Citizen Participation in the Smart City: Findings from An International Comparative Study

Abstract

This article focuses on understanding the dynamics of citizen participation in smart city initiatives. With different degrees of emphases, the literature identifies citizens as key actors in smart cities. At the same time, our understanding of their roles and influence is underdeveloped. Using modes of urban governance to provide contextual depth, alongside the literature on citizen participation in smart cities, this article conducts an in-depth examination of the roles of citizens in smart city environments. It presents the results of an empirical study of citizen engagement in smart city governance in Brazil, the UK and the Netherlands. The research demonstrates that the roles and functions undertaken by citizens are not static, they participate in a dynamic mode that evolves and changes over time. The empirical research presented here identifies three emerging patterns of contextually specific citizen interaction: contestation, acceptance and collaboration. This highlights how smart city initiatives have differentiated outcomes and how the mode of governance in a societal and institutional context plays an important role in shaping patterns of citizen participation.

Keywords: smart city; citizen participation; urban governance; dynamic roles; local government; international comparative research

1. Introduction

This article focuses on understanding how citizens participate in smart city initiatives and in particular where collaboration with local government is mediated by new Information and Communication Technologies (ICTs). Making a city 'smarter' is a key feature of contemporary

urban agendas and takes place in a context of increasing urbanization and a need to develop sustainable urban strategies (Gil-Garcia et al. 2015). Citizen participation is increasingly acknowledged as a key component of these strategies. This article presents a theoretical and empirical exploration of citizen participation in smart cities.

The concept of the 'smart city' has emerged from recent developments in ICTs and their incorporation in urban spaces, especially concerning to the delivery of public services (Albino et al. 2015). There are competing definitions of what constitutes a smart city (Albino et al. 2015; Mora et al. 2017). Typically, a smart city is perceived as one in which new data sources and analytical practices are used to automate and shape the delivery of public services and policy, in the interests of better performance, reduced cost and more sustainable outcomes. The technology-driven perspective dominates and here the smart city is defined as an advanced technology intensive city that connects people, information and services (Mora et al. 2017). An alternative citizen-centric perspective points to a city where residents, workers and service consumers are protagonists who shape the city through continuous interactions and activity (Albino et al. 2015). Technology-driven approaches emphasize the dynamic role of new digital technology (Hollands 2015), whereas citizen-centric frameworks are based on narratives of open ecosystems for innovation, with social participation mediated by ICTs (Meijer and Bolívar 2016). In both perspectives, although with different degrees of emphasis, citizens are recognised as important actors and new ICTs are seen as a crucial transformational medium. However, the debate about citizen participation in smart cities initiatives remains polarized. On the one hand, there is the positive view where the use of ICTs increases opportunities for citizen participation, promoting empowerment and facilitating the transformation of cities (Meijer and Bolívar 2016; Mora et al. 2017). On the other hand, smart 'narratives' are deemed to be part of the neoliberal agenda in which citizens are reduced to simple consumers of advanced digital solutions (Cardullo and Kitchin 2019a; Greenfield 2013; Hollands 2015). This divergence of

opinion points to a need for a robust empirically driven understanding of the nature of citizen engagement and the ways in which these roles unfold within different local contexts (Cardullo and Kitchin 2019a; Granier and Kudo 2016).

This article presents research findings from a comparative international empirical study into citizen participation in smart cities. Existing literature on citizen participation in smart city initiatives often rely on Arnstein's ladder of participation (1969) and other Arnstein based models which assume a differentiated but static role for citizens. Typically, these models also do not consider the unique nature of urban contexts in defining and shaping the role of citizens. Contemporary approaches to governance point to the involvement of citizens in policy and decision-making (Häikiö 2012), this is recognised in urban governance literature (Pierre 2011; Swyngedouw 2005) and publications which focus on examining citizen participation in smart cities (Cardullo and Kitchin 2019a; Granier and Kudo 2016; Willems et al. 2017). The starting point of this research is the question '*what is the role of citizens in smart cities initiatives in different urban governance contexts?*' To address this question, empirical cases of citizen participation were analysed in three cities, Curitiba (Brazil), Glasgow (Scotland, UK) and Utrecht (the Netherlands). These three cities were selected from a criterion based on pragmatism and analytical need. At the pragmatic level the three cities were selected because research funding councils specified the nations/regions to be involved in the research and because the research teams undertaking the research had access to key actors in these three cities. In relation to analytical need the selection of cities was determined by their distinctiveness, in terms of urban history, geography and their traditional perceived modes of governance. 'Governance modes' refer to the ways in which political institutions in each city are linked together by formal and informal arrangements, norms and practices (Swyngedouw 2005). These informal political and social relationships determine how cities are governed, how they shape objectives and goals for the city, as well as the nature of interaction among

governmental and local actors, including the citizenry (DiGaetano and Strom 2003). Here, there is an underlying assumption that different governance contexts and modes will result in differences in the ways in which citizens engage with and utilise smart city initiatives. This view is tested and explored in this article with a view to making a detailed empirically driven assessment of the nature of citizen participation in smart city governance.

2. Towards a Framework for Analysing Citizen Participation in Smart Cities

2.1. Citizen participation in smart cities

The first wave of publications presented either a highly positive image of smart cities, where they were designed to create better urban environments (Mora et al. 2017; Vanolo 2014), or a very critical analysis, where smart cities were seen as a platform created by IT companies designed primarily to sell their products and services (Greenfield 2013; Hollands 2015). A second wave of literature is emerging which empirically explores smart city developments and which places emphasis on non-technical elements and outcomes (Meijer and Bolívar 2016), and how the focus of smart city relates as much to contemporary governance as service delivery (Webster and Leleux 2018). This literature presents a more nuanced understanding of smart city strategies and a better contextualisation of different forms of citizen participation. Nevertheless, a theorised understanding of the roles of citizens in smart cities initiatives is lacking and would highlight the different ways in which citizen act and are engaged with ICTs (Michels and De Graaf 2017).

One strand of thought argues that smart city initiatives allow citizens to participate in city governance and management and become active actors in realising sustainable urban solutions through ICTs (Caragliu et al. 2011; Castelnovo et al. 2016; Mora et al. 2017). In this perspective, the citizenry is more than individuals, but also communities, residents and social

groups, with respective interests and needs within the city environment (Gil-Garcia et al. 2015).

People and communities are city components that require smart city initiatives to be responsive and to balance of the needs of different stakeholders. Scholars stress that citizens play a crucial role in smart cities, in terms of their participation in governance (Meijer and Bolivar 2016; Webster and Leleux, 2018). The governance of smart cities implies that various stakeholders are engaged in decision-making about public policy and services. ICT-mediated governance is fundamental in bringing smart city initiatives to citizens, and to keeping the decision and implementation process transparent. Here it is argued, that e-governance allows for the smart city to be citizen-centric and citizen-driven (Ruhlandt 2018; Tomor et al. 2019).

Another branch of literature is more sceptical of citizen empowerment narratives regarding smart city initiatives (Greenfield 2013; Hollands 2015; Mora et al. 2017). These authors emphasize that technological narratives should be understood as part of a neoliberal agenda to control the future of the city and to serve corporate interests (Hollands 2015, Vanolo 2014). These scholars emphasize the emptiness of the citizen empowerment rhetoric and point to limited civic participation in most smart city initiatives, manifested by the one directional supply of information, the use of citizens as data sensors, and enforced behavioural and lifestyle changes (Cardullo and Kitchin 2019a).

The polarized debate on citizen participation is mostly based on conceptual arguments and analysis, rather than robust empirical study. In-depth case study research of individual city cases offers more nuanced insight, but often lack the required comparative analysis that is needed to develop a theoretical understanding of the relationship between context and patterns of behaviour. When analysing London based smart city initiatives using Arnstein's model (1969), Willems et al. (2017), identify three types of citizen participation: (1) 'non-participatory' citizens; (2) 'token' or 'consultation' citizens; and (3) 'partnership' citizens. Cardullo and Kitchin (2019a) also use the Arnstein model to analyse citizen participation in

Dublin (Ireland) smart city initiatives, using a variant model, which they refer to as a 'scaffold'. They argue that citizens can perform all of the roles and functions identified in Arnstein's model and can experience different forms of participation. They also argue that "*smart cities appear to be largely tokenistic,[…], and smart city initiatives being used to enact a form of technologically-led entrepreneurial urbanism*" (Cardullo and Kitchin, 2019a:10). Granier and Kudo (2016) analysed citizen participation in Kitakyushu (Japan) and conclude that public and private stakeholders encouraged citizens to become 'prosumers', that is, co-producers and consumers of energy production and distribution services. Berntzen and Johannessen (2016) propose three categories of citizen participation in Norwegian smart city initiatives: (1) citizen 'experience and knowledge sharing'; (2) citizens who are 'data sensors'; and (3) citizens as active 'participants'. Other scholars also have focussed on the notion of 'smart citizenship' and conclude that neoliberal logic dominates the participation agenda (Cardullo and Kitchin 2019b; Datta 2017).

Whilst the focus in many of these studies is the different types of citizen participation, they tend to conceptualize participation on a rather one-dimensional manner by presenting it as a 'ladder' - and the higher the citizens travel up the ladder the more empowered they become. More nuanced versions of this approach, such as that offered by Cardullo and Kitchin (2019a), recognise that citizen roles may shift over time and that they are influenced by contextual factors. This implies that a more differentiated understanding of participation is required and highlights the significance of relations between the type of participation and its contextual conditions. The metaphor of the ladder misses the nuance that is needed to grasp this variation.

Urban contexts demand our attention since they affect participation considerably. The characteristics of participation are influenced by national and local factors, such as culture, political tradition, societal and institutional norms, internet reach and use, the social character of the cities under consideration, as well as the modes of governance that predominate within

each context (Irazábal 2017; Tomor et al. 2019). The ambition of this article is to develop a theoretical and empirical understanding of the relation between the various modes of governance and nature of citizen participation.

2.2. Mode of governance as a context for citizen participation

The concept 'governance' is typically used to indicate a form of governing which gives a role in policy-making, administration and implementation, to private economic actors and to parts of civil society (Mayntz 2003; Pierre and Peters 2005; Stoker 2018; Swyngedouw 2005). Governance offers an analytical framework, or at least a set of criteria, to observe the urban polity, and to comprehend the incentives and challenges related to collaborative forms of governing (Peters and Pierre 2012; Stoker 2018). The governance approach also offers opportunities to identify the extent to which citizens participate in the governance process, especially in relation to the design of public policy and decision-making (Garcia 2006; Hanssen and Falleth 2014). Scholars have sought to explain patterns of urban governance and the extent to which different social, political and economic forces tend to produce different models of urban governance (DiGaetano and Strom 2003; Bryson et al 2014; Pierre 2011).

Over the past 30 years the literature on governance has proliferated with several different positions and perspectives emerging (e.g. see Pierre and Peters (2019) and Rhodes (2007)). For the purpose of this article, Pierre's (2011) approach based on modes of governance is utilised. In particular, each 'mode' has an assumed role for the citizen and consequently a specific style of citizen-state relations. In this article, it is argued that these modes of governance can help to understand differences in citizen participation in smart cities. A summary of the key 'modes' of governance in presented in Table 1 highlighting the role and activities of citizens in the governance. In the 'pro-growth' governance, the objective is promoting the economic development of the city. This mode of urban governance is less

participatory since this would politicize the pro-growth strategy (Digaetano and Strom, 2003; Pierre 2011). In 'consensual corporatist' modes of governance, there is a significant and continuous involvement of civil society organizations at the local level featuring negotiation and compromise (Digaetano and Strom, 2003; Pierre 2011). The 'managerial' governance mode can be considered a top-down form of governance. Here, the citizen's role is reduced to being a client or consumer of public services (Bryson et al. 2014; Häikiö 2012; Pierre 2011).

Table 1. The Characteristics of Governance Modes

| Modes of Governance			
Mode	**Description of Mode**	**Citizen-state Relations: Role of citizens**	**Citizenship Tools: Types of Interaction**
Managerial	Emphasises the effectiveness or efficiency of government policy and programs.	Exclusive: Citizens are clients or consumers of public services. Public and private actors dominate the policy agenda.	Voting Contracts User satisfaction Consultation
Consensual Corporatist	Emphasises programmatic public-private governing relations based on negotiation and compromise	Inclusive: Key societal actors/citizens and local leaders shape the political process.	Voting Deliberation Stakeholder dialogue
Pro-growth	Emphasises the re-structuring of public-private relations to boost the local economy	Exclusive: Corporate actors and elected officials determine public policies. Citizens are beneficiaries.	Voting Partnerships Corporate engagement

Source: Adapted from Bryson et al. (2014), DiGaetano and Strom (2003: 366) and Pierre (2011: 338).

In practice, modes of urban governance can overlap and coexist within the same arrangement, and this depends on the capacity of local agencies to promote debates and involve local actors. Since societies and cities are dynamic entities, there is no universal mode of urban governance that is appropriate for all localities, or even the same city, in the longer-term. Governance is created through the development of, and adjustments to, government and social networks, the

restructuring of governmental organizations, and an increase in community involvement (Häikiö 2012).

Utilising existing published work on the role of citizens in smart cities and established approaches based on modes of governance this article advances an analytical model which focuses on emergent local contextual features and citizen engagement. The analytical model presented here is used to analyse patterns of citizen participation in smart cities in three different countries in order to develop an understanding of the roles of citizens in smart city initiatives as a dynamic process, which is fluid and shaped by societal and institutional contexts. The 'Process dynamics of citizen role construction' model is illustrated at Figure 1. It highlights how, over time, and in relation to different modes of governance, the emerging patterns of citizen participation in smart city initiatives is shaped by experience and use of smart city technologies, as well as a raft of other contextual factors. The model is designed to 'shine a light' on how the mode of governance shapes patterns of citizen participation in a specific context.

Figure 1. The Process Dynamics of Citizen Role Construction
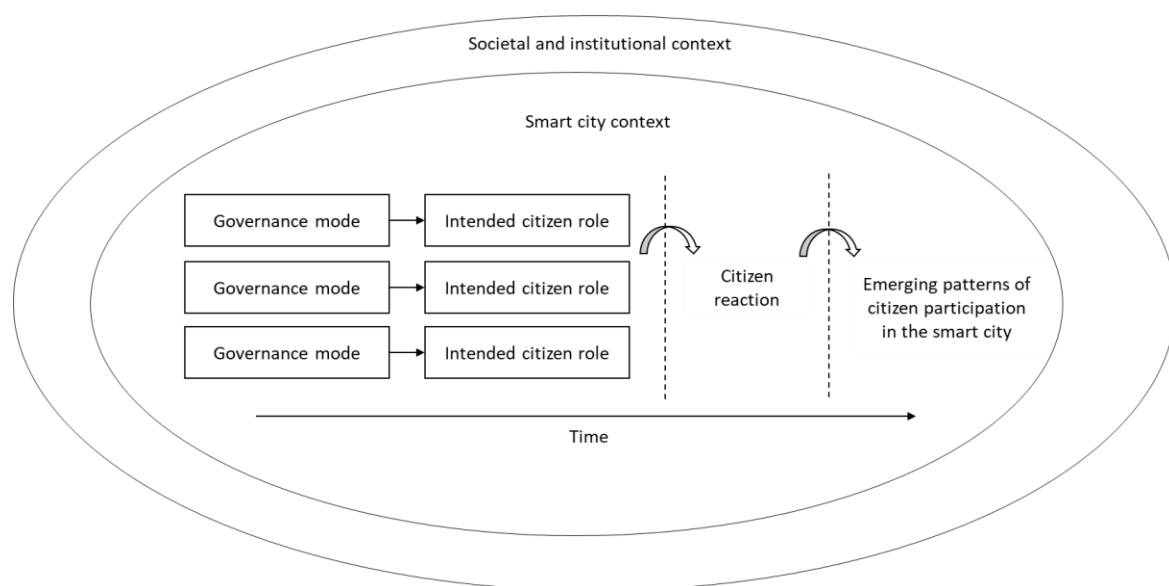
3. Research Methodology

3.1. Case selection

This article uses a case study approach to assess and explore the role of citizens in smart city initiatives. The methodology utilises secondary sources as well as new empirical research. Various methods were deployed including literature reviews, semi-structured interviews and fieldwork, including site visits and observations of meetings. A key feature of the research methodology was to design a process that allowed for international medium-term longitudinal comparative research in a number of geographically diverse smart cities. The case study cities were Curitiba (Brazil), Glasgow (UK) and Utrecht (Netherlands). Each represents a different national and local setting and allows for the study of the institutional contexts of citizen participation in smart city. As previously mentioned, the selection of these three cities was based on a criterion determined by analytical and pragmatic reasons. A further feature of the research was that it was designed to capture a mid-range longitudinal viewpoint by creating a methodology that accurately accounted for historical developments in institutional and actor activity during the period in which the initiatives were being developed and deployed. In this respect, the research underpinning this article offered an opportunity to investigate and learn from practice and experience in three contextually diverse cities and to explore and make theoretical sense of what was happening empirically in relation to citizen participation.

In each case study city, there were a raft of diverse smart city initiatives, ranging from open data initiatives, energy efficiency schemes and new online and social media platforms. The empirical cases selected for analysis in this article were: the Cycling Mobility Plan in Curitiba; the Active Travel Strategy in Glasgow; and the Smart Solar Charging programme in Utrecht. The selection of discrete cases allowed for in-depth qualitative study involving policy formation, implementation and an assessment of citizen activity. The selection of these

initiatives was based on the following criteria: all were explicitly included as smart city initiatives in the case study cities; all were being developed and deployed during the same time period; all specifically referred to citizen participation; and all three related to urban infrastructure services. Importantly, these cases evidenced citizen-government interactions using online and offline tools and provided empirical material for exploring the peculiarities of citizen participation in the contemporary smart city environment. Naturally, due to the huge differences in smart city initiatives in different locations, it was impossible to identify identical schemes for analysis.

3.2 Data Collection and Analysis

The research underpinning this article was conducted between 2015-2019. Initially, between 2015-2017, the research methodology focussed on capturing what was already known about citizenship in smart cities (via literature review) and on designing a case study framework suitable for international comparative research. The data collection for the discrete case studies took various forms and was undertaken between 2016-2018. Table 2 provides an overview of the empirical research. In Curitiba, semi-structured interviews were conducted with cycling activists and government officials between August 2016-January 2017. Also, grey literature was collected and reviewed, as well as publications relating to the 'Master Plan Platform', relevant media and local newspaper publications and a thesis dissertation that examined the case (Coelho 2018). A range of online sources were also reviewed, including videos of public hearings relating to the Curitiba Cycling Mobility Plan available on YouTube and the Facebook pages of cycling groups active in the area. In 2017, the three research teams visited Curitiba and met public officials responsible for the implementation of the Master Plan. In Utrecht, interviews were undertaken with local actors, including local entrepreneurs, local and regional government representatives, representatives from private companies, and a number of other

interested stakeholders. Six public meetings were attended, organized by universities, civil society organizations and local government, and the research teams made site visits in Utrecht in 2016. Grey literature was collected, including media outputs and official government documents. In Glasgow, primary and secondary data was utilised. Interviews were conducted with council officials associated with the Glasgow Future City programme and with those responsible for delivering legacy initiatives. Materials available on the city website, reports produced by independent institutes, and minutes taken in meetings with government representatives were incorporated into the study. The three research teams made site visits to Glasgow City Council, the City Observatory and the Operations Centre in summer 2018.

Table 2. Overview of Data Collection

Case	Instrument	Data Collected	Reference Period
Curitiba – Cycling Mobility Plan	Interviews	Urban planners (2) Public administrators (2) Cyclists (2)	August 2016-January 2017
	Grey Literature	Master Plan (1) Official government documents (21) Internet websites and social media (5) Minutes of meeting urban mobility department (7) Ph.D. thesis (1) Other documents (news, release, etc.) (9)	March 2014-June 2018
	Other Material	Video recordings on YouTube (3 hours) Research field notes: (1 *CicloIguaçu* meeting) Curitiba site visit	December 2014 September 2016-January 2017 October 2017
Glasgow – Active Travel	Interviews	Glasgow City Council officers (3) Leader of the Council, councillors (2) Academics (2) Public managers (3)	January 2017-August 2018
	Grey Literature	Official government documents (5) Internet (Future City Glasgow, Glasgow City Council and 8th City Programme websites) Glasgow Future City End Reports Future City videos Media reports Press releases	October 2016-August 2018
	Other Material	Glasgow site visit (2) Conference participation (2)	January 2016-August 2018

Utrecht – Smart Solar Charging	**Interviews**	Local entrepreneur (1) Local/Regional government officials (5) Private company representatives (2) Academics (3) Civil society representatives (3)	March 2016-August 2017
	Grey Literature	Official government documents (9) Internet websites and social media (10) Research documents (7) Other documents (24)	January 2016-September 2017
	Other Material	Utrecht site visit (June 2016 and February to July 2018) Events participation (7) Audio-video recordings (5)	January 2016-September 2018

Undertaking international comparative research is notoriously challenging and the research methodology was required to be scientifically robust and simultaneously flexible so that it was sympathetic to international cultural and institutional differences. The study was undertaken in multiple languages, Portuguese in Brazil, English in Scotland (UK) and Dutch in the Netherlands. The empirical research was undertaken independently by the research teams in each country using a common case study 'protocol' and with periodic online and face-to-face meetings to ensure consistency and to provide oversight.

It should be noted, that it was not feasible to universally standardize data collection procedures, due to the specific contexts of each city, including such things as: public holiday periods; traditions around the availability of senior administrators; different approaches to the use of online publications; and different organisational responsibilities and reporting arrangements. Nethertheless, the researchers effectively used a common comparative case study protocol highlighting areas of interests and features to be studied. The conceptual model, presented in Figure 1, guided the analysis of the three cases. This meant that for each of the three cases analysed, empirical data was collected to identify and assess: (1) governance modes; (2) intended citizen roles; (3) citizen activity and reactions; and (4) the emerging role patterns of citizen participation. This analytical scheme was used to draw conclusions about

two key assumptions: the relation between governance modes and citizen participation, and the dynamics of citizen participation.

4. Research Findings

The following section sets out the perceived dominant mode of urban governance in each of the three case study cities, followed by a description of the smart city case initiatives studied, with specific reference to citizen activity and emerging role patterns.

4.1 Curitiba – Cycling Mobility Plan

Curitiba, in Brazil, is internationally known for its innovations in the fields of mobility, urban planning and sustainable development, particularly its sustainable urban public transport (Mercier et al. 2015). Curitiba is considered to have a centralized autocratic model of urban governance where traditionally citizens are not encouraged to be engaged with the urban planning process (Follador et al. 2018; Irazábal 2017; Moore 2007). This governance model makes *Curitibano* citizens "*clients of a sustainability regime rather than citizens of the city*" (Moore 2007:102). The role of the citizenry is reduced to being a user of public services, with the legitimacy of political decisions based on the performance of urban public planning and services, rather than an acknowledgement of its citizens in decision-making processes.

The smart city case initiative studied in Curitiba was the new Curitiba Master Plan (2014-2024) and specifically the mobility policy. The Institute for Research and Urban Planning of Curitiba (IPPUC) was responsible for the elaboration of this Plan. The technical and management staff of IPPUC developed a process that involved citizens and stakeholders, including: (1) fifteen workshops conducted in all regions of the city to educate local technical specialists and community leaders about the Master Plan; (2) nineteen public hearings to communicate the activities related to the Plan, where citizens had opportunities to make

suggestions and to ask questions about the Plan; (3) a *Concitiba* - a representative civil institution formed by representatives of civil society and government, responsible for the formulation and implementation of urban public policies; and, (4) the Master Plan Platform, an online platform designed as a space for public dialogue about the published Plan.

During the elaboration of the Master Plan the ruling political party in Curitiba changed and a new, more collaboratively oriented, political coalition came to power. Nevertheless, the direct mode of top-down governance dominated as the core administrative agencies associated with the delivery of the Master Plan remained unchanged. In the events and platforms created for citizen participation, citizens typically took on the role of listeners and/or of information providers, in order to legitimize the ideas of IPPUC technicians. For example, on the Master Plan Platform, citizens were able to submit their ideas, and received generic replies from IPPUC technical specialists. A citizen that submitted a comment on the Master Plan Platform received the following response from an IPPUC specialist '*thank you for your contribution, it will be taken into account*'. A cyclist interviewed for this research who was a member of Upper Iguaçu Cycling Association (*CicloIguaçu),* founded in 2011 as a cycling group cooperative, complained that '*standardized responses, repeated responses, defensive responses, responses of the type: this information is not here, look elsewhere*' was the norm and very dismissive of the inputs offered by citizens. As a result, non-governmental organizations, mainly the cyclists' groups and other civil actors, constantly called for more collaborative spaces to be provided, so that the citizens of Curitiba could have their say about the Master Plan. This resulted in an environment of intense pressure for the city administration. A cyclist stated '*we were trying at that time to explore all possible* (participation) *channels*' (*CicloIguaçu* member). A bottom-up movement started, demanding greater participation and a greater voice in planning decisions in order to influence the Mobility Plan.

With a sense that they were not being listened to, some of the cyclist groups, represented mainly by *CicloIguaçu*, reacted by articulating their message via social media, blogs and other digital tools, along with off-line activities assuming a protest/activist role. Another cyclist interviewed mentioned that during one of the protests they painted a bicycle path on one of the main avenues in Curitiba. They attracted attention from the media and the population in general, as well as from government. Also, in 2014, the cyclists prepared an electronic petition to open streets in the city centre for the exclusive use of pedestrians and cyclists. An IPPUC manager stated, '*with the cyclists' complaints, the city managers and planners felt the need to rethink their planning, understanding that they had to address the cycle mobility issue*'. As a response to their demands, the city government invited one representative from the cycling movement to work for the Transport Secretariat. This individual then became responsible for the actions related to cycle mobility and a representative of the group's demands. They also created an information portal, *MaisBici*, for the cyclists and began to hold monthly open meetings to listen to the demands of the cycling movement and others interested in cycle mobility.

The final Curitiba Master Plan included concrete results for a cycle mobility policy, such as the implementation of 300km of bike paths, an investment of approximately E$22 million over a 10-year period, and the implementation of a traffic calmed area in the city centre, where the speed limit for cars was to be restricted to 40km/h. After the publication of these policies the cycling groups continued to be active in the city and continued to lobby for enhanced cycle facilities and greater cycle mobility, influencing the decision-making process and integrating government and administrative machinery. One of the leaders of the group was elected as a local councillor and was elected Curitiba State Deputy for the 2019-2023 term.

4.2 Glasgow – Active Travel

Glasgow is the largest city in Scotland, and the fifth most populous settlement with city status in the UK. In the late 19th and early 20th centuries, Glasgow was considered one of the most prominent economic cities in the world, most notably due to its shipbuilding, marine engineering industry and merchant trade. However, from the 1970s Glasgow faced dramatic deindustrialization (Gómez 1998) prompting widespread depravation and a desire by political leaders to identify measures to reinvent the city's economy. In Glasgow, the focus has been on economic recovery and growth led by the local authority (Glasgow City Council) and other key public agencies (Boyle 1994; Boyle et al. 2008). The economic prosperity of the city has remained an important policy objective (Calzada 2017; Glasgow Economic Strategy 2016-2023) suggesting a pro-growth mode of governance led by the local authority and designed to create community wealth. In this pro-growth governance, the objective is promoting the economic development of the city, alongside traditional local service provision and other civic matters. This mode of urban governance is considered less participatory, because the main vehicle for participation was voting for local political representatives, which empowered local politicians and politicizes the pro-growth strategy (Pierre 2011).

In 2012, Innovate UK announced a 'Future Cities Demonstrator' competition. The competition was aimed at stimulating new thinking in providing local services, as well as opening up markets for new 'smart' urban management technologies, building on the UK's recognized strengths in urban development and eGovernment (Taylor-Buck and While 2017). Here, the economic orientation was intended to enhance services and was to be complemented by hi-tech digital innovation (Joss and Cowley 2017). Glasgow was one of the four city competition winners and was awarded £24 million (this amount was matched with locally raised funds), with the subsequent 'Glasgow Future City Programme' running from 2013-2015. The program included the Open Glasgow Project, an open data initiative, and 'Demonstrator

Projects', which were to act as 'pathway' initiatives for other local authorities to imitate. For this research, the focus was the 'Active Travel Demonstrator App'. Glasgow's Active Travel Plan was launched in November 2014 and was designed to: (1) provide cyclists with live travel information; and (2) to give the Council additional layers of information from crowd-sourced cycling data to help inform their infrastructure decisions. A private company developed the app to provide a platform for cyclists to map how they move around the city. Using the app, cyclists could record their routes - capturing and publishing their journeys. They also had live access to information about weather, traffic congestion and pollution levels. Using the data collected other cyclists could determine the best routes around the city, allowing them to better plan their journeys and encouraging more people to take up cycling. Citizens were invited to participate during the deployment of the app, but their role was restricted once the service was 'live' to users of the app and suppliers of data '*there's strong ambitions…get people on their bikes and walking more*' (Programme Director, Future City Glasgow).

When it was launched, cycling organizations and interest groups were invited to promote the app through their networks. They were also actively engaged by Glasgow City Council and encouraged to supply recommendations for upgrading routes and proposals for establishing new ones. According a manager of the Future City Programme, marketing took place through peer-to-peer networks and through social media. Looking to encourage cycling, Glasgow City Council wanted to provide an easy platform for cyclists to share their cycling experiences within the city. Data collected about the cycling routes in and around Glasgow was utilized to inform the provision of cycle lanes and other cycling infrastructure. In this respect, real user data directly influenced public policy and service delivery. Citizens reacted positively to the invitation to participate. Citizens and cycling groups used the app and gave the city council ideas through its website and through feedback to local political representatives. With the data collected Glasgow City Council reworked its cycle lane network. By January 2016,

the app had reached a total of 1,200 downloads and 1,393 routes had been captured, with a total mapped distance of 9,138km (Leleux and Webster 2018). The infrastructure investment decisions that the Glasgow City Council took were directly influenced by citizens who provided their data, often unknowingly, through a digitally mediated tool. The development of the app included direct input from other interested stakeholders, such as health organizations, universities, schools and government agencies responsible for public transport. The information generated from the use of the app was used for academic and public health studies, which required a degree of data sharing. The development of the app also helped local companies create opportunities for networking and benefitted the digital economy (Leleux and Webster 2018). The cycling app was 'consumed' as a service in the Glasgow region and citizens played the role of sensors, supplying information to the service providers. Building on the success of the app, the Executive Committee of Glasgow City Council approved the city's Strategic Plan for Cycling from 2016 to 2025, and agreed to commit £2m a year for the following three years based on third party financing. Further investments of £3m by the Council were announced in June 2016 for cycling, walking and transport safety throughout the city, with funding being provided by four partners from the public sector.

4.3 Utrecht – Smart Solar Charging

Utrecht is the fourth largest city in the Netherlands. Utrecht aspires to be a climate neutral city by 2030 and to be 'the' Solar City of the country, leading the way in terms of installed solar panels, smart grid technology and solar charging infrastructure for electric cars (Tomor 2019). The city of Utrecht follows the Netherlands tradition of a consensual corporatist mode of governance (Buijs 2019; Kickert 2003; Michels 2006) that involves stakeholders participating in the urban political process. In this mode, the city is viewed as an inclusive political and democratic system engaging a variety of vested interests including corporate entities and civil

society groups in the urban political process (Pierre 2011).

The Smart Solar Charging initiative featuring innovative technology seeks to: (1) accelerate the transition to providing energy through non-fossil fuels; and (2) a community-based system of solar energy coupled with the use of electric vehicles. This bottom-up initiative was started by a local entrepreneur of the Lombok district of Utrecht in 2010. Having long been involved in neighbourhood improvement, this individual's actions evolved into a prototype of a solar power-based bidirectional household charging station. This smart technological scheme made it possible to charge cars with solar energy during the day and to deplete car batteries to assist the community's electricity network at night (Tomor 2019). As a bottom-up initiative the intended role of the citizen was as an entrepreneurial incubator. At first the entrepreneur was motivated by sustainability-oriented activism '*it frustrates me that my son's classmates from a poorer, traffic-intensive zone get regularly sick due to polluted air*' (local entrepreneur). The entrepreneur played the role of initiator in convincing private and public organizations to form a consortium to support the development of his initial idea. The partners included General Electric, Renault, Nissan, Last Mile Solutions and the Municipality of Utrecht. Together they collectively achieved important innovation milestones, including the developing, testing and deployment of these technologies and their related infrastructure. These connections resulted in a closed public-private consortium which technologically refined the prototype by developing system-conforming electric cars and a car-sharing scheme called 'We Drive Solar'.

An important factor of the scheme is the collaborative contribution of local citizens. The expectations were that residents would join the system as it evolved. The scheme involved placing thousands of solar panels in Lombok, which required residents, business and service providers to provide suitable roof space for the panels. To achieve a broader sustainable energy regime in the wider Lombok area, a further fundamental step was the widespread introduction

of electric cars. They are the essence of the system, as beyond charging solar energy for their own use, electric cars - through their batteries - also supply energy back to the network (Tomor 2019). The entrepreneur also played a role in convincing people to become members and forming car sharing communities. In this respect, citizens played the role of users to provide feedback to improve the system and at the same time '*act as energy producers and supply energy to others*' (Utrecht Economic Board).

Citizens are fundamental to the successful implementation of this project. They not only provide rooftops for solar panels, they also use electric cars and the charging pillars to consume and produce renewable energy. The scheme can only function if citizens become energy producers and consumers. Residents are also encouraged to form e-car sharing communities with monthly membership fees with the aspiration that the We Drive Solar program will be available for all citizens throughout the province of Utrecht. The City of Utrecht supported the dissemination of this alternative energy system by creating charging and parking locations for each car-share community. Residents participated in, or more precisely, followed the development of this project individually without collaborating with the developing actors or with each other. However, as the We Drive Solar program moved beyond its pilot phase they were encouraged to form 'communities' and mobilize their fellow residents to actively engage and become members of the project. In this respect, a citizen-oriented collaboration emerged during project implementation.

5. Discussing the Role of Citizens in Smart City Initiatives

Here, it is argued that an enhanced understanding of the role of citizens in smart cities initiatives is required in order to fully comprehend the way smart cities are evolving. The core argument is that citizen participation in smart cities initiatives is dynamic, it changes over time and citizens can accept, react to, or attempt to reconstitute their roles and activities. This dynamic

can be explained by differences in the local context and urban modes of governance, as well as the tools and opportunities afforded to different citizens. The cases of smart city initiatives in Curitiba, Glasgow and Utrecht, highlight how different forms of citizen engagement, and how citizens react to smart city initiatives, differ considerably, from place to place and country to country.

In Curitiba, the governance mode has traditionally been directed and technocratic (Follador et al. 2018; Moore 2007; Irazábal 2017). Despite the election of a government more open to citizen engagement, the permanent technical staff of the administration resisted interference with the Master Plan. The political and planning regime that has led the development of the Master Plan in Curitiba retained its influence. The role initially attributed to citizens was to provide information and suggestions, and to legitimate the plans prepared by the technical and administrative elite. Citizens, especially cycling group participants, experienced a lack of dialogue and influence in the cycle mobility policy, and consequently mobilized their efforts through social media, online petitions and various forms of action throughout the city. Here, the role of this group was to form resistance and to confront local government policymakers. The movement leaders infiltrated decision-making arenas and were successful in changing policy. In doing so, they facilitated an environment for future dialogue and further citizen-state engagement.

In Glasgow, the societal and institutional context was quite different. The city received a large contribution of capital funding from central government to develop pilot projects involving advanced technology and enhanced service delivery. Here, the City Council had to deploy smart city solutions in a very short period of time and consequently had little time for meaningful citizen engagement (Leleux and Webster 2018). The mode of governance can be considered growth-enhancing as multiple agencies and actors were engaged to develop commercially viable smart city applications which were to be consumed by citizens and service

users (cyclists). In this respect, the primary way in which citizens participated was as consumers of the service, and in doing so, provided data for service improvements and public policy developments. The role attributed in the Active Travel Demonstrator case is that of a citizen sensor, providing information that is used for public administration. An important feature of this case was that local public agencies used the data collected to further enhance public service provision, to formulate cycle mobility plans and to allocate money to invest in cycling infrastructure. The assumed citizen role in this case was more passive when compared to the case of Curitiba. So, whilst citizens influenced city planning in Glasgow, they did so in a less active and arguably unconscious manner.

In Utrecht, in keeping with the Dutch tradition of consensual governance the Smart Solar Charging project can be understood in two different ways. First, as an initiative led by an individual citizen motivated by entrepreneurial spirit and sustainability values, and where he was able to develop a technological solution for the production and storage of solar energy. Local government and companies joined the project, in a corporatist alliance to leverage it, alongside the pursuit of their own particular interests. The way in which this initiative grew in scale and visibility was due, in a large part, to consensual governance in the search for urban solutions, and in this case, the production of clean and sustainable energy. Alternatively, this initiative can be viewed as a commercial exercise designed to be 'sold' to the population. The entrepreneur had an important role to play in convincing neighbourhood residents to become members of the energy production network. The Utrecht initiative can be seen as initially bottom-up, but one which quickly aligned powerful vested interests, whereas the Glasgow initiative was led at the outset by these influential interests.

A summary of citizen roles patterns in each of the three initiatives studies here is presented in Table 3. This table highlights the importance of recognising the evolution in roles over time and the contextual features that explain this dynamism. For each smart city case

Table 3 sets out the city mode of governance, the implied citizen role embedded in this mode and then the new patterns of observed citizen activity emerging around the diffusion and use of the technological initiative.

Table 3. Emerging Citizen Roles Patterns

Case	Mode of Governance	Intended Citizen Roles	Citizen Reaction and Interaction	Emerging Patterns of Citizen Participation
Cycle Mobility Plan: Curitiba	**Centralized and autocratic** Urban planning in the city was lead and controlled by technocratic and administrative experts	- The narrative: citizens can participate and contribute to the Master Plan design - **Informing citizens** about the Plan - **Legitimise the plans** through consultation	- Cycling groups felt under-represented in relation to decision-making and influencing the planning process - Self-mobilization, used online tools and offline actions to gain a voice - Joining the government with new proposals	- **A pattern of *contestation* emerged** - Advocating their own ideas and solutions - Protests/activism from citizens - Direct participation in decision-making
Active Travel: Glasgow	**Economic pro-growth** Actions developed in the city are focused on promoting economic recovery and are led by public agencies	- The narrative: engage people to co-create new cycle lanes and services - **Citizens are data providers** - Citizens consume services provided by the Active Travel App	- Citizens reacted positively to the invitation to participate - Using the App and generating data - Contributing with development ideas on the website	- **A pattern of *acceptance* emerged** - Citizens adopted the technological service offered by the Council - Over time they offered suggestions for improvement - Citizens supply data to develop new plans
Smart Solar Charging: Utrecht	**Consensual and corporatist** City governance is strongly aligned to the Dutch consensual style of addressing societal problems	- There is (initially) no intended role (entrepreneur) - **Bottom-up initiative** - Corporate vested interests would support the scheme - Citizens would join the system once it was operational	- Entrepreneur is the initiator and developed the solution - Once scheme identified as viable corporate interests joined - Community adhered to forming car sharing communities	- **A pattern of *collaboration* emerged** - Local Entrepreneur assumed a leadership position - Government and private companies joined, forming a corporatist alliance to scale up the solution - Community plays the role of producers and consumers of energy

Contextual features and technological tools facilitated and mediated the dynamism in the three cases presented here. In Curitiba, the creation of an online participation platform, coupled with the use of non-governmental social media provided new digitally mediated communication mechanisms allowing interested citizens to mobilise discourse and activity. In Glasgow, the cycling app provided live information to cyclists to inform their route selection and at the same time collected data to shape future cycling policy. And in Utrecht, the bi-directional solar charging system coupled with a car-sharing app enabled local citizens to create a new service and extend environmentally sustainable behaviours. In each case, ICT, shaped by its local context, influenced the citizen-state relationship and provided a mechanism through which citizens expressed and experienced their citizenship.

The dynamic nature of these technologically mediated context sensitive relationships is evidenced in the way that citizen roles evolved through the development of the smart city initiatives studied here. In Curitiba, technology was seen to empower citizens, allowing them exert influence in a policy process traditionally dominated by technocratic elites. This technological empowerment was not by design, but the outcome of contestation, resistance and the mobilisation of ideas, discourse and activity. In Glasgow, the role played by citizens was more passive, but no less influential. Whilst citizens in the Glasgow case can be seen initially as service users, because their primary experience was to consume the service offered by the cycling app, this also evolved, through their use of the app, into unconscious sensory 'devices' providing data which in turn determined future public policy. In this respect, their role evolved from information consumers to information providers. In Utrecht, key individual citizens acted as technological incubators, driving forward a technological solution and then enlisting the support of key organisations. In this case, citizens directly influenced the mobilisation of vested interests around a technological solution that was perceived to be desirable.

In each of the three cases the citizen-state relationship that evolved around the smart technology was fundamentally different. In Curitiba, state actors sought to control the policy process and resist citizen influence. In Glasgow, service delivery and policy formation were centrally driven, with citizens unknowingly influencing public policy. Whilst in Utrecht, local citizens initiated and developed technological solutions in collaboration with state and other actors, with the latter becoming more influential over time. In all cases, the nature of the citizen-state relationship was not 'set in stone' and evolved, although it was strongly influenced by institutional contexts, existing practices and past experiences.

6. Concluding Discussion

This study has sought to understand the emerging role of citizens in smart city, guided by the overarching research question of *'what is the role of citizens in smart city initiatives in different urban governance contexts?'* The three cases presented and discussed here, highlight how the roles and activities of citizens differ according to location and context, and how they evolve over time. In this respect, smart city citizenship is contextually embedded and dynamic and three different participation patters was identified: contestation, acceptance and collaboration

The use of modes of governance here operates as a frame of reference to analyse forms of citizen engagement and the emerging roles of citizens in these smart city initiatives. Although the predominant governance mode may explain the initial role attributed to citizenship - in directed (Curitiba), pro-growth (Glasgow), and consensual (Utrecht) urban governance perspectives - all cases place emphasis on the levels and types of citizen participation and engagement. From this research, it is evident that the role of the citizen may initially be less participatory, but that over time as initiatives evolve and are deployed the role and engagement of the citizenry changes, demonstrating that citizen participation is a dynamic process and that citizens may undertake a specific role at one time and a different one at

another. This is not to assume that over time the participatory practices of citizens will always be enhanced, or that new ICT will drive such enhancements, as it may be the case, in other cities and with other initiatives, that engagement and participation are diminished.

Previous studies concerning citizen participation in smart city initiatives assumed that the citizen played a role relating to direct participation in public decision-making (Cardullo and Kitchin 2019a; Granier and Kudo 2016; Willems et al. 2017). Such studies also assumed citizenship roles to be static with little appreciation of the dynamic fluidity of participation over time. The research presented in this article advances these models by painting a completely different picture, here it is evident that the roles 'designated' to citizens may be accepted, refined, supported, resented and even resisted, and the pattern of citizen activity evolves alongside the development of policy and services. In other words, citizens have a much broader and complex role to play in smart cities than is typically presented by the literature on this subject. Such findings emphasise the importance of conducting longitudinal comparative in-depth qualitative research.

The configuration of elements that constitute a smart city initiative, such as access to digital tools and information, offline participation mechanisms, governance approaches, and types of government-citizen interaction, varies from one initiative to another and from one societal and institutional context to another. The research presented here suggests that these features produce multiple dynamic citizen participation arrangements and that there is a need for a more comprehensive understanding of governance modes in the digital age - which encompasses and embeds the dynamic nature of citizenship. ICTs are configuring new 'collaborative' governance models and are causing the configuration process of governance networks to become more dynamic and extending beyond the traditional governance models prevalent in each societal and institutional context. In this respect, new governance approaches,

based on ICTs, are influencing how government design public services and develop smart cities solutions and dynamism of citizens' participation.

On the basis of this research, it is possible to formulate propositions for the dynamics embedded in the roles of citizens. A first proposition - based on the Curitiba case - is that organized dissatisfaction by a vocal group of citizens can evolve passive forms of participation into more active ones. A second proposition - based on the Utrecht case - is that intense participation by a small group can 'capture' the policy process, in the sense that the engaged citizens become part of the mode of governance and broad participation by other citizens is diminished. A third proposition - based on the Glasgow case - would be that technologically mediated service consumption delivers both citizen engagement and data for policy-making. These propositions, and possibly other patterns in the dynamics of participation, require further theoretical and empirical exploration in order to develop a mature theory of the dynamics of citizen participation in smart cities.

This explorative research was based on three specific cases and additional work is needed to test the extent to which these findings can be generalized. Future research could contribute to the complexities of this debate by examining the longitudinal relationship between citizens and government in smart city scenarios. This research provides an explorative understanding of the dynamics of participatory roles, but a more in-depth understanding of how and why these roles shift over time requires further theoretical and empirical work. Future research could also test the generalizability of the patterns of contestation, acceptance, and collaboration in relation to the different modes of governance that have been identified here. This requires an analysis of a higher number of cases of smart cities with different modes of governance, and a comparison of a broader array of smart city initiatives to systematically test the generalizability of the relation between mode of governance and patterns of citizen participation.

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