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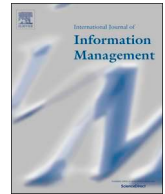
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Investigating context factors in citizen participation strategies: A comparative analysis of Swedish and Belgian smart cities

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ABSTRACT

Modern cities currently face numerous challenges related to mobility, waste management, access to resources, etc. Smart Cities integrate information and communication technologies (ICT) to develop innovative solutions that can solve such challenges and create a higher quality of life for their citizens. Two elements need to be considered for smart cities to be successful. First, citizens must participate in the design of the smart city to take advantage of their ideas so that the smart city answers their real needs. Secondly, each city has its own unique characteristics that need to be considered to design a citizen participation strategy truly tailored and adapted to their respective context. In line with these two considerations, the goal of this paper is to identify the context factors that impact citizen participation strategies in smart cities. In order to reach that goal, we performed a qualitative case study of two cities that strive to be smart: Namur (Belgium) and Linköping (Sweden). This analysis allows us to understand how participation is implemented in two different cases and to infer the context factors that impact the respective strategies. Five context-factors have been identified in this study: the smart city consideration, the drivers for participation, the degree of centralization, the legal requirements, and the citizens' characteristics. By identifying these factors, we can derive context-dependent recommendations about citizen participation for smart cities. These recommendations are then applied to the case of Brussels in Belgium.

1. Introduction

In the 21st century, the concentration of the population in relatively few large cities keeps increasing. In 1950, only 30% of the world's population lived in urban areas, in 2014, this number had increased to 54% and it is predicted to reach 66% by 2050 (United Nations, 2014). Besides the number of citizens, the average size of cities has also increased. At the end of the 20th century, this trend was already present and led to new challenges for the governments in order to tackle its negative effects: traffic congestion, waste management, access to resources, crime, etc. The smart city trend emerged as a possible solution to these issues and was adopted in 2005 by a number of technological companies such as IBM, ABB, HP, Siemens, Ericsson or Cisco (Harrison & Donnelly, 2011). They offered complex information systems to integrate the operation of an urban infrastructure. At that time, smart cities very much relied on technologies such as the Internet of Things (IoT), Cloud Computing or embedded networks of sensors and devices to solve urban issues (Perera, Zaslavsky, Christen, & Georgakopoulos, 2014). However, a growing line of research criticized this techno-

centricity and argued that smart cities should instead emerge from the needs and expectations of its citizens (Hollands, 2008; Vácha, Příbyl, Lom, & Bacúrová, 2016) and meet sustainable goals (Ahmad & Mehmood, 2015; Ismagiloiva, Hughes, Rana, & Dwivedi, 2019; Yigitcanlar, Kamruzzaman et al., 2019; Yigitcanlar, Foth, & Kamruzzaman, 2019). In this line of thought and based on the definitions of (Caragliu, Del Bo, & Nijkamp, 2011; Chourabi et al., 2011), we here define a Smart City as “a city that provides innovative solutions, in collaboration with its citizens and with the support of technology, to solve the specific challenges of its territory in the domains of mobility, economy, governance, environment, living, and people”. This definition clearly states the need for citizen participation in the design of smart cities.

Too often smart cities have not reached their objectives because they assumed citizens' needs and pushed technological solutions without taking into account the specificities of their territory and the people living in it (Dameri, 2014). Numerous participation methods have been put forward to enable the participation of citizen in smart city design (Simonofski, Serral Asensio, Desmedt, & Snoeck, 2017). This

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inventory of method is an essential first step towards participation but does not suffice as cities each have unique characteristics that need to be taken into account to design a citizen participation strategy truly tailored and adapted to the context factors of the city such as values, organization, size, country characteristics, etc. With context factors, we refer to elements from the environment that might influence the decisions of stakeholders about a specific project. For instance, an urban city like New York does not have the same challenges and resources than smaller rural cities. Considering context factors is essential to provide policy-makers with appropriate recommendations that help them in their effort for integrating the input of citizens when developing smart cities.

The goal of this paper is to identify the context factors that impact citizen participation strategies in two smart cities from different countries in Europe - and, to answer the following research question: “Which context factors impact citizen participation strategies in smart cities?”. In order to reach that goal, we performed a qualitative case study of two European smart cities, Linköping (Sweden) and Namur (Belgium), similar enough to be comparable but with enough differences to draw relevant perspectives on context factors. The contribution of this paper is two-fold: (1) analyze the citizen participation strategies in two European cities and (2) derive context factors that impact these strategies. By understanding the context factors and their impact on citizen participation, we aim at formulating better context-specific recommendations to policy makers about citizen participation in smart cities. These recommendations are then applied to the case of Brussels (Belgium) for a preliminary validation.

The remaining of this paper is structured as follows. In the Research Motivation section, we further explain the importance of citizen participation in smart cities and detail the research gaps that this paper aims to address. In the Research Method section, we explain how we analyze both cities by means of the qualitative study. In the Results section, we first present the citizen participation strategies of both cities and then detail the inferred context factors. In the Discussion section, we reflect on the importance of the identified context factors and formulate recommendations for practitioners that aim to be city-specific. This section also details the inherent limitations of the research. In the Conclusion, we summarize the contributions of this study and their implications for research and practice.

2. Research motivation

2.1. Importance of citizen participation in smart cities

The relevance of citizen participation in smart cities has been underlined by Hollands (2008) as a critique of the technological orientation of the concept. Indeed, he states that the smart city must be based on something more than technology and start from the needs, ideas and expectations of its citizens. Citizen participation is frequently construed as a prerequisite for the development of smart cities that are “service-oriented” instead of “technology-oriented” (Nam & Pardo, 2011). In a recent systematic review of the smart city literature, Yigitcanlar et al. (2018) expand on the techno-centric focus of the smart city and underline the need for a decentralized governance. This argument is in line with the participatory governance advocated by Rodríguez Bolívar (2018). This need for decentralization in the smart city ecosystem is also underlined by the Quadruple Helix Model for innovation (Cossetta & Palumbo, 2014). This model refers to the interaction of four pillars in the innovation process: university, government, industry and citizens. In the early innovation process, the end users (the citizens in this case) were confined as passive consumer. The introduction of the civil society as a crucial stakeholder empowered the classical triple helix model and stimulated innovation for new ideas (products, services or models) that can meet social needs. Related research fields, such as Information Systems (IS) and Human-Computer Interaction, also underline this relevance of citizens with the Participatory Design (PD) development

school. Specifically, PD advocates an approach where good ideas are as likely to come from user groups than from decision-makers (Holgersson et al., 2012; Schuler & Namioka, 1993) and finds a relevant application for citizen participation (Foth & Brynskov, 2018)

As discussed above, whether it is in the smart city research fields or in related fields, citizen participation constitutes an important foundation in smart cities. Thus, the smart city literature did not invent the concept of participation but shed a new light on to the need for innovative methods (enabled by new technologies or not) that could scale up to a city level. A recent study analyzed the smart city literature within the IS field and underlined the importance of citizen participation and collaborative governance (Ismagilova, Hughes, Dwivedi, & Raman, 2019). Furthermore, in their analysis of several Indian smart cities, Rana et al. (2019) identify the lack of public involvement one key barrier impeding smart city development. We here structure participation in three main categories based on previous works (Berntzen & Johannessen, 2016; Callahan, 2007; Simonofski, Serral Asensio et al., 2017). Firstly, citizens can be *democratic participants* in the decision-making process of the city and thus support democratic development. The concept of participation has been theorized by Arnstein (1969) who suggests that democratic participation is a spectrum that consists of three main steps: non-participation, tokenism (gathering of ideas but no impact on decision-making) and co-decision (with decision-making shared between officials and citizens). Secondly, citizens can be *co-creators* in order to contribute to knowledge creation and innovation in the city. Thanks to previous studies presenting an inventory of co-creation methods (Simonofski, Snoeck, Vanderose, Crompvoets, & Habra, 2017; Simonofski, Snoeck, & Vanderose, 2019), we were able to collect and analyze the main co-creation methods dedicated to ensure that citizens’ ideas and expertise are collected to propose better solutions and ideas and to decrease the risk of failure early in the process. Finally, the citizens can also participate as *ICT users* by proactively using the smart city infrastructure in a way that makes citizens perceive participation as accessible and enables them to participate more easily (Anthopoulos & Reddick, 2016). These three categories constitute the basis of the CitiVoice Framework (Simonofski, Asensio, De Smedt, & Snoeck, 2018) that we rely on to analyze participation in the two smart cities of interest.

2.2. Importance of contextualization

Context factors are essential elements to examine for every aspect of a smart city strategy. Cities differ in terms of size, characteristics of the population, degree of rurality, etc. Therefore, one smart city strategy may not be replicable as-is to another city as many context factors have to be considered. In a very influential paper, Gil-Garcia, Zhang, and Puron-Cid (2016) stated that there are “several ways to be smart, and several interesting combinations that could be applicable for each context and situation and create different results” and underline the need to perform more research in that direction. Meijer, Gil-Garcia, and Bolívar (2016) also underline the importance of contextualization for smart city governance but mention that the analysis of such factors is still rare. Indeed, there is a lack of comparison of strategies and practices in this regard. Only a few studies compared smart cities to draw conclusions from different contexts (Berntzen & Johannessen, 2016; Dameri, 2014; Odendaal, 2003).

The understanding of these factors will impact the technological choices of the city, the way they communicate to their citizens, the size of the projects but also the citizen participation strategy. In this paper, we have chosen to focus on participation as it is essential to successfully develop smart cities as seen in the previous section. Two particular studies tackled the importance of specific context factors for citizen participation in smart cities: Cardullo and Kitchin (2019) examine citizen participation in Dublin by examining the impact of the neo-liberal view of the city on the implemented actions and Foth (2018) examines the evolution of urban informatics depending on the maturity of the

relationship between the city and the citizenry. This importance of contextualization for participation is further underpinned within the IS field. Participation is also considered as a success factor for IS development (Hartwick & Barki, 1994) but research also showed that this participation could lead to negative effects if the context of interest is not properly considered (Heeks, 1999; Holgersson, Melin, Lindgren, & Axelsson, 2018). However, none of the abovementioned studies attempt to formalize the context factors that impact participation.

3. Research method

Due to the limited number previous studies concerning context factors impacting citizen participation in smart cities, we have chosen to perform a qualitative study of two cases because it allows an explorative study (Benbasat, Goldstein, & Mead, 1987). We chose not to present hypotheses about context in factors in order to be truly explorative and iteratively refine the context factors during the data collection process. We instead used an abductive approach, defined as an approach to data collection and analysis that entails iteration between identifying facts or concepts in the empirical data, and deciding on the most promising explanatory reasons to go forth with exploring (Schurz, 2008). Thus, it can be viewed as an interplay between inductive and deductive reasoning. All the researchers had prior knowledge on citizen participation and smart cities (by using the CitiVoice framework for instance). Therefore a purely inductive approach would not have been possible as we drew from this previous knowledge during the research process (Thornberg, 2012).

In this paper, two case studies were analyzed: Namur (Belgium) and Linköping (Sweden). Namur is a city with 110 939 inhabitants where the service industry is dominant (presence of a university, commercial activities, etc.). City representatives declared in March 2013 their willingness to engage in a smart city strategy and performed several actions since. Linköping has a population of 160 407 (as of Q3 2018). The city focuses on ICT and knowledge development (with a university and several large IT- and technology-focused businesses), manufacturing and a growing service sector. Linköping recently created a central job position for digital transformation and smart city development in order to coordinate and push projects forward. These cities were deemed as suitable cases as they are comparable in terms of size, stakeholders involved, location (European nations), technological development and type of participation methods implemented while still different enough to allow us to spot context differences between cities that might otherwise have been overlooked. This balance between similarities and differences is ideal for our study as it allows to understand how the same methods with the same stakeholders involved can be implemented differently and influenced by different context factors. Furthermore, these two cities have implemented participation methods that are also implemented by a big number of other cities, which would make the results more generalizable. Finally, we have corroborated the obtained context factors with a quite different city, Brussels (much bigger in size, a huge cultural mix, etc.), and did not obtain additional factors at this time. This first validation step will be explained in the Discussion section.

Between November 2018 and January 2019, two researchers collected empirical data through a combination of six in-depth interviews with key stakeholders (cf. Table 1), and complementary official documents, agendas and internal documents provided to us by interviewees. We were also able to draw knowledge from interviews conducted in both cities in previous research projects. The complementary data sources allowed for triangulation and corroboration of the data extracted in the interviews from other sources. The interviews were semi-structured (Drever, 1995) and we based the questions on the three participation categories described in Section 2.1. The complete interview guide can be found in Appendix 1. These stakeholders were selected from different functions to have different perspectives on the smart city. The interviews were limited to three for each city as the

interviewees stated that these were the three main functions involved in the smart city strategy at the city level. We also kept the functions of the interviewees comparable for each case: one person in charge of the overall strategy, one person in charge of urban issues and one person in charge of data valorization. At the end of each interview, complementary potential interviewees were asked, and the suggestions were limited to these three functions.

The abductive research process was implemented as follows. First, as we wanted to ensure the inclusion of questions regarding relevant citizen participation activities, we used the CitiVoice Framework (Simonofski, Serral Asensio et al., 2017) as a starting point for this line of questioning as it was previously validated on numerous smart cities (Simonofski, Serral Asensio et al., 2017). To the best of our knowledge, CitiVoice is currently the most exhaustive list of concrete participation activities spanning all three categories in a smart city context. Second, we purposefully left questions regarding context factors open ended in the initial stage. Thanks to an intensive use of probing (“Why did you choose to perform this action?”, “Which factors influenced your choice?”, etc.), we were able to infer a first identification of the context factors related to their citizen participation strategies. Third, in the following interviews, we iteratively adapted the interview guide based on the need to complete the information about the citizen participation activities, as well as to expand our understanding about of context factors. This iterative identification of citizen participation activities and context factors embedded in previous theoretical frameworks and data collection respectively allowed us to implement the abductive reasoning for this study.

In order to analyze the results in light with citizen participation, we mapped the insights discussed in the interviews to the CitiVoice comparison framework (see Section 4.1 for more details). This study is a prerequisite for the context factor analysis. In order to extract the relevant context factors, the interviews were analyzed with process and initial coding (Saldaña, 2014). We started the analysis by summarizing the interviews and recording them in memo documents. Then, we skimmed the interview to grasp its overall content and highlighted the important sentences based on the research question. The codes were then inserted in a table to summarize the different context factors mentioned by the interviewees. After each interview, we were able to iteratively categorize and compare the factors (see Section 4.2 for more details). The official documentation helped us to outline the context of each city as they provided a frame of reference regarding local policies, agendas and strategies. They also served as a resource for additional information regarding topics that were discussed during interviews. However, no additional context factors were derived by using these documents. Thanks to the diversity in the profiles and backgrounds of the interviews, the analysis performed by multiple researchers and the triangulation with the official documentation, we were able to limit the subjective perception in the data.

4. Results

4.1. Comparative analysis of citizen participation strategies

In this section, we analyze the citizen participation strategies in Namur and Linköping. A comparison of the cities illustrates how a specific participation activity can be implemented differently and for different reasons with respect of the different context factors. The full information about the respective participation strategies can be found in Appendix 2. Fig. 1 shows the links between the stakeholders in charge of the smart city strategy and the participation activities they implemented.

In terms of *stakeholders involved* in Namur, the administration coordinates the participation activities with the university and the private sector as punctual support. Participation is much more difficult to represent simply in Linköping as the actors involved perform more diverse actions autonomously. Indeed, the stakeholders are comparable in

Table 1
Interviews performed in Namur and Linköping.

N°	City	Function	Relevancy
1	Namur	Smart City Manager	Coordination of smart city strategy and responsible for participation platform
2	Namur	Living Lab ^a Manager	Responsible for participation of citizens in Urban Planning.
3	Namur	Data Office Manager	Responsible for the Data Management of the City and for the Open Data platform
4	Linköping	Digital Transformation Manager	Responsible for coordination of digital transformation projects in the city
5	Linköping	Comprehensive planner	Works in comprehensive planning at the city's planning and development office
6	Linköping	Communicator	Works on communication of participation activities towards citizens

Living Lab: "User-driven open innovation ecosystem based on business-citizens-government partnership which enables users to take active part in the research, development and innovation process" (European Commission, 2009).

the two cities, but the implementation of participation activities is much more distributed in Linköping.

In terms of *participation areas*, the analysis of both cities with the CitiVoice framework shows that there are investments in the "Co-creation" and "ICT use" aspects of participation but lower investments for the "Democratic participation" (monitoring of impact on decision-making, efforts to ensure repetitiveness of citizens, etc.). It shows that both cities try to gather the citizens' input (through several methods such as Living Labs, Direct Interaction technique such as meetings or interviews, Open Data or Online Platforms) but there are few considerations for the impact of this input on the decision-making process.

In terms of *methods used*, Online Platforms are heavily used by diverse stakeholders in both cities. Furthermore, the direct interaction techniques (group discussions, town hall meetings, etc.) remain widely used methods as well. Also, Linköping enables the private sector to implement participation (e.g. through formal collaboration in the living lab) whereas Namur confines it to the public organization. Open Data portals are developed in both cities by the digital/data offices of the administration.

This analysis shows that the two cities are comparable in terms of stakeholders involved and participation activities performed. This homogeneity is ideal for our study it will allow to understand how similar situations in terms of participation can be influenced by different context factors. The differences (in terms of location, size or technological development) will enable us to identify relevant context factors. These factors and their impact on the participation activities are detailed in the next sub-section.

4.2. Context factors analysis

In this section, we reflect on the context factors inferred from the coding of the interviews. At this stage, the context factors are labelled by the researchers as broad categories as follows (see summary in Table 2):

4.2.1. Smart city consideration

In Namur, the interviewees disconnect technology in their consideration of "what is a smart city" as technology is for them only an enabler to reach "smartness". Instead, they consider a smart city as a city "capable to react to change" in a "sustainable" way to answer the needs of the territory. The smart city manager mentioned that the main definition used internally is "creating an ecosystem of actors involved in a sustainable transition process by using technologies as means to support the process". This consideration shows that Namur favored the use of non-technological participation methods (direct interaction and living labs) that will be supported in the future by technological devices such as public displays.

In Linköping, the main smart city consideration is linked to digitalization and digital transformation. The idea of becoming a Smart City is quite recent, and the central job position charged with this development currently lack a specific definition of the smart city. During our interview, the digital transformation manager said he would like to "have benchmark objectives in order to be able to measure progress". In the current digital agenda for Linköping (Linköping Municipality, 2016), there are implicit projects linked to the smart city but not explicit ones. The digital transformation manager stated that their view on smart city development is technologically-focused. This focus on digitalization

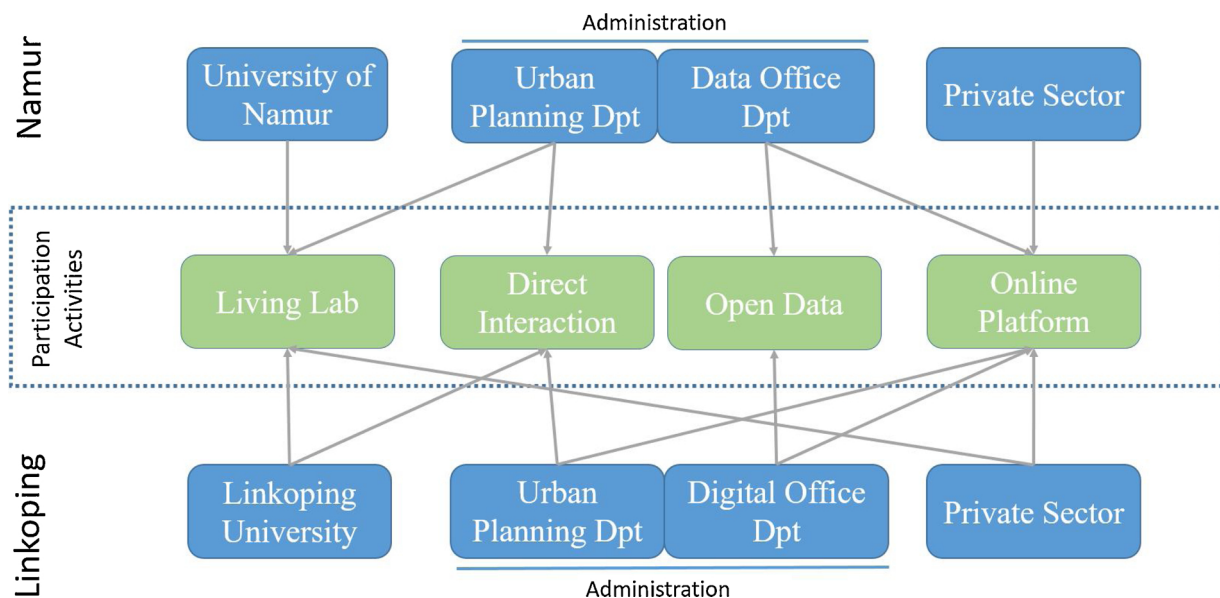


Fig. 1. Stakeholders and Participation Activities.

Table 2
Identified Context Factors.

Context Factor	Definition	Namur	Linköping
Smart City Consideration	The consideration of stakeholders for the smart city concept linked to participation	<i>Participation-Oriented:</i> Sustainable city with ICT as support	<i>Technology-Oriented:</i> Digitalization to facilitate sustainability and manage societal challenges
Drivers	The goals that led to the implementation of participation	<i>Top Down:</i> Political Push (city), Urban Competitiveness, Challenges	<i>Top-Down:</i> Political Push (Country) and Attractiveness, Challenges
Degree of centralization	The extent to which participation is coordinated between stakeholders	<i>Centralized</i> in the administration and coordination through human interaction	<i>Decentralized</i> with an ecosystem view and coordination through official documents
Legal Requirements and Plans	The legal constraints about obligation of participation for the city	<i>No constraints</i> and spontaneous participation	<i>Minimum legal constraints</i> on citizen participation
Citizens' Characteristics	The maturity for participation, as perceived by stakeholders, of the population	<i>Population considered as mature:</i> Educated and employed citizens	<i>Population considered as mature:</i> Educated and employed citizens

might have encouraged the use of technological participation methods (mainly online-platforms) by the administration.

4.2.2. Drivers for smart city development

The main driver for both cities was the political push. In Namur, the political willingness came from the city council (and was influenced from the ecological party). Other factors such as marketing, urban competitiveness to get recognition and traditional societal challenges (social, environmental, participation) were also mentioned to be important drivers. Some bottom-up activities came directly from the citizens in terms of neighborhood coordination but were not directly related to the smart city design.

In Linköping, there has been a political push for digitalization, as there has been nation-wide in Sweden. The digital agenda for Linköping heavily refers to the national digitalization goals, but with focus areas derived from the city's requirements (such as higher levels of digitalization in education and healthcare). Another factor resides in urban competitiveness; the digital transformation manager described attracting people to university, as well as high-tech businesses in the area, as factors that makes it important to have a high level of digitalization within the municipality. In the digital agenda, the impact of digitalization in other domains (education, health, etc.) is also presented as a motivation.

In both cases, the smart city development was driven by a top-down approach, but the cities still invested in participation methods to know the needs of the citizens.

4.2.3. Degree of centralization

In Namur, the majority of citizen participation projects are centralized at city level. At this level, the administration coordinates all actions thanks to the informal human interaction. The Smart City Manager coordinates the actions across all departments internally, the Head of Data Office optimizes data and processes internally and the Living Lab Manager focuses on urban planning. External to the administration, the ecosystem (university and businesses) is also "active and ready to engage in change" but are considered as spontaneous partners. For instance, the university performs research and supports the actions of the administration (e.g. to organize hackathon). Furthermore, Namur has a strong service industry and has several small and very small businesses that can support participation (e.g. to develop an online platform). However, for the specific citizen participation activities, there exists a lot of platforms managed by citizens (community groups, social media, etc.) and the city has a role to scope this participation to set the cursor between representative and direct democracy.

In Linköping, the centralization is currently low. The main coordination activities are performed through official documents such as shared Agenda for planning and development or Digital Agenda. This is intended to be mitigated through the digitalization function (cross functional in nature). The newly established digitalization function (consisting of three people that work cross-functionally within the administration) has been installed as a possible solution to this issue.

Interviewee stated that "Initiatives have been decentralized, and now they are trying to centralize the efforts. All other Swedish municipalities have the same issues with coordinating smart city development as well as digitalization initiatives". There have been "hackathons" in the Mjärdevi Science Park with the objective to develop new open data-based services. There is also a collaboration with municipal-owned companies and university through "problem-oriented workshops", that have been driving the development ICT infrastructure

The stakeholders involved are thus comparable for both cities, but their degree of autonomy differ. Furthermore, the coordination between participation activities is not implemented in the same manner (human interaction in the administration for Namur and official documents for Linköping).

4.2.4. Legal requirements and plans

Namur does not have legal requirements for its smart city strategy. But most of the projects are funded by the European Union (such as the Living Lab) and they therefore must comply with some requirements. In terms of urban planning, the Directive Plan at local level and the Structural Plan at Regional Level also give requirements for the urban development. No legal requirement binds the city to engage in participation activities.

Linköping, through the national Planning and Development Act, requires participation in city development projects in 2 steps. First, the planning is being done in different formats: comprehensive plan, and detailed planning. Second, the act underlines the necessity for minimum efforts in the announcement, participation and analysis/response of citizens. Additional participation can be added at the discretion of each project manager, typically in the earlier stages of a project to collect necessary information (co-creation). Linköping has formulated a policy for 'citizen dialogues' (Linköping City, 2016) which outlines what a dialogue is and the degree of participation is expected. These degrees are based on Arnstein's Ladder of participation' (Arnstein, 1969) and the document is based on national guidelines. This document is followed by concrete guidelines for citizen dialogues that list approaches for participation with a short description. It also shows what approaches have been used in Linköping previously.

Legal requirements for participation are thus stronger in Linköping whereas Namur engage in participation activities for the sake of collecting input.

4.2.5. Citizens' characteristics

Namur is a service industry city with educated citizens. This explains why the city welcomes participation. One interviewee declared that "Since the citizens of Namur are more "educated", citizens have a sort of self-regulation in the opinions their issue and in the level of the debates they can have (true facts, respect, ...)". Similarly, the citizens of Linköping are described by the interviewees as "relatively young with high levels of education (university-city) and high employment rate". The size of both populations is also relatively small which enables to contact them more easily and try to ensure representativeness.

Table 3
Contextualized recommendations for citizen participation in smart cities.

Context Factors (Identified in this study)	Instantiation	Hypotheses: Impact on participation (Observation from the two cases)	Contextualized recommendations for policy-makers (based on scientific literature)
Smart City Consideration	Tech-Oriented	Use of "Online" participation methods (H ₁)	Understand the requirements for the online tools and integrate the citizens in the process through the PD approach (Foth & Brynskov, 2018). Examine the citizen participation actions thanks to analytical tools such as the "scaffold of participation" suggested by Cardullo and Kitchin (2019). Focus on representativeness of participants and measure the impact of participation on decision-making by using the ladder of (Arnstein, 1969). Convince political representatives to evolve towards a middle-out design to draw on the collective knowledge from all actors based on the suggested process of Fredericks, Cadwell, and Tomitsch (2016) or by having frameworks such as the Triple Bottom Line in mind (Ahmad & Mehmood, 2015). Organize traditional participation activities to let citizens communicate with city representatives and position the city as a coordinator of participation (Linders, 2012). Install a pilot project to open the collaboration with other stakeholders and coordinates actions with citizens and businesses taking inspiration from the Quadruple Helix Model for Innovation (Cossetta & Palumbo, 2014). Coordinate all actions through traditional (working group) or innovative (living lab) actions (Cosgrave, Arbuthnot, & Tryfonas, 2013) and elaborate a plan to develop a coherent ecosystem of participation methods (Simonofski et al., 2019). Avoid routinized participation through an evaluation of the influence of citizens on city's decisions with framework such as the one suggested by Simonofski, Asensio et al. (2018). Install plans for participation accepted by city representatives and make sure that the methods implemented are coherent with each other (Simonofski et al., 2019). Develop prototypes of innovative participation methods (online platforms, etc.) by analyzing the requirements of "leads users" from the population (von Hippel, 1986). Balance the online and the offline participation activities and convince representatives through selected use cases and change management initiatives at strategic level (Cameron & Green, 2015).
	Participation oriented	Use of "Offline" Participation methods (H ₂)	
	Drivers	Top-Down Administration invest and coordinates participation with other stakeholders (H ₃)	
	Bottom-Up	The citizens autonomously participate in public life	
Degree of Centralization	Centralized	The administration coordinates participation (H ₄)	
	Decentralized	Each actor implements participation autonomously (H ₅)	
Legal Requirements and Plans	Strong	Administration forced to invest in participation (H ₆)	
	Weak	Administration invest spontaneously in participation (H ₇)	
Citizens' Characteristics	High maturity of the population	Administration more welcoming on citizens' input (H ₈)	
	Low maturity of the population	Administration more reluctant on citizens' input	

In both cases, the population is quite educated with a high employment rate which impacts the view of officials about their relevance for participation.

5. Discussion

In this section, we summarize the theoretical contributions of this study. Then we reflect on the results by providing context-specific recommendations for practitioners. We apply these recommendations to the case of Brussels. Finally, we detail the limitations and further research leads this paper introduces.

5.1. Theoretical contributions

The findings of this research are relevant for academia as they pioneer in formalizing five context factors that can impact citizen participation in smart cities. Previous studies either underlined the importance of context factors without specifying them (Heeks, 1999; Holgersson et al., 2018) or examined one specific context factor in-depth (Cardullo & Kitchin, 2019; Foth, 2018). As a result, this paper constitutes the first attempt to formalize the context factors that impact participation thanks to an international comparison. In the future, researchers will benefit from a theoretical basis to further investigate the relevance and the impact of these factors on citizen participation but also on other elements of the smart city strategy. Additionally, another key theoretical contribution for researchers resides in the fact that the understanding of the context factors is an essential pre-condition to better evaluate and examine citizen participation in smart cities. Having these factors in mind, a fairer comparison between cities is possible. Finally, these factors will enable practitioners to make more sound decisions based on the analysis of the context of their city. The relevance of these factors to formulate recommendations constitutes an

important research avenue and is discussed in the following section.

5.2. Practical implications: context-specific recommendations and application to Brussels

The identified factors are also relevant for practitioners as it helps providing them with recommendations that aim to be city-specific. By analyzing the identified context factors, public servants in charge of citizen participation within the smart city would be able to recognize in which category their city befall and then follow recommendations embedded in literature.

In order to demonstrate this relevance for practitioners, we draw several hypotheses observed in the two cases that would need to be empirically validated in further research. Depending of the smart city consideration, that can be Technology-oriented or Participation-oriented, the use of online (H₁) or offline participation methods (H₂) is observed. However, we must state that that these hypotheses are not mutually exclusive as technology can support the participation process. Linköping constitutes an example of smart city that starts from the tech-oriented view and that invests in online participation methods. In terms of drivers for smart city development, both cities chose a Top-Down Approach and invested in participation to complete and improve their already existing strategy (H₃). No Bottom-Up approach was observed in the two studied cases. The degree of centralization can lead to a participation enabled by the administration mainly (H₄) like in Namur, or in a decentralized ecosystem view (H₅) like in Linköping. The legal requirements can "force" minimal participation activities depending on whether they are strong (H₆) like in Linköping or weak (H₇) like in Namur. The citizens' characteristics can also have an impact on whether the administration welcomes participation or not depending on the perceived maturity of the population. In both cities, the maturity was perceived as high (H₈) and no observation for low maturity was made.

The end-goal of this research area would be to issue recommendations for decisions-makers to make better decisions about citizen participation in smart cities. These recommendations are based on scientific sources or general handbooks such as (Kirby, Lanyon, Cronin, & Sinclair, 2003). Table 3 summarizes the context factors, the hypotheses about their impact on participation as well as the contextualized recommendations for policy-makers.

In order to test the relevance of the context factors and the context-specific recommendations, we have investigated them for Brussels (Belgium), a larger city that has recently decided to engage in a smart city strategy. Data was collected through 1) an in-depth interview with the smart city manager of Brussels and 2) the analysis of key policy documents provided by the manager. Brussels has implemented the following citizen participation activities: direct interaction techniques (such as workshops for participatory budgeting), online platforms ("BPart"), a living lab with a focus on urban planning ("StudioP") and an Open Data platform. We have asked questions about the five identified context factors and the interview revealed that:

- The **Smart City Consideration** is participation-oriented as numerous participation activities constitute the essence of the project.
- The **Drivers** come from the Top as the administration invests in the participation activities.
- The **Degree of Centralization** can be considered as decentralized due to the need for coordination of citizens' initiatives and the actions of the city. In addition, the region itself also invests in complementary actions and raises the degree of decentralization.
- **Legal Requirements** are low as there are no binding requirements for Brussels to invest in participation.
- In terms of **Citizens' Characteristics**, the population is considered as mature by the stakeholders.

Therefore, we issued the recommendations linked with the hypotheses issued in Table 3. The two most relevant recommendations are to analyze the impact of participation and to ensure a coherence between the different participation activities. The city manager deemed these recommendations as useful for the overall strategy.

5.3. Limitations and future research directions

Despite the relevance of the context factors, this study presents some inherent limitations. First, the inferred context factors are based on the analysis of two cities. Even though Brussels constituted a first validation step for these factors, it is necessary to investigate a higher number of cases to be able to generalize the results. Studying other cases, several other factors may be derived. For instance, context factors discussed in the literature such as national culture (Hofstede, 2011), organizational challenges (Simonofski, Ayed, Vanderose, & Snoeck,

2018) or public values (Jaspers & Steen, 2018) were not considered by the interviewees as having an important impact on citizen participation in their cities. Furthermore, the five factors presented in this paper are broad independent categories that could be refined into sub-categories. Secondly, another limitation resides in the focus on top-down activities by city stakeholders about participation and not on spontaneous activities organized by other stakeholders (NGOs, Businesses or the citizens directly) such as information town meetings. The impact of context on these bottom-up activities was not captured by this study. Finally, another limitation refers to the relation between the smart city concept and participation. Some actions were not performed under the "smart" label and the perception of practitioners of this concept related to participation would be beneficial to better understand. Thanks to a higher number of comparisons, the identified context factors could be generalized and more detailed. Furthermore, the importance of each context factor could be weighted using a Likert scale or ranked to better understand their perceived relevance by stakeholders and the impact on the decisions. Another opened research avenue resides in the understanding of the relations and possible tensions between the context factors (e.g. does the smart city consideration impact the degree of centralization?). Finally, the impact of the context factors on existing evaluation frameworks for smart cities, such as (Simonofski, Asensio et al., 2018), is essential to examine to enable a fairer comparison of cities.

6. Conclusion

In order to answer the research question "Which context factors impact citizen participation strategies in smart cities?", we identified five context factors impacting citizen participation strategies in two smart cities (Namur and Linköping): the smart city consideration, the drivers for participation, the degree of centralization, the legal requirements and the citizens' characteristics. By comparing the citizen participation activities, we were able to see how these two cities, with their respective context, invested in participation. It revealed that similar stakeholders were involved (Administration, University and Businesses) and similar participation methods were applied (direct interaction, living lab, open data and online platform). However, these methods were implemented differently for different reasons, and encountered different challenges due to the impact of the five identified context factors. These factors were applied to the case of Brussels, what showed that the identified context factors were relevant as well for a completely different city and that the recommendations were deemed as useful by the city official. As such, the identified these context factors and the stated recommendation look very promising. This study therefore opens a research avenue for a further and broader identification of context factors as well as better contextualized recommendations on citizen participation strategies.

Appendices A

Interview guide

We used the following interview guide and intensive use of "probing" questions to investigate context factors.

a) General Questions

- Can you describe your function within the city?
- Can you describe what smart city developments mean in your city? Why do you focus on the things you focus on?
- Are you working after an overarching plan for smart city development that you apply, or are you project-based?
 - Is there a national plan? Influence from international level?
 - Is there a city-level plan? Influence of the political representatives?
- Do you know what reasons, problems, challenges (drivers) have contributed to the city transformation towards a Smart City? What are the drivers?
- What is the current status of the smart city strategy? Which actors are involved?
- When you are studying a "Smart City" project, are you asking about/looking for citizen participation in this project? Is it necessary? Is it desired?

How is it reached?

a) Democratic Participation

- How was the smart city strategy formulated? Why was it formulated this way?
- Did the citizens have an impact on this strategy? Can you describe the process(es), what approaches and techniques were utilized? Why?
- How was the process facilitated?
- What were the encountered challenges so far? Has anything prevented participation? If so; what?
- How was the citizens' input taken into account?
- What role does the participation have in the enactment of democracy?
- Has it changed the top-down towards the bottom-up in current projects? Will it in future projects?
- Can you talk more about the role that citizens have in participation in smart city development as a democratic process? What role should citizens have to enact democracy in a city development project?

a) Co-Creation

- Do you implement direct interaction activities (town meetings, workshops, etc.)? Why/why not? Which ones?
- Do you currently use online platforms for citizen participation? Why/why not?
- Do you think that the use of online platforms can promote citizen participation?
- Are you currently utilizing Living labs/innovation ecosystems/hackathons/business collaboration as a way to co-create in the city?
- Do you think Living Labs/innovation ecosystems/hackathons/business collaboration can stimulate participation?
- Do you have examples about concrete autonomous projects?

a) ICT Use

- How do you use technology to enable citizen participation?
- Is there an investigation on the Internet of Things, on sensors in the City, underway or already being implemented?
- Do you have an Open Data strategy? How does it foster participation?
- Do you perform any Citizen Science projects?
- Do you perform any augmented reality projects?
- Did you install public displays in the city? Do they foster participation?
- How do you integrate the input of citizens in the development of these ICT tools? Why?

Analysis of citizen participation in Linköping and Namur (CitiVoice framework)

	Evaluation Criterion	Namur	Linköping
Citizens as Democratic Participants	Citizen Selection		
	Representativeness of participants	No assurance for representativeness of citizens (often the “usual suspects” present)	No assurance for representativeness of citizens
	Offering of support for group process	No support	No information
	Presence of competent facilitators	For urban planning, they used a specialized NGO (Tr@m) and experts about some specific themes	No information
	Agreement on the goals of the smart city strategy		
	Evidence that citizens helped to define goals and objectives	The goals were not defined by the citizens.	There is no current strategy that speaks in terms of smart city but rather in terms of digitalization. Needs more information regarding the process of defining these goals.
	Citizen-oriented goals and objectives	The political will to transform Namur into a smart city aims to include the population in public life through digital means.	The goal of the digitalization strategy is to improve the administration internally and the quality of life of citizens in several domains
	Correlation between participation activities and achievement of goals		
Formalization and transparency of the course of action	The course of action is not made available to the citizens.	The course of action is not made available to the citizens.	
Evidence of interaction between citizens and other actors	One-way interaction: citizens are informed of the advancement of the city but have no opportunity to influence it	No evidence of interaction	
Evidence of the influence of citizens' input in priority setting of the projects	No opportunity for the citizens to influence projects. It was done by intermediaries to negotiate with the political representatives	Goals not defined by the citizens – rather drawing from national and supra-national visions and strategies (EU and national digital agendas).	

Citizens as Co-Creators	Direct Interaction		
	Application of traditional techniques	Group discussions are sometimes organized to sensitize citizens about urban planning and let them give their opinion. Namur also coordinates the actions of citizens that organize themselves	Different forms of group discussions (dialogues and workshops) are frequently used in city planning and development. The university has been involved to perform problem-solving workshops
	Application of citizen-centric requirement engineering method	The e-government services are only developed internally.	They develop the e-government services with internal public servants as proxies for the citizens.
	Living lab		
Citizen as ICT users	Development of a Living lab strategy	The TRAKK is a multidisciplinary and co-creation space that aims to promote creative projects in the Namur region (TRAKK 2014). The NID will be developed to foster citizen participation in Urban Planning.	They developed the Ebbepark community – formal and informal stated focus on community development for products and services with collaboration with companies from the private sector.
	Organization of citizen-oriented activities	The TRAKK is used by companies in the digital industry, developers and the creative class.	Use of online platform to gather ideas from the community. Furthermore, Linköping has had reoccurring hackathons, which has included partnerships between municipal companies, private sector, university and citizens.
	Online platforms		
	Presence of an existing or specifically designed online platform	A platform has been deployed by the city of Namur to let citizens give their opinion on cultural matters.	Digital platforms have been used in several city development projects as well as by the administration to collect citizens' ideas about various domains.
	Use of platform by citizens and impact on public life	The platforms are used at small scale by the more literate citizens.	Varying degrees of participation between projects
	Infrastructure		
Presence of ubiquitous computing components	There is a smart mobility project relying on sensors and a visualization display currently ongoing.	The possibilities and value of sensor-technology is being evaluated	
Development of Innovative ICT-based projects	The city of Namur plans to develop intelligent “bus stops” using “augmented reality”.	No information	
Open Data			
Implementation of Open Data Strategy	Open Data Portal that aims to be accessible to all citizens, even the non-developers. Not all datasets are published	Linköping publishes data on website. The PSI directive encourages municipalities to open their data in order to promote the creation of new products and services.	
Use of Open Data by citizens	Collaboration with universities to increase the use of the data for app development	Some examples such as Hackathons and competitions	

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