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Overcoming the Smart City Governance Challenge: An Innovation Management Perspective

Dominik Beckers[a,b] and Luca Mora [a,b,c]*

[a]Tallinn University of Technology, Academy of Architecture and Urban Studies, Estonia; [b]Tallinn University of Technology, FinEst Centre for Smart Cities, Estonia; [c]Edinburgh Napier University, The Business School, Scotland

ABSTRACT

This commentary explores the potential of strengthening smart city development (SCD) governance theory through a more meaningful integration of innovation management studies. We highlight the limited theoretical framework in SCD governance and show how theoretical stimuli from innovation management can address key governance challenges affecting SCD. Our focus encompasses several governance challenges that we use as exemplary cases: conceptualizing SCD, strategizing citywide SCD efforts, introducing monitoring methods and indicators for SCD projects, intermediating among stakeholders, and managing multi-level governance dynamics. The primary goal of our commentary is to advocate for increased multidisciplinary research in the SCD field, emphasizing the accelerated knowledge accumulation achievable by linking it with the more established field of innovation management studies. We conclude that innovation management offers valuable insights for advancing SCD governance theories. This commentary initiates a dialogue on the necessity of cross-disciplinary research in the smart city domain, which is expected to benefit both academics and practitioners.

KEYWORDS

urban innovation; innovation management; smart city projects; governance; theory building

Introduction

Interpreted as an answer to the socioeconomic and environmental sustainability challenges faced by urban environments worldwide, smart city development (SCD)[1] calls for "new ways of organizing city functions and urban life" (Ruohomaa et al., 2019: 6). By introducing digital technologies to boost sustainable urban development, SCD projects can trigger urban innovation processes (Bjørner, 2021). Their objective is to alter unsustainable urban development models by fixing the inefficiencies of social-technical systems for urban service delivery—for example, services related to transport, energy, waste management, healthcare, safety and security, housing, and education systems (Mora et al., 2021). SCD projects can be developed and deployed to rearrange the functioning of any urban socio-technical system. However, they cannot be

CONTACT Luca Mora L.Mora@napier.ac.uk Edinburgh Napier University, 219 Colinton Road, Edinburgh EH14 1DJ

governed in isolation; city-level coordination is required to realize cross-project synergies and ensure that the complexities of systemic urban challenges are addressed through a portfolio of complementary initiatives (De Sanctis et al., 2022). What ensures this level of coordination are governance mechanisms that create an organic whole, by establishing how different societal actors (from individual citizens to public and private organizations) should interact and collaborate in SCD projects (Garcia Alonso and Castro, 2016). Tasks, duties, and responsibilities are distributed across a wide range of stakeholders, leading to what Swyngedouw (2005) defines as "governance-beyond-the-state."

Effective governance frameworks can facilitate cross-sector innovation efforts (Torfing and Triantafillou, 2016) and improve the quality of life of citizens by integrating new technologies in public infrastructure to achieve community goals (Micozzi and Yigitcanlar, 2022). For example, SCD promises improvements in city services, increased social participation, better communication, enhanced education, and reduced digital inequalities (Viale Pereira and Schuch de Azambuja, 2021). However, the assemblage and functioning of governance approaches to SCD has not been sufficiently explored in scholarly research (Ruohomaa et al., 2019). Current theoretical formulations fall short in both explaining and guiding the management of SCD projects, resulting in a gap in evidence-based understanding among societal actors (Mora et al., 2020). Traditional urban governance models often struggle to keep up with the complex demands of digital transformations in urban settings. Research remains limited on how governance structures need to adapt to support SCD effectively (Razaghi and Finger, 2018; Ruhlandt, 2018). Scholars such as Ooms et al. (2020) emphasize that SCD projects require flexible, evolving governance arrangements to match their dynamic timelines. However, further investigation is needed to understand how these adaptable structures can be generalized across different SCD contexts (Chaffin et al., 2014).

In light of this inadequately developed theoretical background, numerous SCD projects launched by municipal governments worldwide have demonstrated issues with suboptimal planning and execution (Lee et al., 2014). This is a global challenge that has gained attention not only in academic circles but also in international policy debates. The United Nations, for example, recognizing the criticality of this challenge, have issued an urgent call to action to enhance research on SCD governance (UN-Habitat, 2022, 2023).

We respond to this call by addressing the following question: how can innovation theory help overcome SCD governance challenges? In this commentary, we show how the weak theoretical apparatus supporting SCD governance practice could be strengthened by invigorating the promising connection between innovation management studies and SCD research. Our perspective builds on the claim that, as of today, this cross-disciplinary connection has been underutilized; relevant theories and conceptual stimuli from innovation studies have been insufficiently leveraged to advance the SCD debate, and the studies that have built on this symbiosis have shown ample potential for theory development that has yet to be fully exploited (Dameri and Ricciardi, 2015; Maye, 2019; Mora et al., 2023). For instance, Karimikia et al. (2022) have applied boundary spanning theory to explore the complexity of governing smart city units—organizations or agencies responsible for coordinating a city's SCD projects. Similarly, Lee

(2020) has analyzed these organizations through the lens of living lab theory. Paskaleva (2011) used open innovation theory to study European trends in SCD projects, highlighting an emerging approach among practitioners that effectively connects technology with people, urban spaces, and other cities while facilitating the sharing of visions, knowledge, skills, and strategies for urban service and policy design. Moreover, Paskaleva stresses the need for clear theoretical frameworks, principles, and strategic agendas to unify these elements effectively. Nilssen (2019: 98) contributes a "typology of smart city initiatives" based on the extent and types of innovations involved, while Costales (2022) and Leitheiser and Follmann (2020) draw on social innovation theory to better understand the socioeconomic dimensions of SCD. Together, these case studies demonstrate the value of examining SCD governance through an innovation management perspective. This approach offers novel insights and supports theory development at the intersection of urban studies and innovation management, where a new field of inquiry is emerging, specifically focused on the interplay between urban settings and innovation (Nilssen, 2019).

Similarly, several scholars have shown that insights from innovation management can enhance our understanding of economic (Nogueira et al., 2019), environmental (Loorbach and Rotmans, 2010), and social (Ardill and Lemes De Oliveira, 2018) dynamics. These dynamics are central to SCD, which, in turn, influence their evolution (Bolívar and Meijer, 2016; Caputo et al., 2019). This intersection offers significant potential for advancing theory-building in SCD governance.

Aligning with scholars like Meijer and Bolívar (2016) and Pereira et al. (2018), we argue that governance arrangements are essential in guiding transformative economic, environmental, and social dynamics. These arrangements must be adaptable and evolve over time to address changing needs, clarify governance objectives, navigate complex contexts, and manage uncertainties in implementation (Rijke et al., 2012). In this commentary, we highlight the potential of innovation management studies to support theoretical advancements in SCD governance research. Table 1 provides examples of how specific innovation management theories can be connected to smart city governance challenges, with further details in the following sections.

The importance of addressing SCD governance and the challenges listed in Table 1 is strongly emphasized in two recent United Nations (UN) reports: *Global Review of Smart City Governance Practices* (UN-Habitat, 2022) and *Managing Smart City Governance: A Playbook for Local and Regional Governments* (UN-Habitat, 2023). These reports identify critical issues in key governance areas of SCD projects. We do not aim to cover all governance challenges comprehensively, but rather to present examples that illustrate the scope of significant issues identified in these UN reports. These examples serve to reveal the often-overlooked potential of innovation management studies to contribute to advancing debates on smart city governance.

It is important to clarify that our objective is not to present an exhaustive list of all theoretical concepts from innovation management studies applicable to SCD governance research. Such an endeavor exceeds our current scope. Instead, we concentrate on showcasing a selection of theories from innovation management that are particularly promising for enriching SCD governance research. These theories are considered fundamental in the innovation management field due to their ability to provide a profound comprehension of the intricacies of managing innovation. Although these theories may have

Table 1. Matching: addressing smart city governance challenges with innovation management theories

Smart City Studies		Innovation Management Studies	
Governance Challenges	Description	Relevant Theories	References
Conceptualization	• Definitional problem caused by terminological confusion • City-level focus • Smart city transformations interpreted as one-size-fits-all applications of technological solutions	*Social-technical transitions*	(Geels and Schot, 2007; Leonard-Barton, 1988)
		Social innovation	(Ardill and Lemes De Oliveira, 2018; Costales, 2022)
		Sensemaking	(Hübel, 2022; Pizzo et al., 2021)
		Boundary objects	(Mäenpää et al., 2016; Zhuo and Chen, 2023)
Strategy	• The need for citywide coordination of smart city projects and the creation of overarching smart city strategies	*Strategic orientation and flexibility*	(Cheng and Huizingh, 2014; Gatignon and Xuereb, 1997; McKee et al., 1989)
		Technology roadmapping	(Lee et al., 2011; Martin and Daim, 2012; Phaal et al., 2004)
		Open strategy	(Chesbrough and Appleyard, 2007; Hautz et al., 2017)
Monitoring	• Universal performance measurement dimensions that tend to overlook local context conditions • Static and formative key performance indicators that are backward-looking and overlook ongoing monitoring	*Innovation indicators*	(Dziallas and Blind, 2019; Truffer et al., 2017)
		Developmental evaluation	(Lam and Shulha, 2015; Patton, 2016)
Intermediation	• Incomplete understanding of smart city units, their organizational design, and their routines	*Innovation intermediaries*	(Howells, 2006; Kanda et al., 2020; Rossi et al., 2022; Sovacool et al., 2020; van Lente et al., 2003)
		Living labs	(Alam and Porras, 2018; Bulkeley et al., 2016)
		Transformational and charismatic leadership	(Aarons and Sommerfeld, 2012; Paulsen et al., 2009)
Multilevel Governance	• Coordination of political structures, regulatory frameworks, and decision-making processes at multiple administrative levels	*Boundary management*	(Capurro et al., 2021; Garzella et al., 2021; He and Berry, 2022)
		Scaling	(De Roo et al., 2019; Schut et al., 2020)

originated from broader disciplines, their refinement and implementation in innovation management have yielded significant relevance and insights.

To align theoretical stimuli with governance challenges, we conducted a review of theories and concepts from the field of innovation management. From this extensive array, we chose those theories that we believe to be exceptionally apt for contributing to SCD governance research. Our selection process was guided by evaluations and personal interpretations of each theory's potential to enhance SCD governance studies. This process was also informed by academic discourses in innovation management literature, particularly where these theories have been effectively employed.

The structure of our commentary is as follows. Following this introduction, we outline the five governance challenges that we selected, drawing on pertinent literature in the SCD domain. We then delve into each challenge, which we examine through the lens of theoretical developments from innovation management studies. The commentary culminates with a concluding section that encapsulates our main arguments and discusses

the possible impact of our perspective on the SCD knowledge field, emphasizing the necessity for more cross-disciplinary research.

Smart City Development Research Meets Innovation Studies

Conceptualization Challenge

Approaching SCD governance requires a clearer, more inclusive, and shared understanding of the SCD concept. This statement builds on a threefold critique. First, when dealing with the smart city term, there is a definitional problem that is caused by "terminological confusion" (Dameri and Cocchia, 2013: 5). Instead of agreeing on a shared definition, scholars and practitioners have been referring to SCD projects by using a multitude of different expressions—such as sustainable, green, smarter, digital, intelligent, and ubiquitous—in an interchangeable way (Samarakkody et al., 2019), without considering that these terms are interrelated but carry different meanings (Mora and Deakin, 2019). This lack of consensus (Gil-Garcia et al., 2015) has resulted in an oftentimes-attested misinterpretation and use of the SCD concept that has raised concerns questioning the effectiveness of the concept altogether (Anthopoulos et al., 2019). Second, by explicitly focusing on the city-level, the SCD term neglects the multitude of SCD projects that involve lower or higher levels of application, such as regions, neighborhoods, buildings, or specific infrastructure components (Walters, 2011). Third, many interpretations tend to describe SCD transformations as the outcome of one-size-fits-all applications of technological solutions rather than the result of social-technical innovation processes that are context-dependent (Meijer and Thaens, 2018). Interpretations based on technological solutionism have been critiqued for fostering a utopian, technology-deterministic view that primarily benefits technology providers, rather than effectively tackling the complexities of urban development (Mora and Deakin, 2019).

From an innovation management perspective, this conceptualization challenge can be comprehended as a form of *sensehiding*: a process of "distorting and manipulating images through holding back particular aspects or cues" (Horbach et al., 2018: 417). Scholars tend "to be subjective and follow personal trajectories in isolation from other researchers" (Mora et al., 2017: 20), and their interpretations only acknowledge aspects of the SCD concept that suit their own research objectives, while deliberately or unconsciously omitting other relevant features. For instance, current literature emphasizes that SCD projects cannot be solely interpreted as a means of generating technological change (Albino et al., 2015). But techno-driven SCD discourses persist (Guma and Monstadt, 2021), neglecting the social-technical implications of digital transformations that innovation studies highlight. Building on theories at the interface between innovation management and social-technical transition studies, SCD projects could be interpreted as social-technical transformation processes that originate from reconfigurations of technological systems as well as normative, cognitive, regulatory, and market mechanisms (Hillman et al., 2011).

Linking the conceptualization of SCD projects to social-technical systems theory enables a more pragmatic and holistic understanding, anchoring these projects within the complex interplay of technology, social structures, and human behavior (Mora et al., 2020). Additionally, it helps transcend their conventional portrayal at just the

city level. Social-technical transitions, as defined in innovation studies, involve extensive socio-spatial changes that span across administrative levels, both within and beyond the boundaries of a city (Späth and Rohracher, 2012). Adopting a social-technical perspective allows for a deeper understanding of the varied scales at which SCD projects operate. This perspective supports a shift from the narrower term smart *cities* to broader, more inclusive concepts like smart *places* and smart *territories*, which have recently begun to emerge at the intersection of innovation management and smart city governance literature (Gorelova et al., 2024; Navío-Marco et al., 2020). These terms offer a more inclusive and realistic interpretation than the traditional notion of smart cities.

Observing SCD through a social-technical lens reveals social innovation as a key catalyst and outcome of urban digital innovation (Ardill and Lemes De Oliveira, 2018). Within this theoretical framework, social innovation acts as a dynamic process that reshapes societal norms, values, and behaviors to offer innovative solutions for pressing social challenges. This transformative process results in lasting changes in social systems, emphasizing the importance of collaboration, inclusivity, and trust (Kim et al., 2021; Moore et al., 2015; Westley et al., 2014). Moreover, the sustainability objectives inherent to SCD projects highlight the complex interplay between social transformation and economic growth, driven by technological advances. Social innovation strategically addresses this interconnectedness (Costales, 2022).

Innovation theory could also help embrace a broader conceptualization of SCD, by building on the notion of *making process* (Geels and Schot, 2007). This notion posits that technological innovation emerges from ongoing interactions between a technology and its surrounding environment (Leonard-Barton, 1988). As a result of these interactions, through SCD projects, digital solutions and urban contexts engage in a mutual adaptation process, where each continuously adjusts to the other.

Zuzul's (2019) research offers relevant insights into how sensehiding can harm SCD. By analyzing two SCD projects, Zuzul observed that project partners embraced varying interpretations of the SCD concept. Their disagreement generated "concept ambiguity" (739), which in turn triggered "process ambiguity" (739). These divergent understandings of how to manage SCD projects resulted in both partnerships failing to achieve their goals, primarily due to the lack of a shared definition of the SCD concept from the outset.

To counteract this conceptual ambiguity, we invite SCD scholars to integrate sensemaking theory into academic discussions. Unlike sensehiding, sensemaking involves a collaborative process where project partners converge on interpretations and applications of contentious concepts (Horbach et al., 2018; Hübel, 2022). For example, Seligman (2006) effectively employs sensemaking theory to dissect technology adoption models, revealing the underlying mental frameworks and how they influence adoption practices. Applying this analytical process in SCD research could illuminate the interplay between mental models and SCD project execution, an area that remains underexplored.

Particularly useful in the SCD context is the retrospective nature of sensemaking. Past experiences and perceptions shape initial mental representations of concepts and boundary objects, linking diverse social worlds (Weick, 1995). By positioning this retrospective view in the SCD domain, these mental models should encompass the array of existing interpretations, forming a basis for an evidence-driven sensemaking process. Connecting these interpretations can help establish a unifying understanding of the SCD concept,

which is vital for aligning academic discourses with practical applications and preventing both concept and process ambiguities (Pizzo et al., 2021).

Finally, research on boundary objects is central to sensemaking theory (Mele et al., 2019) and offers an additional lens from innovation theory for examining project-level conceptualization issues. As innovation scholars explain, "boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use and become strongly structured in individual-site use" (Star and Griesemer, 1989: 393). In SCD, the conceptualization of an SCD project itself can be seen as a boundary object, whose objective is to facilitate alignment among project partners. This alignment extends to other project elements like plans, objectives, and strategic orientations.

Strategy Challenge

The importance of strategizing citywide coordination in smart city initiatives is a critical yet underexplored area in the literature (Pivar, 2019). While many studies encourage local governments to develop digital innovation strategies that involve various societal actors, there is a lack of guidance for creating comprehensive strategies that systematically address SCD projects (Ojo et al., 2015). These frameworks should be regarded as adaptable frameworks, allowing cities to develop approaches that align with their distinct characteristics and requirements. This gap in research leads to a situation in which practical implementation surpasses theoretical generalizations in academic discourses (Lee et al., 2014). However, digital innovation strategies often are too theoretical, based solely on literature reviews without considering practical application, or they focus narrowly on technological and architectural aspects, neglecting social and environmental impacts (Nam and Pardo, 2011; Zygiaris, 2013).

Innovation scholars emphasize that any attempt to orchestrate a portfolio of innovation projects in an organization requires a strategic orientation (Tutar et al., 2015). This perspective is echoed in the SCD domain, where digital innovation strategies are crucial for unified city-level development, preventing the fragmentation of projects and resources (Komninos et al., 2019; Mora et al., 2019). The importance of introducing citywide strategic coordination and orchestration is particularly evident in the work by Mora et al. (2020). Building on transition theory (Geels and Schot, 2007), the authors show that urban digital transformation efforts tend to generate from a multitude of interrelated projects that cannot be implemented in isolation from one another.

For advancing digital innovation strategies for urban areas, SCD can benefit from insights in technology strategy and technology transitions (see Phaal et al., 2004), including technology roadmapping (TRM) theories. These theories, grounded in literature on strategic orientation and flexibility (Gatignon and Xuereb, 1997; McKee et al., 1989), suggest that "a distinct strategic orientation serves as a clear organizational focus, which enables alignment with an appropriate innovation strategy" (Cheng and Huizingh, 2014: 1248). TRM is a framework for strategic decision-making, helping to "develop mid- to long-term technological strategies that can secure future technological alternatives for creating new technological innovations" (Lee et al., 2011: 486). TRM theories "provide a direction for future alignment of activities and planning" (Martin and Daim, 2012: 96),

while adapting to changing technological landscapes (Komninos et al., 2019). Therefore, this approach to innovation strategy formulation can also help examine how to manage technology life cycle stages, a major issue in SCD projects (Cetindamar et al., 2020). Additionally, TRM can help link "technical aspects such as hardware, software, data transmission and processing, to higher socio-technical levels such as users and application scenarios, and societal and community demands" (Mao et al., 2020: 9146).

Available data show that only a few urban areas like the City of Toronto (2022), and some Greek municipalities (Siokas and Tsakanikas, 2022) are employing TRM for their local digital innovation strategies. Moreover, there is a scarcity of studies examining TRM in the SCD context, with Lee et al. (2013) being a notable exception. Their study of a Korean SCD project shows that TRM supports strategic planning in complex digital innovation projects. Additionally, the authors outline an eight-phase process for practitioners to follow when developing strategies for their SCD projects following the TRM approach: planning, demand identification, service identification, device identification, technology identification, roadmap drafting, roadmap adjustment, and follow-up. However, in this case study, attention is mainly posed on practical implications rather than creating the basis for theoretical generalizations. Moreover, the contribution of this research addresses single-project-implementation questions rather than setting the stage for a line of inquiry that investigates strategy-related challenges by adopting a citywide perspective (Mao et al., 2020).

Additionally, examining strategy challenges through the lens of open strategy could also be beneficial (see Hautz et al., 2017). Flexibility is a key challenge for municipal governments in achieving citywide coordination (Brozovic, 2018), a task difficult to perform with traditional strategy processes (Hidalgo and Albors, 2008). Effective local digital innovation strategies for coordinating SCD projects should be adaptable over time. Traditional planning cycles often overlook the potential of bottom-up initiatives (Zygiaris, 2013), an essential component of SCD (Kumar et al., 2020). Open strategy, grounded in open innovation principles (see Chesbrough, 2003), can accommodate organic growth from various societal actors (Bush et al., 2017). This approach enables the integration of new trends and signals while maintaining strategic stability (Chesbrough and Appleyard, 2007).

Monitoring Challenge

Research into SCD project assessments remains limited (Gerogiannis and Manika, 2022). Current tools focus more on ranking cities based on "smart" characteristics rather than evaluating the quality and innovation of their smart city projects. Indexes like the Smart Cities Index and Smart City Observatory[2] exemplify this issue. Giffinger and Gudrun (2010) have noted a trend where the pursuit of high rankings overshadows genuine development. Sharifi (2019) criticizes the prevalent use of static Key Performance Indicators (KPIs) in SCD assessments for their lack of ongoing project monitoring. Kattel et al. (2018) have pointed out the absence of clear guidelines on measuring SCD projects and gathering relevant data. Moreover, De Sanctis et al. (2022) have exposed a significant gap in integrating different data sources in these assessments. Consequently, professionals in the SCD field struggle with a lack of monitoring and assessment tools

that can merge various data sources and adapt to specific local conditions (Gerogiannis and Manika, 2022; Monzon, 2015).

From an innovation management perspective, this gap is worrisome. It is widely acknowledged in innovation studies that monitoring processes are vital project activities and imply assessing social-technical transitions in the making (Farla et al., 2012). Effective monitoring is needed to enhance decision-making (De Oliveira et al., 2015) and project planning (Karo and Kattel, 2018).

Theory-building in this underexplored area of SCD research could benefit from advances in innovation indicators, both product- and process-oriented (Makkonen and van der Have, 2013). These indicators span from *ex ante*, assessing early stages of innovation, to *ex post*, evaluating post-market implementation. At the product level, *ex ante* indicators might include the number of patent applications or the novelty of SCD project solutions, while *ex post* indicators could focus on the number of new solutions introduced or their success rate. At the process level, *ex ante* indicators might involve time allocated for idea generation or management, while *ex post* indicators could measure the extent of process improvements or the rate of idea implementation (Dziallas and Blind, 2019). These examples illustrate how innovation theory can guide the selection of indicators to monitor the various phases of SCD project implementation and assess both tangible and intangible outcomes.

The integration of developmental evaluation into SCD projects addresses a significant gap in current literature. Traditional methods often fail to capture knowledge generated during projects, leading to issues like reduced innovation capacity and stakeholder exclusion (Brorström et al., 2018; Fernandez-Anez et al., 2020; Sharifi, 2019). Developmental evaluation is a method for supporting adaptation in complex environments, emphasizing participatory monitoring involving diverse stakeholders (Preskill and Beer, 2012). Various stakeholders collaborate in designing the monitoring process and simultaneously take on the key roles necessary to sustain its implementation—evaluator, learning facilitator, project manager, and innovator (Lam and Shulha, 2015)—making it particularly suitable for the dynamic nature of SCD projects and the cross-sector innovation ecosystems supporting their development.

Gothenburg, Sweden, is an example of a city where municipal staff recognized the need for developmental evaluation in SCD projects. In response to this need, they sought a tool that could measure normative and relatively easily quantifiable variables related to technical or financial aspects while also addressing the more challenging environmental and social dimensions, an endeavor perceived by staff as more difficult and complex to measure and communicate (Brorström et al., 2018). Similarly, Lam and Shulha (2015) demonstrated the effectiveness of developmental evaluation in a Canadian university's teacher education program, noting its capability to facilitate social innovation and lasting organizational change. They observed that this approach to monitoring provided timely data, aiding decision-makers in responding to evolving needs, and making necessary adjustments.

Patton (2016) describes developmental evaluation as method-agnostic; it grants flexibility when selecting the means for gathering data and can be complemented with monitoring practices that fit with the specific requirements of each project stage (Lam and Shulha, 2015). In SCD projects, this flexibility is particularly valuable as integrating forward-looking practices like technology assessment and scenario-building is

recommended (Truffer et al., 2017). While a combination of such approaches has been largely examined in the field of innovation, it is only scarcely considered in SCD research. These practices are understood "as a participatory form of future-oriented policy support" (Weber et al., 2019: 241), essential for anticipatory agenda setting and decision-making that can help stakeholders in SCD projects to formulate expectations about future developments and outcomes. This is a vital component given the non-linear and volatile nature of technology lifecycles.

Intermediation Challenge

The initiation of SCD projects is a collaborative endeavor, involving a range of actors beyond just municipal governments. This creates a dynamic yet intricate network of collaborations and outcomes. Research in SCD highlights the pivotal role of intermediary organizations in coordinating these efforts and mitigating siloed thinking within and across entities. These organizations, often referred to as smart city units (Mora et al., 2023) are instrumental in fostering local innovation networks and supporting SCD (Ferraris et al., 2018). Karimikia et al. (2022) argue that these units fulfil essential technical, cultural, political, and social roles. However, our understanding of smart city units remains limited (Bakici et al., 2013), with questions remaining about their power, organizational structure, integration into local governance, and resource implications (Ehnert et al., 2022; Kattel et al., 2018). Moreover, there is a lack of comprehensive empirical studies on the methods and processes that these organizations use to cultivate innovation networks. The transition from top-down to bottom-up governance models through smart city units warrants further investigation (Karimikia et al., 2022). Notably, there is an absence of a detailed taxonomy of smart city units, which are generally categorized as either internal departments within municipal governments or external organizations acting on their behalf (Mora et al., 2019). A more nuanced classification is needed.

Literature on innovation intermediaries could bridge the existing knowledge gaps in our understanding of smart city units. This stream of literature provides insights on how these units develop and coordinate the complex innovation ecosystems for SCD, catalyze and spread SCD project solutions (Rossi et al., 2022), and influence the design and implementation of SCD policies and strategies (Kivimaa and Martiskainen, 2018). Innovation management studies indicate that these intermediaries can be public or private organizations, networks, or even individuals (Ehnert et al., 2022; Sovacool et al., 2020) and operating across various sectors, geographic regions, and administrative levels (Kanda et al., 2020). Their multi-functional role in creating and sustaining innovation ecosystems (see below) is critical in complex settings like urban environments. Research on systemic intermediaries, which operate at a system or network level as opposed to conventional bilateral intermediaries, is particularly relevant (van Lente et al., 2003). Building on existing evidence, we can conclude that smart city units are required to facilitate bilateral interactions in SCD projects while assuming a city-wide coordinating role. Therefore, we consider theories on systemic intermediaries particularly suitable for theory-building in SCD debates.

SCD is often supported by intermediary organizations established or led by local governments (Ehnert et al., 2022). From a social-technical perspective, these organizations

function as incumbent intermediaries. Scholars such as Mukhtar-Landgren et al. (2019) or Sovacool et al. (2020) describe local governments as regime intermediaries who advance sustainability transitions and promote innovative governance approaches in urban spaces. As incumbent intermediaries, municipalities are well-positioned to leverage their existing authority and networks to support transformative projects while simultaneously safeguarding the stability of the urban system (Rossi et al., 2022). This dual role of bridging the gap between city administrations and innovative communities is a unique quality of incumbent intermediaries. They leverage their legitimate position and role in prioritizing city agendas (Mukhtar-Landgren et al., 2019). Innovation literature thus offers valuable insights into how municipalities can create effective intermediation spaces to manage complex collaborative environments with diverse smart city actors. But SCD research has yet to explore this theoretical lens.

Reflecting on different types of innovation intermediaries, innovation scholars have also developed taxonomies. Kivimaa et al. (2019) complemented systemic and incumbent intermediaries with niche, process, and user intermediaries. Howells (2006) proposed a comprehensive typology differentiating between organizational and process intermediaries, such as consultants, brokers, and boundary organizations. These include living labs, which are increasingly recognized as crucial for intermediation in SCD projects (Bulkeley et al., 2016; Steen and Van Bueren, 2017). They are conceived as collaborative environments "for fostering ideas and converting them into solutions" (Alam and Porras, 2018: 5). Effective in mediating between bottom-up and top-down dynamics, living labs facilitate experimentation and co-creation (Kronsell and Mukhtar-Landgren, 2018). They enable citizen engagement through "power banking" (Nguyen et al., 2022: 9): a process through which citizens are granted powers by the living lab coordinators, allowing them to obtain a certain level of formal authority and participate in formal governance arrangements. However, Nguyen et al. (2022) caution that living labs might inadvertently perpetuate power imbalances or transparency issues, affecting their impact (Mukhtar-Landgren et al., 2019).

Current literature on SCD has yet to fully delineate the key functions of smart city units, an area where innovation theory can provide valuable insights. For instance, Sovacool et al. (2020) categorize the functions of innovation intermediaries into six groups: knowledge and learning, networking, brokering, innovation and diffusion, visioning, and institutional roles. Building on this parallel between SCD studies and innovation literature, some of the other functions that smart city units fulfil include cross-project coordination (Martiskainen and Kivimaa, 2018), shaping of collaboration mechanisms (Smith et al., 2016), developing collective visions (Geels and Deuten, 2006), lobbying for new policies, technical standards, and regulations (Rohracher, 2009), and promoting institutional changes (van Mierlo and Beers, 2020).

Based on the above-presented concepts, we contend that observing smart city units through the lens of innovation intermediaries opens new theoretical avenues in smart city research. For instance, framing smart city units as innovation intermediaries enhances our understanding of their potential roles and positions in facilitating collaboration and resource allocation within a city's innovation ecosystem. Similarly, insights from the study of innovation intermediaries can guide the alignment of smart city project goals with wider urban strategies.

However, a critical question arises: do smaller urban areas, such as towns and villages, require these intermediary organizations, and can they sustain them? While larger cities often have dedicated smart city units, smaller areas face unique resource challenges. One potential solution is to rely on "charismatic leaders" (Michaelis et al., 2009: 513). This approach invites further investigation into the role of transformational and charismatic leadership within SCD (Aarons and Sommerfeld, 2012; Paulsen et al., 2009), potentially offering new insights on the scalability and adaptability of smart city intermediation strategies across different urban contexts.

Multilevel Governance Challenge

Multilevel governance involves a system where government authority is shared across various public administration levels and with different actors, both public and private (Varró and Bunders, 2019). This concept is particularly relevant in SCD research, which calls for new empirical studies and advanced theories (Homsy and Warner, 2015). For instance, Ciasullo et al. (2020) observed that in Trento, Italy, multilevel governance was critical to sustain cross-sector cooperation and knowledge sharing in SCD projects. Lange and Knieling (2020) discuss the European Union's impact on local SCD projects, particularly through its Horizon 2020 funding. They noted how this funding shaped the approach of Hamburg, Germany, to SCD projects in terms of conceptualization, participant involvement, and strategic implementation.

But multilevel governance can also create challenges, and current research mainly focuses on governance at a single level, rather than exploring inter-level dynamics (Varró and Bunders, 2019). National policies might overlook local needs (Ehnert et al., 2018), and national SCD strategies may conflict with local goals (Reardon et al., 2022). Furthermore, sustainability issues in SCD projects often require cooperation beyond a single municipality's scope, revealing the need for better horizontal and vertical coordination (Meijer et al., 2016; Termeer et al., 2010).

How can innovation theory help improve our understanding of multi-level governance in the SCD field? Boundary management theory, for instance, can help examine how institutional settings positioned at different administrative levels connect (or disconnect). In this theoretical framework, supralocal and local actors can be envisioned as components of boundary zones: "transitional areas" (Garzella et al., 2021: 31) in which different regulatory frameworks on SCD are required to coexist and where exchange of organizational resources take place. Boundary zones create a continuum (Normann and Ramirez, 1993) in which interactions between multi-scalar and cross-jurisdictional regulatory frameworks can be observed (Capurro et al., 2021) to identify friction or harmonized coordination (He and Berry, 2022).

The process of integrating boundaries is further captured by literature on scaling innovation. Scaling describes "the adaptation, uptake, and use of innovations … across broader communities of actors and/or geographies" (Schut et al., 2020: 1). It includes up-scaling (introducing innovations to higher levels), out-scaling (spreading innovations widely), and down-scaling (applying broader innovations locally) (de Roo et al., 2019; Hermans et al., 2016; Schut et al., 2020). These concepts can help address gaps in SCD governance literature, explaining how local conditions influence broader policies and how local and supra-local innovations interact.

Conclusion

This commentary critiques the limited theoretical foundation of SCD governance and illustrates how insights from innovation management studies can help bridge existing knowledge gaps, calling for more cross-disciplinary research in SCD domain. Our observation of SCD governance challenges through the lens of innovation management reveals untapped potential for theory development in the SCD field. Essentially, we show how innovation theory can serve as a springboard for novel SCD research. Our aim is to offer some stimuli that can catalyze cross-disciplinary research efforts, exploring the underutilized synergy between SCD studies and innovation management theory.

Our analysis is also instrumental in opening new avenues for research. First, we introduce sensemaking theory, which provides a valuable perspective against the prevalent techno-centric view of SCD transitions. A more nuanced definition of SCD as social-technical processes at various scales can emerge from this approach. Boundary objects play a key role here, offering a common foundation for understanding the SCD concept while allowing adaptation to local contexts.

Second, the principles of strategic orientation and flexibility from innovation studies offer a framework for examining the challenge of strategizing citywide coordination in SCD projects. This addresses the well-acknowledged need for orchestration in SCD projects, a challenge yet to be fully resolved in SCD research. Strategic orientation and flexibility can act as guiding tools for SCD project implementation, accommodating both planned and spontaneous, bottom-up efforts. Furthermore, we propose using technology roadmapping and open strategy as methods for examining the systematic strategizing of SCD projects.

Third, we link SCD research to discussions on innovation indicators and developmental evaluation practices. These theoretical stimuli can help generate monitoring and assessment tools that contrast with the static, one-size-fits-all performance metrics commonly used in SCD assessments. Innovation indicator theories emphasize the need for ongoing monitoring, while developmental evaluation offers a practical method for applying and operationalizing these indicators.

Fourth, we highlight the potential of literature on innovation intermediaries to help address a gap caused by an incomplete understanding of smart city units and a lack of clarity regarding their organizational design and routines. Studies on innovation intermediaries may help understand how complex innovation ecosystems behind SCD should be managed, how SCD project solutions can be catalyzed and diffused, and how SCD policies and strategies should be designed and implemented. In this theoretical framework, we believe that systemic intermediaries should take a central stage; their actions might be especially important in the context of SCD. Moreover, smart city units in which municipalities participate or lead may assume a transversal role as incumbent intermediaries.

Fifth, we reflect on how the innovation concepts of boundary management and scaling can inform the multifaceted nature of SCD processes across administrative levels. Many crucial aspects of local SCD projects are influenced by higher-level policies and regulations, often without adequate consideration of local needs. Boundary management theory offers insights into the interplay between different institutional levels, while scaling studies provide frameworks for adapting innovations and their conditions across various scales. This constitutes a new theoretical ground for SCD research.

Based on our argumentation, we conclude by stressing that innovation management studies offer promising avenues for advancing SCD theory. This commentary builds upon preliminary research that has investigated this nexus (see Costales, 2022; Karimikia et al., 2022; Lee, 2020; Leitheiser and Follmann, 2020; Nilssen, 2019; Paskaleva, 2011) and aims to accelerate theory development in SCD research through cross-fertilization with more theoretically developed fields. We anticipate that this will lead to a richer, more nuanced array of theoretical frameworks better suited to the complexities of managing SCD projects. We expect these theoretical frameworks to help bridge the gap between SCD theory and practice, helping practitioners in the SCD domain to obtain the knowledge that they need to sustain evidence-informed decisions and improve their SCD governance approaches.

Our approach to SCD governance through the lens of innovation management studies provides advantages to both streams of literature. However, our examination of innovation management is constrained by the limited scope of our commentary, whose primary focus is on advancing theory in SCD research. Through this commentary, we ultimately seek to foster a stronger, more consistent multidisciplinary connection in the study and practice of SCD governance. It is important to note that the innovation concepts discussed here are illustrative examples of how SCD and innovation theories can intersect to address gaps in SCD governance research. Likewise, the governance challenges highlighted are representative rather than exhaustive. While this commentary presents a promising direction for theoretical advancement, further exploration of these connections is essential.

We invite the scholarly community to expand upon the theories introduced in this commentary by conducting empirical research that explores their applicability in addressing SCD governance challenges. Existing studies provide promising evidence, but further efforts are needed to extend theoretical generalizations and practical applications. For example, while we introduce innovation management concepts with potential to inform SCD governance theory, additional research is needed to clarify how these can be effectively implemented in practice. Furthermore, a more diverse evidence base is necessary, as the cases referenced in this commentary are primarily from European and North American contexts—a common pattern in the literature on smart city governance and innovation management (Mora et al., 2017).

By embracing diverse theoretical perspectives from innovation management studies, and encouraging cross-disciplinary research, we can deepen our understanding of SCD governance. A collaborative approach, drawing on insights from mature research fields like innovation management, is essential for accelerating knowledge accumulation in the SCD domain.

Notes

1. While we acknowledge that the concept of SCD requires careful and context-dependent interpretations (see *Conceptualization Challenge*), in the scope of this commentary, we refer to SCD as an approach to urban innovation that implies introducing digital technologies and digital services in urban environments to improve their socioeconomic and ecological conditions and enhance the quality of life of their citizens.
2. See https://smartcitiesindex.org/smartcitiesindexreport2022 and https://www.imd.org/smart-city-observatory

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Notes on Contributors

Dominik Beckers is a doctoral candidate at Tallinn University of Technology, where he is collaborating with the FinEst Center for Smart Cities and the Academy of Architecture and Urban Studies.

Luca Mora is a professor of urban innovation at the Business School of Edinburgh Napier University and at Tallinn University of Technology.

ORCID

Luca Mora http://orcid.org/0000-0003-4680-6985

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