Smart urban governance: An urgent symbiosis?

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Abstract. Over the past decade, two dominant perspectives prevail on the governance of smart cities. From a public administration perspective, 'smart governance' emphasizes the importance of technology-based tools in transforming government institutions. From an urban planning perspective, the governance of smart cities focuses on the institution interaction with spatial challenges. Within this backdrop, these perspectives can learn from each other to arrive at new transformative smart governance approaches. This paper proposes a specific urban planning perspective on smart governance, labeled as 'smart urban governance'. It is aiming specifically at the transformative governance of the socio-spatial context of urban challenges associated to smart cities via technological innovations and opening up new possibilities for city transformation. To this end, the meaning of smart urban governance is conceptualized from three dimensions: purposes, components and contexts. Based on a systematic literature review, these three dimensions are integrated into one holistic framework. A case illustration was applied to demonstrate the use and advantages of this framework. From this, this paper concludes that smart urban governance, by explicitly taking into account the specific socio-spatial context, can improve our understanding of the urban challenges associated to smart cities and contribute to its appropriate and 'smart' governance.

Keywords: Smart cities, smart governance, ICT, an urban planning perspective, transformation of cities

Key points for practitioners:

- Two dominant perspectives prevail on the present governance of smart cities – a public administration perspective and an urban planning perspective.
- The identified shortfalls along with the context ignorance within the two present dominant perspectives have impeded the transformation of cities.
- The paper argues that the mentioned perspectives can learn from each other to arrive at new transformative smart governance approaches.
- This paper proposes a specific urban planning perspective on smart governance, labeled as 'smart urban governance'.
- Smart urban governance intends a symbiosis between the 'smart' from smart governance literature and the 'urban' from urban governance literature, as a means to 'smartening' urban governance as well as drawing attention to the importance of socio-spatial transformations in shaping smart governance.

1. Introduction

The notion of smart city has gained significant momentum to deal with the impact of industrialization and urbanization over the past decade (Kitchin, 2019; Meijer et al., 2016; Batty et al., 2012; Hollands, 2015, 2008). It appeared as a merging of thoughts and ideas aimed at fueling sustainable economic

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growth and a high quality of life by the mobilization of information and communication technology (ICT) and participatory governance (Caragliu et al., 2011). To address the challenges of smart cities, smart governance is proposed to strengthen government institutions and integrate all sections of society through the use of various ICTs (Meijer & Bolívar, 2016; Bolívar & Meijer, 2016; Giffinger et al., 2007). In practice, the added value of smart governance for smartening a city is evidenced by a range of smart initiatives. For instance, Scholl and AlAwadhi (2016) find that smart governance in the city of Munich arouses interest of local needs and helps government to make smarter decision-making by conducting major ICT overhaul with regard to government organization. Meijer and Thaens (2018) reveal that by providing functionalities such as geo-data gathering and visualization, smart governance can effectively strengthen urban safety. Despite the claimed potential, for the past decade practical smart governance overemphasizes the role of technocrats and technology-based tools as a way to achieve the governance of a smart city (McFarlane & Söderström, 2017). Indeed, this approach often neglects the role of substantive urban challenges in shaping governance structures and the functions of ICT (Shelton et al., 2015). Consequently, smart governance is more or less deemed as a way to take advantage of various ICTs, aimed at bringing changes in public policy and government institutions from a public administration perspective (Jiang et al., 2019; Meijer, 2016).

Therefore, many authors from urban planning highlight that there is a necessity for governance processes to focus more on the factual and urgent urban problems linked to smart cities (Kummitha & Crutzen, 2017; Bertot et al., 2016; Hollands, 2015). As Shelton et al. (2015) argue, the governance of smart cities should be situated in time and space. Studies in this view focus on how varying forms of cooperation and partnership (e.g., public-private partnership, self-governance) can be built between different stakeholder groups (e.g., government, market parties and civil society) to cope with these problems and reshape the spatial urban environment. Although positive results have been achieved so far, particularly with regard to urban infrastructure upgrading (Shahrour et al., 2017), critiques show that the urban planning perspective on smart city governance is overly "attributed to local state entrepreneurial governance based on a close relationship between the local state and enterprises" (Xue & Wu, 2015, p. 10). For instance, some of the prominent smart city projects (e.g., Tianjing Smart Eco-city in China, Songdo Ubiqutous Eco-city in South Korea, and Masdar in the United Arab Emirates) are largely controlled by large high-tech companies (Jiang et al., 2019; Hollands, 2015). These companies typically contend that technology is fundamentally beneficial to urban development; however, technology's usefulness in dealing with real urban problems and augmenting urban governance processes is seriously weakened by a lack of considering the social dimensions (Meijer & Thaens, 2018; Cels et al., 2012). According to Kitchin (2015), the so-called smart city projects just serve the interests of investors and big companies looking for capital.

The discussion above shows that up till now, two dominant perspectives on the present governance of smart cities can be identified. First, so-called 'smart governance' emphasizes the importance of technology-based tools in transforming government institutions from a public administration perspective (i.e., technology interaction with institution). Second, from an urban planning perspective a focus on the urban spatial challenges associated to a smart city highlights the varying forms of cooperation and partnership between government, market parties and civil society to cope with these challenges (i.e., institution interaction with spatial challenges). However, both perspectives are insufficient to deal with the challenges in the realm of smart cities. According to some authors, a lack of considering the specific socio-spatial context of urban challenges associated to smart cities constitutes the main hindrance to the present governance of smart cities (Jiang et al., 2019; Ruhlandt, 2018; Meijer et al., 2016; Meijer, 2016). Too often urban measurements in one city are considered appropriate to other cities too, without

critical assessment of its contextual specificities. As a result, the identified shortfalls along with the context ignorance within the two present dominant perspectives have impeded the transformation of cities. Therefore, some authors urge that more integrative and context-oriented approaches should be developed to transcend these two dominant perspectives (Ruhlandt, 2018; McFarlane & Söderström, 2017).

Within this backdrop, we claim that the mentioned perspectives can learn from each other to arrive at new transformative smart governance approaches. Based on an intensive literature review, this paper therefore proposes a specific urban planning perspective on smart governance, labeled as 'smart urban governance'. It is aiming specifically at the transformative governance of the socio-spatial context of urban challenges associated to smart cities via technological innovations and opening up new possibilities for city transformations. In doing so, it intends a symbiosis between the 'smart' from smart governance literature and the 'urban' from urban governance literature, as a means to 'smartening' urban governance as well as drawing attention to the importance of socio-spatial transformations in shaping smart governance. This is how smart urban governance orginates from, but at the same time goes beyond, the two present perspectives on governance of smart cities.

This paper is structured as follows. Section 2 elaborates on the theoretical background of smart urban governance. Section 3 presents the research methodology to conceptualize smart urban governance. Next, three key dimensions of smart urban governance (i.e., purpose, component, context) will be investigated in Sections 4 to 6. Section 7 will integrate the dimensions and present a general framework of smart urban governance. Then, a case illustration was applied to demonstrate the use and advantages of this framework. Section 8 reflects on the findings of this study and suggests some avenues for further research.

2. Theoretical foundations

Research on the governance of smart cities can be conducted either from a public administraton perspective or from a spatial planning perspective. This section reviews the five most significant forerunners of 'smart urban governance' from both fields, that is: 1) e-government, 2) e-governance, 3) smart (city) governance, 4) urban governance and 5) ICT-enabled participatory planning. It purposes at analyzing the conceptual roots that arguably lead to the novelty of the proposed smart urban governance concept.

2.1. E-government

First, e-government is understood as the use of ICTs such as websites, social media and mobile devises to improve public service delivery (Manoharan & Ingrams, 2018). Driven by the need for government transformation, ICT has become the core element of e-government in a short period of time (Bertot et al., 2016). The deployment of e-government has focused on technological and operational matters for a long time, focusing attention mainly on the role of ICT in transforming the internal operations of the public sector (Savoldelli et al., 2014). By integrating various ICTs into government structures, operations and processes, e-government to a large degree increases government efficiency, accountability and transparency (Janowski, 2015). Apart from changes in the internal governmental operations, e-government also aims to create new opportunities for external actors, such as private companies and non-governmental organizations, for instance in the sense of delivering information and developing new services (Mahou-Lago & Varela-Álvarez, 2016). However, relying heavily on the control from government to expand their reach, e-government has failed to build up effective mechanisms for different stakeholders to really engage in the decision-making process. Shortcomings in transforming e-government are

expected to be overcome by increasing participation and engagement (Janowski, 2015; Savoldelli et al., 2014). Or, as stated by Linders (2012, p. 453), there is a need to transform e-government into "we-government, in which society place more trust in – and empowers – the public to play a far more active role in the functioning of their government".

2.2. E-governance

Second, e-governance is a broader concept which includes the utilization of ICT by government, private and civil society to encourage greater participation of non-state actors in the governance of public issues (Palvia & Sharma, 2007). Compared to e-government in which ICT usually supports one-way information publishing, in e-governance ICTs can better facilitate two-way communication between the state and non-state actors (Marche & McNiven, 2003). By empowering citizens through access to government information and policy-making processes, interactions between different groups have been largely improved in e-governance. Besides, unlike e-government, which treats citizens as consumers of services, e-governance is "more about engaging citizens and stakeholders and allowing them to co-produce public services" (Meijer, 2015, p. 199). According to Scholl and Scholl (2014), co-production in public services through the use of ICT builds the foundation for e-governance.

In fact, by conscientiously allowing open-minded participation and collaboration, e-governance manifests its transition from traditional top-down administration to flat institutional arrangements – that is, to emphasize external government transformation and improve the possibilities for citizens and businesses to participate in the policy-making process (Milakovich, 2012). Nevertheless, Johnston and Hansen (2011) note that the evolving relationships between government and non-government need not to be limited to the public sector but can also be applied to the private sector. For instance, e-governance can be used to collectively foster a common sense of community among different stakeholders and facilitate the building of self-governing communities (Paskaleva, 2013). However, Meijer (2015) argues that institutional-cultural and technological barriers, such as technological restraints, individual preferences, and resistance from government, impede innovations in e-governance; therefore, creative strategies are needed to reframe e-governance.

2.3. Smart (city) governance

Third, smart governance aims to establish a new type of governance arrangement through the use of new technologies (Meijer, 2016). Smart governance goes beyond e-government/e-governance as it has escalated from the public sector to a higher and broader city level (Meijer & Bolívar, 2016). Hence, city governments are forced to "rethink, change, and improve their governing routines, procedures, and processes" (Van Dijk et al., 2017, p. 3). Currently, smart governance is elaborated from two perspectives. First, a technology-centric perspective highlights the process of information exchange between different actors by employing smart e-participation devices (Johnston & Hansen, 2011). This ICT-enablement enhances the management and functioning of a city, which is treated as the key driver of the governance of smart cities. Second, a human-centric view underlines the role of smart people as being central to smart city governance. In this view, human capital and/or human resources are the key feature of smart governance. Building on the characteristics of 'smart' people, smart governance relies heavily on the ideas, information, knowledge, skills, and cooperations acquired by these people that contribute to the prosperity of a smart city. Nevertheless, in practice more importance has been given to new technologies rather than empowering individuals and groups to determine agency decisions in a self-organized manner. Therefore, Ruhlandt (2018) argues that effectively integrating technology into the participatory

process of urban governance mediated by context-specificities is crucial for developing a transformative form of smart city governance. This means that smart (city) governance in practice should focus more on the synergy between technical and social systems.

2.4. Urban governance

Fourth, urban governance refers to the concept of governing cities from a broad perspective (Obeng-Odoom, 2012). Land, capital, information, labor, and technology are integrated to seek sustainable development of cities. In a narrow sense, urban governance refers to multi-agent governance networks in which government, private sector, and civil society are interdependent for solving urban issues (DiGaetano & Strom, 2003). Although a lot of empirical case studies have been conducted to explore the concept of urban governance, its meaning still remains undefined (Obeng-Odoom, 2012). Aspects of definitions can either focus on various theories of power to investigate the behaviour of actors (Nicholls, 2005) or highlight a neoliberal model of urban governance (Harvey, 1989) or emphasizes the decision-making process restrained by contextual factors (Beumont & Nicholls, 2008).

Focusing on power relations, urban governance involves a complex process of political decision-making between different stakeholder groups (Stoker, 1998; Pierre, 1999). The interaction between different actors can either regain control and restore traditional structures, thus underlining bureaucracies and hierarchies, or shift to a decentralized structure centering on self-governing networks (Jessop, 1998). As a neoliberal model, urban governance is deemed as a partnership mechanism for alliances between the government and enterprises to promote local development. Then, referred as "the process of coordinating political decision making" (DiGaetano & Strom, 2003, p. 373), urban governance is largely shaped by the economic-political, cultural and agency-level factors. Therefore, new research and application possibilities for urban governance should consider the impact of the broad socio-spatial contexts on decision-makers and the decision-making process.

Although urban governance has gained much momentum, it should also be noticed that problems such as under-equipped infrastructures, tensions and social conflicts over access and/or control of the city, dysfunction of urban services, and overlapping or incoherent responsibilities between institutions have gone beyond its capacity (Devas, 2014). Van Dijk et al. (2017, p. 3) argue that "cities need to develop *smart* governance in order to become smart". Despite urban governance being a mature academic field, technology and innovation should be connected to develop smarter urban governance approaches to confront the recent 'smart urbanism' (Meijer & Bolívar, 2016).

2.5. ICT-enabled participatory planning

Finally, participatory planning is a policy-making process that includes affected stakeholders, especially non-governmental parties (Healey, 1997). In a typical participatory planning endeavor, such as a community development planning, different stakeholders will get involved in the processes of decision-making on certain issues. The purpose of participatory planning is to contribute to public awareness of local issues and to give the public opportunities to state their concerns. To facilitate participation and engagement from individuals and the local community, a large variety of instruments and tools have been developed and applied. For instance, computer-based information systems such as Decision Support Systems (DSS) and Planning Support System (PSS) are often used to support the decision-making process in ICT-enabled participatory planning (Geertman, 2015). Currently, new ICT tools such as social media, websites, crowd-sourcing and Internet-of-Things are applied by planners and governments to

increasingly include private sector and citizens in planning processes (Sebastian et al., 2018). Nevertheless, fierce debates remain about the use of ICT in planning. For instance, the digital divide that restricts some residents' access to the planning process is still very real (Crowe et al., 2016). In addition, individuals' engagement in ICT-enabled participatory planning can be seen as skewed due to power imbalances between bureaucrats and citizens (Zhang et al., 2018). In the future, ICT-enabled participatory planning is expected to enhance its adaptiveness to consistently changing societal environments and conditions and satisfy the real needs of relevant stakeholders (Zhang et al., 2018; Pelzer, 2017; Geertman, 2015).

2.6. Integration: Towards smart urban governance?

On the basis of reviewing the five most significant forerunners of our notion of 'smart urban governance', it can be concluded that the academic debates on contemporary smart governance and urban planning approaches mainly focus on three factors. First, technology is perceived as a key driver of developing *smart* governance approaches. Second, the need for restructuring public organizations reflects the interdependency and high degree of mutuality between various stakeholders, including governmental and non-governmental bodies and persons. Third, many scholars have argued that ICT-enabled governance does not operate in a vacuum but is deeply rooted in urban space, thus socio-spatial contexts of urban challenges should be taken into account explicitly. Accordingly, smart urban governance originates from, but should go beyond, these five antecedents.

Besides, the review of the five forerunners also uncovered the following main categories of the broad research relative to the governance of smart cities: 1) purpose (or outcome), 2) component, and 3) context (e.g., Jiang et al., 2019; Lin, 2018; Webster & Leleux, 2018; Ruhlandt, 2018; Bolívar & Meijer, 2016; Meijer, 2016). For our conceptualization, we refer to these three variables that in our view reflect three key dimensions of smart urban governance, that is: *purpose, component* and *context*. The *purpose* concerns the goals or intentions of smart urban governance to be achieved. The *component* constitutes the process, that facilitates the formation of smart urban governance arrangements. The *context* rephrases what was explained earlier about the socio-spatial context of urban challenges associated to smart cities initiating the need for smart urban governance. These three dimensions will be integrated into one holistic framework.

3. Methodology

By conducting an inventory and analysis of the purpose, component and context dimensions of smart urban governance, this paper aims to conceptualize and frame smart urban governance. According to Ruhlandt (2018), a systematic review approach specifies its rule-based selection procedure and precludes the possibility of one-sidedness and bias of the literature review. Besides, a stringent systematic literature review enhances "the sophistication of reviewers' efforts in pursuit of theoretical progress and more original empirical study" (Wolfswinkel et al., 2013, p. 45). Therefore, this paper follows the well-explicated systematic literature review methodology proposed by Wolfswinkel et al. (2013) to collect, analyze and integrate dimensions of smart urban governance. Steps for conducting the literature review were shown in Table 1.

Based on the steps of Table 1, the five mentioned forerunners of smart urban governance were used as stepping stones to first determine relevant search terms. This step acquired 8 relevant search terms used in our literature review: e-government, e-governance, smart city management, smart governance, smart city governance, urban governance, participatory planning and smart urban governance. Then, in our

Table 1
A method for rigorous literature review (Created by authors based on Wolfswinkel et al. (2013))

Stages	Tasks	Guidelines
1. Define	Determine relevant search terms	Provide relevant keywords related to the current research area
	Choose database	Determine the database to be adopted for document retrieval
	Specify inclusion/exclusion criteria	Confine the search to the most suitable literature within the database (e.g., language, year, peer-reviewed, journal requirements)
2. Search	Explore suitable texts	Navigate the databases and conduct the actual search for the suitable literature for the research topic (this process involves iteration, namely refinement and adjustment)
3. Select	Filter out doubles	Identify and remove duplicate records from systematic review
	Refine sample based on title, abstract and keywords	Select the sample that is accurately connected to the main topics of the study based on title, abstract and keywords
	Refine sample based on full text	Pick out articles that are closely associated to the research topic based on a full reading of the material
	Add forward/backward citations	Including some of the most important articles that are not included in the selected sample based on forward/backward citations
4. Analyze	Coding	Read the final sample and code and classify the findings and insights in the text that are significantly related to the main topics of the study

literature review we only focused on peer-reviewed international journals and papers. Scopus was used for selection purposes because it is the world's largest abstract and citation database of peer-reviewed literature, delivering a comprehensive overview of the world's research output in the fields of science, social sciences, and arts and humanities.[1]

Further, we limited our review to publications dated from 2010, up to and including the year of 2018. The year 2010 is chosen as a delimiter because the strong 'boom' in articles concerning this theme of smart city and its governance started in 2010 (Dameri & Cocchia, 2013). Then, we restricted our retrieval to publications written in English. Although the notion of smart city has been widely studied in Asian countries such as China and India (Jiang et al., 2019), ICT-enabled governance such as smart city governance and e-governance is mainly studied in Europe and the USA (Lin, 2018). The literature review was first conducted from March 2017 to April 2017 and later updated in October 2018 and January 2019.

The systematic literature search comprised of four major phases. The first phase was restricted to journal articles that consist of carefully identified key terms. Eight thematic searches in Scopus were conducted by combining each of the identified 8 key terms with the term 'smart city' in an iterative manner. The Boolean operator was: ((Combined:("*Key search term*")) AND ((Combined:("smart city"))). The key terms applied in all searches were directed to the title, abstract and keyword of the articles. This phase in the end produced 1578 papers published and the majority of the articles originated from the field of e-government/e-governance and smart (city) governance.

The second phase produced a selection of relevant articles on the basis of the title, abstract and keywords. All the articles from the first broad literature search were analyzed for their relevance to debates on smart urban governance. We read the abstract and introduction section, surveyed the structure of the paper and then selected the papers that were most relevant to our requirements. This process resulted in a sample of 365 journal articles. The third phase involved a full-text analysis of all articles to develop consensus regarding the purposes, components and contexts linked to smart urban governance. The key requirement of selecting these articles in this phrase is that each article should have a conceptual framework that consists of terms relevant either to the purpose, or the component or to the context, even when

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[1] https://www.elsevier.com/solutions/scopus.

Table 2
Identification of selected key terms for smart urban governance

Identified dimensions	Criteria for identification	Originally identified key terms	Selected key terms
Purpose	What were seen as the main effects or purposes explained in earlier forerunner literature?	Efficiency & productivity; learning & innovation; technological savviness; human & social capital; public services & value; organization improvements; social inclusion & cohesion; transparency & trust; improvements to city; ecological performance; sustainability; quality of life & well-being; belonging & liveability	Economics: productivity & innovation Politics: human and social capital & public value Ecology: spatial capital & liveability Culture: psychological capital & well-being
Component	What constitute the main components explained in earlier forerunner literature?	Government or governance; political actors or stakeholders; participation or engagement; collaboration or partnership; openness & transparency; leadership & accountability; power & empowerment; policy; management & organization; decision-making; strategies & visions; legal & regulatory; technology or ICT; big data; place or space	Institutional: governance Technological: smart tools Spatial: urban space
Context	What were the main contexts (constraints) explained in earlier forerunner literature?	Economic structure; technological development; political system and institution; culture and customs; personal rationality & preference; geographical particularity; resources constraints; urban problems as context	Social context Spatial context

these terms are expressed with an alternative word (Table 2). The full-text reading produced 98 articles. Subsequently, a forward and backward searching for relevant references in the citation index was conducted. This phase produced 10 articles that fulfill our requirements.

At last, 108 journal articles were identified. Then, a detailed conceptual analysis to decide the framework elements related to the proposed three dimensions (i.e., purpose, component and context) of smart urban governance was carried out. The systematic analysis in the end identified thirteen key terms as the purpose dimension, fifteen key terms as the component dimension and eight key terms as the context dimension (Table 2). We analyzed the frequency of each term that appeared in these articles (Figs 1 to 3). Based on a further analysis of these key terms (see Appendix), we identified semantic repetition and condensed the originally identified key terms into a smaller set of selected key terms. These selected key terms made a conclusive understanding of the purposes, components and contexts identified.

4. Purpose of smart urban governance

The purpose dimension states the reasons for which smart urban governance is created. Figure 1 illustrates the frequency of the 13 variables that can be characterized as key purpose-relevant terms of smart urban governance. It can be seen that 'public service and value', 'efficiency and productivity', and 'transparency and trust' are the three highest scoring indicators whereas 'technological savviness' and 'belonging and liveability' have relatively low scores. In this paper, the four domains of social practice – economics, politics, ecology and culture, proposed by James (2014) – were adopted to regroup the original key purpose terms into four new categories, aimed at substantiating the purpose of smart urban governance. For a long time, the dominant approach focusing on economic, social and environmental sustainability has been used to delineate the purposes of urban governance or spatial planning (Campbell, 2016). However, this approach "centers on economics and gives it a prominence that threatens to expand
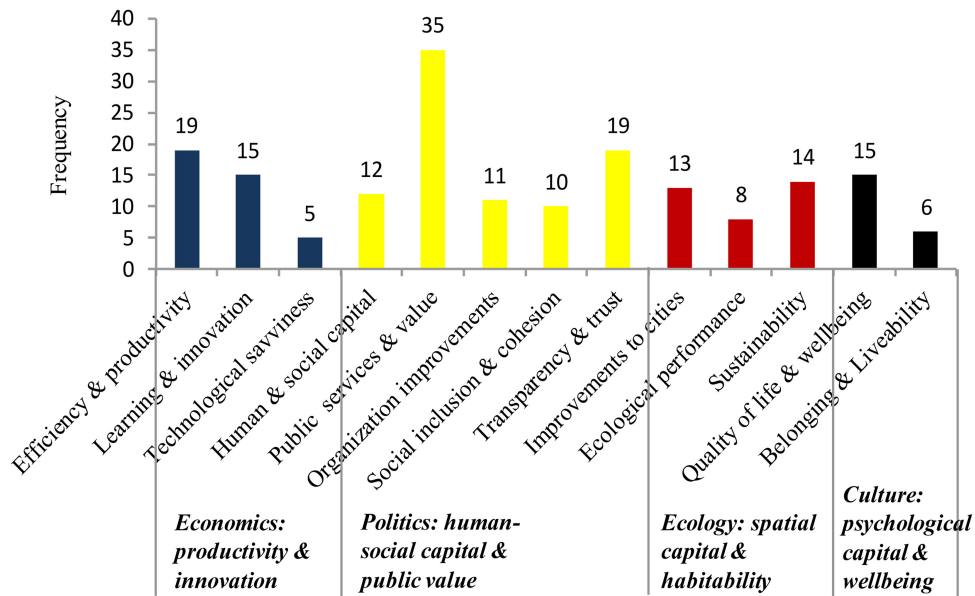
Fig. 1. Key 'purpose' terms of smart urban governance.

to consume the realm called society" (James, 2014, p. 46). In agreement with James critiques, this newly proposed category was adopted to center on the socialized urban life – the 'urban'.

4.1. Economic purpose: Productivity and innovation

If governance concentrates on productivity and innovation associated with the production, use and management of resources, the purpose is economic. In the field of smart city goverance, one of the main purposes found in literature is to promote economic growth. In this sense, pro-growth smart city governance treats the improvement of productivity and economic growth as an overarching goal for local economies (Hollands, 2015). According to Kumar et al. (2017, p. 1), "smart urban economies are largely the result of the influence of ICT applications on all aspects of urban economy". Adoption of ICT-enhanced policies or governance nowadays is on top of the economic agendas for governments in most countries (Pradhan et al., 2018). For instance, the governance of smart cities in China to a large degree revolves around productivity, entrepreneurship, innovation, as well as economic competitiveness in the global market (Jiang et al., 2019).

In addition, Gil-Garcia et al. (2014) highlight the role of a creative mix of emerging technologies in facilitating the producitivity of service delivery and innovation. By promoting transparent decision-making, open information sharing use, and ICT-enabled participation and collaboration, smart initiatives will alter how people interact with each and lead to advancements in term of technological innovation (Kummitha & Crutzen, 2017). An example is Barcelona Smart City (Bakici et al., 2013). This project integrates top-down and bottom-up approaches towards urban digitalization and incorporates big data and smart sensors into everything from parkland irrigation to air quality, trash collection, parking and transportation. By effectively integrating smart technologies with smart people, Barcelona has improved its economic competitive edge.

4.2. Political purpose: Human-social capital and public value

If governance is defined to emphasize the contributions of human-social capital and public value to a social life held in common, the purpose is political. In ICT-enabled governance, by offering a variety of ICT tools to citizens, it not only empowers human actors to access knowledge, information and data in an efficient and economical manner, but also enables community members to communicate with each other (Meijer, 2016; Linders, 2012). Investments in interactive learning and collaboration are essential for ICT-enabled governance to foster the capabilities of citizens and the accumulation of human and social capital dispersed in civil society (Caragliu et al., 2011). The acquisition of human and social capital often has a considerable influence upon the generating of value and the process of problem solving (Angelidou, 2015).

In smart governance literature, public value is highlighted as the main goal of smart cities (Meijer et al., 2016). Described as "a reflection of collectively expressed, politically mediated preferences consumed by the citizenry" (O'Flynn, 2007, p. 358), public value evaluates the extent to which the demands of individuals, organizations and society as a whole can be satisfied (Bozeman, 2007). In fact, public value not only generates value from the experiences provided by different stakeholders but also provides them values in return (Williams & Shearer, 2011). According to Meijer et al. (2016), three types of public value produced by smart governance can be identified: 1) efficient government organization; 2) better relationships between government and other urban actors and 3) improvements to cities. In practice, the production of public value is closely connected with learning, innovation and common pool resources. For instance, by using open data as a way to facilitate the 'smart' governance of Rio de Janeiro, interactions and communications between city government and citizens have been largely improved. Through becoming custodians of public data, Rio de Janeiro government demonstrates trustworthiness and enhances its skills for urban service delivery in smart city contexts (Pereira et al., 2017).

4.3. Ecological purpose: Spatial capital and habitability

If governance strives to contribute spatial capital and habitability across the intersection between social and natural realms, the purpose is ecological. In this, spatial capital is the information and resources accumulated by cities and communities that enable different actors to exploit the spatial dimension of a society (Roche, 2016). According to Roche (2017), the acquirement of spatial capital is closely linked with digital technology, especially geo-technology. For instance, emerging technologies such as social media, electronic maps, Internet-of-Things, and peer-to-peer sharing applications have enhanced citizens' access to geography-related information and data. However, critiques also show that the current urban infrastructure upgrading and many smart city initiatives are mainly controlled by high-tech companies, which demonstrates a sense of privatizing public space (Kummitha & Crutzen, 2017). In reality, improved quality of life for its citizens might not be produced best through a well-planned urban system.

In this context, Leydesdorff and Deakin (2013:53) declare that the increasing growth of ICT should facilitate the interactions between "the intellectual capital of universities, the industry of wealth creation and their participation in the democratic government of civil society". In this sense, smartness is not merely about the deployment of technologies but more related to how to cultivate a technology-based ecological and habitable surrounding – a place of vibrant life and livelihoods that everyone can efficiently get involved and gain access to things that are wanted or required. An example of this kind of *smart* city governance is the Smart Nation Singapore project, which strongly encourages the private sector and civil society to smarten their living surroundings with their own creative ideas, knowledges and technologies. It is worth noting that the integration of technology into the daily life of the Singaporean has contributed

to the creation of new forms of techno-cultures and habitable environments. For smart urban governance, more attention should be transferred to the intersection between the social and natural realms, since here spatial capital is concentrated and habitability is fostered.

4.4. Cultural purpose: Psychological capital and well-being

Finally, if goverance centers on psychological capital and well-being of social meaning of a life held in common, the purpose is cultural. Psychological capital is conceptualized as the positive and developmental state of an individual as characterized by high hopes, self-efficacy, optimism, and resiliencey (Luthans & Youssef, 2004). Well-being is the satisfaction of objective needs (e.g., food) or subjective needs (e.g., respect) (Oswald & Wu, 2010). In smart governance, participation through empowerment is the main enabler of improving stakeholders' psychological capital and well-being (e.g., mutual trust, shared understanding) (Webster & Leleux, 2018). Empowered participation in governance processes allows actors to gain mastery and control over their own affairs, which help them to build a sense of accountability for their communities (Granier & Kudo, 2016). For instance, the Amsterdam Smart City project organizes smart collaboration between citizens, enterprises, knowledge institutions and municipalities which effectively fosters social inclusion among society (Lin, 2018).

Long-term continued engagement and collaboration assists actors to cultivate a supportive sense of belonging and membership. In smart cities projects, ICT creates more space and opportunities for different actors to get involved in debates about their living surroundings (Bolívar & Meijer, 2016). Social media, websites, and living labs are widely utilized to encourage collaborative policy-making. Characteristics of both the objective and subjective factors that improve health and quality of life have been identified in multiple ICT-enabled governance initiatives (Battarra et al., 2018; Ojo et al., 2013). For instance, by developing long-term cooperation among business firms, citizen, knowledge insitutions, and municipal agencies, the Smart Aarhus project in Denmark has built a strong psychological sense of community among its citizens (Snow et al., 2016). For smart urban governance to be considered successful in the eye of local people, more human-oriented configurations will enable ordinary people to become contributing members of the city.

5. Components of smart urban governance

The component dimension identifies the main constituting elements of smart urban governance. Figure 2 illustrates the frequency of the 15 variables that can be characterized as component-relevant terms of smart urban governance. It can be seen that 'technology or ICT', 'participation and engagement', and 'governance (government)' are the three highest scoring indicators whereas 'power and empowerment', and 'legal and regulatory' have relatively low scores. Attentively, the importance of urban space (place) in shaping ICT-enabled governance is highlighted by journals. Based on their semantic repetition, fifteen key component terms were regrouped into three component groups: institutional, technological and spatial.

5.1. Institutional component: Governance theories

From the perpective of public administration, governance theory encapsulates eleven key terms illustrated in Fig. 2. Three aspects of governance can be identified: governance as as an analytical framework; as a set of norms and rules; and as a decentralized process rather than government control (Nuissl
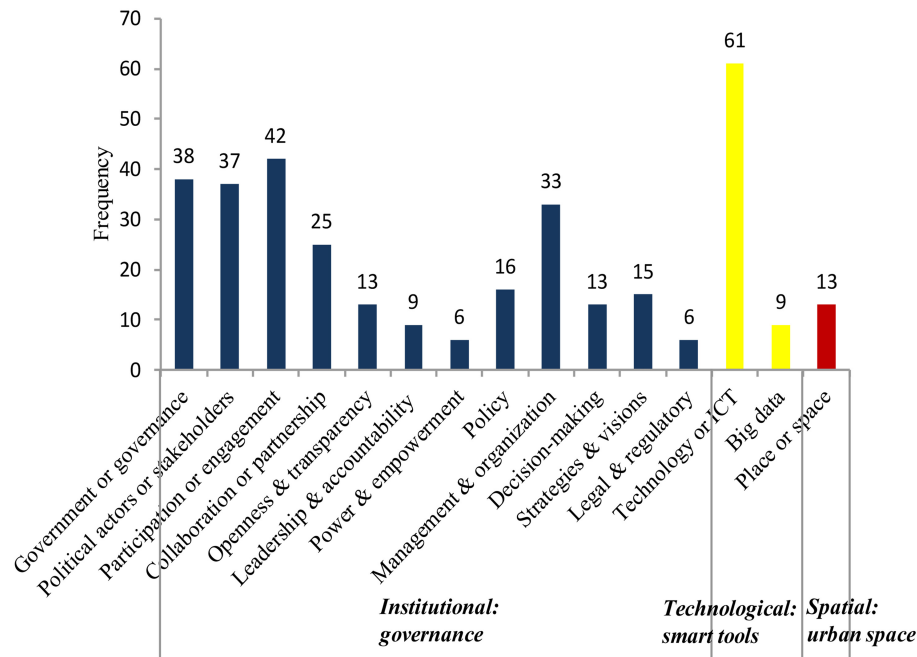
Fig. 2. Key 'component' terms of smart urban governance.

& Heinrichs, 2011). In ICT-enabled governance, this is conceptualized as a way to promote participation and collaboration from non-governmental actors to deal with collectively concerned issues via ICT (Caragliu et al., 2011). In this process, political actors or stakeholders are both the subject and object of governance (Rhodes, 1997). By using ICT, different political actors and stakeholders can get engaged and empowered in the decision-making process (Misuraca & Viscusi, 2015). Giving authority to the 'have-not citizens' through ICT enhances the abilities of communities, groups and/or individuals to participate. Governance also contains the formulation of strategies and visions, which are usually deemed as legal or regulatory objectives that indicate the way to implementing decision-making or policies. According to Hufty (2011, p. 405), "the processes of interaction and decision-making among the actors involved in a collective problem" finally "leads to the creation, reinforcement, or reproduction of social norms and institutions". Accordingly, governance entails the way different norms, rationalities and actions are structured, arranged, formed and sustained.

Although a rapidly growing number of ICT-enabled governance literature focuses on the concept of governance at different descriptive and analytical levels, this paper conceptualizes governance as an institutional arrangement aimed at steering and coordinating interdependent actors to deal with collective concerned issues. As governance theory provides an angle to understand the various aspects of ICT-enabled governance (e.g., political actors and stakeholders, participaton and collaboration, power and empowerment, decision-making, management and organization, and so on), it is designated as the institutional component of smart urban governance.

5.2. Technological component: Smart tools

The second component of smart urban governance is technology, mainly composed of smart tools. Zook (2017) highlights that the appropriate integration of ICT into governance is necessary because of

the ability of ICT to innovatively adapt to contextual environments. In practice, the incorporation of ICT into governance can technically promote the smartness of governance (Scholl H & Scholl M, 2014). For instance, new technologies such as sensors or sensor networks used in smart city governance help government to collect different kinds of data. These data enhance the rationality and effectiveness of government's decision-making (Walravens, 2012).

Scholl H and Scholl M (2014, p. 163) argue that "the actionable and omnipresent ICT are substantial prerequisites and backbones for developing (various) models of smart (democratic) governance". The applications of ICT for the development of innovative and smart governance contribute to enhancing communication and collaboration between different stakeholders within communities and cities. By mining various resources and expertise distributed among different actors in the cities, ICT-enablement will support "to maximize the socio-economic and ecological performance of cities, and to cope with negative externalities and historically grown path dependencies" (Kourtit et al., 2012). However, Hollands (2015, p. 61) criticizes that the great facilitating role of ICT does not imply technological determinism. Instead, research should be designed to investigate the creation of smart tools that cater for the particularities of specific working groups and organizations (Pelzer, 2017). In sum, smart tools are driving the technology component of smart urban governance.

5.3. Spatial component: Urban space

The third component of smart urban governance is the spatial component, reflected in urban space. In accordance with Lefebvre (1991), urban space can be perceived as a set of social relationships. In governance literature, socialized urban space is closely linked with urban governance. As an object of urban governance, it delineates the content to which a specified governance action is directed. As a spatial characteristic, it brings about situational influences on the structure of urban goverance. However, this treatment of urban space is seldom considered in ICT-enabled governance. For instance, spatial scale is often postulated as a hierarchical model of scales, in which the portraying of actor constellations and power relations is limited within these nested and linear scales (Smith, 2010).

Distinctive from previous conceptualization of urban space as an analytical tool, this paper focuses on the social process of urban space – urban space as a category of practice – as Moore (2008) advocates. This means that concepts of urban space (such as scale and place) are no longer grasped as an instrument to analyze the decision-making process; instead, it is regarded as a spatial variable that interacts with the other components (institutions and technology) under specific socio-spatial contexts. As such, urban space is socially structured, formed, constructed and altered. Yigitcanlar et al. (2018) argue that urban space also drives the development of technology-based smart cities. Consequently, urban space' interaction with the smart city process should be conceptualized as a crucial element in defining the meaning of smart city governance. Based on this, this paper highlights that it is the spatially-enabled practice (such as ideas, claims, assumptions, and actions with regard to urban space), along with the institutional and technological components that construct and define the meaning of smart urban governance.

6. Context of smart urban governance

Context refers to the circumstances and situations that form the setting for one specific governance approach, and in terms of which it can be fully understood and assessed. Figure 3 shows the frequency of the 8 key contextual terms that were found in the reviewed literature. The result illustrates that 'political system and institution' and 'urban problems as context' are the most frequently mentioned contextual factors, while 'economic structure' is least frequently found. Based on their semantic relationships, the eight key contextual terms were re-categorized into two groups: social context and spatial context.
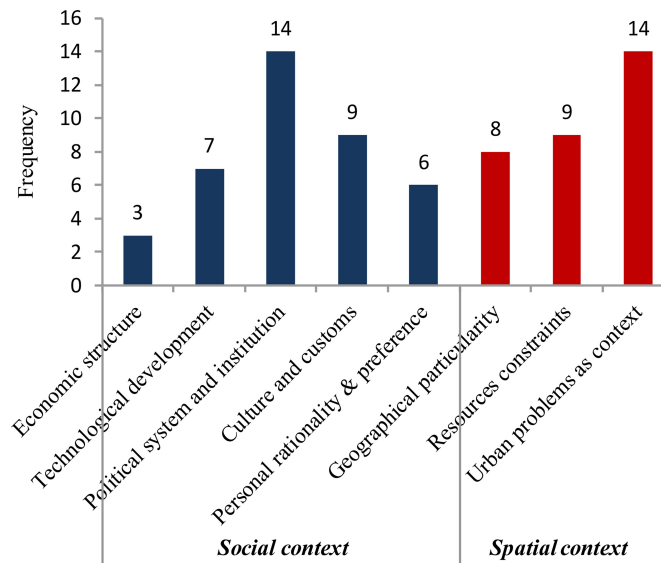
Fig. 3. Key 'context'-related terms of smart urban governance.

6.1. Social context

Social context includes factors that relate to the way people live together (Fig. 3). These include first, financial/economic barriers that have limited the development of structural forms of citizen engagement in ICT-governance innovation (Meijer, 2015). Second, the accessibility or availability of technologies enable governments to collect, connect and analyze data and initiate policies (Alathur et al., 2016). Normally, a higher level of technology development enriches people who would like to participate in the governance of smart cities (Anttiroiko, 2016). Third, the political system and institutions influence the degree of uncertainty regarding strategic decisions, power relations, interdependence, etc. (Nielsen & Pedersen, 2014). For instance, Lin (2018) identifies that different institutions in China and Europe have largely affected their smart governance strategies, arrangements and outcomes. Fourth, culture and customs, deemed as a set of informal rules or norms embedded in people's daily life, influence the behaviors of particular political actors (DiGaetano & Strom, 2003). Meijer (2015, p. 199) claims that e-government under bureaucratic cultures tends to "preserve the traditional ways of interacting with citizens". Finally, governance often fails when personal preferences and rationality of different political actors are not fully considered (Healey et al., 2017). According to Hollands (2015), constructive inclusive communication between different stakeholders in smart city governance can facilitate engaging with multiple perspectives.

6.2. Spatial context

Distinctive from the spatial component, which is closely related to social practice and produced by human activities, spatial context refers to the spatial characteristics related to urban issues – geographic particularity, resource contraints and the nature of urban problems. Geographic particularity refers to the geographical attributes of an area such as place, space or scale (Gupta et al., 2015). Resource constraints represent the limitation and enrichment of spatial resources (e.g. facilities and utilities) to be utilized in dealing with social and urban issues. The availability of relevant resources for different locations,

places, communities and countries influences the willingness and the governing capability to tackle a common-concerned problem (Howlett, 2009). Sufficient resources allow actors and cities to perform a thorough analysis of the alternatives while a lack of resources can be detrimental to the whole city governing system, causing city operations with elevated amounts of errors, transport delays and high stress levels (Sorensen, 2018). The nature of urban problems is about the challenges related to industrialization and urbanization. According to Meijer (2016, p. 75), the nature of urban problems in smart city governance portrays the conditioning of a problem that "interacts with a series of political, administrative, and technological choices regarding the use of new technologies for urban governance".

Many studies on ICT-enabled governance have recognized the role of socio-spatial transformations in offering effective and meaningful directions for governance research. However, so far, few papers in the governance of smart cities have discussed, theorised or investigated the usefulness of this socio-spatial context. According to Ruhlandt (2018), the influence of contextual factors on the transformative governance of smart cities still remains concealed. Contextual factors are argued to influence the governance of smart cities, at least in part, but a lack of empirical evidence has weakened this connection. Besides, governance approaches from public administration often give prominence to social contexts (e.g. political system, institutions, and culture), while urban govenance and planning literature centers on spatial contexts without treating the social factors in an earnest manner (Healey, 1997). As a consequence, an effective smart urban governance approach should study a wide range of socio-spatial transformations in reality, since these contextual factors are not mutually exclusive, but are complementary and reciprocally beneficial to understand smart urban governance practices.

7. Towards a framework for smart urban governance

The body of work reviewed in the previous sections offers evidence that the impact of socio-spatial contexts upon the governance of smart cities has been increasingly receiving importance. However, urban space along with institutions and technology acting as key drivers of governance process have not been adequately recognized and conceptualized. These findings suggest that existing ICT-enabled governance and urban governance are not sufficiently able to deal with an alternative smart urbanism – that is, actor relation, technology along with urban space all that matter (McFarlane & Söderström, 2017).

To extend this discussion, the model of smart governance elaborated by Bolívar and Meijer (2016, p. 650) was adapted to integrate the selected contexts, components and purposes into a holistic framework (see Fig. 4). The framework for smart urban governance developed in this paper comprises the socio-spatial context of urban challenges associated to smart cities, three interlinked components (institutions, technology, urban space) and four sustainability-oriented purposes (economic, political, ecological and cultural). The internal logic of this model suggests 1) a potential relation between the socio-spatial context and smart urban governance arrangements, 2) that the potential effect of the socio-spatial context on smart urban governance arrangements relies on the interaction between technology, institution and urban space, 3) that smart urban governance arrangements intends to realize desired purposes, and 4) a feedback effect of smart urban governance purposes (or outcomes) on the socio-spatial context. Based on this, smart urban governance can be defined as "a dynamic institutional arrangement, operating within certain socio-spatial contexts, and enabling with the help of smart technologies public participation and stakeholder collaboration to accomplish urban sustainability".

This conceptual framework distinguishes itself in three aspects. First, smart urban governance decision-making consists of an in-depth understanding of the specific influence of socio-spatial contexts.
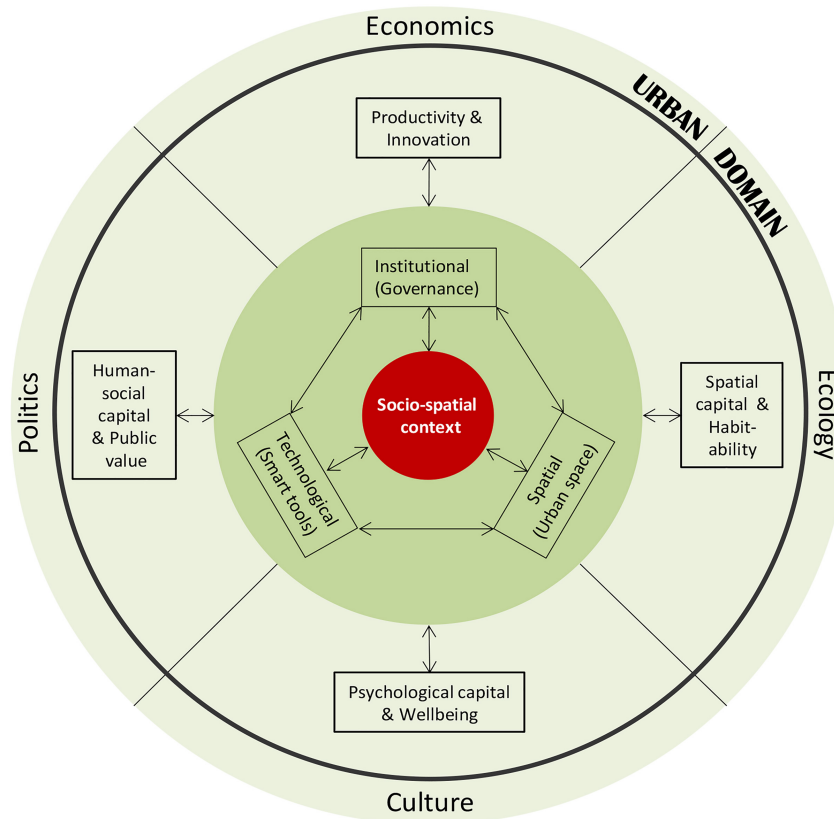
Fig. 4. A conceptual framework for smart urban governance.

Quite often, a governance approach that succeeds in generating excellent policies in one place may fail in another (Meijer, 2015), since contextual specificities act as "a frame of reference for co-operative activities" (Lang & Roessl, 2011, p. 726). Second, distinctive from other ICT-enabled governane approaches, this framework stresses that urban space is an inseparable component of smart urban governance. In e-governance or smart governance, urban space is presented as a surface with little conception of the urban at work. In this paper, the substantive content of urban space as a category of practice is explicitly proposed. In other words, "the presence or otherwise of technology, and the nature of that presence, then follows the identification of what the urban problem is and how the people are living those issues' frames and redefines an alternative 'smart' urban governance" (McFarlane & Söderström, 2017, p. 313). Third, smart urban governance intends to facilitate particular efforts by people, communities, countries and other social units to strive for an ongoing lifeworld of urban flourishing – urban sustainability – based on James (2014) conceptualization of sustainability. In this, sustainability is more related to the socialized urban life – the 'urban'. This argues for a move beyond the aim to achieve a tangible technology-based outcome such as better infrastructure, clean energy and economic development, but towards more intangible gainings such as human well-being, public value and smart habitability. To tentatively demonstrate how the framework works in practice, an illustration case was applied in the following subsection.

7.1. A case illustration for the smart urban governance framework

Helsinki is confronted with fierce competition from other cities globally. At the local level, the city faces the challenges of urban economic renewal. Devoted to dealing with these challenges and improving residents' quality of life, the project City-as-a-Platform was proposed by taking a broader contextual view.[2]

First, to make full use of Finland's democratic tradition and citizens' strong sense of participation in the city affair, the smart city discourse and practices in Helsinki provided a sense of democratizing innovation, i.e., cooperation and aggregation of ideas and knowledge of public sector, academia, business and citizens. One example is the Smart Kalasatama program, which built a network of actors in which innovations were created and tested. By initiating numerous activities that brought business and civil society together, this platform had a special role in Helsinki's smart city-inspired development (e.g., open access to public data, smart city services testing and growth companies services). Another example is the Climate Street Project. Focusing on environmental protection, firms, real estate owners, universities and residents were invited to contribute their ideas and knowledge of energy saving and carbon emission reduction. A range of positive results have been achieved such as using shared spaces more efficiently, the provision of climate friendly products and trust building between stakeholders.

Second, although user-driven platforms in Helsinki to some extent enhance the interdependence of different stakeholders, but its ability to reinforce the interconnected ecosystems for urban innovation is weakened by a lack of mechanisms that can intensify collaboration between the key institutional actors and mobilize innovation potential of the city. Thus, Helsinki government intervention, strongly influenced by its welfarism, involved in extending user-driven platforms or living labs into the city level. By making a clear strategic plan, the Helsinki Strategy Program 2013–2016, Helsinki government integrated open participation and custromership, open data and interfaces, and open innovation platforms into a comprehensive city platform. The best example of this integration is the Forum Virium Helsinki. By aggregating most of the platforms in one place, this project succeeded in applying the platform thinking to Helsinki and reshaping interaction potential in urban communities.

Third, it should be noticed that the dynamics of Helsinki's City-as-a-Platform did not stand alone but revolved around Helsinki's technological ability to strengthen social behaviors and practices. As an important center for knowledge economy and innovation in Europe, Helsinki is capable of providing hardware and software solutions for extracting meaningful intelligence and smartening city operations. The user-driven online/offline platforms created in Helsinki provided technological intelligence to organize and process data and information that were dispersed and distributed amongst individuals. This ICT-enabled platformatization not only restructured Helsinki's urban infrastructure, but also provided collaborative supports for economic development and urban services innovation.

Influenced by Finland's democratic tradition and technological basis, it shows that both firms and individuals in Helsinki tend to share their innovations with others, creating more open innovation processes. Then, facilitated by government intervention, these user-driven platforms or living labs had contributed to Helsinki's City-as-a-Platform, characterized by enhanced connectivity, better access to products and services and user-innovation communities. As a result, urban space is no longer a physical entity but an interconnected system in which people can obtain and exchange information and knowledge in a timely manner. Within this system, tensions between pro-growth and anti-growth coalitions had been effectively eased by participatory processes and the enhanced quality of life.

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[2]Note: the review of this case is largely based on the work by Anttiroiko (2016).

In this case, smart urban governance is about integrating technologies into a city and building participatory and collaborative spaces to inspire Helsinki's urban innovativeness and improve its global competition. Taken together, the case well demonstrates the linkages between socio-spatial contexts, interactions between technology, institution and urban space, and the desired outcomes. It also reveals that socio-spatial contexts of urban challenges associated to smart cities, if properly considered, can maximize the potentials of interactions between technology, institution and urban space and produced smart urban governance.

8. Conclusion and future research directions

At present, a public administration perspective (like in the elaboration of the concept of Smart Governance) and an urban planning perspective (characterized by entrepreneurial forms of urban governance) have dominated the governance of smart cities. However, the identified shortfalls along with the context ignorance within the two present dominant perspectives have impeded the transformation of cities. To put a fundamental step forward, this paper proposes a specific urban planning perspective on smart governance, labeled as 'smart urban governance'. It is aiming specifically at the transformative governance of the socio-spatial context of urban challenges associated to smart cities via technological innovations and opening up new possibilities for city transformation. In doing so, it intends a symbiosis between the 'smart' from smart governance literature and the 'urban' from urban governance literature, as a means to 'smartening' urban governance as well as drawing attention to the importance of socio-spatial transformations in shaping smart governance. To this end, the meaning of smart urban governance is conceptualized from three dimensions: purposes, components and contexts. Based on a systematic literature review, these three dimensions are integrated into one holistic framework. Taken together, smart urban governance can be defined as a dynamic institutional arrangement, operating within certain socio-spatial contexts, and enabling with the help of smart technologies public participation and stakeholder collaboration to accomplish urban sustainability.

This understanding proves useful in expanding our view of how a context-oriented governance approach in the era of the smart city can be established. According to Kummitha and Crutzen (2017), a city that is smart only exists when it applies ICTs to enrich governance and build creative and inclusive urban space. In this, neither technology determinism nor a human-centric view is sufficient to realize the governance of smart cities. Instead, this paper shows that only through real-time and dedicated interaction between governance, urban space, and ICT, attuned to specific socio-spatial transformations under which it operates, will the opportunities for innovation of urban governance be achieved. By offering guiding principles such as the consideration of socio-spatial context, urban space as a category of practice, technology as a means instead of an end, and comprehensive purpose indicators, our suggested framework reorients the technological orientation to urban space more towards a human-centric approach, in which more intangible gainings such as human well-being, public value and smart habitability (see e.g., Webster & Leleux, 2018; Granier & Kudo, 2016) also play a prominent role. In addition, the applied case illustration has tentatively demonstrated the presumed added value of this framework. This paper concludes that smart urban governance, by explicitly taking into account the specific socio-spatial context, can improve our understanding of the urban challenges associated to smart cities and contribute to its appropriate and 'smart' governance.

Despite the potential of smart urban governance for handling city transformations, our conceptual framework is in its initial stage, and certain blind spots and biases still exist. From this perspective, we

set out some suggestions for future research, to further enhance our conceptual and theoretical understanding of smart urban governance and its usefulness in practice. First, we think an international survey on practical smart urban governance projects can benefit the discussion on what are the contextual factors influencing smart urban governance in practice. Second, research could concentrate on the interrelationship of technology (mainly ICT) with governance and urban space, mediated by context-specificities. Questions for this research include: what is the added value of technology within smart urban governance? How does technology shape urban space and governance processes in smart urban governance? What kinds of smart urban governance modes can be produced through the interaction between urban space, institutional actors and technology in practice? Third, research could focus on the mechanisms of how present-day 'urban governance' can be transformed into 'smart urban governance'. Problem statement for research can be: key success/failure factors that transform traditional urban governance into smart urban governance in practice. In our research we provided the first steps, but these need further elaboration to stress the urgency of the symbiosis between the smart governance and urban governance discourses.

Acknowledgments

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Appendix

Table 3
Descriptions of smart urban governance (SUG)-relevant terms

	Selected descriptions	References
SUG-relevant purposes		
Efficiency and productivity	"Smart governance helps to promote economic growth performance of cities due to the expected improved efficiency of public sector services in Smart cities."	Bolívar and Meijer (2016, p. 681)
Learning and innovation	"To really achieve smart cities – that is to create the conditions of continuous learning and innovation."	Campbell (2012, p. 1)
Technological savviness	Smart governance aims to create "infrastructure overhaul and ubiquitous high-speed connectivity."	Scholl and Scholl (2014, p. 167)
	"…citywide information and communication technologies (ICTs) turned out to be at the core of creating an environment conducive to smart operations and smart services, and ultimately, smart city government."	Scholl and AlAwadhi (2016, p. 21)
Human and social capital	"Smart governance, which relies and rests on timely and actionable information as well as the underlying facilitating ICTs, requires human skills capable of bringing the component parts of smart governance into action and interaction."	Scholl and Scholl (2014, p. 169)
	"Such smart cities are based on a promising mix of human capital (e.g., skilled labor force), infrastructural capital (e.g., high-tech communication facilities), social capital (e.g., intense and open network linkages) and entrepreneurial capital (e.g., creative and risk-taking business activities)."	Kourtit et al. (2012, p. 93)
Public services and value	In smart cities, public services are services provided by government via innovative ICTs, including "smart traffic and bus services, smart parking, water management, smart metering and grid, smart buildings and so on."	Pérez González, and Díaz Díaz (2015, p. 252)
	"Public value generation, which aims to measure the outcomes and/or the long-term impacts of the initiatives implemented. This value generation usually includes the more general social objectives that the interventions address, such as economic growth, employment, social inclusion, and well-being."	Castelnovo et al. (2016, p. 733)
Organization improvements	"Smart governance is the pro-active and open-minded governance structures, with all actors involved […]."	Kourtit et al. (2012, p. 18)
	"…the need for fundamental change and overhaul with regard to organizational integration and alignment as well as interorganizational information system interoperability as a pre-requisite for creating smart operations and providing smart services."	Scholl and AlAwadhi (2016, p. 21)
Social inclusion and cohesion	"Policies have been undertaken under the heading of smart governance with the aim of achieving of the social inclusion of urban residents in public services."	Caragliu et al. (2009, p. 48)
Transparency and trust	"Transparency appears as a key to effective administration of the 21st century as well as to the legislative process."	Scholl and Scholl (2014, p. 169)
	"[Smart governance] create open technologies for government, private sectors and citizens to work together for their daily issues. Improved services, a more transparent government and allowed participation with the help of a combined use of open and closed technologies [increase] the satisfaction and trust of local citizens."	Jiang et al. (2019, p. 109)
Improvements to city	"Third-order outcomes: improvements to the city" includes "economic growth, social inclusion, ecological performance, highly educated citizens."	Bolívar and Meijer (2016, p. 679)
Ecological performance	"Ecological performance is another expected outcome derived from Smart governance."	Kourtit et al. (2012, p. 232)
	"Smart governments should possess both dimensions being able to take into account the ecological implications of growth and development, improving the quality of life for future generations, and quickly recover and respond to their citizens in cases of emergency and disaster."	Pereira et al. (2018, p. 16); also see Gil-Garcia et al. (2016)
Sustainability	"The smart system represents a real support for an urban development, which will generate a sustainable development of our cities."	Bătăgan (2011, p. 83)

Table 3, continued

	Selected descriptions	References
SUG-relevant purposes		
Quality of life and well-being	The main goal of governing smart city is to "utilise information and communication technologies with the aim to increase the life quality of their inhabitants [. . .]."	Bakici et al. (2013, p. 137)
Belonging and liveability	The governance of smart cities "strives to meet aspirations of citizens," and "provides assurance to citizens."	BSI-RoS (2014, p. 4); also see Joss et al. (2017)
SUG-relevant components		
Government or governance	"We believe a smart city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance."	Caragliu et al. (2011, p. 70)
	"The concept Smart governance is a label associated to a governmental management of a city whenever the city is badging itself as smart."	Batty et al. (2012, p. 505)
	"Smart cities are supposed to be supported by appropriate and trustworthy governance structures and by open-minded, creative people, who through a joint effort are able to increase local productivity, [. . .]."	Kourtit and Nijkamp (2012, p. 93)
	"We should study smart city governance as a complex process of institutional change and acknowledge the political nature of appealing visions of socio-technical governance."	Meijer and Bolívar (2016, p. 392)
Political actors or stakeholders	"The stakeholder term has been widely defined and refers to individuals groups, agencies, parties or organizations that are involved in smart city governance in any way."	Ruhlandt (2018, p. 6)
Participation or engagement	"Citizen engagement in and evidence-based decision-making processes: [. . .] the engagement of citizens in decision-making processes rather than participating in the improvement of services based on a citizen/customer approach."	Pereira et al. (2018, p. 11)
	"Smart governance comprises aspects of political participation, services for citizens as well as the functioning of the administration."	Giffinger et al. (2007, p. 11)
Collaboration or partnership	In ICT-enabled governance, "collaborating across departments and with communities, helping to promote economic growth and at the most important level making operations and services truly citizen-centric."	Bătăgan (2011, p. 85)
Openness and transparency	"Open Government, Transparency, and Accountability" are crucial to define smart governance, which "encompass a proactive involvement of stakeholders in the public decision making processes."	Scholl and Scholl (2014, p. 167)
Leadership and accountability	"The concept of smart cities with the notion of governance, in which it perceives a greater intention on value creation for society through aspects such as leadership, accountability, responsiveness."	Osella et al. (2016)
Power and empowerment	Castelnovo et al. (2015, p. 12) "reaffirm the central role of citizens in the decision-making process and their fundamental contribution to public value creation in the city context."	Castelnovo et al. (2016, p. 12)
Policy	"Government in Smart cities must promote policies oriented toward strengthening innovation systems, specially focused on knowledge that might be more basic, fundamental."	Yigitcanlar et al. (2008, p. 17)
Management and organization	"Community building and management, which aims to assess urban stakeholders' engagement in smart city governance and decision-making processes."	Castelnovo et al. (2016, p. 733)
Decision-making	"Smart cities need to develop Smart governance systems that take all key factors into account, which includes three-step policy-making process: "beginning by diagnosing the situation, then developing a strategic plan, and finally taking action."	Berrone and Ricart (2012, p. 52)
Strategies and visions	"Vision and strategy formulation, which aims to assess a smart city's capability of using strategic planning and implementing monitoring and evaluation techniques to generate evidence to inform future strategic plans."	Castelnovo et al. (2016, p. 733)

Table 3, continued

	Selected descriptions	References
SUG-relevant components		
Legal and regulatory	"Regulatory, legal and policy frameworks play a conditioning role in scaling processes of smart city pilot projects."	van Winden and van den Buuse (2017, p. 58)
Technology or ICT	"Smart city governance is about crafting new forms of human collaboration through the use of ICTs to obtain better outcomes and more open governance processes."	Meijer and Bolívar (2016, p. 681)
	"In the context of smart governance, ICTs and other technologies play highly critical roles as they technically facilitate the "smartness" of governance, and consequently, government. In that sense, they apply to and permeate all eight areas of focus."	Scholl and Scholl (2014, p. 169)
Big data	"[Big] data, smart city advocates argue enables real-time analysis of city life, new modes of urban governance, and provides the raw material for envisioning and enacting more efficient, sustainable, competitive, productive, open and transparent cities."	Kitchin (2014, p. 1)
Place or space	"Place matters in smart towns and cities."	Walters (2011, p. 198)
	"The intelligence of a city should be measured by its ability to produce favourable conditions to get urban operators (citizens, organizations, private companies, etc.) actively involved into sociospatial innovation dynamics."	Roche (2014, p. 7.3)
	"Spatial (urban and environmental) development in smart cities: We need to reform our cities by adopting sustainable urban development principles – e.g., minimising urban footprint, limiting emissions, establishing urban farms."	Yigitcanlar et al. (2018, p. 149)
SUG-relevant contexts		
Economic structure	"The availability of economic and financial resources" influence the capability of government to cities.	Castelnovo et al. (2016, p. 733)
Technological development	"Smart governance is influenced by contextual factors such as [. . .] technological factors."	Bolívar and Meijer (2016, p. 688)
Political system and institution	In practice, "different institutions have largely affected smart governance strategies, arrangements and outcomes."	Lin (2018, p. 1)
	"Different levels of [political] regulation (transnational, international, national, regional, local) [. . .]" influence the governance of smart cities.	Walravens (2012, p. 125)
	"Issues of responsibility, [. . .] and the regulations that extra national government agencies may impose on what and how and where and why citizens are able to influence the governance of their cities."	Batty et al. (2012, p. 512)
Culture and customs	"There are cultural barriers to ICT-enabled governance": 1) "bureautic culture-formality, uniformity and hierarchy-preserves the traditional ways of interacting with citizens"; 2) "citizens may be opposed to changes in the relationship with government because they feel it threatens their autonomy or privacy."	Meijer (2015, p. 199)
Personal rationality and preference	"The availability of relevant knowledge among citizens and stakeholders, and the willingness to contribute this knowledge to collective problem-solving" will influence the governance of smart cities.	Meijer (2016, p. 77)
Geographical particularity	"Situational characteristics, such as democratic institutions and culture, the physical environment, the economic production, etc., matter for the effectiveness of smart city governance since these characteristics are either conducive or limiting to different modes of smart city governance."	Meijer (2016, p. 77)
Resources constraints	Resource constraints represent the limitation and enrichment of spatial resources (e.g., facilities and utilities) to be utilized in dealing with social and urban issues.	Hawkins (2011)
Urban problems as context	"Social, economic and environmental challenges associated with urbanization are key drivers of the development of smart cities. They influence the choice of smart governance models and related strategies and actions."	Lin (2018, p. 3)