Engagement. Inhibitory factors (Political Instability and Ineffective Tourism Management). Smart City in a Tourist Destination.
5	**Zhu et al. [28]**	To analyze how the quality of services in a smart city affects citizen engagement during a public emergency, such as the COVID-19 pandemic.	Multiple case study	Implementation of ICTs vs. Citizen Engagement. Inhibitory factors (Political Instability and Ineffective Tourism Management). Smart City in a Tourist Destination.
6	**Bricout et al. [29]**	To analyze critically how the use of technology affects the potential for engagement, especially of individuals with disabilities, in a smart city.	Case study	Use of Technology and Inclusion (People with Disabilities). Three Synergistic Outcomes for Sustainability (Engagement, Evaluation, and Leadership). Smart and Inclusive Technologies.
7	**Clarinval et al. [30]**	To understand how public exhibitions can encourage citizen participation in urban issues.	SLR	Best Practices and Lessons Learned. Encouraging Participation in Urban Issues.
8	**Cortés-Cediel et al. [24]**	To analyze citizen participation and engagement in European smart cities.	Multiple case study	Participatory Democracy and Collaborative Governance. Citizen Innovation. Relationship between Digital Technologies and Participation.
9	**Csukás et al. [31]**	To investigate the presence of value proposition components in smart city activities, in six cities known for their excellence in these initiatives.	Multiple case study	Value Proposition and Engagement Levels. Cities with Advanced Technology and Engagement/Knowledge Sharing.
10	**Karatzimas [32]**	To investigate the impact of government accounting knowledge on enhancing smart citizenship and improving citizen engagement.	Multiple case study	Smart Citizenship. Government Accounting Knowledge. Social Innovation and Co-production of Public Value.
11	**Mohseni [33]**	To propose a model for understanding the level of citizen power as a dimension of public engagement.	Grounded Theory	Level of Citizen Power and Public Engagement. Maximum Engagement via focus on Quality of Life and Inclusion. Hierarchical Power Distribution and Violation of Rights.
12	**Shin et al. [34]**	To examine citizens' ability to use seven new technologies that could be implemented in future smart cities.	Case study	Digital Divide: Access, Quantitative Use, and Engagement. Digital Exclusion and Impacts on individuals' lives.
13	**Allen et al. [35]**	To investigate and analyze the use and effects of various public engagement platforms within the framework of local government.	Field study	Relationship between Engagement Platforms, Active Citizenship, and Local Governance. Concepts: Inclusion, Accessibility, Representation, and Social Justice.
14	**Cravero [36]**	To analyse and discuss the main characters of Serious Games, to understand the several possibilities and application fields where they can be applied, discovering their potentiality towards sustainability issues.	SLR	Use of Serious Games for Citizen Participation. Strategies: Gamification, Co-creation, Game-Based Learning. Bottom-Up Approach in Urban Planning.
15	**Goodman et al. [37]**	To investigate the extent of public engagement in the 'smart' development process.	Case study	Importance of Participation in Planning Smart City Solutions. Participation viewed as a Top-Down tool by local governments.
16	**Johnson et al. [38]**	To examine citizen engagement in the process of developing smart city initiatives.	Multiple case study	Citizen Engagement in Traditional Forms (meetings, workshops). Contrast with the use of Innovation, Apps, and Social Media.
17	**Levenda et al. [39]**	To explore two case studies in the city of Calgary that used technology to enhance public engagement.	Multiple case study	Need to Rethink Participation in Urban Governance. Digital Technologies change the citizen's role to Co-creator.

Table 1. *Cont.*

No.	Author (Year)	Goal	Method	Conceptual Focus of the Paper
18	**Ranchordás [40]**	To analyze how smart city technologies can be used to collect and analyze data on citizens' behavior, and explore the potential of using 'nudges' to influence that behavior.	SLR	Use of 'Nudges' (Data-driven pushing). Alignment with Consensus and Democratic Legitimacy. Concerns with Data Security and Privacy.
19	**Artopoulos et al. [41]**	To provide a critical and reflective overview of the role of smart city technologies in historic cities, and explore their effective use for improving participatory urban planning in those cities.	SLR	Application of Data Technologies in Historic Cities. Challenges and Opportunities for Participatory Urban Governance.
20	**Bouzguenda et al. [42]**	To identify the role of Information and Communication Technology (ICT) in citizen participation, as one of the main contributing factors to smart and sustainable cities.	SLR	Role of ICT in Citizen Participation. Relationship between Digital Citizen Capacity and Participation. Contribution of ICT to Social Sustainability via Digital Citizenship.
21	**Cardullo & Kitchin [3]**	To explore the role of citizens in smart city initiatives, and suggest an expansion of Arnstein's influential research.	Multiple case study	Framework for Citizen Participation in Smart Cities. Expansion of Arnstein's Research. Typology, Form, and Nature of Engagement.
22	**El-Haddadeh et al. [43]**	To examine the role of the perceived value of IoT for enhancing citizens' engagement in public services.	Case study	Perceived Value of IoT (Internet of Things). Citizen Empowerment (Sense of Empowerment). Engagement in Public Services.
23	**Xu & Zhu [44]**	To present a survey of the research literature and carry out an in-depth study on the experience of Smart Cities' initiatives in Europe.	SLR	Smart Cities Initiatives in Europe. Key Themes: Citizen Participation, Public–Private Collaboration, Innovation. Digital Transformation.
24	**Fredericks et al. [45]**	To investigate the use of participatory technologies for enhancing urban governance, and empower citizens and local communities to have an active voice in the process of city building.	Field study	Use of Participatory Technologies in Urban Governance. Value of Digital and Analog Engagement Channels. Empowerment of Citizens and Local Communities.
25	**Lim et al. [46]**	To identify the desired characteristics of citizens in citizen-centric smart cities, as well as discuss the obstacles to participation in smart city initiatives.	SLR	Desired Characteristics of the Citizen. Obstacles to Participation in Smart Cities. Actions to enhance participation in Citizen-Centric cities.
26	**Elaine & Leigh [47]**	To explore how higher education institutions can enhance their engagement with the community.	Case study	Engagement of Higher Education Institutions (HEIs) with the Community. HEI Relevance to Community Needs.
27	**Granier & Kudo [48]**	To examine the roles assigned to citizens and their actual engagement practices, in order to understand how they participate in smart city initiatives, including barriers and challenges.	Multiple case study	Assigned Roles vs. Citizens' Engagement Practices. Inclusive and Collaborative Strategies. Barriers and Challenges in Integration.
28	**Salim & Haque [49]**	To present a survey of approaches to citizen participation and the design of interactions with various urban areas.	Case study	Five-Step Strategy for Urban Engagement. Design of Interactions in the Urban Environment. Phases: Needs Identification, Stakeholders, Incentives, Evidence, and Tools.
29	**Bonsón et al. [50]**	To assess the influence of media and content formats on stakeholder engagement on Facebook pages of local governments, in Western Europe.	Multiple case study	Influence of Media and Content Formats (Facebook). Engagement in Local Governments (Western Europe). Differences by Media/Content Type and Institutional Context.

Table 1. *Cont.*

No.	Author (Year)	Goal	Method	Conceptual Focus of the Paper
30	**Chadwick [51]**	To analyze and understand the factors that contributed to the failure of a specific online initiative for citizen engagement.	Case study	Failure of Online Initiatives for Engagement. Relationship between Institutional Structure/Operation and Success/Failure.
31	**Masso et al. [10]**	To explore how gamification can be used to encourage citizens to share micromobility data and contribute to sustainable urban planning, within the framework of the European data strategy.	Case study	Gamification and Civic Engagement. Micromobility and Urban Sustainability. Collaborative Governance and Open Data. Behavioral Change.
32	**Ruess & Müller [6]**	To interrogate co-creation practices and how they shape techno-social relations through the inclusion of the public in smart city contexts.	Case study	Co-creation and collaborative innovation. Urban governance and public participation. Responsible Research and Innovation (RRI). Socio-technical imagination and citizen agency in smart cities.
33	**Relvas et al. [52]**	To explore the role of social innovation techniques, such as co-creation and participatory sensing, in citizen engagement and raising awareness about air pollution.	Case study	Air Quality. Low-Cost Sensors and IoT. Citizen Engagement and Smart Cities. Participatory Sensing. Social Innovation.
34	**Landa Oregi et al. [2]**	To explore how HCD (Human-Centered Design) applies specifically to citizen participation in different smart city contexts and to examine two case studies to examine the practical outcomes of such an application.	Survey	Human-Centered Design (HCD). Citizen-centered smart cities. Co-creation methods. Inclusion of older adults. Link between participatory design and policymaking.
35	**Nasifuhan et al. [53]**	To analyze the current situation, influencing factors, and governance strategies for stimulating citizen co-production in urban environmental governance stations, considering the context of smart cities and the 'Internet+ IoT' paradigm in China.	Survey	Digital environmental governance. Co-production and public participation. Smart and inclusive governance. Internet of Things (IoT) and 'Internet+'. Co-production theory and new public governance.
36	**Armaki & Roudi [54]**	To design a strategic model for minimizing urban solid waste management through maximum citizen and stakeholder participation in decision-making.	Case study	Strategic Model for Municipal Solid Waste Minimization (MSW). Emphasis on Public and Stakeholder Participation. Decision-making and Executive Systems of Waste Management.
37	**Hansen & Dahiya [55]**	To analyze the role of the Traffy Fondue digital platform as a tool for citizen engagement and urban co-production in smart cities, highlighting how the use of data and collective intelligence can improve the management of public services and urban planning in Bangkok (Thailand).	Case study	Citizen engagement in smart cities. Digital governance and urban co-production. Co-creation of public value and collective intelligence. Urban data and participatory platforms.
38	**Kummitha [4]**	To examine how different governance models in smart cities shape active citizen engagement, investigating how citizens participate in the co-creation of public value, decision-making, and collaborative practices that characterize smart governance.	SLR	Smart city governance. Citizen engagement and participation. Co-creation of public value. New Public Service (NPS) paradigm. Collaborative governance models (embedded, blended, and networked).
39	**Choo et al. [5]**	To investigate how Living Labs can serve as effective mechanisms for citizen engagement in smart city planning, analyzing practical cases in South Korea.	Multiple case study	Smart cities and participatory governance. Living Labs and co-creation of urban solutions. Social innovation and co-production of public value. Citizen engagement and quadruple helix.

Table 1. *Cont.*

No.	Author (Year)	Goal	Method	Conceptual Focus of the Paper
40	**Jung & Kang [16]**	To propose a new theoretical framework for 'smart engagement' that combines technological innovation with democratic deliberation and urban justice.	SLR	Citizen engagement in data-driven cities. Smart urbanism and digital governance. Deliberative democracy and urban justice. Data ethics and inclusive participation.
41	**Alamoudi et al. [56]**	To examine the impact of the Level of Citizen Participation (NPC) on the Results of Sustainable Smart Cities (RCSI).	Survey	Smart sustainable cities (SSC). Citizen participation (CPL). Participatory urban governance and accountability. Transparency and social inclusion. Relationship between public participation and urban sustainability.
42	**Correia et al. [57]**	Understanding how different population groups wish to participate and what barriers and perceptions influence engagement.	Survey	Citizen Participation and Urban Governance. Smart Cities and Co-production of Public Policies. Social Inclusion and Digital Engagement. Personalized Participatory Methodologies.
43	**Ricardo et al. [58]**	To complement existing methods with activities and work products that address the specific conditions of citizen-centered smart cities.	Case study	Citizen Participation and Value Co-creation. Development of ICT Products and Services. People-Centered Smart Cities Model (Smart City 3.0).

Source: Prepared by the authors based on survey data (2025).

Table 2. Distribution of reviewed articles by publication period and geographic region.

Period	n	Europe	North America	Asia	Middle East	Oceania	Multi-Country
2011–2015	3	2	—	—	—	—	1
2016–2019	9	2	—	1	—	1	5
2020–2022	18	2	5	1	1	—	9
2023–2025	13	4	—	3	2	—	4
Total	**43**	**10**	**5**	**5**	**3**	**1**	**19**

Source: Prepared by the authors based on survey data (2025).

- The 2011–2015 period is dominated by pioneering exploratory studies (Chadwick [35]; Bonsón et al. [34]; Salim and Haque [33]), all European or multi-country, focusing on social media and urban computing.
- The 2016–2019 period shows methodological and thematic diversification, with the emergence of the first SLRs on the role of ICTs in participation and the first conceptual frameworks (Cardullo and Kitchin [23]).
- The marked expansion from 2020 onwards likely reflects the acceleration of the global smart city agenda and the governance challenges brought by the COVID-19 pandemic, which intensified scholarly interest in citizen engagement mechanisms.
- The 2023–2025 period presents greater theoretical sophistication: five of the eleven articles with rigorous conceptual treatment (Finding 4) belong to this period, indicating the gradual maturation of the field.
- Case studies (single and multiple) predominate in the corpus, reinforcing the exploratory and context-specific character of the field. This methodological dominance partly explains the difficulty in comparing results and generalizing findings about engagement mechanisms.
- SLRs are distributed throughout the entire period; notably, the most recent examples (Jung and Kang [50]; Kummitha [48]) demonstrate the greatest conceptual rigor, suggesting that methodological and theoretical maturation are advancing in tandem.

- Surveys are a recent phenomenon (all from 2023 to 2025), indicating a transition toward quantitative and larger-scale approaches, potentially in response to growing criticism of the field's lack of empirical breadth.
- The complete absence of experimental methods, simulations, or longitudinal comparative analyses constitutes an identifiable methodological gap, limiting the field's capacity to establish causal relationships between engagement strategies and their outcomes.

Table 3. Distribution of reviewed articles by research method and publication period.

Research Method	Total	2011–2015	2016–2019	2020–2022	2023–2025	% Corpus	Trend
Systematic Literature Review (SLR)	10	—	4	4	2	23%	Consolidating
Multiple case study	12	1	2	8	1	28%	Comparative
Single case study	14	2	2	4	6	33%	Exploratory
Survey	4	—	—	—	4	9%	Emerging
Field study	2	—	1	1	—	5%	Stable
Grounded Theory	1	—	—	1	—	2%	Isolated

Source: Prepared by the authors based on survey data (2025).

Table 4. Distribution of reviewed articles by thematic focus and publication period.

Thematic Focus	Total	2011–2015	2016–2019	2020–2022	2023–2025	%
Governance/Institutional	15	—	1	9	5	35%
Technology/Platform	12	1	4	3	4	28%
Mechanisms/Incentives	10	—	3	3	4	23%
Social Inclusion	6	2	1	3	—	14%
Total	**43**	**3**	**9**	**18**	**13**	**100%**

Source: Prepared by the authors based on survey data (2025).

- Governance/Institutional is the dominant thematic focus across all periods, with a marked concentration from 2020 onwards, reflecting the growing centrality of participatory governance in smart city agendas following the COVID-19 pandemic.
- Technology/Platform studies are distributed throughout all periods, confirming that digital platforms have been a consistent feature of smart city engagement research since its earliest phase.
- Mechanisms/Incentives studies emerge predominantly from 2016 onwards, suggesting that practical questions about how to foster engagement only gained systematic scholarly attention after the initial conceptual and governance frameworks were established.
- Social Inclusion is the only thematic focus concentrated in the earlier periods (2011–2019), with no articles in 2023–2025, indicating that equity and accessibility concerns—prominent in early smart city discourse—have been partially displaced by governance and co-creation frameworks in more recent scholarship.

Table 5. Conceptual treatment of engagement and participation by publication period.

Conceptual Treatment	Total	2011–2015	2016–2019	2020–2022	2023–2025	%	Finding
Interchangeable use	23	2	5	9	7	53%	F1
Rigorous distinction	11	—	2	6	3	26%	F4
Participation framed as engagement	6	—	2	1	3	14%	F2
Conceptual inversion (engagement as part)	3	1	1	1	—	7%	F3

Source: Prepared by the authors based on survey data (2025).

- Interchangeable use predominates across all publication periods with no discernible trend toward reduction, confirming that terminological ambiguity is a structural feature of the field rather than an isolated oversight or transitional phase.
- Articles with rigorous conceptual treatment are concentrated from 2019 onwards, with a peak in 2023–2025, suggesting gradual but still incipient maturation of the conceptual standards of the field.
- Conceptual inversion (Finding 3—engagement practices labeled as participation) affects articles across three distinct periods: Salim and Haque [33], Yeh [59], and Przeybilovicz et al. [26]. Although the least frequent pattern, it is methodologically the most problematic, as it leads to misaligned measurement strategies and potentially suboptimal intervention design.
- Participation framed as engagement (Finding 2) occurs predominantly in governance and mechanisms studies, where genuinely engaging interventions are labeled "participation" due to terminological inheritance from public administration traditions.

Table 6. Cross-tabulation: thematic focus by conceptual treatment.

Thematic Focus	Interchangeable	Rigorous	Part. as Eng.	Conc. Inversion	Total
Governance/Institutional	7	5	1	1	15
Technology/Platform	6	3	2	1	12
Mechanisms/Incentives	4	2	4	—	10
Social Inclusion	5	1	—	—	6
Total	**23**	**11**	**6**	**3**	**43**

Source: Prepared by the authors based on survey data (2025).

- Governance/Institutional studies present the highest proportion of rigorous conceptual treatment, suggesting that researchers in this area are more attentive to conceptual distinctions, likely due to the stronger tradition of participatory democracy theory in public administration scholarship.
- Technology/Platform studies show the highest rate of interchangeable use, indicating that ICT and systems researchers tend to treat the concepts as operational equivalents within platform engagement frameworks.
- Mechanisms/Incentives is the only thematic focus without a majority of rigorously framed articles, with interchangeable use and participation-framed-as-engagement dominating—directly compromising the assessment of mechanism effectiveness reported in those studies.
- Social Inclusion concentrates interchangeable use, with only Shin et al. [34] offering a rigorous treatment, revealing that the digital equity agenda has yet to fully internalize the distinction between promoting access (participation) and fostering genuine belonging and influence (engagement).

4. Discussion

The findings of this systematic review reveal more than a terminological inconsistency: they expose a structural condition of smart city governance research. The persistent conflation of citizen participation and citizen engagement, documented across 53% of the reviewed articles and across all publication periods from 2011 to 2025, is not a transitional phase of an emerging field, nor a mere oversight by individual authors. It reflects deeper institutional and epistemological dynamics that shape how smart city initiatives are designed, evaluated, and legitimized.

Smart city governance operates predominantly within a managerial and technocratic logic that prioritizes measurable, auditable outputs [60,61]. Within this logic, participation

metrics, number of registered users, platform interactions, and consultation responses are structurally preferred over the more diffuse and harder-to-quantify dimensions of genuine civic engagement. Participation can be counted; engagement must be interpreted. This institutional incentive structure creates what Cardullo and Kitchin [3] termed "participation washing": the deployment of participatory rhetoric to legitimize governance decisions without substantively redistributing decision-making power to citizens. The conceptual ambiguity documented in this review is, in part, a reflection of this dynamic: when governance frameworks do not operationally distinguish between showing up and being meaningfully involved, the literature that studies those frameworks tends to reproduce the same conflation.

A second structural driver lies in the fragmented disciplinary landscape of smart city research. As documented in Table 3, the corpus spans governance studies, urban planning, information systems, and human–computer interaction, each with its own terminological traditions. Researchers trained in public administration traditions tend to default to "participation" as the umbrella term [59,62], while IS and HCI scholars treat both concepts as operational equivalents within platform engagement frameworks. A third and most consequential driver is the underdevelopment of engagement mechanism design: 30% of reviewed articles report no engagement mechanism whatsoever, and only 23% report outcomes with verifiable indicators. Without a precise definition of what engagement is, researchers and practitioners lack clear parameters for what mechanisms should produce, how their effects should be measured, and over what time horizon success should be assessed. The following six findings present the empirical evidence for this structural condition and its consequences for smart city governance research and practice.

4.1. Finding 1: Concepts of Participation and Engagement Used Interchangeably

As shown in Table 5, the most prevalent pattern across the corpus is the interchangeable use of 'participation' and 'engagement': 23 of the 43 reviewed articles (53%) employ these terms without explicit conceptual distinction. This pattern is not concentrated in any single period; it appears consistently from 2011 to 2025, confirming that terminological ambiguity is a structural feature of the field rather than a transitional phase. Representative examples illustrate the breadth of this pattern: Bonsón, Royo, and Ratkai [50] discuss "citizen engagement in social media," while other articles explore "engagement through games" [36], "engagement of people with disabilities in the use of technologies" [29], and "empowering communities through citizen engagement" [52]. Although the studies vary considerably in their objects of analysis, all use the two concepts interchangeably, making it difficult to compare constructs, evaluate outcomes, or accumulate cumulative knowledge across studies.

To deepen understanding of these concepts, we situate them within the broader literature. Arnstein [63] defined eight levels of citizen power through the ladder of citizen participation, from manipulation to citizen control, theorizing the gradient from symbolic inclusion to genuine decision-making authority. Pateman [64] grounded participation in the participatory democracy tradition, arguing it is not merely a legitimizing mechanism but an educational process that develops civic capacities and transforms passive individuals into active citizens.

Cardullo and Kitchin [3] later introduced more contemporary terminology fitting the smart city context, describing participation as a dynamic and continuous process increasingly mediated by digital platforms, while warning about the risk of "participation washing," where participatory rhetoric is used to legitimize decisions already made without effectively redistributing power.

Regarding citizen engagement, the literature presents several concepts focused on active and deep citizen involvement. Khan [65] described how individuals can engage different aspects of themselves (physical, cognitive, and emotional) in their performances. Nam and Pardo [21] defined engagement as the ability of citizens to participate actively in city governance and collaborate with other stakeholders to create innovative solutions. Chourabi et al. [66] described engagement as the active participation of citizens in the co-creation, implementation, and evaluation of urban policies and services, emphasizing the use of digital technologies to facilitate this interaction. Zarei and Nik-Bakht [12] proposed the concept of "urban cocreation," involving collaboration between citizens and governments facilitated by digital platforms. Although described by different terms, these concepts share the same essence: engagement encompasses a depth, continuity, and multidimensionality that participation alone does not capture.

4.2. Finding 2: Concepts of Participation Referred to as Citizen Engagement

Table 5 identifies a second and qualitatively distinct pattern: 6 articles (14%) employ the concept of participation in contexts where the phenomena studied actually align more closely with citizen engagement as theoretically defined in the literature. These articles, Fredericks et al. [45], Artopoulos and Costa [41], Levenda et al. [39], Correia et al. [57], Ricardo et al. [58], and Armaki and Roudi [54] address urban interventions, adoption and use of new digital public services, and contexts where individuals were actively involved in the cocreation, coproduction, and coimplementation of projects. Rather than focusing on the concept of engagement, which requires deeper and more comprehensive citizen involvement considering motivations and capabilities, these articles addressed the phenomena through the narrower lens of participation, underestimating the depth of the processes they were actually studying.

This conceptual distinction is not merely semantic but reflects different levels of intensity and depth of citizen involvement [63]. Engagement implies continuous, multidimensional, and emotionally invested processes, while participation can be episodic and transactional. In smart city contexts, Cardullo and Kitchin [3] adapted Arnstein's taxonomy, warning that many technological initiatives promote only "digital tokenism", superficial forms of consultation that do not transfer real decision-making power to citizens. The choice of "participation" over "engagement" in these six articles may reflect: (i) the punctual nature of the studied interventions; (ii) limitations of digital platforms in capturing affective and motivational dimensions; or (iii) a more instrumental perspective of the citizen-government relationship. Levenda et al. [39] and Armaki and Roudi [54], for instance, document cases where smart city technologies were implemented with limited consultation, perpetuating top-down urban governance models.

4.3. Finding 3: Concepts of Engagement Used as Participation

The mirror image of Finding 2 is documented in Table 5 as conceptual inversion: 3 articles (7%), spanning three distinct periods, label engagement-oriented practices as 'participation', the inverse terminological slippage. Although the least frequent pattern in the corpus, conceptual inversion carries the highest methodological cost, as it directly undermines the measurement frameworks and intervention designs of the studies concerned. The three articles exhibiting this pattern are Salim and Haque [49], Yeh [59], and Przeybilovicz et al. [26], each exploring strategies that align more closely with citizen engagement as theoretically defined, yet systematically framing them as participation. The temporal distribution (2015, 2017, and 2022) demonstrates that conceptual inversion is not confined to the earlier phase of the field but persists into more recent scholarship.

The three studies exhibit distinct characteristics that warrant engagement rather than participation framing. Salim and Haque [49] examined continuous interaction patterns, technological appropriation, and behavioral changes, dimensions requiring the sustained commitment and emotional investment characteristic of engagement. Yeh [59] addressed active contributions to data generation and service co-design. Przeybilovicz et al. [26] investigated motivational factors, capability development, and long-term commitment, all hallmarks of engagement frameworks [11].

This conflation may stem from several factors. First, the engagement literature emerged more prominently in marketing, education, and organizational studies before being adapted to civic contexts, potentially creating unfamiliarity among urban studies scholars who default to the more established "participation" terminology. Second, some research traditions, particularly in European governance studies, have historically privileged "participation" as the umbrella term for all forms of citizen involvement [67]. Third, the sociotechnical complexity of smart city platforms may blur conceptual boundaries. This conceptual confusion carries significant implications: theoretically, it impedes the development of cumulative knowledge; methodologically, participation metrics (attendance numbers, comment submissions) inadequately capture engagement dimensions such as emotional connection and sustained behavioral change; practically, policymakers may design interventions based on participation assumptions when engagement mechanisms are required, leading to suboptimal outcomes [3]. Future research should adopt what Sartori [68] termed conceptual precision, drawing on established frameworks from civic engagement theory [59,68] and explicitly justifying terminological choices.

4.4. Finding 4: Appropriate Conceptual Distinction and Operationalization

As Table 5 shows, only 11 of the 43 reviewed articles (26%) demonstrate rigorous conceptual treatment, explicitly distinguishing citizen engagement from citizen participation and operationalizing each through distinct analytical frameworks and measurement strategies. Significantly, this cluster is concentrated from 2019 onwards, with a peak in 2023–2025 (5 articles), suggesting that conceptual maturation is a recent and still incipient development. The eleven studies are: Granier and Kudo [48], El-Haddadeh et al. [43], Goodman et al. [37], Johnson et al. [38], Ranchordás [40], Mohseni [33], Shin et al. [34], Zarei and Nik-Bakht [12], Zhu et al. [28], Hansen and Dahiya [55], and Kummitha [4]. These studies not only recognized conceptual differences but operationalized them through specific measurement strategies—a critical step that the majority of the corpus fails to take.

Early foundational studies (2016–2019) established important groundwork, investigating how ICT facilitates citizen transition from passive consumers to active co-producers [45,69]. Studies on governance and institutional frameworks (2020–2021) advanced understanding of structural prerequisites: [38] Johnson, Acedo, and Robinson (2020) explicitly differentiated participation (episodic involvement) from engagement (sustained relationships with emotional investment), operationalizing engagement through indicators such as interaction frequency, communication diversity, and evidence of responsive governmental action. Ranchordás [40] examined the ethical implications of nudges for citizen engagement; Mohseni [33] identified institutional prerequisites for sustained civic involvement. Research addressing inclusion and equity (2020–2022) demonstrated that ICT implementation does not necessarily increase engagement, governance quality and local context emerged as more significant determinants [26,33,36]. Recent comprehensive frameworks (2021–2025) synthesized multidisciplinary perspectives: Kummitha [4] defined engagement as a process whereby citizens address social problems through continuous innovation and collaboration to co-create public value, proposing three governance models: embedded (citizen-led), blended (citizen-corporate), and networked (multi-stakeholder co-creation).

These eleven studies share distinctive characteristics: they ground definitions in multidisciplinary engagement theory; employ multidimensional measurement capturing cognitive, emotional, and behavioral dimensions; recognize the continuous nature of citizen-government interactions; and critically examine contextual factors. However, they also identify persistent challenges: the digital divide remains a significant barrier to inclusive engagement, and engagement may be staged or deprioritized during implementation phases. The question of who is not engaged remains critical, as digital, socioeconomic, and educational exclusions may be amplified by supposedly democratizing technologies. Smart city frameworks must address these gaps through multi-channel participation strategies, multilingual accessibility, and inclusive design.

4.5. Finding 5: Scarce and Superficial Description of Engagement Mechanisms in the Literature

The analysis of engagement mechanisms across the 43 reviewed articles reveals a twofold gap documented in Tables 7–9: a quantitative gap, 13 articles (30%) do not reference any mechanism whatsoever and a qualitative gap, of the 30 articles that do reference strategies, only 10 (23%) report outcomes with verifiable indicators. Together, these gaps confirm that the literature on citizen engagement in smart cities is systematically unable to answer the most basic operational questions: what mechanisms were used, for whom, for how long, and with what measurable effect.

Table 7. Typology of citizen engagement mechanisms identified in the reviewed literature.

Type	Category	2011–2015	2016–2019	2020–2022	2023–2025	Total	%
A	Financial Incentives	—	1	—	—	1	2%
B	Non-financial Behavioral (Nudges/Gamification)	1	1	2	1	5	12%
C	Process-based/Co-creation	—	—	3	6	9	21%
D	Technology-mediated Platform	4	3	4	2	11	26%
E	Governance-based/Institutional	—	—	1	3	4	9%
—	Not reported	1	4	8	1	13	30%

Source: Prepared by the authors based on survey data (2025). Type A = Financial Incentives; Type B = Non-financial Behavioral (nudges/gamification); Type C = Process-based/Co-creation; Type D = Technology-mediated Platform; Type E = Governance-based/Institutional.

Table 8. Distribution of mechanism types by publication period.

Type	Category	2011–2015	2016–2019	2020–2022	2023–2025	Total	%
A	Financial	—	1	—	—	1	2%
B	Nudge/Gamif.	1	1	2	1	5	12%
C	Process/Co-creation	—	—	3	6	9	21%
D	Technology	4	3	4	2	11	26%
E	Governance	—	—	1	3	4	9%
—	Not reported	1	4	8	1	13	30%

Source: Prepared by the authors based on survey data (2025).

Before examining these gaps in detail, a typological framework organizes the diversity of strategies encountered across the corpus. Drawing on the mechanisms identified across the 43 articles, five distinct categories emerge, differentiated by their motivational basis, extrinsic versus intrinsic, the type of citizen action they seek to elicit, and their relationship to the conceptual distinction between participation and engagement established in this study.

Table 9. Mechanism types by quality of outcome reporting and key limitations.

Type	Category	Measured Outcome	Partial/Qualitative	Not Reported	Key Limitation
A	Financial	1	—	—	Effectiveness linked to cultural context, not incentive per se
B	Nudge/Gamification	1	4	—	Sustainability after rewards removed; privacy concerns
C	Process/Co-creation	1	8	—	Time-intensive; specialist skills required; risk of exclusion
D	Technology-mediated	4	7	—	Does not guarantee engagement without institutional trust
E	Governance-based	3	1	—	Requires genuine power-sharing; risk of procedural legitimation
—	Not reported	—	13	—	No basis for mechanism design or evaluation

Source: Prepared by the authors based on survey data (2025). 'Measured outcome' = results reported with verifiable indicators or statistical evidence; 'Partial/qualitative' = results described without formal metrics.

4.5.1. A Typology of Citizen Engagement Mechanisms in Smart Cities

Type A mechanisms (Financial Incentives) are the least frequent in the corpus, characterized by the offer of direct material rewards in exchange for citizen participation in urban co-production initiatives. Type B mechanisms (Non-financial Behavioral) encompass nudges and gamification, strategies that leverage behavioral economics and game design to influence citizen action without direct monetary compensation [10,39,41]. Although they are the only extrinsic mechanisms with more detailed empirical documentation, their counterintuitive results are addressed in Finding 6. Type C mechanisms (Process-based/Co-creation) represent the largest and most theoretically coherent category, encompassing Human-Centered Design [2], Living Labs [5], participatory sensing [52], co-creation frameworks [6,57], and hybrid participation approaches [38]. These strategies share a common orientation toward intrinsic motivation. However, critical examination reveals an important caveat: co-creation processes can become mechanisms of technological or procedural legitimation when predetermined agendas constrain citizen agency [6]. Type D mechanisms (Technology-mediated Platforms) are the most frequently identified category, including digital governance platforms [55], IoT-based public services [43], social media channels [50], and digital engagement apps. This category occupies an intermediate position in the extrinsic–intrinsic spectrum: platform utility serves as an implicit motivator, but effectiveness depends heavily on institutional trust and digital literacy. Type E mechanisms (Governance-based/Institutional) are the most recent to emerge in the corpus, all published from 2023 onwards, reflecting a paradigmatic shift toward treating governance design itself as the most durable mechanism for fostering authentic citizen engagement.

4.5.2. The Quantitative Gap: Scope of Mechanism Non-Reporting

Of the reviewed articles, a substantial share do not reference any mechanism or incentive strategy for fostering citizen engagement. This absence is concentrated among studies whose primary methodology does not require intervention design, including theoretical frameworks [16,32], retrospective institutional analyses [3,14,36], and SLRs focused on conceptual mapping rather than mechanism identification. This methodological pattern partly explains, but does not fully justify, the gap, as even retrospec-

tive and conceptual studies could document the mechanisms employed in the initiatives they analyze.

- Extrinsic mechanisms (Types A and B) are concentrated in the earlier periods (2011–2019), reflecting an initial phase where engagement was conceptualized primarily as a behavioral challenge addressable through incentives and nudges.
- Process-based and governance-based mechanisms (Types C and E) emerge predominantly from 2020 onwards, signaling a paradigmatic shift toward intrinsic motivation, co-design, and institutional trust as the primary levers for sustainable engagement.
- Technology-mediated mechanisms (Type D) appear throughout all periods, confirming that digital platforms have been a constant feature of smart city engagement strategies, though with evolving sophistication—from early social media analysis [49,50] to integrated urban co-production platforms [55].
- Non-reporting (Type—) is stable across periods, suggesting that the structural tendency to omit mechanism description has not diminished despite the field's maturation, indicating a disciplinary convention rather than an isolated methodological oversight.

4.5.3. The Qualitative Gap: Depth of Mechanism Description

Among the articles that do reference a mechanism or strategy, the depth of description varies considerably. Table 9 cross-tabulates mechanism type with the quality of outcome reporting, revealing that measured outcomes, defined as results reported with verifiable indicators, statistical correlations, or documented empirical evidence, are concentrated in specific categories and largely absent from others.

The most analytically robust studies are: Masso et al. [10], with quantified participation data (422 participants, 38,000 cycling sessions, 237,941 km of data); Bonsón et al. [50], with media-type predictors of engagement; Johnson et al. [38], with operational indicators distinguishing episodic participation from sustained engagement; Kummitha [4], with a governance model framework validated across multiple cases; and Alamoudi et al. [56], with empirical correlations between participation levels and smart city sustainability outcomes.

- Process-based mechanisms (Type C), despite being the most theoretically developed category, present the weakest outcome documentation. This reflects a structural challenge: co-creation and HCD processes generate outcomes that are inherently multidimensional and difficult to quantify, yet the field has not developed standardized measurement frameworks capable of capturing their complexity.
- The absence of standardized measurement frameworks for co-creation processes represents the most urgent challenge for the field's consolidation: without shared criteria for what constitutes a successful engagement outcome, the accumulation of comparative knowledge remains structurally limited.

4.5.4. The Structural Connection Between Conceptual Ambiguity and Mechanism Underdevelopment

The gaps identified in Findings 1 through 4—the widespread conflation of participation and engagement and the mechanism underdevelopment documented here—are not independent phenomena. They share a common structural root: without a precise definition of what engagement is (as opposed to participation), researchers and practitioners lack clear parameters for what mechanisms should produce, how their effects should be measured, and over what time horizon success should be assessed. A mechanism designed to increase participation—to generate attendance, form submissions, or platform registrations—is fundamentally different from a mechanism designed to foster engagement—to develop

intrinsic motivation, sense of ownership, and genuine influence over decisions. Conflating the two at the conceptual level inevitably produces confusion at the operational level.

This observation reinforces the contribution of the conceptual model proposed in this study and underscores the practical implications of terminological precision: smart city managers who design engagement strategies without distinguishing between participation and engagement risk deploying mechanisms that maximize visible metrics while failing to achieve the deeper civic involvement that sustainable urban governance requires. Table 10 consolidates this evidence, illustrating that the gap between mechanism description and outcome measurement is consistent across all five typological categories identified in this study.

Table 10. Engagement mechanisms reported across all 43 reviewed articles.

#	Author (Year)	Type	Mechanism/Strategy	Nature	Outcome
1	Blasi et al. [1]	D	Social media platform (Twitter)—data mining	Contextual	Partial
2	Chantry [14]	—	Not reported	None	Partial
3	Przeybilovicz et al. [26]	D	ICT platforms for smart city participation (studied, not applied)	Contextual	Partial
4	Cavalheiro et al. [27]	—	Not reported	None	Partial
5	Zhu et al. [28]	E	Service quality and responsiveness of smart city systems	Intrinsic	Measured
6	Bricout et al. [29]	C	Inclusive technology design for people with disabilities	Intrinsic	Partial
7	Clarinval et al. [30]	C	Public exhibitions as participation spaces	Intrinsic	Partial
8	Cortés-Cediel et al. [24]	—	Not reported	None	Partial
9	Csukás et al. [31]	—	Not reported	None	Partial
10	Karatzimas [32]	—	Not reported	None	Partial
11	Mohseni [33]	—	Not reported (theoretical model)	None	Partial
12	Shin et al. [34]	—	Not reported (barrier analysis)	None	Partial
13	Cho et al. [5]	D	Digital public engagement platforms	Contextual	Partial
14	Cravero [36]	B	Serious games and gamification for participation	Extrinsic	Partial
15	Goodman et al. [37]	—	Not reported (participation as top-down tool)	None	Partial
16	Johnson et al. [38]	C	Traditional meetings, workshops, apps and social media (hybrid)	Intrinsic	Measured
17	Levenda et al. [39]	D	Digital technologies to enhance public engagement	Contextual	Partial
18	Ranchordás [40]	B	Nudges (data-driven behavioral nudging)	Extrinsic	Partial
19	Artopoulos et al. [41]	D	Data-driven processes in participatory urbanism	Contextual	Partial
20	Bouzguenda et al. [42]	D	ICT role in citizen participation (studied, not applied)	Contextual	Partial
21	Cardullo & Kitchin [3]	—	Not reported	None	Partial
22	El-Haddadeh et al. [43]	D	IoT-based public services (perceived value as motivator)	Intrinsic	Measured
23	Xu & Zhu [44]	—	Not reported	None	Partial
24	Fredericks et al. [45]	B	Nudges via analog/digital media and urban sensors	Extrinsic	Partial
25	Lim et al. [46]	—	Not reported	None	Partial
26	Elaine & Leigh [47]	—	Not reported	None	Partial
27	Granier & Kudo [48]	A	Financial incentives for energy co-production	Extrinsic	Measured

Table 10. *Cont.*

#	Author (Year)	Type	Mechanism/Strategy	Nature	Outcome
28	Salim & Haque [49]	B	Urban computing and sensors for route mapping (nudge-type)	Extrinsic	Partial
29	Bonsón et al. [50]	D	Facebook as engagement platform for local governments	Contextual	Measured
30	Chadwick [51]	D	Online initiative for citizen engagement (failed case)	Contextual	Measured
31	Masso et al. [10]	B	Gamification: rewards and competitive comparisons for data sharing	Extrinsic	Measured
32	Ruess & Müller [6]	C	Co-creation processes in municipal governance	Intrinsic	Partial
33	Relvas et al. [52]	C	Participatory sensing and co-creation for air quality monitoring	Intrinsic	Partial
34	Landa Oregi et al. [2]	C	Human-Centered Design (HCD) for citizen participation	Intrinsic	Partial
35	Nasifuhan et al. [53]	D	Internet+ and IoT platform for co-production	Contextual	Partial
36	Armaki & Roudi [54]	E	Strategic participation model for waste management governance	Intrinsic	Partial
37	Hansen & Dahiya [55]	D	Traffy Fondue digital platform (Bangkok)	Intrinsic	Measured
38	Kummitha [4]	E	Governance models: embedded, blended and networked co-creation	Intrinsic	Measured
39	Choo et al. [5]	C	Living Labs as citizen engagement mechanisms	Intrinsic	Partial
40	Jung & Kang [16]	—	Not reported (theoretical framework only)	None	Partial
41	Alamoudi et al. [56]	E	Citizen participation framework (Vision 2030)	Intrinsic	Measured
42	Correia et al. [57]	C	Personalized participatory methodologies (unspecified type)	Intrinsic	Partial
43	Ricardo et al. [58]	C	Co-creation and value co-production (Smart City 3.0 model)	Intrinsic	Partial

Source: Prepared by the authors based on survey data (2025). Type A = Financial Incentives; B = Non-financial Behavioral; C = Process-based/Co-creation; D = Technology-mediated; E = Governance-based; — = Not reported. Outcome: Measured = verifiable indicators reported; Partial = described without formal metrics.

Future research should systematically document mechanism type, implementation context, participant demographics, duration, and measurable outcomes, not only to advance comparative knowledge in the field, but to ensure that the growing investment in smart city participation infrastructure translates into authentic democratic empowerment rather than sophisticated forms of consultation theater.

4.6. Finding 6: Reward Mechanisms Are Scarce and Yield Counterintuitive Results

As established by the typology presented in Finding 5, extrinsic mechanisms—Type A (Financial Incentives) and Type B (Non-financial Behavioral: nudges and gamification)—represent a minority of the corpus. Although they constitute the most intuitive approach to stimulating citizen engagement in smart cities, the analysis of their outcomes reveals a consistent and counterintuitive pattern: in none of the studied cases was the increase in engagement attributed directly to the incentive itself. Instead, contextual, cultural, and institutional factors emerged as more significant determinants, raising fundamental questions about the adequacy of reward-based models as a central engagement strategy.

4.6.1. Financial Incentives: Results Mediated by Context

Financial incentive mechanisms were identified in four articles [26,36,37,45], involving studies conducted in China, Canada, and Japan. In all cases, the increase in citizen engagement was not attributed to the financial incentive itself, but to system quality and the cultural context in which the initiatives were embedded.

Granier and Kudo [48] analyzed citizen participation in Japanese 'smart communities' where residents received financial incentives to co-create and distribute energy services. The primary motivating factor for engagement was the desire to contribute to society, not the material reward. Zhu et al. [28] demonstrated that smart city service quality, particularly system responsiveness and reliability, is the primary predictor of citizen engagement during public emergencies. Johnson et al. [38] found that despite offered incentives, citizens engaged more frequently through traditional approaches, meetings, roundtables, and workshops, suggesting that sustained engagement requires continuous interaction and a perception of genuine impact, not merely point-in-time rewards. Goodman et al. [37] reinforce this perspective, showing that ICT implementation alone does not automatically increase engagement, with governance quality and local context emerging as more significant determinants.

4.6.2. Nudges: Potential and Limits of Choice Architecture

Four articles document the use of nudges as a non-financial engagement mechanism [35,40,41,48], employing analog and digital media, digital platforms, gamification, and body sensors for urban planning processes. Ranchordás [40] examined the legal and ethical implications of data-driven nudges in smart city contexts, warning that although effective in the short term, these strategies raise serious questions about citizen autonomy, informed consent, and alignment with democratic legitimacy. The author argues that data-driven nudges, when used by governments without transparency about the criteria and algorithms involved, may constitute forms of behavioral manipulation incompatible with the conception of the citizen as an active agent rather than an object of intervention.

4.6.3. Gamification: The Most Documented Case and Its Contradictions

Gamification emerges as the extrinsic mechanism with the greatest empirical documentation in the corpus. Masso et al. [10] conducted the only study to report explicit quantitative participation data: gamification elements, rewards and competitive comparisons were used to engage 422 participants in micromobility data sharing, generating 38,000 cycling sessions and 237,941 km of collected data. Results demonstrated the gamification potential to stimulate voluntary data sharing and promote sustainable behaviors. However, the study also revealed critical challenges: first, privacy concerns from systematic collection of individual mobility data; second, institutional integration difficulties, as citizen-generated data was not fully incorporated into urban planning processes; and third, long-term sustainability concerns, as the study explicitly questions the viability of the incentive model once rewards are discontinued. This confirms that while gamification can effectively generate initial participation, its success as a mechanism of sustained engagement depends on careful design that addresses ethical concerns and ensures that the citizen-government bond does not dissolve with the end of rewards.

4.6.4. The Methodological Gap in Incentive Specification

Despite growing recognition of the potential role of incentive mechanisms, a persistent methodological gap limits the practical utility of available evidence. Nasifuhan et al. [53] acknowledge the need for differentiated incentive strategies tailored to different social profiles, recognizing that age, political affiliation, digital media literacy, and environmental

awareness influence participation behavior, yet fail to specify whether recommended incentives are financial, social, or structural in nature. Similarly, Correia et al. [57] identify significant differences in engagement preferences between socioeconomic segments, yet provide insufficient detail about the specific stimuli or incentives that might address these differences. This lack of specificity limits the practical applicability of these findings and hampers efforts to design evidence-based incentive programs.

4.6.5. The Role of Intrinsic Motivation and Social Value

The body of evidence on extrinsic mechanisms points to a conclusion that transcends the incentives question: sustained citizen engagement depends fundamentally on factors that cannot be replicated by material rewards. Intrinsic motivation, engaging for the pleasure and satisfaction inherent to the action rather than for external rewards, emerges as the most robust predictor of lasting involvement. It encompasses a sense of belonging, personal fulfillment, and the capacity to positively influence the community. Trust in government and perceived technological self-efficacy emerged as primary predictors of both engagement and participation success in smart city platforms [2], suggesting that investments in transparency, accountability, and citizen capacity-building may be as or more effective than direct incentives alone.

In summary, while financial and non-financial mechanisms such as nudges and gamification offer pathways to foster citizen engagement, their success is heavily conditioned by contextual factors, cultural values, trust in public systems, and the intrinsic motivations of individuals. The evidence underscores that sustainable engagement requires a multifaceted approach that goes beyond transactional incentives, integrating opportunities for meaningful participation and emphasizing the social value of individual contributions. The persistent methodological gap, where studies recognize the need for tailored incentives but fail to specify their nature, magnitude, or implementation strategies, underlines the urgent need for more rigorous documentation and evaluation of engagement mechanisms in smart city contexts.

4.7. Conceptual Synthesis: Distinguishing Engagement from Participation in Smart City Governance

The distinction between the concepts of engagement and participation is of paramount importance for understanding the complexity and dynamics of the relationship between citizens and public institutions, especially with regard to smart cities and political decision-making. The clarity of these two concepts allows for the identification and promotion of more effective and inclusive approaches to involve citizens in decision-making processes and the development of public policies. Figure 3 was created based on the Venn Diagram to provide a graphical representation that highlights the distinctions between the concepts of participation and engagement, thus providing a better perspective on the actors involved.

The literature review reveals considerable inconsistency in how these terms are used in smart city research, as documented by Findings 1 through 3. Participation tends to refer to the formal act of participating in civic activities, such as attending meetings, voting in consultations, submitting reports through digital platforms, or participating in workshops, emphasizing the behavioral dimension: whether citizens show up and contribute information through available channels. In contrast, engagement encompasses a deeper and more sustained connection, characterized by intrinsic motivation, emotional investment, active contribution to co-creation processes, and ongoing meaningful dialogue with public institutions. Engagement implies not only presence but also quality of involvement, the degree to which citizens feel ownership, have the power to act, and have genuine influence over outcomes. This distinction is illustrated by empirical findings showing that participation does not automatically translate into engagement: citizens may actively use digital

platforms (high participation) yet lack confidence that their contributions significantly influence decisions (low engagement).

In short, although often used synonymously, participation represents the behavioral act of taking part, while engagement encompasses the quality and depth of involvement, characterized by sustained commitment, a sense of ownership, and genuine influence on outcomes. Recognizing this distinction is essential for designing smart city governance that goes beyond symbolic consultation toward authentic co-creation and democratic empowerment.

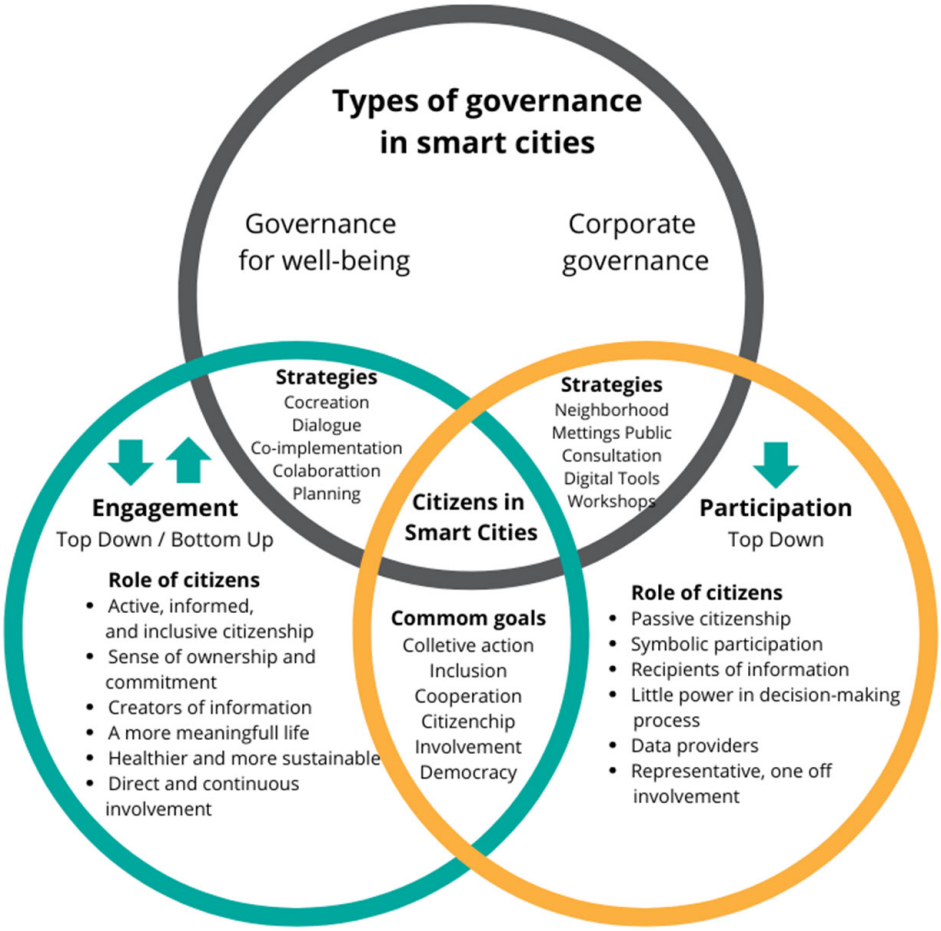


Figure 3. Distinguishing between the concepts of engagement and participation. Source: Prepared by the authors (2025).

Figure 3 integrates key elements drawn from governance typologies [70] and findings from the systematic analysis of the examined articles. The diagram illustrates how engagement and participation operate within two primary governance frameworks in smart cities: governance for well-being and corporate governance. Cornwall [71] observed that engagement represents a deeper and more active involvement of citizens in the decision-making process, covering intrinsic motivation, collaborative learning, and empowerment. Recent scholarship reinforces this view, proposing that genuine engagement integrates three critical dimensions: informational (access and comprehension of data), interactive (deliberation and cocreation), and institutional (real influence on decisions), distinguishing it from conventional participation [16].

As depicted in Figure 3, engagement is characterized by bidirectional flow (both top-down and bottom-up initiatives), positioning citizens as active, informed, and inclusive participants who assume a sense of ownership and commitment. Voorberg, Bekkers, and Tummers [19] mention co-creation, co-production, and co-implementation projects, strate-

gies explicitly represented in the engagement circle. Contemporary research confirms that such collaborative approaches, when supported by genuine institutional infrastructure and trust, prove most effective in fostering sustained citizen involvement [4]. In contrast, participation, as described by Arnstein [63] and Rowe and Frewer [72], is closely related to involving citizens in one-off activities, such as neighborhood meetings or public consultations. Recent empirical studies distinguish between symbolic participation, where citizens attend events but exercise minimal influence and substantive engagement characterized by genuine co-creation and decision-making power [5]. Participation, in this sense, can be seen as a component of engagement, but it does not fully cover the depth and breadth that engagement implies; participation represents an initial step in promoting engagement by ensuring that citizens' voices and opinions are heard and considered.

Despite these distinctions, Figure 3 demonstrates that both engagement and participation share common goals at their intersection: collective action, inclusion, cooperation, citizenship, involvement, and democracy, which are fundamental to advancing smart city governance. Evidence demonstrates that trust in government and technological self-efficacy are primary predictors of both engagement and participation success in smart city platforms [2]. By adopting approaches that strategically prioritize both engagement and participation, public managers can foster greater inclusion, equity, and efficiency in decision-making and the implementation of policies and projects in smart cities.

The conceptual framework proposed in this study also carries direct implications for sustainable urban development as defined by the United Nations Sustainable Development Goals. SDG 11—Sustainable Cities and Communities—calls explicitly for inclusive, safe, resilient, and sustainable cities, emphasizing participatory governance as a structural condition for urban sustainability rather than an optional feature. The distinction between participation and engagement operationalized here is consequential for this agenda: cities that conflate the two concepts risk designing governance mechanisms that maximize visible participation metrics while failing to foster the deeper civic ownership that SDG 11 requires.

Genuine engagement, characterized by sustained commitment, meaningful influence, and co-creation, is not merely a democratic aspiration but a functional prerequisite for the long-term viability of smart city initiatives. Without it, citizen-centric frameworks risk reproducing the symbolic consultation patterns that undermine public trust and institutional legitimacy. The conceptual model proposed in this study thus offers urban managers and policymakers a practical instrument to align smart city governance design with the substantive demands of sustainable and inclusive urban development.

5. Conclusions

This study set out to examine the conceptual boundaries between citizen participation and engagement in smart city research, analyze the mechanisms employed to foster engagement, and propose a framework that supports evidence-based governance design. The findings confirm that the conflation of both concepts is a structural feature of the field, not a transitional phase, with direct consequences for how urban managers design governance instruments and measure their effectiveness.

The analysis reveals that while only a minority of studies employ explicit incentive mechanisms, many leverage alternative approaches emphasizing intrinsic motivation, well-designed participatory processes, and institutional trust, suggesting an evolution in smart city engagement strategies from transactional incentives toward more sustainable models of civic involvement. Previous studies by Hollands [73] and Nam and Pardo [21] emphasize the relevance of increasing understanding about engagement and participation, noting that the success of smart cities relies on the active involvement and collaboration between citizens, the public sector, and academic institutions.

It is expected that, with this clarification, urban planners and public managers will not only understand the importance of aligning theory and practice in their urban projects but also clearly identify what works in terms of "participation" and "engagement" in the context of smart cities. It is necessary that they recognize the conditions, strategies, and mechanisms that promote active citizen involvement, whether through incentives, coproduction, or opportunities to directly influence public decisions.

Critically, managers must distinguish between creating participatory channels, which may generate high participation rates, and fostering genuine engagement, characterized by trust, meaningful influence, sustained commitment, and a sense of ownership. Success requires moving beyond superficial metrics toward authentic power-sharing, transparent responsiveness to citizen input, and institutional structures that support cocreation rather than mere consultation.

By effectively integrating the perspectives and needs of citizens, managers have the opportunity to create more inclusive, balanced, and sustainable initiatives. Furthermore, they can develop public policies and urban projects that go beyond superficial expectations, consolidating enduring engagement that fosters innovation, social justice, and collective well-being. This approach not only legitimizes smart city initiatives but also ensures that they evolve into truly collaborative and transformative spaces, capable of meeting the demands of a more human and participatory urban future.

The conceptual framework proposed in this study also carries direct implications for sustainable urban development as defined by the United Nations Sustainable Development Goals. SDG 11—Sustainable Cities and Communities—calls explicitly for inclusive, safe, resilient, and sustainable cities, emphasizing participatory governance as a structural condition for urban sustainability rather than an optional feature. The distinction between participation and engagement operationalized here is consequential for this agenda: cities that conflate the two concepts risk designing governance mechanisms that maximize visible participation metrics while failing to foster the deeper civic ownership that SDG 11 requires. Genuine engagement, characterized by sustained commitment, meaningful influence, and co-creation, is not merely a democratic aspiration but a functional prerequisite for the long-term viability of smart city initiatives.

As limitations of this study, three are particularly relevant. First, the methodological gap identified in the literature, where many studies recognize the need for engagement mechanisms but fail to specify their nature, magnitude, or implementation strategies, constrains our ability to provide definitive guidance on which mechanisms work best under what conditions. Second, while the review includes studies from diverse geographic contexts, including Thailand, China, Saudi Arabia, and South Korea, the corpus is concentrated in the Global North, reflecting the indexing bias of Scopus and Web of Science. Further research in Latin American, African, and Southeast Asian contexts would strengthen the understanding of how cultural and governance factors mediate engagement strategy effectiveness. Third, the predominance of case study methods in the corpus limits the generalizability of findings and the field's capacity to establish causal relationships between engagement strategies and their outcomes.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su18168577/s1, Table S1: PRISMA 2020 Checklist.

Author Contributions: Conceptualization, K.E.B. and E.M.L.; methodology, K.E.B. and E.M.L.; investigation, K.E.B.; data curation, K.E.B. and E.M.L.; formal analysis, K.E.B.; writing—original draft preparation, K.E.B.; writing, review and editing, K.E.B., E.M.L. and R.B.; review and supervision, R.B. and J.M.P.H. All authors have read and agreed to the published version of the manuscript.

Funding: The first author (K.E.B.) was supported by a doctoral tuition scholarship granted by CAPES through the PROSUC Program (Programa de Suporte à Pós-Graduação de Instituições Comunitárias de Educação Superior), Grant No. 88887.482154/2020-00, during the doctoral research conducted at the Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS). No additional external funding was received.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data supporting the findings of this study are available within the article.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

CC	Creative Commons
COVID-19	Coronavirus Disease 2019
CPL	Citizen Participation Level
EC	Exclusion Criteria
HCD	Human-Centered Design
HCI	Human–Computer Interaction
HEI	Higher Education Institution
IC	Inclusion Criteria
ICT	Information and Communication Technology
IoT	Internet of Things
IS	Information Systems
MSW	Municipal Solid Waste
NPC	Level of Citizen Participation
NPS	New Public Service
RQ	Research Question
RRI	Responsible Research and Innovation
SLR	Systematic Literature Review
SPAR-4-SLR	Scientific Procedures and Rationales for Systematic Literature Reviews
SSC	Smart Sustainable Cities
WoS	Web of Science

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