



# How do boundary objects influence people-centered smart cities? A systematic literature review

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## Abstract

This study explores the critical role of boundary objects in the context of people-centred smart cities, a new paradigm in urban development that emphasises citizen participation in planning and decision-making. Boundary objects—artefacts, documents, or concepts that facilitate communication and collaboration across different knowledge domains—are increasingly recognized as essential tools in the complex, multi-stakeholder environment of urban governance. Despite extensive research on boundary objects in organizational contexts, their specific application in smart cities remains underexplored. This study addresses this gap by investigating how BOs, particularly collaborative tools and spaces, contribute to innovation, engagement, and knowledge-sharing in people-centred smart cities. Employing a Systematic Literature Review following the PRISMA protocol, this research synthesizes key insights from scholarly articles to comprehensively understand boundary objects' role in urban governance. This study offers a theoretical framework for leveraging boundary objects to enhance the inclusivity and sustainability of smart cities. It suggests avenues for future research, including empirical validation and exploration of boundary objects in diverse geographic and cultural contexts.

**Keywords** Collaboration tools · Collaboration spaces · Innovation management · Knowledge sharing · Smart cities · Boundary object

**JEL Classification** O3 Innovation · Research and Development · Technological Change · Intellectual Property Rights O33 Technological Change: Choices and Consequences · Diffusion Processes; O35 Social Innovation; O38 Government Policy

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## 1 Introduction

In recent years, the concept of Boundary Objects (BOs) has emerged as a critical focus area in urban planning and Smart City development (Benn and Martin 2010; Shepherd et al. 2023; Williams et al. 2019). BOs are artifacts, documents, or concepts that serve as interfaces between different knowledge domains and facilitate communication and collaboration among diverse groups. Initially developed in the social sciences to bridge gaps between different communities of practice (Dar 2018; Fox 2011; Green 2011; Hawkins et al. 2017; Sapsed and Salter 2004), BOs have become increasingly relevant in addressing the complex multi-stakeholder environment of urban governance (Mora et al. 2023a). This study explores the intersection of BOs and people-centered Smart Cities to understand how these objects influence innovation, engagement, and sharing in urban initiatives. People-centered Smart Cities represent a new paradigm in urban development that emphasizes citizens' active participation in planning and decision-making processes (Saldert 2024; Zuzul 2019). Specifically, this study investigates the role of BOs, particularly collaborative tools and spaces, in enhancing the effectiveness of urban governance in people-centered Smart Cities. The focus was on identifying best practices and theoretical frameworks that could support the creation of cohesive and adaptive urban environments. This study is particularly concerned with how these collaborative tools and spaces can be harnessed to promote sustainable and inclusive urban development, thereby making cities more responsive to residents' needs.

The context of this research is grounded in the increasing complexity of urban environments, where diverse stakeholders, including government agencies, private sector entities, local communities and international organizations, must collaborate to address intricate urban challenges. In this context, BOs are increasingly viewed as essential arrangements for fostering collaboration and innovation, allowing stakeholders to effectively address urban challenges. Despite the extensive study of BOs across various disciplines, a notable gap exists in the literature regarding their specific applications in people-centered Smart Cities. Although prior research has examined BOs in organizational contexts, their role in urban governance, particularly in fostering innovation and engagement within Smart Cities, remains underexplored. This study addresses this gap by examining how BOs can be utilized to enhance collaborative governance in people-centered Smart Cities, thereby contributing to a more nuanced understanding of how urban initiatives can be managed more effectively.

To achieve the research objectives, this study employed a Systematic Literature Review (SLR), which is a rigorous method for synthesizing existing knowledge on the topic. The SLR was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol (Liberati 2009), which ensures a transparent and replicable process. Through a systematic review and analysis of scholarly articles sourced from reputable databases such as Scopus and Web of Science, this study identifies key insights and theoretical perspectives on the role of BOs in Smart City governance. This methodological approach not only enhances the reliability of the findings but also provides a comprehensive exploration of the subject matter. The findings reveal that BOs, such as collaborative tools and spaces, play a critical role in fostering innovation, stakeholder engagement, and knowledge

and resource sharing in people-centered Smart Cities. These objects enable collaboration by offering the necessary structure and flexibility to align diverse perspectives and interests. Moreover, this study emphasizes the importance of designing BOs that are adaptable to the evolving needs of urban environments, ensuring their continued effectiveness in facilitating collaboration as conditions change. In conclusion, this study advances the discourse on Smart City governance by demonstrating how BOs can be strategically leveraged to enhance the inclusivity and sustainability of urban initiatives. This study provides a framework for understanding the role of BOs in people-centered Smart Cities and offers valuable insights for both practitioners and scholars. Additionally, it identifies several avenues for future research, including the need for the empirical validation of this theoretical model and the exploration of BOs in various geographic and cultural contexts. This study contributes to the broader goal of developing responsive, resilient, and people-centered urban environments.

## 2 Theoretical background—boundary objects and cities

Over the past four decades, the concept of “boundary objects” has gained significant importance in the fields of business and management, as well as in broader social sciences (Yakura 2002; Zikic and Voloshyna 2023; Zuzul 2019). This theoretical construct was initially introduced to describe artifacts or concepts that facilitate communication between different social worlds and has been extensively explored in more than 1,000 scholarly articles published in authoritative journals (Benn et al. 2013; Cohen 2012; Döring and Ratter 2015; MacGillivray and Franklin 2015; Pilon-Summons et al. 2022; van Pelt et al. 2015). Recent literature has increasingly focused on the application of knowledge management principles in BOs, highlighting their role in facilitating governance approaches, decision-making, innovation, and participatory practices (Dar 2018; Fox 2011; Green 2011; Hawkins et al. 2017; Sapsed and Salter 2004). This reflects an emerging trend in which BOs are not only passive intermediaries, but also active components in promoting collaborative innovation and inclusive decision-making in complex urban and organizational contexts (Caccamo 2023; Karaba et al. 2023). This evolving concept aligns with the broader push toward human-centered urban development that emphasizes the integration of diverse stakeholder perspectives in shaping sustainable and resilient cities. A BO is defined as an artifact, document, term, or concept that serves as an interface between different knowledge domains, facilitating communication and collaboration between groups. The concept of BOs was first introduced by Star and Griesemer (1989). They defined BOs as entities that are adaptable to different viewpoints and are sufficiently robust to maintain a common identity across these viewpoints, thus facilitating *collaboration* and *communication* among diverse groups of stakeholders. These objects possess the flexibility to be interpreted differently in different social worlds, while maintaining sufficient consistency to be recognized and used by all parties involved. This dual characteristic allows BOs to act as *mediating tools* that help stakeholders with different perspectives and expertise collaborate effectively, bridging gaps in understanding and promoting innovation (Marheineke et al. 2016). Researchers in these fields have pointed out that BOs are critical in environments characterized by high levels of com-

plexity and diversity, such as interdisciplinary projects or multi-stakeholder initiatives (Spee and Jarzabkowski 2009). They function by providing a shared reference point that supports the negotiation, alignment and integration of disparate knowledge bases and interests, thereby enabling cohesive and productive interactions. This concept emphasizes the importance of context specificity and adaptability, as BOs must evolve to meet the changing needs of the groups to which they connect (Haagensen 2024). This adaptability is critical in dynamic environments, such as business innovation, where rapid changes in technology and market conditions require agile and responsive forms of coordination and collaboration (Harvey and Chrisman 1998).

In recent years, the application of BOs in urban settings has gained significant attention in the fields of management and innovation, particularly within the context of people-centered cities (Zuzul 2019). BOs, initially conceptualized to facilitate *communication* and *collaboration* across different social worlds or communities of practice, have proven instrumental in addressing the complex and often fragmented landscape of urban governance and planning (Dolmans et al. 2023). Several articles in business, management, and social sciences journals have contributed to this discourse, with an emerging focus on governance approaches and participatory planning processes (Camboim et al. 2019; Mora et al. 2023a; Nielsen et al. 2019; Nilssen 2019). Thematically, the literature underscores the relevance of BOs in facilitating urban development and planning, particularly through participatory approaches that engage diverse stakeholders in the decision-making processes. This body of work not only highlights the theoretical significance of BOs in urban studies but also emphasizes their practical utility in fostering more inclusive and adaptive urban governance frameworks. People-centered cities prioritize citizens' involvement in the planning and development of urban spaces (Gleeson 2022). They aim to harness local knowledge and insights to address urban challenges and improve their quality of life. By incorporating citizen input and fostering collaborative problem solving, people-centered cities reflect a similar ethos of knowledge sharing and co-creation (Dameri and Ricciardi 2015; Rizzo et al. 2021; Sandulli et al. 2017). Underscoring the importance of harnessing collective knowledge and engaging diverse stakeholders to drive innovation and address complex challenges (Snow et al. 2016), BOs in people-centered cities can create platforms for citizen engagement, where communities collaboratively work on urban solutions and innovations. Hence, the concepts of *community engagement* and *empowerment* become more evident when members foster a deep sense of belonging and participation. People-centered urban planning emphasizes empowering citizens and ensures their active participation in city development (Mora et al. 2019). It seeks to create environments in which residents feel connected with and engaged in their city's development processes. Adaptive learning and *innovation* processes in people-centered cities are a means of collaborative problem solving and iterative development (Dolmans et al. 2023). Both emphasize the importance of continuous learning and adaptation to foster innovation and address complex challenges. Therefore, innovation in people-centered cities often emerges from the collaborative efforts of citizens and stakeholders who work together to address urban issues and improve city life (Barrutia et al. 2022).

The conceptual framework for Smart City initiatives outlined in the UN Habitat Report (Managing Smart Cities Beckers et al. 2023), identifies three core dimensions

that underpin the governance of Smart City initiatives: strategy, collaborative ecosystem, and technology. Building on our research gap and theoretical background, the collaborative ecosystem pillar is crucial (Wirtz and Müller 2023), as it encompasses the governance mechanisms necessary for managing the involvement of diverse stakeholders (Yahia et al. 2021). These mechanisms can be categorized into two main themes: innovation partnerships and their formation. Innovation partnerships, which drive the advancement of Smart City projects (Abella et al. 2017; Dupont et al. 2015; Ferraris et al. 2018; Richter et al. 2015), are divided into cross and intra-sector partnerships. Cross-sector partnerships typically involve *collaborations* between entities from different sectors, such as municipal governments and private companies (Ferraris et al. 2020), facilitating resource and expertise *sharing*. In contrast, intra-sector partnerships involve *collaborations* within the same sector, such as between national and local governments to ensure coherent policy implementation and operational practices. The formation of innovation partnerships involves a range of strategies and tools designed to organize and manage these collaborations. This includes establishing agreements that clarify the roles and responsibilities of partners and employing *tools* and strategies to build consensus among participants (Mora et al. 2019; Oschinsky et al. 2022). Additionally, creating collaborative *spaces and resources*, such as hackathons and living labs (Bertello et al. 2022; Leite 2022; Nguyen et al. 2022), is essential for engaging various stakeholders and fostering a participatory approach to urban innovation and development (Velsberg et al. 2020). The key participatory tools and methods include public consultations, public meetings, citizens' assemblies, co-creation workshops, participatory budgeting, hackathons, application contests, bootcamps, living labs, incubators, and accelerators.

In our research, we investigated the question, *How do boundary objects, such as collaborative tools and spaces, impact innovation, engagement, and sharing in people-centered smart cities?*. The focus is on understanding how these BOs—specifically collaborative tools and spaces—facilitate effective governance in urban initiatives (Wirtz and Müller 2023). We examine how these elements contribute to *knowledge and resource sharing*, enhance *stakeholder engagement*, and drive *innovation*, to support a cohesive and adaptive approach to urban development (Bernardi and Diamantini 2018). By identifying the best practices and frameworks, we seek to understand how these practices influence cities and urban development, thereby ensuring their sustainability and inclusivity (Correia et al. 2024). Through this exploration, we aim to advance the discourse on governance by building responsive and resilient urban environments.

### 3 Methodology

SLR is a structured and essential method for thoroughly analyzing and synthesizing research findings in a specific field (Behl et al. 2022). By integrating both qualitative and quantitative methodologies, SLR ensures a comprehensive and unbiased evaluation of the literature, thus improving the overall quality and reliability of the review process (Centobelli et al. 2020; Chauhan et al. 2022; Haefner et al. 2021; Molina-Azorín et al. 2009; Muñoz and Cohen 2018). This methodological framework helps

minimise bias, reduce errors and establish clear and replicable steps for knowledge synthesis, which in turn improves the validity and generalisability of findings (Kraus et al. 2020; Leonidou et al. 2018; Tranfield et al. 2003; Wang and Chugh 2014). The SLR methodology allows researchers to build on existing knowledge, enabling them to "stand on the shoulders of giants," and produce insightful and impactful research results (Massaro et al. 2016).

We employed a content analysis literature review, which is particularly suited to integrating theoretical perspectives and key findings relevant to our research question. This approach allowed us to conduct a thorough examination of each study, providing a detailed analysis of both the theoretical underpinnings and empirical results (Baregheh et al. 2009; Bhimani et al. 2019; Centobelli et al. 2020; Gomes et al. 2018; Haefner et al. 2021; Marikyan et al. 2019). By focusing on the influence of BOs, such as collaborative tools and spaces, on Smart City dynamics we extracted and synthesized relevant insights from each paper, thereby enhancing our theoretical understanding.

This SLR adheres to the PRISMA Protocol (Liberati 2009) and involves a meticulous full-read and detailed review of each selected study (Batista et al. 2021; Behl et al. 2022; Huovila et al. 2022; Kajol et al. 2022; Kraus et al. 2022, 2024; Lim et al. 2019; Sauer & Seuring 2023). This rigorous process enables us to identify and enhance the nuanced ways in which BOs influence Smart City dynamics. To ensure thoroughness, our search protocol (Fig. 1) began with the formulation of three separate search strings. The first search string addressed the central topic of *Smart City* (Echebarria et al. 2021) and *collaboration-related terms*. The second string addressed *boundary objects*, and the third focused on *people-centered cities*. The use of truncation in the second string, denoted by the asterisk, allowed for capturing variations of these terms, including collaboration and collaborative or plural terms such as cities (Christofi et al. 2019).

Following these steps (see the first inclusion and exclusion criteria in Fig. 1), our search generated an initial sample of 3,113 articles from Scopus and Web of Science. We refined the search to include only articles and reviews in Business and Management research, excluded book chapters and conference proceedings, and specified English as the publication language. We also limited the time frame to articles published between 2014 and 2024 and included only those from Academic Journal Guide (AJG) journals 2-3-4-4\*. After removing duplicates and applying our second inclusion and exclusion criteria, we obtained a sample of 3,019 articles. The next step (Eligibility in Fig. 1) involved a detailed screening process, assessing the relevance of each article based on its title and abstract, resulting in 53 articles being included in this study. Articles that did not directly address our research question were excluded ( $n=2,966$  articles). For articles with uncertain relevance, the main author performed a full-text review to ensure consistent evaluation, which led to a final set of 39 articles (Fig. 1). Our protocol also involved comparing our findings with those of other significant literature reviews on collaborative arrangements within Smart Cities. This comparative analysis, summarized in Table 1, helps contextualize our study within the existing body of work and confirms the necessity of SLR. This approach aligns with practices observed in similar studies, such as the systematic reviews by Gomes et al. (2018), Lim et al. (2019), Ruhlandt (2018), and Schiavone et al. (2019). These

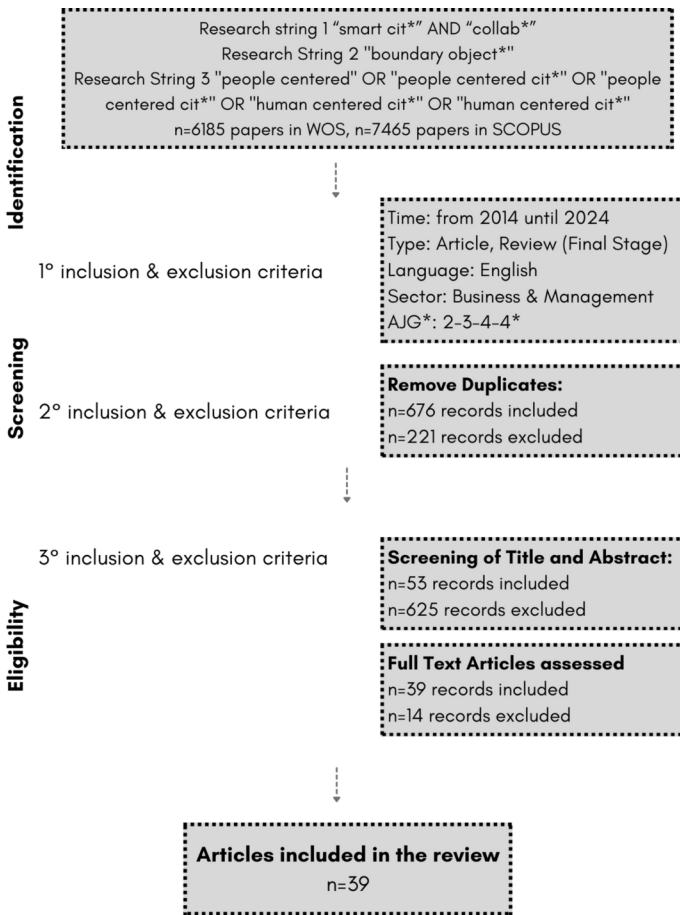


Fig. 1 PRISMA protocol (own elaboration based on Mishra and Mishra 2023)

studies began with a broad dataset and then applied stringent criteria to derive a manageable and relevant sample to ensure that the analysis is based on relevant and high-quality data. The SLR included in our sample (Table 1) were removed from our research observations because they did not contribute to the conversation on BOs and people-centered Smart Cities.

SLR data analysis followed a structured approach to ensure a comprehensive understanding of the selected studies. The main author conducted a qualitative thematic analysis of each article, focusing on BOs and their categories, collaborative tools and spaces. Any disagreements regarding categorization and conceptualization were resolved through constructive discussions among all authors, ensuring consensus in data interpretation. The analysis began with open coding, which involved assessing each article’s research focus, hypotheses, and key findings (Secinaro et al. 2022). Inductive and deductive approaches were applied iteratively to reinforce the robustness of the analysis. Initially, open coding was used to identify categories within the data, followed by axial coding to refine the categories and establish con-

**Table 1** Systematic literature reviews in our sample [own elaboration based on Zarei and Nik-Bakht (2021)]

Title	Author(s)	Sample Nr	Focus of analysis	Research goal
Citizen engagement body of knowledge—a fuzzy decision maker for index-term selection in built environment projects	Zarei and Nik-Bakht (2021)	1092	Urban development	Conceptualize and categorize the existing body of knowledge on citizen engagement for Smart City infrastructure
Driving elements to make cities smarter: evidence from European projects	Cam-boim et al. (2019)	110	Multi-stakeholder governance	Clarify the Smart City concept and its dimensions
Smart City governance from an innovation management perspective: theoretical framing, review of current practices, and future research agenda	Mora et al. (2023a, 2023b)	138	Governance practices	Examine the governance dimensions of Smart City transitions
Smart City reporting: a bibliometric and structured literature review analysis to identify technological opportunities and challenges for sustainable development	Secinaro et al. (2022)	357	Smart City sustainability	Identify the outcomes in Smart City reporting for developing collaborative governance and sustainable resource allocation through disruptive technologies
The landscape and evolution of urban planning science	Haghani et al. (2023)	100.00.000	Urban planning	Determine divisions, temporal trends, and influential references and actors in urban planning
Understanding the sharing economy and its implication on sustainability in smart cities	Akande et al. (2020)	22	Smart City sustainability	Drivers of the sharing economy
The present study		39	Boundary objects impact on cities	Identify boundary objects—such as collaborative tools and spaces—and their influence on shaping people-centered Smart Cities

nections between them (Strauss and Corbin 1998). This process uncovered both positive and negative attributes associated with BOs. In addition to categorizing BOs, the analysis explored how these objects contributed to the urban development of people-centered Smart Cities. Each full paper is meticulously reviewed to determine the role of BOs within specific categories and how their influence on the dynamics of Smart City development. This comprehensive approach ensures that our findings are detailed and closely aligned with the research question, thus providing a nuanced understanding of how BOs enhance innovation, engagement, and sharing in Smart Cities.



## 4 Findings

To address our research question we conducted a systematic review of relevant literature. We identify key examples in which BOs, including innovation networks (Leite 2022), living labs, collaborative communities (Snow et al. 2016), and Information and Communication Technology (ICT) tools, significantly impact *sharing, innovation, and engagement processes*. These BOs play a critical role in enhancing stakeholder engagement and driving innovation by bridging diverse expertise. For instance, innovation networks and living labs (Nguyen et al. 2022) act as collaborative spaces that foster stakeholder involvement. Collaborative communities leverage shared platforms for collective innovation, while governance networks (Nesti and Graziano 2020) and participatory tools like blockchain-based platforms (Marsal-Llacuna 2020) and participatory budgets (Pansera et al. 2023) support collaborative sharing and resource management. Additionally, formal agreements (Zuzul 2019), ICT literacy (Curşeu et al. 2021), and platform urbanism (van der Graaf and Balloon 2019) act as collaborative tools that spur engagement and technological innovation. Public procurement for innovation (Van Winden and Carvalho 2019) and urban crowdfunding (Steils et al. 2021) further illustrate how structured mechanisms mobilize resources and encourage collaborative problem solving. These findings (Table 2) underscore the vital role of BOs in shaping effective collaboration and advancing people-centered Smart City development.

**Table 2** Findings: boundary object

Boundary object (BO)	Boundary object (BO) category	The role of the BO in the urban development of people-centered Smart City
Innovation network	Collaborative space	Engagement
Living lab	Collaborative space	Engagement
Collaborative community	Collaborative space	Innovation
Governance network	Collaborative space	Sharing
Cooperation agreement	Collaborative tool	Engagement
Formal contracts and project documentation	Collaborative tool	Engagement
ICT literacy	Collaborative tool	Engagement
Living lab	Collaborative tool	Innovation
Platform urbanism	Collaborative tool	Innovation
Public procurement for innovation (PPI)	Collaborative tool	Innovation
Research design	Collaborative tool	Innovation
Technology	Collaborative tool	Innovation
Urban crowdfunding	Collaborative tool	Innovation
Blockchain-based community-driven tool	Collaborative tool	Sharing
Participatory budget	Collaborative tool	Sharing

## 4.1 Innovation

Innovation in Smart Cities refers to the introduction of novel ideas, technologies, and processes that enhance the functionality, efficiency, and inclusivity of the urban environment. This involves deploying advanced technologies and creating new value propositions that address urban challenges and improve residents' quality of life (Chesbrough 2004, 2003; Chesbrough et al. 2006; Christensen et al. 2017, 2006). In people-centered Smart Cities, innovation fosters engagement, sustainability, and adaptability through inclusive and collaborative approaches. This perspective emphasizes the need for innovations that are aligned with the diverse needs of urban populations. This section explores the role of BOs in urban development, focusing on collaborative communities, living labs, platform urbanism, public procurement of innovation, and urban crowdfunding. BOs foster innovation by enabling resource exchange and facilitating practical experimentation. Our findings (Table 3) highlight their roles in integrating innovative practices into urban development, thus contributing to responsive and inclusive smart-city environments.

### 4.1.1 Collaborative space: collaborative community

In urban development, a "collaborative community" acts as a key BO and collaborative space, defined as a collection of stakeholders, including citizens, businesses, and municipal leaders, working toward shared goals (Fjeldstad et al. 2012). It integrates diverse perspectives and resources to enhance collective problem solving and innovation (Star and Griesemer 1989). Initiatives such as Smart Aarhus utilize resources such as "Open Data Aarhus" to foster collaboration. The effectiveness of a collaborative community depends on maintaining engagement and managing diverse interests (Kramer 1990). Misalignments in goals or communication challenges may limit innovation outcomes (Eisenhardt and Schoonhoven 1996). Thus, although valuable for driving urban innovation, the impact of collaborative communities relies on effective stakeholder management and alignment.

### 4.1.2 Collaborative tool: living lab

Living labs are key BOs in urban development and serve as collaborative tools that support innovation and citizen engagement. Defined as user-centered innovation environments, living labs integrate diverse stakeholders—such as technology providers, end users, researchers, and city authorities—into their development process (Schuurman et al. 2016). They create a shared fulcrum for collaboration, while maintaining flexibility in integrating contributions (Paskaleva et al. 2015). Living labs facilitate practical experimentation, bridging theoretical research and urban needs (Hartley et al. 2013). By involving citizens in co-creation, living labs ensure that innovations are socially relevant (Paskaleva and Cooper 2019), increasing the likelihood of successful implementation. Despite their advantages, living labs face challenges; an emphasis on technology may overshadow their social aspects (Veeckman and Graaf 2015). Success depends on service managers' ability to coordinate diverse interests and manage co-production processes (Paskaleva and Cooper 2018).

**Table 3** Findings: boundary object—innovation

The influence of “Innovation” in the urban development of people-centered smart cities	BO category	Positive influence	Negative influence
Collaborative community	Collaborative space	Enhances collective problem-solving and innovation through collaborative exchanges	This compromises innovation outcomes due to misalignment and communication challenges
Living lab	Collaborative tool	Bridges theory and practice by integrating user feedback to create socially relevant solutions	There is a risk of overlooking social complexities and challenges in coordinating diverse stakeholder interests
Platform urbanism	Collaborative tool	Enhances urban planning by integrating diverse inputs and using data analysis to address emerging challenges	Raises concerns about data privacy, digital inequality, and the commercialization of public spaces
Public procurement for innovation (PPI)	Collaborative tool	Facilitates innovation by connecting public sector buyers with suppliers, defining procurement challenges, and aligning the interests of stakeholders	It is hindered by bureaucratic rigidity, risk aversion, and misalignment with the dynamic needs of innovative firms, limiting its effectiveness
Research design	Collaborative tool	Facilitates collaboration that is both structured and flexible, enabling effective dialogue and co-creation among diverse stakeholders	Misalignment with practical constraints and inadequate stakeholder integration can obstruct collaboration and impede successful implementation
Technology	Collaborative tool	Enables integration and collaboration by supporting real-time data sharing and fostering community engagement	It can create gaps between technological ideals and practical urban needs and may be exploited for political gain, thus overshadowing genuine innovation
Urban crowdfunding	Collaborative tool	Fosters transparency and promotes active citizen involvement in urban development, strengthening the connection between residents and authorities	It requires careful management to effectively integrate diverse contributions and sustain participant engagement throughout the process

#### 4.1.3 Collaborative tool: platform urbanism

Platform urbanism focuses on digital platforms that play a critical role in urban development and management. This model integrates digital platforms that provide browsing services, social networks, and e-commerce into urban space organizations (Gillespie 2010; Srnicek 2017). As a BO, it facilitates collaboration among public authorities, private companies, and citizens (Komninos and Mora 2018). Platforms such as Waze demonstrate how user-generated data connects commuters with urban planners, enhancing traffic management. Platform urbanism fosters innovation by incorporating diverse perspectives into planning (Hagiu 2014). It improves the information exchange among stakeholders, and promotes participatory urban manage-

ment (Livingstone 2010). However, challenges persist, such as data privacy, unequal access to technology, and potential commercialization of public spaces (Mansell 2012). Successful integration requires addressing these challenges and creating inclusive digital platforms serving the public goods.

#### 4.1.4 Collaborative tool: public procurement for innovation

Public Procurement for Innovation (PPI) is a critical BO and collaborative tool in urban innovation, and is defined as a strategic mechanism that stimulates innovation through public procurement processes. It can facilitate innovation-driven economic development (Edler et al. 2005; Edler and Georghiou 2007) and address societal challenges (Coenen et al. 2015; Mazzucato 2018). PPI facilitates interactions among stakeholders such as public sector agencies, private companies, and technology developers (Uyarra and Flanagan 2010), thus creating a structured yet flexible space for collaboration. This occurs through facilitating, configuring, and brokering functions (Stewart and Hyysalo 2008). Despite their potential, PPI face limitations, such as bureaucratic rigidity and risk aversion (Edler and Yeow 2016). Misalignments between procurement objectives and innovative firms' needs can limit successful outcomes (Edquist and Zabala-Iturriagoitia 2012; European Union 2023). The challenges of market readiness and stakeholder coordination further undermine PPI effectiveness. Collectively, these issues highlight the systemic constraints that affect PPI's role in driving urban innovation.

#### 4.1.5 Collaborative tool: research design

Research design acts as a BO, and facilitates collaboration and innovation in urban development. This is a systematic approach used to investigate phenomena and generate actionable insights (Archer et al. 1981; Bayazit 2004). As a BO, the research design provides an adaptable framework that supports collaboration among stakeholders, thus enabling effective dialogue and co-creation (Paroutis et al. 2014). Success depends on addressing evolving stakeholder needs; misalignments or insufficient feedback integration can hinder collaboration and innovation (Liedtka 2018). Process ambiguity can also create obstacles in implementation. While valuable for driving innovation, the effectiveness of research design relies on its adaptability to stakeholder needs and the management of complexity.

#### 4.1.6 Collaborative tool: technology

In urban development, technology serves as a significant BO and collaborative tool. Technology, defined as the application of scientific knowledge for practical purposes, plays a pivotal role in facilitating innovation (Meijer and Bolívar 2016). As a BO, it provides a common reference for stakeholders—including municipal authorities, businesses, and citizens, to effectively engage in urban initiatives (Albino et al. 2015; Holland 2008). Technological platforms support real-time data sharing and collaborative decision-making, which are essential for addressing complex urban challenges (Nilssen 2019). However, misalignment between technological capabilities

and urban needs can lead to discrepancies between goals and outcomes. The strategic use of technology for political gain may overshadow genuine innovation (Batty 2013; Huizingh 2011). Therefore, although technology can drive advancements in Smart Cities, its success in promoting innovation relies on its integration into broader governance strategies.

#### 4.1.7 Collaborative tool: urban crowdsourcing

Urban crowdsourcing or citizen sourcing, is an important BO and collaborative tool in urban development (Steils et al. 2021). Defined as the outsourcing of tasks to the public through digital platforms (Renault and Boutigny 2014), it integrates citizens into urban innovation stages, thus allowing residents, businesses, and public authorities to contribute to their expertise (Etgar 2008; Nam 2012a). By leveraging collective intelligence, crowdsourcing promotes innovation and enhances urban services (Spring 2003). As a BO, it provides a framework for interaction among stakeholders (Bagherzadeh et al. 2021; Bresciani et al. 2018; Du et al. 2014). Platforms such as Open Data Aarhus facilitate idea exchanges and feedback, strengthening the bond between residents and municipal authorities (Nam 2012b). Success depends on managing stakeholder interactions and effectively integrating contributions. Challenges such as varying involvement levels and robust management needs can affect the overall initiative success (Faems et al. 2005; Liu et al. 2020). Although crowdsourcing offers valuable insights, careful orchestration is necessary to ensure effective input and participant engagement (Steils and Hanine 2019).

### 4.2 Sharing

The concept of sharing is crucial in developing human-centered Smart Cities, shaping urban environments through collaborative and inclusive practices. This section explores how various BOs, including governance networks, blockchain-based community-driven tools, and participatory budgets act as sharing catalysts in urban contexts. Governance networks serve as collaborative spaces, facilitating the exchange of ideas and resources among diverse stakeholders, thereby enhancing collective decision making. Blockchain-based community tools ensure transparency and trust in sharing processes through decentralized record-keeping. Participatory budgets empower citizens to engage in financial decision-making, fostering a sense of ownership and inclusivity. By examining these BOs, our research findings (Table 4) revealed their collective contributions to equitable and responsive urban development, reinforcing the importance of sharing in creating human-centered Smart Cities.

#### 4.2.1 Collaborative space: governance network

Governance networks are pivotal BOs in urban development and Smart City initiatives, facilitating interaction among diverse stakeholders (Nesti and Graziano 2020). Defined as stable patterns of social relations among mutually dependent actors clustering around policy problems and resources (Klijn and Koppenjan 2014), these networks coordinate efforts across public, private, and civil society sectors to address

**Table 4** Findings: boundary object—sharing

The influence of “Sharing” in the urban development of people-centered smart cities	BO category	Positive influence	Negative influence
Governance network	Collaborative space	It facilitates stakeholder collaboration by providing a structured framework for sharing knowledge and resources, thereby enhancing collective problem-solving and policy development	They may suffer from limited democratic legitimacy and transparency, as they can exclude broader citizen participation, reinforce existing power imbalances, and face challenges in maintaining coherence and equitable representation of stakeholder interests
Blockchain based community-driven tool	Collaborative tool	By decentralizing authority, this tool enhances citizen participation and engagement, fostering a more inclusive and participatory governance structure in urban initiatives	Challenges related to technology maturity and the complexity of integration with existing urban systems can hinder effective implementation and adoption
Participatory budget	Collaborative tool	Facilitates equitable resource distribution and collaborative engagement, aiming to democratize resource allocation and foster inclusive decision-making processes	Projects influenced by political figures may receive preferential treatment, potentially sidelining grassroots initiatives. This misalignment can erode trust and hinder effective resource sharing. Additionally, bureaucratic complexities may conflict with the flexibility needed for innovative urban solutions, reducing responsiveness to dynamic challenges

urban challenges and drive innovation. They provide a structured framework for stakeholders to share knowledge, resources, and ideas, enhancing collective problem-solving (Sørensen and Torfing 2009). However, governance networks face limitations; critics argue that they often lack democratic legitimacy, excluding broader citizen participation and reinforce power imbalances (Papadopoulos 2012). Participant selection and decision-making processes can be opaque, undermining transparency and accountability (Klijn and Skelcher 2007). The informal nature of these networks may lead to challenges in maintaining coherence and ensuring equitable representation of stakeholder interests (Vanolo 2014). Although, while governance networks enable dynamic interactions, they must be carefully designed to address the inclusivity and transparency of effective urban development.

#### 4.2.2 Collaborative tool: blockchain based community tool

Blockchain-based community-driven tools are pivotal in urban development, as exemplified by initiatives such as the People's Smart City Dashboard (PSCD) (Marzal-Llacuna 2020). Blockchain technology enhances transparency and collective decision-making through its decentralized nature, allowing peer-to-peer interactions

without a central authority (Marsal-Llacuna 2018). The PSCD promotes a community-centered approach, enabling citizens to implement and govern Smart City agendas (Swan and de Filippi 2017). As a BO, this tool connects residents, public authorities, and private entities, providing a transparent platform for collaboration (Star and Griesemer 1989). It decentralizes authority, enabling citizens to contribute directly to and manage urban initiatives, thus addressing issues of low involvement and adoption in traditional Smart City models (Hughes 2017). The blockchain's decentralized structure promotes equitable access to information and decision-making, facilitating resource distribution (Sun et al. 2016). However, challenges such as technological development stages and integration complexities persist in existing urban systems (Dos Santos 2017; Manski 2017). Overcoming these obstacles is essential for the successful implementation and management of diverse stakeholder interactions (Wheeler 2017). Despite these challenges, blockchain holds significant potential for transforming urban governance by enhancing community participation and shared decision making.

#### **4.2.3 Collaborative tool: participatory budget**

A participatory budget is a significant BO in urban development, serving as a collaborative tool that facilitates the sharing of resources and knowledge among stakeholders (Pansera et al. 2023). It is a democratic process in which citizens decide how to allocate a portion of public funds and ensure their distribution according to community priorities (Cardullo and Kitchin 2019). This approach enables community members to propose, discuss, and vote on projects, thereby enhancing the transparency and inclusivity of resource allocation. However, participatory budgets face challenges limiting their effectiveness as BOs. For example, neighborhood security applications may be hindered by higher-level agencies reallocating funds to avoid project duplication (Mora et al. 2017), thereby undermining the budget's role in empowering communities (León and Rosen 2021). Political factors can lead to the preferential treatment of projects endorsed by influential figures, sidelining grassroots initiatives and eroding trust in the process (Balestrini et al. 2017; Martin et al. 2018). Additionally, bureaucratic complexities and the formalization required for participatory budgeting can clash with the flexibility needed for innovative solutions, reducing responsiveness to dynamic urban challenges (Arellano-Gault et al. 2013). While participatory budgets aim to democratize resource distribution and foster engagement, institutional pressures and political biases can compromise their effectiveness, thus highlighting the need for mechanisms that balance clarity and flexibility in urban development contexts.

#### **4.3 Engagement**

In human-centered Smart Cities, engagement is crucial for effective urban development. This section examines how various BOs, categorized as collaborative spaces and tools, foster stakeholders engagement. Innovation networks and living labs provide dynamic environments that facilitate interaction and knowledge exchange, driving collaborative problem solving and innovation. By contrast, cooperation

agreements, formal contracts, and ICT literacy serve as collaborative tools, establishing essential frameworks and competencies for active participation. By analyzing these elements (Table 5), we elucidated how structured engagement mechanisms advance inclusive and adaptive urban environments, enhancing the effectiveness and sustainability of Smart City initiatives.

**Table 5** Findings: boundary object—engagement

The influence of “Engagement” in the urban development of people-centered smart cities	BO category	Positive influence	Negative influence
Innovation network	Collaborative space	Innovation networks provide a structured environment that facilitates the sharing of insights and the collaborative development of solutions, integrating diverse technological, social, and economic perspectives to address complex urban challenges	The effectiveness of innovation networks can be limited by difficulties in coordination, power imbalances, and governance challenges
Living lab	Collaborative space	Living labs foster user-centered innovation by integrating diverse perspectives and interests into real-world contexts, thereby enhancing collaborative engagement across various sectors in urban development	Power imbalances, along with challenges in incentivizing participation and managing diverse stakeholder interests, can undermine the collaborative ethos and lead to inefficiencies in achieving impactful outcomes
Cooperation agreement	Collaborative tool	Cooperation agreements establish clear terms and goals, enhancing commitment and resource allocation by aligning efforts and reducing ambiguity	The formalization of cooperation agreements can introduce rigidity, limiting the flexibility required for adaptive and innovative urban projects and potentially increasing governance complexity
Formal contracts and project documentation	Collaborative tool	Formal contracts and project documentation provide a structured framework that clearly defines responsibilities and deliverables, facilitating the coordination and integration of diverse perspectives in urban development projects	The rigidity of formal contracts and documentation can hinder adaptability to evolving project conditions, potentially leading to conflicts if stakeholders cannot amend terms to address changing needs
ICT literacy	Collaborative tool	ICT literacy empowers citizens to actively engage in and contribute to Smart City initiatives, enhancing their ability to interact with digital platforms and leverage technology for personal and community development	Low ICT literacy can create a digital divide, excluding less technologically adept individuals from participating in and benefiting from Smart City initiatives, which may exacerbate social and economic inequalities



### 4.3.1 Collaborative space: innovation network

Innovation networks are vital BOs in urban development and act as collaborative spaces engaging diverse stakeholders (Leite 2022). Defined as stable patterns of social relations among mutually dependent actors around policy problems and resources (Klijn and Koppenjan 2014), these networks pool knowledge and resources from various sectors to drive technological and social advancements. They enable collaboration between government bodies, private enterprises, and civic groups to address urban challenges and seize innovation opportunities (Alberti and Pizzurno 2017; Möller and Halinen 2017). In Smart Cities, innovation networks create structured environments for interaction and co-creation, integrating technological, social, and economic perspectives to tackle complex urban issues. However, challenges such as conflicts from diverse stakeholder interests and coordination difficulties may hinder effective decision making. Power imbalances can lead to inequitable contributions (Bouncken and Fredrich 2016), while concerns about representativeness and transparency can undermine effectiveness (Sørensen and Torfing 2009). In addition, managing complex interactions can lead to fragmentation if not integrated with broader governance structures (Gavetti 2012; Papadopoulos 2012). Collectively, these challenges suggest that while innovation networks offer promise for urban development, their effectiveness is constrained by coordination issues and governance challenges.

### 4.3.2 Collaborative space: living lab

Living labs are experimental environments designed to foster real-life innovation through active collaboration among diverse stakeholders, including citizens, researchers, and businesses. They aim to create user-centered solutions by involving participants early in the innovation process, co-creating solutions, and simulating real-world contexts (Almirall and Wareham 2011; Eriksson et al. 2005). Similar to BOs, living labs integrate multiple perspectives to facilitate engagement across sectors in urban development (Bergvall-Kareborn and Stahlbrost 2009; Leminen et al. 2015). This setup is particularly valuable for addressing complex urban issues by incorporating technological, social, and economic perspectives (Feurstein et al. 2008). However, living labs have significant limitations, including power imbalances that can overshadow less influential participants (Engels et al. 2019; Kähkönen 2014). Challenges in incentivizing participation and managing diverse interests can lead to inefficiencies (Nguyen and Marques 2022). However, coordinating multiple actors may hinder cohesive and impactful outcomes (Hossain 2018). Therefore, although living labs provide valuable platforms for innovation, their effectiveness as BOs is limited by structural and operational challenges.

### 4.3.3 Collaborative tool: cooperation agreement

Cooperation agreements are crucial in urban development and serve as a formal framework that facilitates stakeholder engagement by delineating roles, responsibilities, and expectations (Dolmans et al. 2023). This document structures collaborative efforts by setting explicit terms for investments and processes, and enhancing

commitment (Bryson et al. 2006). Such agreements are vital for securing resources and support by aligning efforts with clear goals (Torfing 2019). However, formalization in cooperation agreements can introduce rigidity, constraining the flexibility required for innovative urban projects (Dolmans et al. 2023). As projects transition from exploratory phases to rigid frameworks, this rigidity can conflict with their initial innovative nature (Mazzucato 2013). Bureaucratic hurdles can also impede decision-making and complicate implementation (Edler and Georghiou 2007). Moreover, adherence to established practices may misalign innovative objectives with entrenched organizational practices, leading to inefficiencies (Wegrich 2019). Therefore, while cooperation agreements provide structure and reduce uncertainty, they must balance formalization with flexibility to effectively support dynamic urban development (Sørensen and Torfing 2011).

#### 4.3.4 Collaborative tool: contracts and project documentation

In urban development, formal contracts and project documentation (masterplans, proformas, financial decks, and design prototypes) play crucial roles as collaborative tools, thus contributing uniquely to stakeholder engagement and project alignment (Zuzul 2019). Formal contracts establish foundational agreements that clearly define stakeholders' responsibilities and provide a structured framework for coordination and expectations. While effective, their rigidity can hinder adaptability to changing project conditions, potentially creating conflicts if stakeholders struggle to amend the terms (Seidel and O'Mahony 2014). Project master plans offer a comprehensive vision for development, guide the overall direction, and ensure alignment among diverse actors (Weick et al. 2005). However, inherent ambiguities can lead to misunderstandings and disagreements, thus complicating collaboration. Proformas and financial decks provide critical financial planning projections, aligning stakeholders with the expectations essential for project viability. Nevertheless, their static nature can fail to reflect the dynamic urban development landscape, risking misalignment if financial assumptions are not updated. Design prototypes facilitate the visualization and testing of ideas, allowing stakeholders to refine concepts (Nicolini et al. 2012). While fostering innovation and feedback, prototypes can become contentious if they do not meet design constraints, leading to confusion (Townsend 2013). Although BOs are essential for integrating perspectives in complex urban projects, their effectiveness depends on their adaptability and responsiveness to the dynamic nature of Smart City initiatives (Boland and Tenkasi 1995).

#### 4.3.5 Collaborative tool: ICT literacy

In urban development, ICT literacy serves as a significant BO, facilitating engagement by providing a common framework for interaction and collaboration (Curşeu et al. 2021). Defined as the ability to use and understand ICTs for problem-solving and communication (Shelton and Lodato 2019), ICT literacy encompasses technical skills and digital competencies necessary for navigating modern urban environments. As a BO, ICT literacy supports citizen engagement by enabling participation in Smart City initiatives. It empowers individuals to interact with digital platforms and access

essential services for personal and professional growth (Ramaswami et al. 2016). Highly ICT-literate individuals can engage in roles that drive innovation and enhance a city's technological and economic capacities (Martin et al. 2018). However, lower ICT literacy can create barriers to participation and exacerbate social and economic inequalities (Graham 2002). This divide may hinder effective contributions to urban development, leading to disparities in the benefits of Smart City initiatives. Moreover, the rapid evolution of digital technologies can pressure individuals to maintain their current skills, risking the exclusion of those who are unable to adapt (Stromquist 2019). Therefore, while ICT literacy facilitates engagement and collaboration, it also highlights the need for inclusive strategies that address digital inequalities and support continuous skill development, ensuring that all citizens participate fully in Smart City opportunities.

## 5 Discussion and conclusions

The findings of this research provide substantial insights into the far-reaching implications for policymakers, practitioners, and scholars engaged in the development and management of people-centered Smart Cities. By illustrating the influence of BOs such as collaborative spaces and tools, on innovation, sharing and engagement, this study reveals how these elements shape the effectiveness and inclusiveness of urban initiatives. For practitioners, the findings offer guidance for creating supportive structures and policies to improve stakeholder collaboration and resource utilization. These insights can be used to implement effective strategies for community engagement and technological integration. Scholars have a refined understanding of how the theoretical concepts in Smart City development translate into practical outcomes, paving the way for further research and theoretical advances in this ever-evolving field.

### 5.1 Implications for scholars

When designing BOs for people-centered Smart Cities, several inherent paradoxes must be carefully navigated to ensure effective results. One of the most important contradictions is the balance between *flexibility and rigidity*. Flexibility is crucial to adapting BOs to changing urban conditions and for integrating new knowledge. However, excessive flexibility can undermine the structures necessary for coordination and clarity. Therefore, BOs should be designed to provide a robust structure that accommodates iterative changes and allows for adaptability without compromising the overall structure, which is essential for effective management and alignment. Another significant paradox is related to *integration and complexity*. Integration seeks to bring together different perspectives and inputs in order to foster a comprehensive approach to urban development. However, this process can lead to increased complexity, potentially overwhelming the participants and complicating BO management. To resolve this paradox, it is essential to design BOs that facilitate integration while maintaining process simplicity. This approach ensures an effective combination of different inputs without introducing unnecessary complexity that can hinder

its usability and practical applications. Moreover, a balance between *engagement and exclusion* is crucial. Engagement empowers stakeholders by actively involving them in the process, enhancing collaboration and innovation. Conversely, if not managed properly, engagement efforts may inadvertently lead to exclusion, and some groups may be left out or marginalized. Therefore, BOs must be designed with inclusive features that promote broad participation and address potential barriers, ensuring that the benefits of involvement are distributed and that no group is unfairly excluded. When outlining objects for people-centered Smart Cities, several key considerations must guide the process to maximize the effectiveness and mitigate potential challenges (Table 6).

*Integration* is a key attribute that ensures a harmonious combination of perspectives and inputs to address complex urban problems. A well-conceived BO facilitates this integration by providing continuous feedback mechanisms and adjustments that align stakeholder objectives and reduce divergence. *Involvement* is a crucial factor in this process. An effective BO empowers stakeholders by actively involving them in the urban development process and fostering collaboration and innovation. To this end, BOs should include inclusive features that support broad participation and address barriers to entry, thereby improving the bonds between residents and municipal authorities. *Clarity* in the design helps establish clear expectations and responsibilities, facilitates coordination, and reduces misunderstandings. However, the challenge is avoiding excessive complexity. Although clarity is essential, it must be balanced with the flexibility to adapt to changing conditions and provide new insights. A well-designed BO must provide structured guidelines while remaining adaptable to changing needs. *Alignment* among objectives, processes, and stakeholders improves consistency and reduces conflict. To maintain alignment and ensure that stakeholders' interests are consistently met, regular reviews and adjustments of the BO are necessary. Effective communication channels must be established to identify and correct misalignments promptly. *Empowerment* through BOs enables stakeholders to assume ownership of their roles and contribute effectively to urban development. To avoid power imbalances and ensure fair representation, the BOs must be designed to promote equal participation and prevent a single group from dominating the process. *Democratization* ensures that all stakeholders have equal opportunities to participate and influence outcomes. BOs must include mechanisms that support broad access and prevent exclusivity, thereby promoting an inclusive environment in which diverse contributions are welcomed and valued.

## 5.2 Implications for practitioners

The findings of this study have significant implications for practitioners involved in advancing Smart City initiatives. First, the strategic use of BOs—such as living labs, innovation networks, and blockchain-based tools, has emerged as a critical factor in fostering collaborative environments and optimizing innovation processes. Policymakers can leverage these objectives to design and implement policies that improve public engagement and streamline collaborative efforts, thereby improving the overall effectiveness of Smart City projects. Furthermore, this study highlighted the importance of improving resource allocation. By understanding the role

**Table 6** Boundary object attribute for people-centered smart cities

Positive attribute	Negative attribute	Design
Integration	Discrepancy	A BO should provide mechanisms for ongoing feedback and adjustments to maintain alignment among stakeholders and reduce discrepancies. It should integrate diverse inputs while adapting to evolving needs
Engagement	Exclusion	To foster engagement and prevent exclusion, BOs should be designed with inclusive features that facilitate broad participation and address barriers to entry. Accessibility and user support should be integral to their design
Clarity	Complexity	BOs should balance providing clear, structured guidelines and maintaining enough flexibility to accommodate dynamic conditions. Avoid excessive rigidity that could complicate management and adaptation
Alignment	Misalignment	Regularly review and adjust the BO to ensure continuous alignment with stakeholder goals and project objectives. Facilitate open communication channels to address and rectify misalignments early
Empowerment	Oversight	Ensure that BOs provide equitable opportunities for participation and decision-making. Implement checks to prevent domination and promote fair representation of all stakeholders
Democratization	Exclusivity	Design BOs with features that support broad access and participation. Create inclusive processes that welcome diverse inputs and prevent exclusivity

of collaborative tools and spaces in driving urban development, practitioners can efficiently target resources. This approach involves prioritizing initiatives that effectively harness BOs to increase public participation and foster innovation, ensuring that investments are aligned with Smart City development goals. Finally, promoting inclusiveness is essential for creating equitable Smart City projects. Policies should encourage the integration of collaborative spaces to facilitate the active participation of diverse stakeholder groups. This inclusiveness ensures that Smart City initiatives not only meet the needs of all community members but also reflect their aspirations, leading to more balanced and representative urban development. By incorporating these insights, practitioners can improve the impact and sustainability of Smart City strategies. By effectively using BOs, such as collaborative communities and ICT tools, they can significantly improve stakeholder engagement, facilitate innovation and streamline project management processes. These practices are crucial to foster a collaborative environment that supports dynamic and effective urban development. This study provides a valuable framework for the selection and integration of BOs into urban development initiatives. Practitioners can use our emerging framework (Table 6) to select and adapt tools according to the specific requirements of their projects. This tailor-made approach ensures that BOs are optimally aligned with the project objectives, thereby maximizing their impact on engagement and innovation. Capacity building is essential for the successful implementation of BOs. Practitioners should invest in ICT stakeholder training and create strong governance structures that support collaborative processes. By building these capacities, practitioners can improve the effectiveness of BOs and ensure that collaborative efforts are well supported, leading to more successful and sustainable Smart City dynamics.

### 5.3 Research limitations and avenues for future research

In the realm of people-centered Smart Cities, it is imperative to recognize the limitations of the current research and identify potential avenues for future exploration. Despite the valuable insights provided, this study has several limitations that may affect the generalizability and depth of its findings. For example, the scope of the research may be limited by the specific contexts and case studies examined, which may not fully represent the diverse range of Smart City initiatives worldwide. Furthermore, while this study addresses various aspects of BOs and their role in improving urban development, it may not capture all the complexities involved in implementing people-centered approaches. Acknowledging these limitations opens opportunities for further research, including exploring different geographical contexts, broadening the types of BOs studied, and analyzing their long-term impact on Smart City initiatives.

The scope of the literature review was constrained by the selection of sources from specific databases (SCOPUS and WoS) and the availability of relevant studies in the management and social science research streams. This selection bias may have resulted in an incomplete representation of the existing research, potentially overlooking significant contributions that could have influenced or complemented the findings. Second, this study has notable contextual limitations. The case studies and examples examined predominantly focus on specific geographic regions or types of

Smart City initiatives (mainly in northern Europe instead of the south of the world). This regional concentration may limit the generalizability of the findings to other locations with distinct socioeconomic, cultural, or political contexts. Similarly, this research might emphasize certain sectors or governance models that could restrict the applicability of the insights to other areas of urban development. Methodologically, the reliance on qualitative analysis through a systematic literature review introduces potential bias and subjectivity. The absence of empirical data such as surveys or case studies further limits the ability to directly assess the impact of BOs on Smart City development and citizen engagement.

Finally, the dynamic and rapidly evolving nature of Smart City projects and practices presents challenges. The findings of this study may quickly become outdated as new BOs and collaborative tools and spaces emerge or as existing ones undergo significant changes. To address these limitations, future research should consider expanding the range of sources included in the literature reviews, incorporating empirical data to validate the findings, and exploring diverse geographical and sectoral contexts. In addition, efforts to harmonize definitions and conceptual frameworks across disciplines could enhance the coherence and applicability of research on BOs in Smart City development.

Based on the insights gained from this study, several promising avenues for future research have emerged. First, *longitudinal studies* can analyze the evolution of BOs over time and assess their long-term impact on Smart City initiatives. This approach provides valuable insight into the sustainability and changing roles of BOs as urban environments and technologies develop. Second, *comparative studies* across geographical and cultural contexts could improve our understanding of how BOs function in different contexts. By examining Smart Cities in different regions, researchers can identify specific challenges and opportunities, leading to more personalized and effective urban strategies. As mentioned earlier, another critical area is the *empirical validation of theoretical models*. Therefore, testing existing theories on BOs through empirical methods such as surveys and case studies would help confirm their practical implications and refine existing conceptual and theoretical frameworks. This approach bridges the gap between theory and practice, and offers workable insights for implementation. As technology advances, exploring the *impact of emerging technologies* on BOs has become critical. Research could focus on how innovations such as artificial intelligence, blockchain and IoT interact with BOs and influence collaborative processes, shedding light on their evolving role in Smart Cities. Developing citizen-centered *assessment frameworks* is another important direction. By creating and testing frameworks that incorporate feedback from urban residents, researchers can better understand how BOs influence citizen engagement and satisfaction, thereby leading to more effective and responsive Smart City solutions. *Interdisciplinary research* that combines insights from fields such as urban studies, information systems, and organizational behavior can offer a more comprehensive view of BOs. This interdisciplinary approach addresses the complexity of BOs and their role in promoting collaboration and innovation in Smart Cities. In addition, examining *how BOs influence decision-making and governance* could provide valuable insights for policymakers. Research could explore how BOs facilitate or hinder decision-making processes, stakeholder coordination, and policy implementation in Smart Cities.

Finally, the evaluation of *collaborative processes facilitated by BOs* is a key area for future research. Studying best practices and strategies for improving stakeholder cooperation could improve collaborative models and their impact on innovation and engagement. Additionally, it is essential to understand the other challenges and limitations of BOs. Research should focus on identifying common pitfalls and developing strategies to overcome obstacles to effective collaboration and innovation, thereby improving the design and implementation of BOs. These future research directions have the potential to significantly advance our understanding of BOs in Smart City development by offering valuable knowledge to scholars and practitioners committed to creating more effective and inclusive urban environments.

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## References

- Abella A, Ortiz-de-Urbina-Criado M, De-Pablos-Heredero C (2017) A model for the analysis of data-driven innovation and value generation in smart cities' ecosystems. *Cities* 64:47–53
- Akande A, Cabral P, Casteleyn S (2020) Understanding the sharing economy and its implication on sustainability in smart cities. *J Clean Prod* 277:124077
- Alberti FG, Pizzurno E (2017) Oops, i did it again! Knowledge leaks in open innovation networks with start-ups. *Eur J Innov Manag* 20(1):50–79. <https://doi.org/10.1108/EJIM-11-2015-0116>
- Albino V, Berardi U, Dangelico RM (2015) Smart cities: definitions, dimensions, performance, and initiatives. *J Urban Technol* 22(1):3–21. <https://doi.org/10.1080/10630732.2014.942092>
- Almirall E, Wareham J (2011) Living labs: arbiters of mid- and ground-level innovation. *Technol Anal Strateg Manag* 23(1):87–102. <https://doi.org/10.1080/09537325.2011.537110>
- Archer, Jacques R, Powell JA (1981) A view of the nature of the design research. 30–47
- Arellano-Gault D, Demortain D, Rouillard C, Thoenig J-C (2013) Bringing public organization and organizing back in. *Organ Stud* 34(2):145–167. <https://doi.org/10.1177/0170840612473538>
- Bagherzadeh M, Markovic S, Bogers M (2021) Managing open innovation: a project-level perspective. *IEEE Trans Eng Manag* 68(1):301–316. <https://doi.org/10.1109/TEM.2019.2949714>
- Balestrini M, Rogers Y, Hassan C, Creus J, King M, Marshall P (2017) A city in common: a framework to orchestrate large-scale citizen engagement around urban issues. In: Proceedings of the 2017 CHI conference on human factors in computing systems, 2282–2294. <https://doi.org/10.1145/3025453.3025915>
- Baregheh A, Rowley J, Sambrook S (2009) Towards a multidisciplinary definition of innovation. *Manag Decis* 47(8):1323–1339. <https://doi.org/10.1108/00251740910984578>
- Barrutia JM, Echebarria C, Aguado-Moralejo I, Apaolaza-Ibáñez V, Hartmann P (2022) Leading Smart City projects: government dynamic capabilities and public value creation. *Technol Forecast Soc Chang* 179:121679



- Batista M, Goyannes Gusmão Caiado R, Gonçalves Quelhas OL, Brito Alves Lima G, Leal Filho W, Rocha Yparraguirre IT (2021) A framework for sustainable and integrated municipal solid waste management: barriers and critical factors to developing countries. *J Clean Prod* 312:127516. <https://doi.org/10.1016/j.jclepro.2021.127516>
- Batty M (2013) Big data, smart cities and city planning. *Dialogues Hum Geogr* 3(3):274–279. <https://doi.org/10.1177/2043820613513390>
- Bayazit N (2004) Investigating design: a review of forty years of design research. *Des Issues* 20(1):16–29
- Beckers D, Gerli P, Mora L (2023) Managing Smart City governance—a playbook for local and regional governments (UN-Habitat HS/060/20E). United Nations Human Settlements Programme (UN-Habitat)
- Behl A, Jayawardena N, Pereira V, Islam N, Del Giudice M, Choudrie J (2022) Gamification and e-learning for young learners: a systematic literature review, bibliometric analysis, and future research agenda. *Technol Forecast Soc Chang* 176:121445
- Benn S, Martin A (2010) Learning and change for sustainability reconsidered: a role for boundary objects. *Acad Manag Learn Educ* 9(3):397–412. <https://doi.org/10.5465/amle.9.3.zqr397>
- Benn S, Edwards M, Angus-Leppan T (2013) Organizational learning and the sustainability community of practice: the role of boundary objects. *Organ Environ* 26(2):184–202. <https://doi.org/10.1177/1086026613489559>
- Bergvall-Kareborn B, Stahlbrost A (2009) Living lab: an open and citizen-centric approach for innovation. *Int J Innov Reg Dev* 1(4):356–370. <https://doi.org/10.1504/IJIRD.2009.022727>
- Bernardi M, Diamantini D (2018) Shaping the sharing city: an exploratory study on Seoul and Milan. *J Clean Prod* 203:30–42
- Bertello A, Bogers MLAM, De Bernardi P (2022) Open innovation in the face of the COVID-19 grand challenge: insights from the Pan-European hackathon ‘EUvsVirus.’ *R&D Manag* 52(2):178–192. <https://doi.org/10.1111/radm.12456>
- Bhimani H, Mention A-L, Barlatier P-J (2019) Social media and innovation: a systematic literature review and future research directions. *Technol Forecast Soc Change* 144:251–269. <https://doi.org/10.1016/j.techfore.2018.10.007>
- Boland RJ, Tenkasi RV (1995) Perspective making and perspective taking in communities of knowing. *Organ Sci* 6(4):350–372
- Bouncken RB, Fredrich V (2016) Learning in coepitition: alliance orientation, network size, and firm types. *J Bus Res* 69(5):1753–1758. <https://doi.org/10.1016/j.jbusres.2015.10.050>
- Bresciani S, Ferraris A, Del Giudice M (2018) The management of organizational ambidexterity through alliances in a new context of analysis: Internet of Things (IoT) Smart City projects. *Technol Forecast Soc Chang* 136:331–338. <https://doi.org/10.1016/j.techfore.2017.03.002>
- Bryson JM, Crosby BC, Stone MM (2006) The design and implementation of cross-sector collaborations: propositions from the literature. *Public Adm Rev* 66(s1):44–55. <https://doi.org/10.1111/j.1540-6210.2006.00665.x>
- Caccamo M, Pittino D, Tell F (2023) boundary objects, knowledge integration, and innovation management: a systematic review of the literature. *Technovation* 122:102645. <https://doi.org/10.1016/j.technovation.2022.102645>
- Camboim GF, Zawislak PA, Pufal NA (2019) Driving elements to make cities smarter: evidences from European projects. *Technol Forecast Soc Chang* 142:154–167
- Cardullo P, Kitchin R (2019) Being a ‘citizen’ in the Smart City: up and down the scaffold of smart citizen participation in Dublin. *Ireland Geojournal* 84(1):1–13
- Centobelli P, Cerchione R, Chiaroni D, Del Vecchio P, Urbinati A (2020) Designing business models in circular economy: a systematic literature review and research agenda. *Bus Strateg Environ* 29(4):1734–1749. <https://doi.org/10.1002/bse.2466>
- Chauhan C, Parida V, Dhir A (2022) Linking circular economy and digitalisation technologies: a systematic literature review of past achievements and future promises. *Technol Forecast Soc Chang* 177:121508. <https://doi.org/10.1016/j.techfore.2022.121508>
- Chesbrough HW (2003) *Open innovation: the new imperative for creating and profiting from technology*. Harvard Business Press, Brighton
- Chesbrough H (2004) Managing open innovation. *Res Technol Manag* 47(1):23–26. <https://doi.org/10.1080/08956308.2004.11671604>
- Chesbrough H, Vanhaverbeke W, West J (2006) *Open innovation: researching a new paradigm*. OUP, Oxford
- Christensen CM, Baumann H, Ruggles R, Sadtler TM (2006) Disruptive innovation for social change. *Harvard Bus Rev* 84(12):94–101

- Christensen C, Raynor M, McDonald R (2017) What is disruptive innovation? *Harvard business review*. <https://hbr.org/2015/12/what-is-disruptive-innovation>, 5(5)
- Christofi M, Vrontis D, Thrassou A, Shams SR (2019) Triggering technological innovation through cross-border mergers and acquisitions: a micro-foundational perspective. *Technol Forecast Soc Chang* 146:148–166
- Coenen L, Hansen T, Rekers JV (2015) Innovation policy for grand challenges. An economic geography perspective. *Geogr Compass* 9(9):483–496. <https://doi.org/10.1111/gec3.12231>
- Cohen A (2012) Rescaling environmental governance: watersheds as boundary objects at the intersection of science, neoliberalism, and participation. *Environ Plann Econ Space* 44(9):2207–2224. <https://doi.org/10.1068/a44265>
- Correia D, Vagos C, Marques JL, Teixeira L (2024) Fulfilment of last-mile urban logistics for sustainable and inclusive smart cities: a case study conducted in Portugal. *Int J Log Res Appl* 27(6):931–958. <https://doi.org/10.1080/13675567.2022.2130211>
- Curşeu PL, Semeijn JH, Nikolova I (2021) Career challenges in smart cities: a sociotechnical systems view on sustainable careers. *Hum Relat* 74(5):656–677. <https://doi.org/10.1177/0018726720949925>
- Dameri RP, Ricciardi F (2015) Smart City intellectual capital: an emerging view of territorial systems innovation management. *J Intellect Cap* 16(4):860–887. <https://doi.org/10.1108/JIC-02-2015-0018>
- Dar S (2018) De-colonizing the boundary-object. *Organ Stud* 39(4):565–584. <https://doi.org/10.1177/0170840617708003>
- Dolmans SAM, Van Galen WPL, Walrave B, Den Ouden E, Valkenburg R, Romme AGL (2023) A dynamic perspective on collaborative innovation for Smart City development: the role of uncertainty, governance, and institutional logics. *Organ Stud* 44(10):1577–1601. <https://doi.org/10.1177/01708406231169422>
- Döring M, Ratter B (2015) ‘Heimat’ as a boundary object? Exploring the potentialities of a boundary object to instigate productive science-stakeholder interaction in North Frisia (Germany). *Environ Sci Policy* 54:448–455. <https://doi.org/10.1016/j.envsci.2015.08.009>
- Dos Santos RP (2017) On the philosophy of bitcoin/blockchain technology: is it a chaotic, complex system? *Metaphilosophy* 48(5):620–633. <https://doi.org/10.1111/meta.12266>
- Du J, Leten B, Vanhaverbeke W (2014) Managing open innovation projects with science-based and market-based partners. *Res Policy* 43(5):828–840. <https://doi.org/10.1016/j.respol.2013.12.008>
- Dupont L, Morel L, Guidat C (2015) Innovative public-private partnership to support Smart City: the case of “Chaire REVES.” *J Strateg Manag* 8(3):245–265. <https://doi.org/10.1108/JSMA-03-2015-0027>
- Echebarria C, Barrutia JM, Aguado-Moralejo I (2021) The Smart City journey: a systematic review and future research agenda. *Innov Eur J Soc Sci Res* 34(2):159–201. <https://doi.org/10.1080/13511610.2020.1785277>
- Edler J, Ruhlant RWS, Hommen (2005). Innovation and public procurement. *Review of Issues at Stake*
- Edler J, Georghiou L (2007) Public procurement and innovation—resurrecting the demand side. *Res Policy* 36(7):949–963. <https://doi.org/10.1016/j.respol.2007.03.003>
- Edler J, Yeow J (2016) Connecting demand and supply: the role of intermediation in public procurement of innovation. *Res Policy* 45(2):414–426. <https://doi.org/10.1016/j.respol.2015.10.010>
- Edquist C, Zabala-Iturriaga JM (2012) Public procurement for innovation as mission-oriented innovation policy. *Res Policy* 41(10):1757–1769. <https://doi.org/10.1016/j.respol.2012.04.022>
- Eisenhardt KM, Schoonhoven CB (1996) Resource-based view of strategic alliance formation: strategic and social effects in entrepreneurial firms. *Organ Sci* 7(2):136–150
- Engels F, Wentland A, Pfothenhauer SM (2019) Testing future societies? Developing a framework for test beds and living labs as instruments of innovation governance. *Res Policy* 48(9):103826. <https://doi.org/10.1016/j.respol.2019.103826>
- Eriksson M, Niitamo V-P, Kulkki S (2005) State-of-the-art in utilizing living labs approach to user-centric ICT innovation—A European approach
- Etgar M (2008) A descriptive model of the consumer co-production process. *J Acad Mark Sci* 36(1):97–108. <https://doi.org/10.1007/s11747-007-0061-1>
- European Union GCP (2023) Orientation paper of the urban agenda for the EU greening cities partnership
- Faems D, Van Looy B, Debackere K (2005) Interorganizational collaboration and innovation: toward a portfolio approach. *J Prod Innov Manag* 22(3):238–250. <https://doi.org/10.1111/j.0737-6782.2005.00120.x>
- Ferraris A, Santoro G, Papa A (2018) The cities of the future: hybrid alliances for open innovation projects. *Futures* 103:51–60. <https://doi.org/10.1016/j.futures.2018.03.012>

- Ferraris A, Santoro G, Pellicelli AC (2020) “Openness” of public governments in smart cities: removing the barriers for innovation and entrepreneurship. *Int Entrep Manag J* 16(4):1259–1280. <https://doi.org/10.1007/s11365-020-00651-4>
- Feurstein K, Hesmer A, Hribernik K, Thoben K-D, Schumacher J (2008) Living labs: a new development strategy, pp 1–14
- Fjeldstad ØD, Snow CC, Miles RE, Lettl C (2012) The architecture of collaboration. *Strateg Manag J* 33(6):734–750. <https://doi.org/10.1002/smj.1968>
- Fox NJ (2011) Boundary objects, social meanings and the success of new technologies. *Sociology* 45(1):70–85. <https://doi.org/10.1177/0038038510387196>
- Gavetti G (2012) Perspective—toward a behavioral theory of strategy. *Organ Sci* 23(1):267–285. <https://doi.org/10.1287/orsc.1110.0644>
- Gillespie T (2010) The politics of ‘platforms.’ *New Media Soc* 12(3):347–364. <https://doi.org/10.1177/1461444809342738>
- Gleeson AD, Kosovac A, Fastenrath S, Acuto M, Gleeson B (2022) Fragmentation and urban knowledge: an analysis of urban knowledge exchange institutions. Elsevier
- Gomes LADV, Facin ALF, Salerno MS, Ikenami RK (2018) Unpacking the innovation ecosystem construct: evolution, gaps and trends. *Technol Forecast Soc Change* 136:30–48. <https://doi.org/10.1016/j.techfore.2016.11.009>
- Graham S (2002) Bridging urban digital divides? Urban polarisation and information and communications technologies (ICTs). *Urban Stud* 39(1):33–56. <https://doi.org/10.1080/00420980220099050>
- Green M (2011) Making development agents: participation as boundary object in international development. In: *The government of chronic poverty*. Routledge
- Haagensen N (2024) Boundary objects in complex governance systems: collective action clauses in European sovereign debt governance. *J Eur Publ Policy* 31(2):586–609. <https://doi.org/10.1080/13501763.2022.2143867>
- Haefner N, Wincent J, Parida V, Gassmann O (2021) Artificial intelligence and innovation management: a review, framework, and research agenda. *Technol Forecast Soc Chang* 162:120392. <https://doi.org/10.1016/j.techfore.2020.120392>
- Haghani M, Sabri S, De Gruyter C, Ardeshiri A, Shahhoseini Z, Sanchez TW, Acuto M (2023) The landscape and evolution of urban planning science. *Cities* 136:104261
- Hagiü A (2014) Strategic decisions for multisided platforms. MIT
- Hartley J, Sørensen E, Torfing J (2013) Collaborative innovation: a viable alternative to market competition and organizational entrepreneurship. *Public Adm Rev* 73(6):821–830. <https://doi.org/10.1111/puar.12136>
- Harvey F, Chrisman N (1998) Boundary objects and the social construction of GIS technology. *Environ Plann Econ Space* 30(9):1683–1694. <https://doi.org/10.1068/a301683>
- Hawkins B, Pye A, Correia F (2017) Boundary objects, power, and learning: the matter of developing sustainable practice in organizations. *Manag Learn* 48(3):292–310. <https://doi.org/10.1177/1350507616677199>
- Holland R (2008) Will the real Smart City please stand up? Creative, progressive or just Entrepreneurial. *City* 12(3):302–320
- Hossain M (2018) Frugal innovation: a review and research agenda. *J Clean Prod* 182:926–936. <https://doi.org/10.1016/j.jclepro.2018.02.091>
- Hughes K (2017) Blockchain, the greater good, and human and civil rights. *Metaphilosophy* 48(5):654–665. <https://doi.org/10.1111/meta.12271>
- Huizingh EKRE (2011) Open innovation: state of the art and future perspectives. *Technovation* 31(1):2–9. <https://doi.org/10.1016/j.technovation.2010.10.002>
- Huovila A, Siikavirta H, Antuña Rozado C, Rökman J, Tuominen P, Paiho S, Hedman Å, Ylén P (2022) Carbon-neutral cities: critical review of theory and practice. *J Clean Prod* 341:130912. <https://doi.org/10.1016/j.jclepro.2022.130912>
- Kähkönen A-K (2014) The influence of power position on the depth of collaboration. *Supply Chain Manag Int J* 19(1):17–30. <https://doi.org/10.1108/SCM-03-2013-0079>
- Kajol K, Singh R, Paul J (2022) Adoption of digital financial transactions: a review of literature and future research agenda. *Technol Forecast Soc Chang* 184:121991. <https://doi.org/10.1016/j.techfore.2022.121991>
- Karaba F, Roehrich JK, Conway S, Turner J (2023) Information sharing in public-private relationships: the role of boundary objects in contracts. *Public Manag Rev* 25(11):2166–2190. <https://doi.org/10.1080/14719037.2022.2065344>

- Klijin E-H, Koppenjan J (2014) Complexity in governance network theory. *Complex Gov Netw* 1(1):1. <https://doi.org/10.7564/14-CGN8>
- Klijin E-H, Skelcher C (2007) Democracy and governance networks: compatible or not? *Public Adm* 85(3):587–608. <https://doi.org/10.1111/j.1467-9299.2007.00662.x>
- Komninos N, Mora L (2018) Exploring the big picture of Smart City research. *Sci Reg* 17(1):15–38. <https://doi.org/10.14650/88815>
- Kramer R (1990) [Review of review of collaborating: finding common ground for multiparty problems, by B. Gray]. *The Academy of Management Review*, 15(3):545–547. <https://doi.org/10.2307/258026>
- Kraus S, Breier M, Dasí-Rodríguez S (2020) The art of crafting a systematic literature review in entrepreneurship research. *Int Entrep Manag J* 16(3):1023–1042. <https://doi.org/10.1007/s11365-020-00635-4>
- Kraus S, Breier M, Lim WM, Dabić M, Kumar S, Kanbach D, Mukherjee D, Corvello V, Piñeiro-Chousa J, Liguori E, Palacios-Marqués D, Schiavone F, Ferraris A, Fernandes C, Ferreira JJ (2022) Literature reviews as independent studies: guidelines for academic practice. *RMS* 16(8):2577–2595. <https://doi.org/10.1007/s11846-022-00588-8>
- Kraus S, Bouncken RB, Yela Aránega A (2024) The burgeoning role of literature review articles in management research: an introduction and outlook. *RMS* 18(2):299–314. <https://doi.org/10.1007/s11846-024-00729-1>
- Leite E (2022) Innovation networks for social impact: an empirical study on multi-actor collaboration in projects for smart cities. *J Bus Res* 139:325–337
- Leminen S, Nyström A-G, Westerlund M (2015) A typology of creative consumers in living labs. *J Eng Tech Manag* 37:6–20. <https://doi.org/10.1016/j.jengtecman.2015.08.008>
- León LFA, Rosen J (2021) Technology as ideology in urban governance. In: *Smart spaces and places*, Routledge
- Leonidou LC, Katsikeas CS, Samiee S, Aykol B (2018) International marketing research: a state-of-the-art review and the way forward. In: Leonidou LC, Katsikeas CS, Samiee S, Aykol B (eds) *Advances in global marketing*. Springer, Cham, pp 3–33. [https://doi.org/10.1007/978-3-319-61385-7\\_1](https://doi.org/10.1007/978-3-319-61385-7_1)
- Liberati A (2009) The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Ann Intern Med*. <https://doi.org/10.7326/0003-4819-151-4-200908180-00136>
- Liedtka J (2018) Why design thinking works (Harvard Business Review)
- Lim Y, Edelenbos J, Gianoli A (2019) Identifying the results of Smart City development: findings from systematic literature review. *Cities*. <https://doi.org/10.1016/j.cities.2019.102397>
- Liu R, Rindt J, Hart S (2020) How firms learn in NPD networks: the 4S model. *Ind Mark Manag* 89:446–458. <https://doi.org/10.1016/j.indmarman.2020.02.025>
- Livingstone S (2010) Youthful participation: what have we learned, what shall we ask next?
- MacGillivray BH, Franklin A (2015) Place as a boundary device for the sustainability sciences: concepts of place, their value in characterising sustainability problems, and their role in fostering integrative research and action. *Environ Sci Policy* 53:1–7. <https://doi.org/10.1016/j.envsci.2015.06.021>
- Mansell R (2012) *Imagining the internet: communication, innovation, and governance*. Oxford University Press
- Manski S (2017) Building the blockchain world: technological commonwealth or just more of the same? *Strateg Chang* 26(5):511–522. <https://doi.org/10.1002/jsc.2151>
- Marheineke M, Habicht H, Möslein KM (2016) Bridging knowledge boundaries: the use of boundary objects in virtual innovation communities. *R&D Manag* 46(S3):1084–1094. <https://doi.org/10.1111/radm.12216>
- Marikyan D, Papagiannidis S, Alamanos E (2019) A systematic review of the smart home literature: a user perspective. *Technol Forecast Soc Change* 138:139–154. <https://doi.org/10.1016/j.techfore.2018.08.015>
- Marsal-Llacuna M-L (2018) Future living framework: Is blockchain the next enabling network? *Technol Forecast Soc Chang* 128:226–234. <https://doi.org/10.1016/j.techfore.2017.12.005>
- Marsal-Llacuna M-L (2020) The people's Smart City dashboard (PSCD): delivering on community-led governance with blockchain. *Technol Forecast Soc Chang* 158:120150. <https://doi.org/10.1016/j.techfore.2020.120150>
- Martin CJ, Evans J, Karvonen A (2018) Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America. *Technol Forecast Soc Chang* 133:269–278. <https://doi.org/10.1016/j.techfore.2018.01.005>
- Massaro M, Dumay J, Guthrie J (2016) On the shoulders of giants: undertaking a structured literature review in accounting. *Account Audit Account J* 29(5):767–801

- Mazzucato M (2013) Financing innovation: creative destruction vs. destructive creation. *Ind Corp Change* 22(4):851–867. <https://doi.org/10.1093/icc/dtt025>
- Mazzucato, M. (2018). *Mission-Oriented Research & Innovation in the European Union*.
- Meijer A, Bolívar MPR (2016) Governing the Smart City: a review of the literature on smart urban governance. *Int Rev Adm Sci* 82(2):392–408. <https://doi.org/10.1177/0020852314564308>
- Mishra V, Mishra MP (2023) PRISMA for review of management literature—method, merits, and limitations— an academic review. In: Rana S, Singh J, Kathuria S (eds) *Advancing methodologies of conducting literature review in management domain*. Emerald Publishing Limited, pp 125–136. <https://doi.org/10.1108/S2754-586520230000002007>
- Molina-Azorín JF, Claver-Cortés E, López-Gamero MD, Tari JJ (2009) Green management and financial performance: a literature review. *Manag Decis* 47(7):1080–1100. <https://doi.org/10.1108/00251740910978313>
- Möller K, Halinen A (2017) Managing business and innovation networks—from strategic nets to business fields and ecosystems. *Ind Mark Manag* 67:5–22. <https://doi.org/10.1016/j.indmarman.2017.09.018>
- Mora L, Bolici R, Deakin M (2017) The first two decades of smart-city research: a bibliometric analysis. *J Urban Technol* 24(1):3–27. <https://doi.org/10.1080/10630732.2017.1285123>
- Mora L, Gerli P, Ardito L, Messeni Petruzzelli A (2023b) Smart City governance from an innovation management perspective: theoretical framing, review of current practices, and future research agenda. *Technovation*. <https://doi.org/10.1016/j.technovation.2023.102717>
- Mora L, Deakin M, Reid A (2019) Strategic principles for Smart City development: a multiple case study analysis of European best practices. Elsevier
- Mora L, Appio FP, Foss NJ, Arellano-Gault D, Zhang X (2023) Organizing for Smart City development: Research at the crossroads. Introduction to the special issue. In: *Organization studies*, Vol. 44(10), pp. 1559–1575, SAGE Publications Sage, London, England. [https://journals.sagepub.com/doi/abs/https://doi.org/10.1177/01708406231197815?casa\\_token=5gyMFwifxyUAAAAA:u3SFjNjX1-Lr6X3fp2vcx0kBF-InhXel38mvrXkeYXWKOzKj3ny7YpNtf\\_Lt4q74MVkeq1fHU6FtSw](https://journals.sagepub.com/doi/abs/https://doi.org/10.1177/01708406231197815?casa_token=5gyMFwifxyUAAAAA:u3SFjNjX1-Lr6X3fp2vcx0kBF-InhXel38mvrXkeYXWKOzKj3ny7YpNtf_Lt4q74MVkeq1fHU6FtSw)
- Muñoz P, Cohen B (2018) Sustainable entrepreneurship research: taking stock and looking ahead. *Bus Strateg Environ* 27(3):300–322. <https://doi.org/10.1002/bse.2000>
- Nam T (2012a) Citizens' attitudes toward open government and government 2.0. *Int Rev Adm Sci* 78(2):346–368. <https://doi.org/10.1177/0020852312438783>
- Nam T (2012b) Suggesting frameworks of citizen-sourcing via government 2.0. *Gov Inf Q* 29(1):12–20. <https://doi.org/10.1016/j.giq.2011.07.005>
- Nesti G, Graziano PR (2020) The democratic anchorage of governance networks in smart cities: an empirical assessment. *Public Manag Rev* 22(5):648–667. <https://doi.org/10.1080/14719037.2019.1588355>
- Nguyen HT, Marques P (2022) The promise of living labs to the Quadruple Helix stakeholders: exploring the sources of (dis)satisfaction. *Eur Plan Stud* 30(6):1124–1143. <https://doi.org/10.1080/09654313.2021.1968798>
- Nguyen HT, Marques P, Benneworth P (2022) Living labs: challenging and changing the Smart City power relations? *Technol Forecast Soc Chang* 183:121866
- Nicolini D, Mengis J, Swan J (2012) Understanding the role of objects in cross-disciplinary collaboration. *Organ Sci* 23(3):612–629. <https://doi.org/10.1287/orsc.1110.0664>
- Nielsen BF, Baer D, Lindkvist C (2019) Identifying and supporting exploratory and exploitative models of innovation in municipal urban planning; key challenges from seven Norwegian energy ambitious neighborhood pilots. *Technol Forecast Soc Chang* 142:142–153. <https://doi.org/10.1016/j.techfore.2018.11.007>
- Nilssen M (2019) To the Smart City and beyond? Developing a typology of smart urban innovation. *Technol Forecast Soc Chang* 142:98–104. <https://doi.org/10.1016/j.techfore.2018.07.060>
- Oschinsky FM, Klein HC, Niehaves B (2022) Invite everyone to the table, but not to every course: how design-thinking collaboration can be implemented in smart cities to design digital services. *Electron Mark* 32(4):1925–1941. <https://doi.org/10.1007/s12525-022-00567-7>
- Pansera M, Marsh A, Owen R, Flores López JA, De Alba Ulloa JL (2023) Exploring citizen participation in Smart City development in Mexico City: an institutional logics approach. *Organ Stud* 44(10):1679–1701. <https://doi.org/10.1177/01708406221094194>
- Papadopoulos Y (2012) Accountability and multi-level governance: more accountability, less democracy? In: *Accountability and European Governance*, Routledge
- Paroutis S, Bennett M, Heracleous L (2014) A strategic view on Smart City technology: the case of IBM smarter cities during a recession. *Technol Forecast Soc Chang* 89:262–272. <https://doi.org/10.1016/j.techfore.2013.08.041>

- Paskaleva K, Cooper I (2018) Open innovation and the evaluation of internet-enabled public services in smart cities. *Technovation* 78:4–14
- Paskaleva K, Cooper I (2019) Innovations in co-created Smart City services. In: Bolivar MPR (ed) *Setting foundations for the creation of public value in smart cities*. Springer, Cham, pp 165–195. [https://doi.org/10.1007/978-3-319-98953-2\\_7](https://doi.org/10.1007/978-3-319-98953-2_7)
- Paskaleva K, Cooper I, Linde P, Peterson B, Götz C (2015) Stakeholder engagement in the Smart City: making living labs work. In: Rodríguez-Bolivar MP (ed) *Transforming city governments for successful smart cities*. Springer, Cham, pp 115–145. [https://doi.org/10.1007/978-3-319-03167-5\\_7](https://doi.org/10.1007/978-3-319-03167-5_7)
- Pilon-Summons C, Pratt S, Brown PJ, Baumber A (2022) From barriers to boundary objects: rights of nature in Australia. *Environ Sci Policy* 134:13–22. <https://doi.org/10.1016/j.envsci.2022.03.013>
- Ramaswami A, Russell AG, Culligan PJ, Sharma KR, Kumar E (2016) Meta-principles for developing smart, sustainable, and healthy cities. *Science* 352(6288):940–943. <https://doi.org/10.1126/science.aaf7160>
- Renault S, Boutigny E (2014) Crowdsourcing citizen: Définition et enjeux pour les villes. *Politiques Et Management Public* 31:215–237
- Richter C, Kraus S, Syrjä P (2015) The Smart City as an opportunity for entrepreneurship. *Int J Entrep Ventur* 7(3):211–226. <https://doi.org/10.1504/IJEV.2015.071481>
- Rizzo A, Habibipour A, Ståhlbröst A (2021) Transformative thinking and urban living labs in planning practice: a critical review and ongoing case studies in Europe. *Eur Plan Stud* 29(10):1739–1757. <https://doi.org/10.1080/09654313.2021.1911955>
- Ruhlandt RWS (2018) The governance of smart cities: a systematic literature review. *Cities* 81:1–23
- Saldert H (2024) Social sustainability for whom? The role of discursive boundary objects in Swedish strategic urban planning. *Geoforum* 152:104022. <https://doi.org/10.1016/j.geoforum.2024.104022>
- Sandulli FD, Ferraris A, Bresciani S (2017) How to select the right public partner in Smart City projects. *R&D Manag* 47(4):607–619. <https://doi.org/10.1111/radm.12250>
- Sapsed J, Salter A (2004) Postcards from the edge: local communities, global programs and boundary objects. *Organ Stud* 25(9):1515–1534. <https://doi.org/10.1177/0170840604047998>
- Sauer PC, Seuring S (2023) How to conduct systematic literature reviews in management research: a guide in 6 steps and 14 decisions. *RMS* 17(5):1899–1933. <https://doi.org/10.1007/s11846-023-00668-3>
- Schiavone F, Paolone F, Mancini D (2019) Business model innovation for urban smartization. *Technol Forecast Soc Chang* 142:210–219. <https://doi.org/10.1016/j.techfore.2018.10.028>
- Schuurman D, De Marez L, Ballon P (2016) The impact of living lab methodology on open innovation contributions and outcomes. *Technol Innov Manag Rev* 6(1):1. <https://doi.org/10.22215/timreview/956>
- Secinaro S, Brescia V, Lanzalonga F, Santoro G (2022) Smart City reporting: a bibliometric and structured literature review analysis to identify technological opportunities and challenges for sustainable development. *J Bus Res* 149:296–313
- Seidel VP, O'Mahony S (2014) Managing the repertoire: stories, metaphors, prototypes, and concept coherence in product innovation. *Organ Sci* 25(3):691–712. <https://doi.org/10.1287/orsc.2013.0879>
- Shelton T, Lodato T (2019) Actually existing smart citizens: expertise and (non)participation in the making of the Smart City. *City* 23(1):35–52. <https://doi.org/10.1080/13604813.2019.1575115>
- Shepherd DA, Seyb SK, George G (2023) Grounding business models: cognition, boundary objects, and business model change. *Acad Manag Rev* 48(1):100–122. <https://doi.org/10.5465/amr.2020.0173>
- Snow CC, Håkansson DD, Obel B (2016) A Smart City is a collaborative community: lessons from smart Aarhus. *Calif Manag Rev* 59(1):92–108. <https://doi.org/10.1177/0008125616683954>
- Sørensen E, Torfing J (2009) Making governance networks effective and democratic through metagovernance. *Public Adm* 87(2):234–258. <https://doi.org/10.1111/j.1467-9299.2009.01753.x>
- Sørensen E, Torfing J (2011) Enhancing collaborative innovation in the public sector. *Adm Soc* 43(8):842–868. <https://doi.org/10.1177/0095399711418768>
- Spee AP, Jarzabkowski P (2009) Strategy tools as boundary objects. *Strateg Organ* 7(2):223–232. <https://doi.org/10.1177/1476127009102674>
- Spring J (2003) *Educating the consumer-citizen: a history of the marriage of schools, advertising, and media*. Routledge. <https://doi.org/10.4324/9781410607591>
- Srnicek N (2017) *Platform capitalism*. John Wiley & Sons
- Star SL, Griesemer JR (1989) Institutional ecology, 'translations' and boundary objects: amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907–39. *Soc Stud Sci* 19(3):387–420. <https://doi.org/10.1177/030631289019003001>

- Steils N, Hanine S, Rochdane H, Hamdani S (2021) Urban crowdsourcing: stakeholder selection and dynamic knowledge flows in high and low complexity projects. *Ind Mark Manag* 94:164–173. <https://doi.org/10.1016/j.indmarm.2021.02.011>
- Steils N, Hanine S (2019) Value-added crowdsourcing: digital catalysts for creative contests. In: *Managing diversity, innovation, and infrastructure in digital business*, pp 160–178. IGI Global. <https://doi.org/10.4018/978-1-5225-5993-1.ch008>
- Stewart J, Hyysalo S (2008) Intermediaries, users and social learning in technological innovation. *Int J Innov Manag* 12(03):295–325. <https://doi.org/10.1142/S1363919608002035>
- Strauss AL, Corbin JM (1998) *Basics of qualitative research: techniques and procedures for developing grounded theory*, 2nd edn. Sage Publications, California
- Stromquist NP (2019) World development report 2019: the changing nature of work. *Int Rev Educ* 65(2):321–329. <https://doi.org/10.1007/s11159-019-09762-9>
- Sun J, Yan J, Zhang KZK (2016) Blockchain-based sharing services: what blockchain technology can contribute to smart cities. *Financ Innov* 2(1):26. <https://doi.org/10.1186/s40854-016-0040-y>
- Swan M, de Filippi P (2017) Toward a philosophy of blockchain: a symposium: introduction. *Metaphilosophy* 48(5):603–619. <https://doi.org/10.1111/meta.12270>
- Torfing J (2019) Collaborative innovation in the public sector: the argument. *Public Manag Rev* 21(1):1–11. <https://doi.org/10.1080/14719037.2018.1430248>
- Townsend AM (2013) *Smart Cities: big data, civic hackers, and the quest for a New Utopia*. W. W. Norton & Company
- Tranfield D, Denyer D, Smart P (2003) Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *Br J Manag* 14(3):207–222. <https://doi.org/10.1111/1467-8551.00375>
- Uyerra E, Flanagan K (2010) Understanding the innovation impacts of public procurement. *Eur Plan Stud* 18(1):123–143. <https://doi.org/10.1080/09654310903343567>
- van der Graaf S, Ballon P (2019) Navigating platform urbanism. *Technol Forecast Soc Change* 142:364–372
- van Pelt SC, Haasnoot M, Arts B, Ludwig F, Swart R, Biesbroek R (2015) Communicating climate (change) uncertainties: simulation games as boundary objects. *Environ Sci Policy* 45:41–52. <https://doi.org/10.1016/j.envsci.2014.09.004>
- Van Winden W, Carvalho L (2019) Intermediation in public procurement of innovation: how Amsterdam's startup-in-residence programme connects startups to urban challenges. *Res Policy* 48(9):103789
- Vanolo A (2014) Smartmentality: the Smart City as disciplinary strategy. *Urban Stud* 51(5):883–898. <https://doi.org/10.1177/0042098013494427>
- Veeckman C, van der Graaf S (2015) The city as living laboratory: empowering citizens with the citadel toolkit. *Technol Innov Manag Rev*. <https://doi.org/10.22215/timreview/877>
- Velsberg O, Westergren UH, Jonsson K (2020) Exploring smartness in public sector innovation—creating smart public services with the Internet of Things. *Eur J Inf Syst* 29(4):350–368. <https://doi.org/10.1080/0960085X.2020.1761272>
- Wang CL, Chugh H (2014) Entrepreneurial learning: past research and future challenges. *Int J Manag Rev* 16(1):24–61. <https://doi.org/10.1111/ijmr.12007>
- Wegrich K (2019) The blind spots of collaborative innovation. *Public Manag Rev* 21(1):12–20. <https://doi.org/10.1080/14719037.2018.1433311>
- Weick KE, Sutcliffe KM, Obstfeld D (2005) Organizing and the process of sensemaking. *Organ Sci* 16(4):409–421. <https://doi.org/10.1287/orsc.1050.0133>
- Wheeler S (2017) Visions of contract. *J Law Soc* 44(S1):S74–S92. <https://doi.org/10.1111/jols.12050>
- Williams A, Whiteman G, Parker JN (2019) Backstage interorganizational collaboration: corporate endorsement of the sustainable development goals. *Acad Manag Discov* 5(4):367–395. <https://doi.org/10.5465/amd.2018.0154>
- Wirtz BW, Müller WM (2023) An integrative collaborative ecosystem for smart cities—a framework for organizational governance. *Int J Public Adm* 46(7):499–518. <https://doi.org/10.1080/01900692.2021.2001014>
- Yahia NB, Eljaoued W, Saoud NBB, Colomo-Palacios R (2021) Towards sustainable collaborative networks for smart cities co-governance. *Int J Inf Manag* 56:102037
- Yakura EK (2002) Charting time: timelines as temporal boundary objects. *Acad Manag J* 45(5):956–970. <https://doi.org/10.5465/3069324>
- Zarei F, Nik-Bakht M (2021) Citizen engagement body of knowledge—a fuzzy decision maker for index-term selection in built environment projects. *Cities* 112:103137. <https://doi.org/10.1016/j.cities.2021.103137>

- Zikic J, Voloshyna V (2023) Untangling space and career action: migrant career recontextualization in the host city. *Acad Manag Discov* 9(2):160–186. <https://doi.org/10.5465/amd.2020.0156>
- Zuzul TW (2019) “Matter Battles”: cognitive representations, boundary objects, and the failure of collaboration in two smart cities. *Acad Manag J* 62(3):739–764. <https://doi.org/10.5465/amj.2016.0625>

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