"Smart" Participation: Confronting Theoretical and Operational Perspectives

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Abstract—**This paper explores the relatively new phenomenon of citizen participation in the Smart City context. We present a case study comparative analysis of three participatory approaches implemented in three European Smart Cities. Each of those operational perspectives is studied in view of the theoretical concepts conveyed by the scientific state of the art, this way highlighting similarities and gaps between theory and practice. The results are focused on (i) the various existing interpretations of the "citizen participation" and the "Smart City" definitions, on (ii) the different selection processes applied in all three cases to recruit the participating citizens and on (iii) the benefits and drawbacks associated with the implementation of participative processes in a Smart City. The article closes with a discussion about key elements to keep in mind when implementing a bottom-up participative approach in the context of a Smart City. Eventually, the confrontation between theoretical and practical perspectives results in a revisited version of Arstein's ladder of citizen participation, adapted to the Smart City context.**

Keywords-Smart City; citizen participation; Smart City definitions; operational perspective; selection of participants.

I. INTRODUCTION

This paper is an extended version of a previous, shorter publication presented at the conference Smart 2018, the Seventh International Conference on Smart Cities, Systems, Devices and Technologies [1].

The first Smart Cities were essentially focused on technological deployment aiming at optimizing urban performances, for instance thanks to freely accessible internet access, sensors and other pervasive devices. After this first wave of completely top-down and techno-centric cities (such as Songdo in South Korea or Masdar in the United Arab Emirates), we are slowly entering the era of a more bottom-up and participative model of Smart Cities. The citizens are now given an increasingly important role in the making of their smart built environments, because their acceptability is essential to insure the sustainability of the global smart model [2]. If many researchers acknowledge the fact that smart citizens are indeed key to Smart Cities, few information is yet available about how to implement a renewed participative approach, built on 1970 participatory models, in the making of such smart urban environments.

This research is one of the first steps of a larger research project, which is mainly focused on the citizens' perspective regarding the Smart City and the participative approach. This paper aims at studying and comparing different participatory initiatives conducted in 3 European Smart Cities particularly known for their citizen engagement and their bottom-up dynamics. The goal here is to document actual participative approaches in order to extract some key elements regarding citizen participation in the Smart City.

Comparing scientific perspectives with day-to-day, operational implementations of Smart City initiatives, this paper is structured in four additional sections. In Section II, we present a short literature review about participation in the Smart City. Section III then describes the interview-based methodology used for the comparative analysis of participative processes implemented in three carefully selected Smart Cities (one in the United Kingdom, one in the Netherlands and one in Spain). Section IV describes the obtained results: Subsection A gives the participatory context, while Subsection B is focused on the practical vision of two key definitions (Smart City and citizen participation) compared to more theoretical ones coming from the literature review, Subsection C presents the participants' selection processes in the three chosen cases and Subsection D focuses on the benefits and drawbacks related to the introduction of citizen participation in the Smart City. Section V discusses the results and raises some questions in regard of what the three chosen Smart Cities consider as "best practices", given their specific contexts.

II. STATE OF THE ART

This state of the art is kept voluntary short and will only present major theoretical models underlying the concepts of Smart City and citizen participation. Our subsequent intention is indeed to further study literature review in regard of empirical results in order to establish a comparison between theoretical and operational perspectives.

Two main concepts are at the root of this research project, namely "Smart City" and "citizen participation". Both concepts carry a multitude of (sometimes confused) definitions as they designate multifaceted realities [3][4]. As far as the "Smart City" concept is concerned, there are indeed a multitude of definitions and no real consensus about the meaning of this "buzzword" [5]. First of all, one should consider the common misconception according to which every Smart City is built from scratch, exactly like Songdo or Masdar [6]. Contrary to those emblematic and idealized

cities, which "*are the exception rather than the rule*", the "*actually existing smart city*" is far more nuanced, context-related and under-construction [6]. Keeping that in mind, we start this literature review with Giffinger's definition, one of the most frequently referred to. This definition puts some emphasis on the urban performance, which is nurtured by both information and communication technologies (ICT) and the smart inhabitants [7]. Giffinger's model dissects the concept of Smart City into six axes: economy, environment, governance, living, mobility and people [7]. Especially because of this "people" component, the citizen participation has lately become more and more popular in the Smart City context [8][9], building on the realization that citizens' potential rejection of the Smart City concepts could entirely jeopardize the sustainability of the global smart model itself [5][10]. Examples include the deployment of smart meters in each private home, which was among the first techno-centric, top-down smart initiatives. Although the guiding idea was to positively impact both personal consumptions and energy sector sustainable goals, acceptability was way below expectations as smart meters received a very cold reception from the inhabitants, sometimes even complete rejection [11][12][13]. Among the reasons for failure, those solutions missed the end-users' actual priorities, needs and concerns [14][15] and neglected the potentialities offered by users' active involvement into the design and decision processes. Citizens are thus increasingly considered as key actors of the making of the Smart City, and their sensitization and participation are the first steps towards awareness and acceptability [3]. The original vision of passive [15] or even invisible citizens [16] grows weaker, considering the significant influence of users' behaviors and practices on the adoption of (technological) solutions [14]. Gradually, the techno-centric smart environments give way to more eco-systemic Smart Cities and a shift is observed from the triple helix to the quadruple-helix model [17][18]. Side by side with universities, governments and industries, citizens are henceforth recognized as the fourth main stakeholder of any smart innovation [19]. Their role is no longer limited to on-the-move urban sensors and data generators [20], but shall extend to ideas generators, co-creators and co-decision makers given their local knowledge and use expertise [15]. Even though many authors nowadays share this viewpoint and promote citizens' engagement and empowerment, few information is available about how, concretely speaking, one should apply citizen participation in the specific context of Smart Cities [16]. In that regard, Fehér's study of a corpus of governmental, business and academic documents revealed that "*the expected active participation of citizens in the smart cities*" is one of the least documented [21]. Moreover, we suggest that older models of citizen participation, such as Arstein's ladder or Glass' objectives of participation [22][23], should be re-interpreted and might differently take place in practice given the renewed context of Smart Cities and given the opportunities offered by new technologies.

It is therefore crucial to confront theoretical and practical realities and to explore what local actors have in mind when referring to citizen participation in the Smart City.

III. METHODOLOGY

The methodology used to conduct this research is a comparative analysis of three cases, nurtured by semi-structured interviews with several stakeholders linked to smart projects and participative initiatives in each of those cases. This paper focuses on three European Smart Cities, the first one in the United Kingdom, the second one in the Netherlands and the last one in Spain. In all three cities, one research lab was chosen because it meets the following criteria: it is localized in an internationally recognized Smart City; it works in collaboration with the city officials and its main research activities are linked to citizen participation in future urban environments. The selection of those Smart Cities was moreover based on the Smart City Index, an international ranking proposed by Cohen, which is one among the few to consider some participatory dimension, at least beyond the voter turnout. The three finally chosen Smart Cities rank well in regard of inclusion (especially number of civic engagement activities offered by the municipality and voter participation in municipal elections) and creativity (in particular, number of registered living labs) [24].

Beyond those similarities, the three research centers remain quite different in their approaches. The Dutch lab generally considers self-organized citizens' communities and bottom-up movements as essential triggers for any launched project, while the British lab rather tries to integrate a participative dimension to existing projects that would not make sense otherwise. The Spanish lab holds an intermediate position, conducting participative experiments essentially in the public space and starting as well from a living community or a given context. Thus, the Dutch and the Spanish labs are always involved in participatory initiatives, but the British lab also conducts some research projects without any citizen participation. Another difference between the labs lies in the end-use of the material produced through the participative process. The British lab seeks to develop a marketable product, while the Dutch lab rather promotes open-access material that can be freely reused after the end of each project. The Spanish lab, on the other hand, gets involved in upstream phases of the decision-making process and rather delivers information and recommendations for the benefit of the municipality. A last difference is linked to the various profiles and backgrounds of the members of the three labs that therefore develop different identities. The British lab is mainly composed of computer scientists using data for socio-technological purposes. The Dutch lab brings together researchers with data, design and digital humanities backgrounds. The Spanish lab, specialized in Arts and Science, includes experts in Physical, Chemical, Computer and Social Sciences.

In practice, each interview was expected to last about one hour, but the effective length varies between forty and eighty minutes. Several types of stakeholders were interviewed: directors of the research centers, labs' team members, Smart City managers, city officials and other experts from the fields of participation, technology and urban planning. Given this variety of interviewees' profiles, different sets of questions

were prepared, in line with the specific expertise of each actor. In addition, some essential issues were discussed with the complete sample of respondents, such as their own definitions of "Smart City" and "citizen participation".

As a first step of our comparative analysis, this paper will focus on eight essential interviews and more specifically on the results of meetings conducted with three lab directors and five team members. We decided to start our study with those stakeholders because they are very close to fields' realities: the team members are the day-to-day operational actors, while the directors are the spokespersons of each lab and therefore structure those labs' vision and attitude. The idea is to understand the global visions of those three labs and to compare their different interpretation of the participative approach, given their actual perception of the Smart City.

Globally, eight main themes are addressed through the interviews (see Table I). Additional questions regarding the presentation of the city (specificities, history, population) and the policy (objectives, priorities, citizens' input) are discussed with city officials and Smart City managers, but will not be presented in this paper.

IV. RESULTS

The results of the eight interviews are structured in four subsections. First, we will present the contexts in which citizens become active participants for each city. Then, we will present interviewees' definitions of the Smart City and the citizen participation, in comparison with the scientific state of the art. We will next compare the participants' selection processes as conducted in all three labs and we will study the impact such processes have on the recruited citizens' profiles. Eventually, we will detail the perceived benefits and drawbacks resulting from the implementation of citizen participation in concrete smart urban environments.

A. Participatory context

The citizen participation is a complex process that may tire the citizens if their input is repeatedly requested for each and every project related to the Smart City. Therefore, it is of crucial importance to wisely choose topics for which participants' contribution is considered essential. Each lab has a different strategy regarding this issue. The British lab focuses on "*the stress points in the city (…), priorities, which have been identified with the council*" and uses citizen

participation mainly to get feedbacks about the solutions developed by the researchers in cooperation with the local authorities. The logic of the Dutch lab is quite different. Once again, they start from context-specific urban problems, but the chosen topics result from shared interests between the citizens' preoccupations and the local authorities' priorities. Thus citizens are always involved in projects that they feel concerned about, and that they wanted to integrate even prior to any involvement from the city itself. The Spanish lab, for its part, always initiates a participatory process when requested by a different stakeholder, be it municipality or community members or even sometimes a more complex group bringing together several profiles. Therefore, the proposed topic always results from a demand of some locally involved people. However, even though the lab does not choose the specific topic, its expertise in environmental health and air quality definitely fuels the participative processes. Another difference between the three approaches is the timing chosen for citizens' participation. British citizens often participate at the end of the process, while the Dutch citizens always participate from the beginning and generally during the whole project. Spanish citizens can be part of the project from the beginning or join later, especially in the case of broad public participation occurring in public spaces. A more continuous participation is also possible when considering co-design sessions for instance.

B. Definitions

The two following subsections aim to define the Smart City and the citizen participation on basis of the interpretations proposed by the eight interviewees. The results are examined with respect to the state of the art, highlighting the convergences and the divergences between theory and practice.

1) Smart City: We focus here on the definition of the Smart City, as perceived by the stakeholders interviewed on the field. On the basis of the most widespread definitions, we will compare the different visions hold by those experts (see Table II and Table III).

The first interesting observation is that there is a distinction between their current vision (see Table II) and their prospective vision (see Table III) of what the Smart City is. In other words, the interviewees are fully conscious that the Smart City is an ongoing process that can be described on the one hand on the basis of current initiatives, with their promising achievements and their manifest limitations, or, on the other hand, on the basis of the likely evolutions and hopes for the future. All eight interviewees are moreover fully conscious that their own definitions match their personal "*way of understanding a Smart City*" (Director of the Spanish lab) and rely both on their scientific background and their perception while experiencing their city becoming smarter. In the interviewees' discourses, we obviously find key elements that meet some definitions from the state of the art. The interviewees' propositions are identified by codes (see Table II and Table III), which are referenced in brackets hereafter.

TABLE I. MAIN THEMES STRUCTURING THE INTERVIEWS WITH THE DIRECTORS AND THE TEAM MEMBERS OF THE LAB

Common themes	Directors
- Presentation of each actor (background and role) - Own definitions of the two main concepts (Smart City and citizen participation) - Presentation of concrete projects (context, success stories, possible improvements) - Participatory approach (benefits, drawbacks, challenges) - Technology (role, ethics, privacy)	- Contacts with other stakeholders of the ecosystem (city officials, citizens, industrial partners)
	Team members
	- Participatory methodology (phases, methods, objectives) - Participants (roles, selection criteria, profiles)

TABLE II.   INTERVIEWEES' CURRENT VISION OF THE SMART CITY

A Smart City is…		Interviewees	
		Directors of the labs (D)	*Team members (M)*
Smart City	*United-Kingdom (U)*	DU1 a technology-connoted word DU2 a city for one citizen category	MU1 a smartphone-adapted city MU2 a fuzzy concept
			MU3 the use of data science and artificial intelligence to better understand its needs
	Netherlands (N)	DN1 a set of fully autonomous systems DN2 a top-down controlled city DN3 an easily managed city DN4 a city of "*dumb citizens*"	MN1 a set of technological infrastructures MN2 a product of big technology companies MN3 a concept disconnected from citizens MN4 an optimized and efficient city
			MN5 a maybe more efficient city MN6 a city developed for the companies
	Spain (S)	DS1 a multi-meaning word	MS1 a responsive and reactive city regarding its citizens' needs

DU = Director of the lab in the United-Kingdom (UK); DN = Director of the lab in the Netherlands; DS = Director of the lab in Spain; MU = team Members of the lab in the UK; MN = team Members of the lab in the Netherlands; MS = team Member of the lab in Spain.

TABLE III.   INTERVIEWEES' PROSPECTIVE VISION OF THE SMART CITY

A Smart City should be …		Interviewees	
		Directors of the labs (D)	*Team members (M)*
Smart City	*United-Kingdom (U)*	DU3 a technology-improved city DU4 an inclusive city	MU4 a set of facilitating technologies MU5 a support in daily life MU6 an assistance for everybody
			MU7 a system facilitating decision-making
	Netherlands (N)	DN5 a less obvious city management DN6 a city of creative citizens DN7 a city of "*smart citizens that are able to fulfill their own information needs*"	MN7 /
			MN8 a more citizen-centric city MN9 an improved living environment
	Spain (S)	DS2 a rethink or a redesign of the city DS3 a set of solutions defined thanks to citizen participation	MS2 a dynamic and flexible city MS3 an inclusive city

DU = Director of the lab in the United-Kingdom (UK); DN = Director of the lab in the Netherlands; DS = Director of the lab in Spain; MU = team Members of the lab in the UK; MN = team Members of the lab in the Netherlands; MS = team Member of the lab in Spain.

First of all, each expert mentions the technological aspect of the Smart City, be it considered as a positive or a negative element (DU1, DU3, MU1, MU3-4, DN1, MN1-2, MN6). Following some authors, new technologies are obviously part of the Smart City, in the sense that they support any other key aspect of the city such as wellbeing and quality of life [8][25]. This vision is shared by the interviewees, but perhaps in a more nuanced way as they feel that actual Smart Cities may misinterpret this use of technology, making it an end per se especially due to the market pressure. The Dutch team members even suggest that the Smart City, as currently configured, will only benefit big companies (MN2, MN6), such as those who originally introduced the concept [6]. However, the two British team members still believe that technological developments will evolve into daily-life facilitators, as much for the citizens as for the decision makers (MU4-5, MU7). The Dutch lab is more cautious and considers that the current practical message conveyed by the Smart City is not yet the perfect solution for our future urban ideal (MN5, MN7). Even though they recognize that technology should help to generate more efficient urban systems (MN4), they doubt those technical improvements will suffice to produce more livable urban spaces (MN5, MN9). The Spanish lab also remains prudent, since the introduction of smartness into the city is not only based on technology, but also on the people that will "*redesign or rethink a little bit the city*" (DS2). Actually, this nuance and moderate (mis)trust regarding the Smart City concept is also the consequence of an almost exclusively top-down governance of many smart projects (DN2). This approach, although neglecting

citizens' input (MN3, MN8), provides the advantage of easily managing the city (DN3, DN5) and rather efficiently optimizing its day-to-day operation [7][26]. Ben Letaifa yet emphasizes the importance of a complementary bottom-up approach through citizen participation [5]. Furthermore, Giffinger insists on the fact that a city cannot be smart and efficient unless citizen's intelligence is valued and exploited [7]. According to the interviewees, citizens should indeed play a specific role in their smart urban environments, and should be empowered in order to actively participate (DN4, DN6-7, DS3). Citizens are indeed best placed to express the specific needs of the city, which should orient the solutions that ought to be developed (MS1). The Dutch director even specifies that citizens should themselves be able to respond to their information needs, i.e., to become "*self-decisive, independent and aware citizens*" [7]. This citizen autonomy is only possible in an inclusive Smart City (DU2, DU4, MU6, MS3) and one of the next big challenges is to limit obstacles to such inclusion, such as the digital divide [15]. Following one of the Spanish team members, this inclusivity is especially hard to reach while the "*Smart City discourse narrative*" focuses exclusively on technological aspects, and is therefore far too often "*restricted to a specific target group*". Finally, compared to the literature, one important aspect is missing from the interviewees' discourses: sustainability. Surprisingly, no participant refers to environmental and demographic issues while those are among the main reasons to promote smart initiatives, offering a long-term solution for our urban environments [20][27]. This demonstrates the extent to which the Smart City is a complex concept with many meanings and no

unanimous definition, especially in regard of specific, locally constrained situations (MU2, DS1). According to the participants, the Smart City should, as far as possible, remain dynamic and flexible, i.e., adaptive to every city particular context (MS2).

Giving a definition of such a complex notion is sometimes very difficult for the interviewees. Therefore, two of them formulate their answer on the basis of definitions coming from the state of the art. The researcher shows them five references (Table IV) and they can pick those that match or contradict their mind, while commenting and arguing their choice. The most appropriate definition is Giffinger's [7], while Dameri's [25], Toppeta's [28] and Hall's [26] are considered less convincing, probably because those three envision the citizen as a recipient, rather than a real actor of the Smart City. This idea of a passive citizen is obviously not in line with the participatory vision of the selected labs, but is clearly ever present in the literature. The fifth definition comes from the Smart City Institute [29] and is well received by the interviewees, since it reflects both technological and eco-systemic aspects of the Smart City, including citizens' equal involvement as the other smart actors.

TABLE IV.　Sᴍᴀʀᴛ Cɪᴛʏ ᴅᴇꜰɪɴɪᴛɪᴏɴs

Reference	Definition
GIFFINGER (2007)	A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens.
HALL (2000)	A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better organize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens.
DAMERI (2013)	A smart city is a well defined geographical area, in which high technologies such as ICT, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well being, inclusion and participation, environmental quality, intelligent development; it is governed by a well defined pool of subjects, able to state the rules and policy for the city government and development.
TOPPETA (2010)	A city combining ICT and Web 2.0 technology with other organizational, design and planning efforts to de- materialize and speed up bureaucratic processes and help to identify new, innovative solutions to city management complexity, in order to improve sustainability and livability.
SMART CITY INSTITUTE (2015)	A "smart city" is a multi-stakeholders' ecosystem (composed with local governments, citizens' associations, multinational and local businesses, universities, international institutions...) engaged in a sustainability strategy using technologies (ICT, engineering, hybrid technologies) as enabler in order become more sustainable (economic prosperity, social well-being and conservation of our natural resources).

2) Citizen participation: Another notion difficult to grasp is the citizen participation, although this time it goes back to a nearly fifty-year-old concept [30]. Throughout the years, the participatory approach has evolved into new practices and its "smart" interpretation is certainly still another perspective to take into account. Based on the experts' interviews and the keywords they use, we identify four main axes around which we summarize their propositions in order to characterize participation in the age of Smart Cities: communication, citizen control, conditions and data manipulation (Figure 1).

The three labs generally tend to agree on some key aspects of citizen participation, but each of them insists on different axes. First of all, the British and the Spanish labs notice that participation is above all **communication**, and most preferably two-way communication. Information has to be exchanged between citizens and power holders, be they researchers or local authorities, because every actor's perspective is valuable and should at least be listened to. This continuous dialog between the different stakeholders is
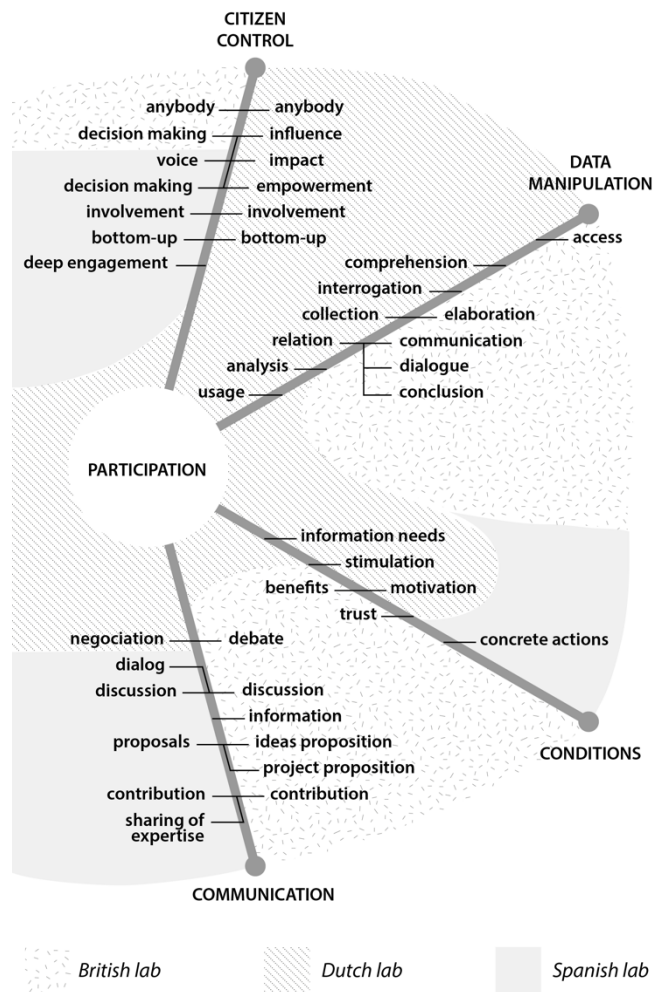

Figure 1.　Axes of citizen participation on basis of interviewees' visions

an opportunity to explore everybody's perspective, to share personal experiences, to benefit from each individual expertise and to enrich them. There are several levels of communication depending on the contribution of the participants, who either just receive information, propose their own ideas or even negotiate with the power holders. British and Spanish actors put a certain emphasis on verbal exchanges, which do not yet suffice to qualify as participation according to some authors [31]. One step further, all three labs agree with Arnstein and consider that "*citizen participation is citizen power*", meaning that citizens should have a real impact on the decision-making of any participative process [22]. Citizens are not just informed, educated or consulted to ease tensions, but should have an actual voice translated into action [22][32]. The Dutch and the Spanish labs both consider that this **citizen control** goes hand in hand with involved and empowered citizens, which means that they are given the opportunity to actively and wisely participate. Furthermore, anybody should enjoy such opportunity, according to the British and the Dutch labs, irrespective of gender, social status or even technology acquaintance. Along with this empowerment, the citizens also have a responsibility since they need to engage themselves in the participatory process. Therefore, beyond being offered with the possibility to participate, all three labs are conscious that citizens' willingness to participate is crucial and that they are some **conditions** that can ease the participative process and impact its implementation. The Dutch lab, in accordance with Klandermans and Oegema, specifies that the participants have to be motivated in order to actually take part to the project [33]. More importantly, participation often arises from an information need, directly expressed by the participants or identified after a stimulation phase. Consequently, citizens should be present from the early phases of the project [34], in order to make sure their needs will nurture the project definition. Moreover, the British lab is convinced that participation cannot efficiently operate without trust and benefits. Citizens are indeed more prone to participate if they "*foresee the benefits in the long run*", such as time and money savings. Following the Spanish lab, processes that end up providing concrete actions and results also motivate participants. They indeed generally want to be agents for change, transforming and impacting their environment, their neighborhood, their community or even their own person. The Dutch lab adds that it is very important to tell people about the ins and outs of the project from its beginning, even if sometimes their participation can remain quite modest, rather than deluding and letting them believe that their individual thoughts will automatically be part of the final output. As documented in the literature, such tokenism will inevitably result in disappointment, mistrust and failure of the participative process [32]. Eventually, the fourth axis concerns **data manipulation**, which is intrinsically linked to the era of the Smart Cities. This axis has yet not been extensively documented in the

literature review about citizen participation, maybe because there is a temporal gap between participatory theories introduced in the 70s and the first references to smart technologies appearing in the early 2000s. The "data manipulation" designates the way citizens interact with the data produced through the participative process. According to the Dutch and Spanish labs, citizen participation is not limited to data collection, but should extend to their understanding, appropriation (interrogation and relation), analysis and usage by the citizens in order to create new knowledge. Indeed, new technologies might impact participative processes and are seen as an empowering factor, since "*digital technology allows cities to engage with citizens in decision-making processes*" [9]. This new form of participation will enable participants to elaborate their own data, to communicate about them, to draw evidence-based conclusions and to propose relevant actions for their local environment. Learning to manipulate data will therefore empower the citizens and give more weight to their concerns and ideas, while their local expertise is sometimes questioned because considered as less legitimate by some professionals.

C. Selection of participants

Given their different approaches, the three labs also show some discrepancies regarding the participants' selection. This section will present which participant profiles are targeted when a participative process is implemented, according to each Smart City. One recurrent goal in participatory processes is to make everyone participate, but in practice it is considered as nearly impossible. To select the participants, all three labs therefore start from a local neighborhood, but their different interpretation of "local" has implications on the profiles of the sampled participants. Figure 2 summarizes the descriptions proposed by the three labs regarding recurrent citizen profiles taking part to their smart initiatives. The shaded zones in Figure 2 highlight the keywords discribing similar citizens' profiles in the three labs.

The Dutch lab "*select(s) (...) citizens basically by tapping into existing platforms or organizations that feed into the community*" while the British lab focuses on one specific geographical area. As a matter of fact, the Dutch interpretation is linked to existing communities that have already initiated some projects in order to solve local issues. In line with its research interests, the Dutch lab chooses to support and develop the ideas of the community, because it seems more relevant to tackle actual people's concerns and to meet a real need. The British perspective is quite different and rather aims at testing on pilot sites some technologies, which would in fine be deployed at scale, requiring to get more "*general users*". Therefore, the British researchers just select a neighborhood and consequently the whole group of people living there. Halfway of those two approaches, the Spanish lab proceeds on a case-by-case analysis, alternating the recruitment of "*given communities and neighbors in general*". This switch of strategy is explained by two main
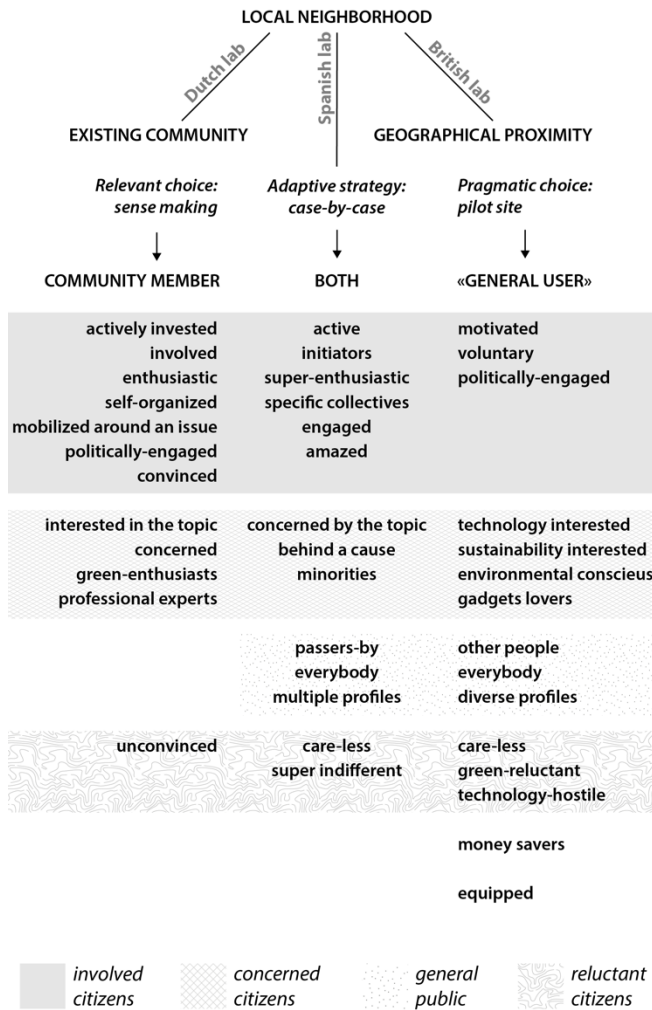
Figure 2.   Participants' profiles on basis of interviewees' selection process

factors: (1) the initiator of the participative project and (2) the chosen participatory method. Actually, the person or the group of people who initiates the participative process can be either a municipality or a local community itself, which will then automatically feed the selected group of citizens. In the case of a more top-down initiative, decision-makers might face difficulties recruiting those local communities, which could claim for autonomy. Moreover, their position rather pushes public administrators to select as many people as possible, trying to reach some citizens' representativeness. In addition, the participants' profile will also vary depending on the participatory method. For instance, co-design workshops about very specific topics require a long-term commitment that is more easily achieved with organized communities of concerned citizens. Conversely, pop-up interventions deployed in public spaces in order to sensitize the citizens, explore their perceptions and/or test some solutions call "*every person passing by*" to participate.

Given their divergent selection strategies, Dutch and British labs' participants present different profiles, which are all quite well represented in the Spanish samples. As far as the Dutch community members are concerned, they are of course very active and are described as "*involved*" and "*invested*" in the topic or even in concrete actions. This also means more environmental-conscious citizens that are generally interested in any initiative related to the smart city agenda. Although the Dutch sample mainly comprises pro-active citizens, all participants might not be convinced by the process, in particular when a change of habits is involved. For instance, some people could have strong interest in the environmental topic but at the same time believe that they already manage their own situation quite successfully, and that other people should improve their individual behaviors and practices first. Therefore, even if they seem less enthusiastic, those participants are still the engaged ones that always show up at this kind of participatory process, or that have already started their own initiative. Since the British recruitment is made on a voluntary basis, the same super-enthusiastic profiles are also present but this time they are not self-organized around common values. The only condition to participate to the British project is to be equipped, i.e., for instance in a project of garden watering the condition is to have a garden. Besides the always-involved people, other profiles show up such as careless people, technology- and green-reluctant citizens that may decide to participate in order to save time or money for instance. Contrary to the Dutch communities, the British participants therefore constitute a less homogeneous sample presenting a limited amount of shared values and interests, but rather a group of people motivated to participate for various reasons.

The Spanish participants, for their part, are closer to the British profiles, in the sense that they are sometimes showing enthusiasm and sometimes indifference. However, those less motivated citizens are only present in the case of kiosks for instance or any other one-time opportunity to participate. In contrast, in the case of a more demanding and continuous participation approach, such as co-design sessions, the Spanish sample is mainly composed of community members, characterized by higher engagement and motivation.

D.   Benefits and drawbacks of smart participation

This section focuses on the benefits and drawbacks of smart participation as they are reported by the interviewees. More particularly, our hypothesis is that the implementation of a participative process in a Smart City might lead to several consequences, as well positive or negative effects and externalities. Those (dis)advantages are often already documented in the state of the art about citizen participation in general, irrespective of its applicability in a Smart City. However, this specific digital context may reveal new repercussions, which deserve to be taken into account when introducing a participatory dynamic in a Smart City.

1)   Benefits: Figure 3 highlights the main benefits following our eight respondents. Benefits are organized according to three levels of stakeholders: the individual level corresponds to the personal gains of one participant,

the participants' level refers to the collective advantages collected by the people who are involved in the participatory process, and the beneficiaries' level takes into account the more global benefits, i.e., for the participants, the neighborhood, the local community, the municipality or even the city professionals (engineers, architects, urban planners, designers). Furthermore, all those contributions from the citizen participation to the Smart City agenda are perceived at different time phases. Indeed, the pre-participation benefits are often associated with promises or expectations that might be realized in a post-participation phase and broaden the extent of benefits achieved. During the participative activities, other elements intervene and they often constitute essential premises of the final success of the whole participatory approach.

Considering the pre-participation benefits, each lab has a different but complementary vision. While the British lab is focused on the incentive to reward the citizens for their participation, the Dutch lab rather mentions the importance of participation to ensure the relevance and the sustainability of the project, and the Spanish lab envisions participation as a huge opportunity to take action for every potential participant. Once again, those three postures correspond to their philosophies, respectively starting from a community, a project or an alternation between both.

The three labs are more in line when they consider the direct benefits of participation, which occur during the process itself. They above all stress the awareness as the biggest contribution, advantageous for all three stakeholders' levels. Indeed, through their participation, the citizens become more conscious of the operational constraints, i.e., the economic, technical, normative, etc. aspects of the project that they may ignore if they are out of their personal or professional expertise. Participants also gain a clearer view and a better understanding of environmental issues and technological innovations, two major elements of the Smart City era. The Dutch lab even points out that citizens are more aware of their own living environment, which they now see with brand new eyes.

Similarly, the city officials and professionals become aware of the citizens' field perspective, i.e., their actual and local problems, needs and usages. Such a practical experience of the area is clearly an expertise that the so-called experts in particular may lack. The Spanish and the Dutch labs therefore insist on the necessity to share contextual information, whether be between participants or, at a larger level, with the professionals, the power holders and the communities. Thereby, participants will also develop new knowledge and capacities, especially regarding data and technologies. Those learning processes and awareness favor the citizens' empowerment, since their new capabilities allow them to make "*not better choices or different choices, but they at least are informed in which choices they can make, based on that data*" (Director of the Dutch lab), as far as their behaviors, lifestyles and habits are
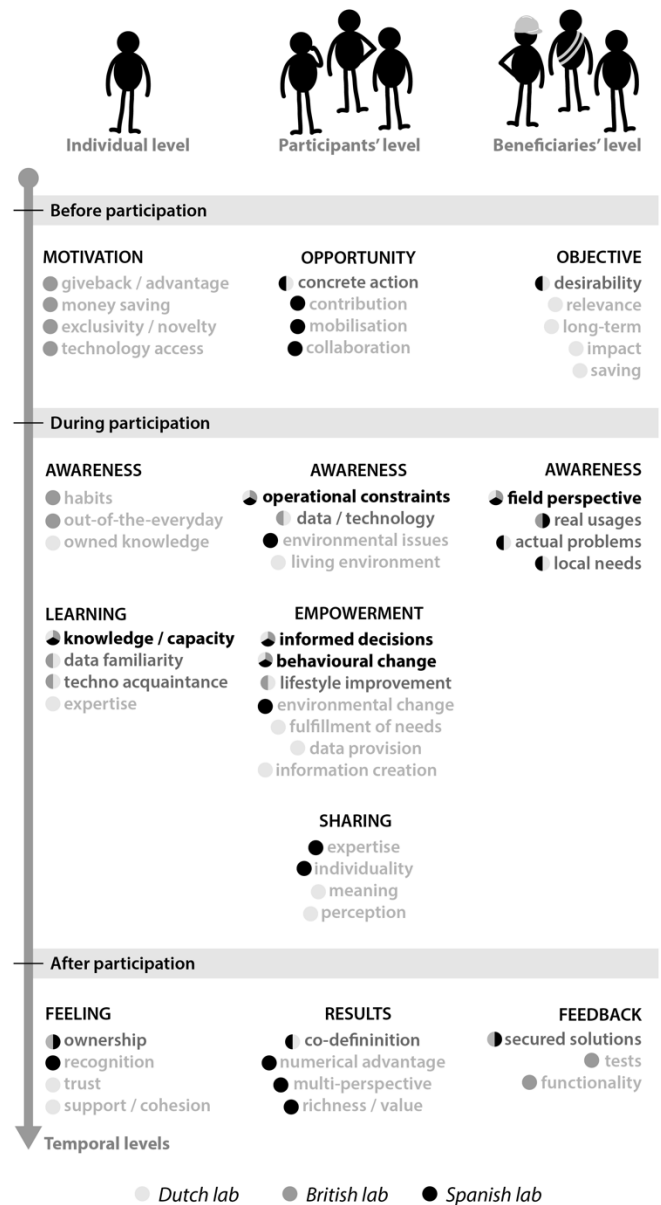

Figure 3. Benefits of the implementation of a participative process in a Smart City

concerned.

At the end of the participatory process, the additional benefits naturally include the feedbacks, which lead to final solutions that are functional and adapted to the citizens' needs and concerns. Besides this likely optimized reception, the co-definition of the results makes them richer and more valuable. Moreover, participation enables to gather much more data, which was very useful when the Spanish lab collected air quality measurements through the installation of hundreds of chemical sensors for instance. Finally, the participation provides a sense of ownership to the participants, who feel that they have personally and collectively contributed to the project and are recognized for

the time and the efforts they invested. The community comes back with more cohesion and support, and participation might even build trust towards the municipality.

2) Drawbacks: Figure 4 emphasizes the main drawbacks of participation, even though the interviewees rather call them "*challenges*" or "*difficulties*". As a matter of fact, all the identified downsides can be organized into two categories: the threats and barriers that may accentuate one critical aspect of the participative process (e.g., representativeness), and the resulting consequences, i.e., the potential risks and disadvantages, which may slow down, compromise or completely derail the participative process.

In comparison to the state of the art, several drawbacks mentioned by the interviewees correspond to the well-known limits of the traditional 70's participatory theories. The tokenism, or pseudo-participation, is a recurrent problem, which results from a symbolic consideration of the citizen input, in order to complete the participatory obligation and/or to ease one's conscience [32]. The participants' contribution, limited and often punctual, is therefore not taken into account by the power holders [22]. Of course, citizens are conscious that their participation make few or no difference, so they feel disappointed and insignificant because "*they thought they were more important*" and "*do not want to be in the margins of whatever*" (Team member of the Dutch lab). Another inescapable issue is the lack of representativeness of the sample, which generally includes the most engaged and motivated citizens [34]. Following the Dutch and the Spanish labs, the main difficulty is to find a way to reach the whole citizenry, which is impossible given their various profiles, especially regarding language and culture. Moreover, some populations are even harder to contact, such as the poor and elderly for instance. Both representativeness and tokenism are not referred as inconvenient by the British lab, given its specific participatory strategy. First, the recruitment of citizens occurs in a determined geographical area, which eases the representativeness. Second, the participants' input occurs during the evaluation phase, which is the moment when citizen participation is popularly considered as the most valuable and legitimate.

There is a consensus among the three labs that "*time constraint is dramatic*" (Director of the Spanish lab), as much for the researchers or organizers of the participatory process than for the participants themselves. The first effect of timing is the difficulty to end up with concrete solutions, results or actions that will impact policy [34], while being committed to the budget and ensuring the continuation of the project by the beneficiaries on their own. In the literature, this time-consuming aspect of participation is also often raised by practitioners who are encouraged to integrate participation into their day-to-day work [35]. Timing is also critical for the citizens who have other concerns and
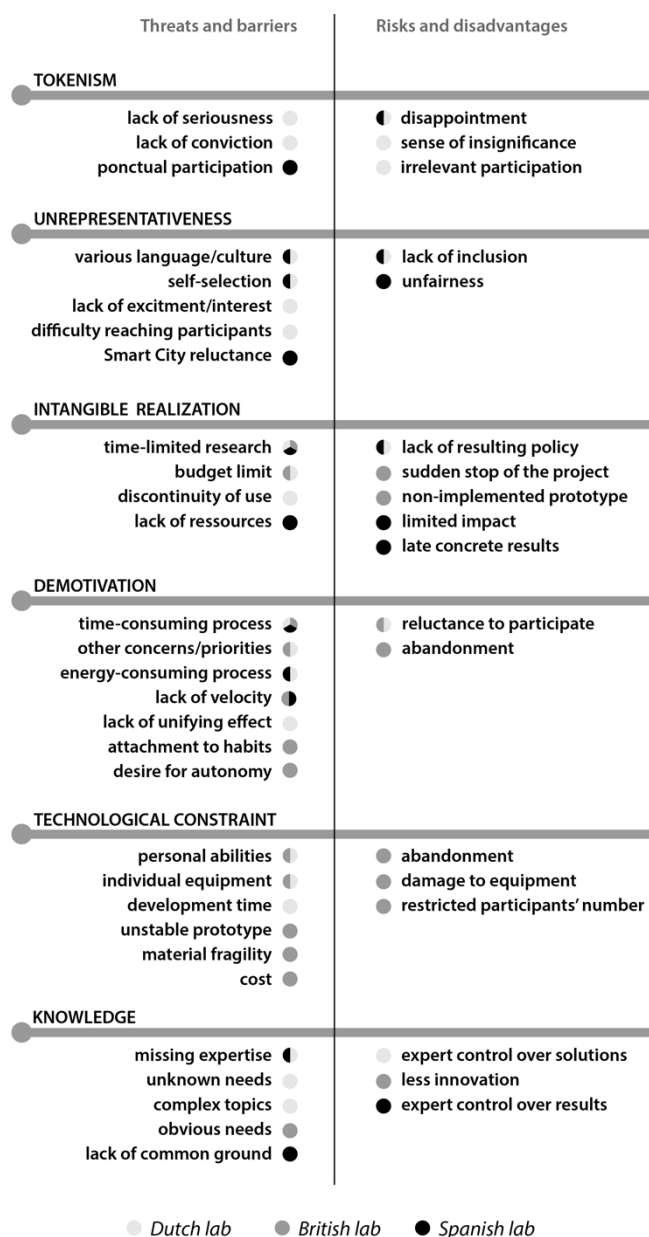

Figure 4. Drawbacks of the implementation of a participative process in a Smart City

priorities, which may dissuade them to invest energy for participating. Even when they are informed of the benefits, they might sometimes prefer to keep their current situation and even pay more money, rather than making additional efforts or changing their actual habits and behaviors [14]. Convincing them to get involved is therefore even more complicated when the foreseen advantages will be only perceived at the end of a long process, which makes them intangible and pushes participants to progressively lose interest. Another element that may sometimes lead to abandon the project is the technological issue, which reveals particularly present in the case of smart projects. The problem is not only related to the unfamiliarity of the

citizens with the technologies, but also to their lack of equipment to manipulate them, which are the two chore characteristics of the digital divide [15]. For instance, the Dutch lab found alternatives when they realized that some neighborhoods had no Wi-Fi, and the British lab had to deal with "*users (that) keep breaking the sensors*" (Team member of the British lab). Furthermore, balancing citizen participation and technological development is all the more difficult given that it requires a temporal synchronization and that the fragile prototypes are available in reduced number. Finally, the last limit reported by the interviewees is the lack of knowledge, if not naivety, of the citizens in certain complex domains [36]. For example, the Spanish lab would like to collectively analyze the data with the participants, but it remains a task reserved for specialists who will "*eventually look for certain results and not others*" (Team member of the Spanish lab) and orient the following discussions and decisions. In addition, the citizens sometimes face difficulties expressing their needs and sometimes propose ideas that are less innovative than already-existing solutions.

V. Discussion

The participative approach is gaining more and more popularity in Smart City projects, but there is very little practical advice about how to conduct a participatory methodology in such specific context. Given the ground experience of the interviewed experts, we identify several questions emerging from their ongoing and completed projects in terms of concept definitions, selection of participants, benefits and drawbacks. Those key elements provide useful information both for scientific researchers and operational stakeholders.

First, the various existing interpretations of the Smart City concept definitely have an impact on its operational implementation. For instance, the concept of pervasive technology seems to play a major part in the current vision of the Smart City, but the citizen is expected to play a larger role in our future smart cities. The interviewees' prospective vision of the Smart City is generally closer to the definitions found in the scientific state of the art, while their current vision is less optimistic and is probably nurtured by the first failures encountered by Smart City projects around the world. Moreover, the interviewees' visions of the Smart City are affected by the Smart City discourses, such as the marketing literature conveyed by IBM, Cisco or Siemens. Undoubtedly, this approach is inappropriate to an "*actually existing smart city*" [6] such as our three European cases and unsatisfactory for our interviewees who therefore develop a prospective vision exceeding the techno-centric popular belief. Furthermore, this variety of interpretations is also linked to the fact that "*the smart city concept encompasses intangible aspects such as quality of life and well-being components, whose measurement is subjective and difficult to perform*" [37]. One team member of the Dutch lab even considers that the technology is just as difficult to grasp, since it "*is just very much an invisible world and a government program*". Given the plethora of interpretations and definitions, each ecosystem of actors working on smart initiatives should at least, and as a priority, agree on a shared vision, generating clear objectives and means to achieve them. The question to keep in mind is: how do we define the Smart City, and especially regarding the roles played by the technologies and by the citizens? Although the absence of a consensual definition may seem problematic, it represents at the same time an opportunity for the local key stakeholders to adjust and to contextualize their own definition, thus falling outside the preconceived notion of a technocratic city and finding a balance between technological and collective intelligences.

The second attention point concerns the definition of the citizen participation. Among the four axes previously identified (Figure 1), the communication, the citizen control and the conditions are explicitly discussed in the literature review, but the data manipulation is not yet part of the traditional scientific discourse. Citizen appropriation of the produced data is nonetheless a new form of participation and this technological dimension is even more crucial in the current smart context. This late integration of this data component as an additional facet of the citizen participation is clue that older concepts introduced in the 70s should evolve and that new participatory tools and methods are needed to complement the existing ones. Indeed, Arnstein's ladder is nowadays still a valid theory, but it may lack some new steps, indicative of the numeric participation. Therefore, one question to ask is: how can the new technologies support the participative process and the citizens' active, inclusive involvement? Based on the operational perspectives of the labs, Figure 5 below is an attempt to add this technological component to Arnstein's theory, considering new participatory modes such as data manipulation, online platforms, mobile applications and sensors. This supplemented version of the original ladder attests to the new alternatives and specificities of the numeric participation, which oscillates between rather low and rather high influence and decision power of the citizens. Nonetheless, contrary to Arnstein's willingness to reach the upper levels of citizen power [22], our perspective is that every step of the ladder is legitimate (or even complementary), except the therapy and the manipulation, if the citizens are conscious of their role and of the objective of their participation. As one member of the Dutch lab said, participation has to be taken seriously, but we believe that sometimes more modest participatory processes can fill a need, even if the participants remain passive informants for instance. Moreover, time constraints render impossible the ideal scenario, i.e., some kind of persistently, continuous and super-active participation of each participant at each step of the process and in each case. In order to avoid weariness and overload of participants, facilitators and city officials, we suggest to make compromises and choose carefully when a full citizen power is necessary and feasible, this choice becoming thus one of the biggest challenges when implementing a participative process in a Smart City. Following Glass, the chosen methodology (and therefore the associated citizen decision-power) depends on the objective of the Participation (e.g., information exchange,
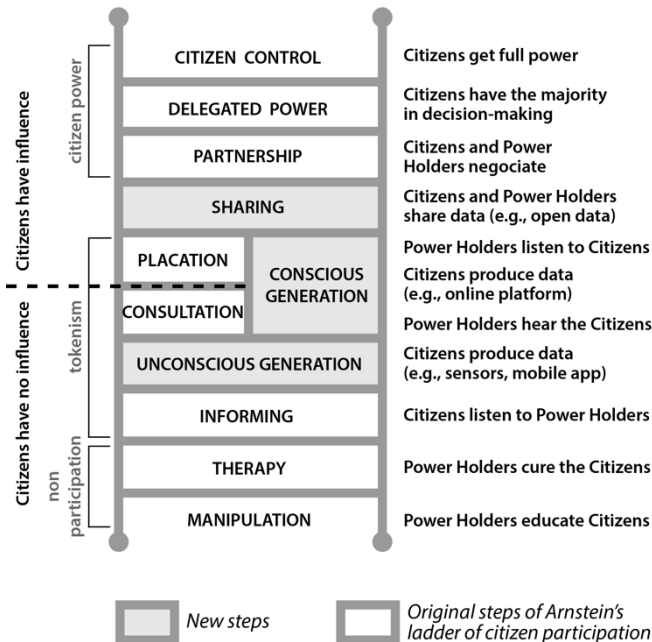
Figure 5. Arnstein's ladder of citizen participation adapted to the Smart City context

representational input, education or decision-making supplement) [23]. From our point of view, this decision should also particularly rely on the object of the participation, which can sometimes require more usage or professional expertise, more local or global perspective, more deep or "automatic" contribution, etc. The projects conducted by the three labs are the proof that several levels of participation deserve to exist and result in different benefits (and drawbacks). One last impact of the digital era on the participatory theories relates to the inclusive dimension of the participative process. While the literature review often envisions the Smart City as an exclusive concept, generating digital divide, the interviewees also mention that technology can increase the participation rate, because there are much more diffusion channels (e.g., social networks) and a better access to information.

The interviewees' interpretations about citizen participation introduce the notion of citizens' motivation, nurturing our third focus point. The results regarding the selection of the citizens show that participants can be characterized by different motivation spectrums: Dutch citizens share the same values while the British participants have more diverse interests. Following Deci, the participants' motivation may have intrinsic or extrinsic sources [38]. In other words, the citizens can respectively decide to participate "*because it is inherently interesting or enjoyable*" or "*because it leads to a separable outcome*" like for instance a reward [38]. In our case, the benefits promoted by the British lab, such as technology exclusivity, time or money savings, might be identified as extrinsic motivations. The Dutch and Spanish participants rather seem to be motivated by intrinsic factors, such as the personal willingness to take part to the life of their community or to collaborate around shared values and interests. According to

Amabile's extensive research on the subject, this dichotomy between extrinsic and intrinsic motivations has consequences on the participants' creativity: extrinsic motivations could undermine the intrinsic motivation and the creative outputs, because the subject is not performing for its own sake anymore but rather for an external purpose [39]. Therefore, in our opinion, extrinsically motivated people will maybe more easily grow weary than intrinsically motivated citizens, who will probably commit themselves to participate in the long run. However, in the domain of technologies, participants' remuneration reveals quite decisive, not so much as the primary motivation to participate, but rather as a reinforcement of long-term commitment [40]. Consequently, our third question is: what are the citizens' motivations and what is the potential impact on the participants' long-term involvement within the project? Our point of view is that several sources of motivation are complementary and should be mobilized at different stages of the process. On the one hand, offering stipend from the beginning presents a high risk to participant's creativity [39]. On the other hand, stipends offer the advantage to reach more profiles of citizens and to value their engagement as a real job, which maintains commitment and reduces dropout [40]. Therefore, the recruitment of the citizens should, as far as possible, be based on intrinsic motivations, but some compensation must be considered during the process for long-term participation or when a more general, mixed public is needed.

Another important consequence regarding the selection of the participants is related to the representativeness of the sample. One recurrent wish of the interviewees is to reach everybody, but they agree that this dream scenario is too optimistic. Therefore, the three labs developed their own practical approach. On the one hand, the Dutch lab relies on existing communities, already active and probably prone to participate. On the other hand, the British lab recruits the most motivated citizens from a limited geographical area, based on some kind of "*first come, first served*" rule. Finally, the Spanish lab uses both strategies, depending on the initiator of the participative process and the chosen participatory method. The British lab hopes to get more "*general users*" in the sense that the researchers do not know anything about the selected citizens, nor about their diverse motivations, leaving the possibility to include participants who have reservations about some aspects of the project. Even if the British and the Spanish samples are generally more heterogeneous, none of the three labs insures a representative sample. We should then be aware that each approach provides different target audiences and ask ourselves: how will the participants be selected and what are the consequences on the variety of the citizen profiles and, as a result, on the project outcomes? If none of the extreme situations is optimal, maybe the Spanish adaptive strategy is a good alternative. Indeed, the potential bias of the British and the Dutch approaches, i.e., low citizen motivation versus only-motivated citizens, are reassessed for each project in order to choose the selection criterion that will best support this specific case.

Regarding the benefits of citizen participation, all three labs are truly convinced by the participation contribution to

the making of a Smart City. Their individual interpretations sometimes differ, but they all take root in the same vision of more aware, empowered and knowledgeable citizens. Moreover, they all agree on the importance to mobilize citizen's field perspective, which the professional and official stakeholders are definitely lacking. Contrary to the state of the art, the interviewees never mentioned the professional protectionism [41] or the political alibi [42] as major limits, while those are among the most frequent reasons a participative process might fail to achieve concrete results. Actually, our hypothesis is that our three cases faced their own sets of problems, but also represent three success stories, which would not have been the case if the municipality and the lab were not aware of the benefits of citizen participation. Consequently, before launching a participative process, every stakeholder should wonder: what knowledge or skill can I bring to the others and what can I learn from them? Indeed, the realization that collective intelligence and professional expertise are complementary [43] is the key to build trust and to implement an effective participative process. Following Glass, this efficiency also relies on the chosen participatory technique that has to fit the pursued objective [23]. In order to enhance the impact of the participation, we also believe that the technique has to match the temporal frame of the participation process. For instance, some exploratory methods should not be used too late in the design process, at the risk of generating frustration because the participants' proposals cannot be implemented in an advanced solution or a nearly-finished project. The Dutch and the Spanish labs therefore promote co-design sessions with a citizen engagement as soon as the early phases of the process, while the British lab invites the participants to test some technologies in the late evaluation stages of the process.

VI. Conclusion and Future Work

This paper considers the citizen participation in the Smart City from the operational perspective. Based on interviews with field actors, three Smart Cities' perceptions and participative approaches are compared and confronted with the literature review. The results show that the theoretical definitions of the "Smart City" rather correspond to the interviewees' prospective visions, while their current vision is not that optimistic, especially regarding the role citizens might play. The interviewees' interpretation of the "citizen participation" is close to the existing theoretical models, but enriched by a new dimension related to the technological era, which we call "data manipulation". Regarding the participants' selection, striving to reach every citizen is seen as an un-achievable ideal and all three labs develop their own alternative approach, tapping into existing communities, focusing on a specific geographical area or mixing the two strategies on a case-by-case basis. This choice has a direct impact on the participants' profiles, in terms of interests and motivations, or even creativity and commitment to the project. The perceived benefits of the implementation of citizen participation in a Smart City are not really different from the ones in the literature review, even though a particular emphasis on awareness, empowerment and

learning suggests that citizens might gain new skills and knowledge, especially regarding smart technologies. Conversely, the drawbacks reveals that some technological constraints could jeopardize the smart participation in particular, compared to more traditional contexts. The nuanced interviewees' visions highlight key elements that should be kept in mind while implementing a participative approach in the Smart City. Moreover, confronting practical and theoretical perspectives helps us to revise the traditional Arnstein's ladder of citizen participation into an adapted version reflecting the Smart City context. Given the variety of interpretations, further research will explore other case studies nurturing our comparative analysis. Future work will also deepen the citizens' perspective regarding their participation in the Smart City (preferences, barriers and motivations).

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