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Searching for the Real Sustainable Smart City?

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Abstract

The emergence of 'Smart Cities' is a contemporary global phenomenon which is closely aligned to a vision of modern technologically advanced sustainable urban environments. However, public policy and academic discourses differ about what constitutes a city that is either 'smart' or 'sustainable', and assumptions are frequently made about the positive impact of technology and its potential benefit to the environment. Whilst a smart city is not necessarily a sustainable city, the terms 'smart city' and the 'sustainable city' are increasingly being fused together in the concept of the *Sustainable Smart City* (SSC). This article seeks to explore the conceptual components of the SSC, with a particular focus on the participatory role of the citizen, where this involves the use of new digital technologies. Conventional eGovernment has tended to focus on service delivery rather than engaging citizens in participatory activity, whilst traditional discourses on sustainability focus on environmentalism rather than broader societal sustainability. Sustainability in the context of the SSC is a much wider concept, where the aspiration is also to improve the quality life by engaging citizens in participatory governance, by co-creating sustainability values, and by developing relationships, trust and sustainable mechanisms for ongoing engagement. In this respect, new digital technology is understood according to its transformational potential and the opportunities which it offers to citizens in delivery of services, meaningful participation and of sustainable societal solutions. This article explores the three underlying conceptual pillars of the SCC, namely insights deriving from perspectives associated with (1) sustainability, (2) new technology and (3) participation, where each of these perspectives offers up its own rationale and institutional logic. Here, it is argued, that whilst practice

around SSC's differs considerably, the 'real' SSC stands at the nexus of new technology, citizen engagement and sustainable outcomes.

Keywords

Sustainable smart cities, smart cities, sustainability, citizen participation, eGovernance

1. Introduction

There are competing discourses in academia and public policy about what constitutes a city that is either smart (Nam & Pardo, 2011) or sustainable (Haughton and Hunter, 2004). Within these discourses there are assumptions about their positive role played by technology (Sæbø, Rose & Flak, 2008) and the positive impact on the environment (Mitchell & Casalegno, 2009). Whilst strictly speaking a smart city is not necessarily also a sustainable city, these concepts are increasingly being conflated in the term – the *Sustainable Smart City (SSC)* (Kramers *et al.*, 2014). In this article, we review the conceptual components of an SSC from the perspective of the citizen, and 'unpick' how each of these terms relate to each other in practice. A critical account is provided of traditional eGovernment approaches, which focus on service delivery at the expense of citizen engagement (Meijer, 2011), and of the sustainability literature, which focuses on environmentalism at the expense of sustainable societies (Robinson, 2004). Sustainability in the SSC context is much more than simply being environmentally friendly, it is about designing organisational structures and processes and institutional norms and values that will exist over time, in a manner that enriches citizens' lives and at the same time prioritises the efficient use of societal resources and the environment. The term 'sustainability' is a contested one and it is evident that the dominant discourse is being shaped by commercial interests, which may be repurposing the concept to suit business needs (Gray,

2010). New digital technologies, including social media, contribute to this vision by providing opportunities for streamlined public service provision and a more economic use of scarce resources. The transformative potential of technology also offers long-term sustainable outcomes where they engage citizens actively in participatory activities, and where these activities are linked to the services which they need (Batty *et al.*, 2012). In this respect, new digital technologies act as a critical conduit in the co-production of public services and citizen-government engagement mechanisms, in which the citizen is becoming increasingly empowered to participate in SSC governance (Meijer & Bolivar, 2016).

The research approach embedded in this article is to conceptually explore the key analytical components of the term the SCC, with a core research question of ‘how do we conceptually define the term and practices associated with the SCC. This is achieved by identifying and exploring the key intellectual and normative components of the concept and the degree to which they are simultaneously both independent and interdependent. Here, the contribution to knowledge is realised by recognising that there are three intellectually distinct traditions informing our understanding of the SSC and that by bringing these perspectives together it is possible to have a more holistic understanding of how SCCs are evolving and how this evolution should be understood. In this respect, the underlying argument of the article is that SSCs should not be defined by concepts, literatures and approaches associated with narrow but dominant discourses, for example in relation to environmentalism or technological diffusion, but rather, where these ideas and assumption intersect a more nuanced understanding and conceptualisation can be achieved. This necessarily involves a reframing of established literatures, normative assumptions and approaches.

1.1 The Rise of the Smart City

Although the concept of the smart city has been in existence since the mid-1990s (Hollands, 2008; Harrison & Donnelly, 2011; Neirotti *et al.*, 2014), its origins and use are subject to different interpretations. It is claimed that the smart city idea originated from the '*New Urbanism movement in the USA of the 1980s and...the concept of the technology-based intelligent city*' (Söderström, Paasche & Klauser, 2014, p.310). An alternative view is offered through the legacy of the 'Connected Sustainable Cities' project (Mitchell & Casalegno, 2009), which showed how technological innovation can enhance opportunity, equity and cultural creativity in urban areas. This led to city planners designing 'creative cities' where policy interventions revitalised derelict spaces into creative clusters and where the opportunity and conditions were provided for creative industries to flourish (Hall, 2000; Scott, 2006; Pratt, 2010). Kitchin (2014) describes a key feature of the smart city as being the development of a knowledge economy, involving a combination of ICTs and human capital, a point reinforced by Meijer and Thaens (2016), who emphasise the importance of combining social structures and new technologies in order to realise urban innovation. Since the late 2000s, discourse around the term smart city has been increasingly influenced by large IT companies (Lee and Lee, 2014; Shelton, Zook & Wiig, 2015), and IBM adopted the trademark 'smarter cities' in 2011 (Söderström, Paasche, & Klauser, 2014). Subsequently, many multinational IT companies have sought to be involved in the transformation taking place around delivery of public services and renewal of city infrastructure (Hollands, 2015). Smart cities are also synonymous with many other connected terms, such as the intelligent city, the information city, the digital city and the virtual city (Batty, 2013), and these terms are often used interchangeably (Albino, Berardi & Dangelico, 2015). What they share is a positive perspective

concerning the transformational potential of technology and the benefits to society that can accrue from their use.

1.2 Defining the Smart City

Conflicting views on the concept of a Smart city are reflected in the difficulties experienced in attempting to find a suitable definition: *'The label smart city is a fuzzy concept and is used in ways that are not always consistent. There is neither a single template of framing smart city nor a one-size-fits-all definition of smart city'* (Nam & Pardo, 2011, p.283). The application of the term 'smart' to a city, or to its constituent elements, such as smart economy, smart mobility, smart environment, smart people, smart living, smart governance, etc. (Lee, Phaal & Lee, 2013), does not necessarily mean that there will be equanimity of interventions, allocation of resources, or equality of opportunities to all citizens, neighbourhoods and spaces: *'Whatever it means for a city to be 'smart', it is also readily apparent that not all spaces of the city will be equally smart, meaning that smart cities will privilege some places, people and activities over others'* (Shelton, Zook & Wiig, 2015, p.15). The normative assumptions around the beneficial aspects of a smart city, including its 'self-congratulatory nature' should be challenged, as should the assumption that new technology will deliver this transformation (Hollands, 2015, p.62). New technologies are central to the smart city vision and play a critical role in shaping service provision and also in providing new opportunities for greater participation by citizens in public policy, decision making and the co-production of services (Schaffers *et al.*, 2011; Meijer & Bolivar, 2016). The extent to which these initiatives are truly smart, or simply the rebranding of existing eGovernment policy and services, is open to question.

1.3 The Sustainable Smart City

The focus on the sustainability aspect of smart cities has been gaining traction in recent years, due in part to projected population levels in urban areas (Albino, Berardi & Dangelico, 2015) and a growing concern about climate change. Increasing population growth places pressure on a city's ability to manage waste, natural resources, air pollution, traffic, infrastructure and governance (Chourabi *et al.*, 2012). In this respect, cities are increasingly required to reflect on, consider and design sustainable futures. The concept of the SSC has grown due to five main developments: (1) globalization of environmental problems (climate change and decline in biodiversity); (2) urbanization (rise in the numbers of people living in cities); (3) sustainable development (managing urban environments); (4) ICTs (embedded in everyday life); and, (5) smart cities (the transformative application of ICTs in the public sector) (Höjer & Wangel, 2015, pp.334-337). Smart solutions involving the use of new technologies are increasingly being sought in response to these pressures and are contributing to the rise in the currency of the concept of the SSC (Höjer and Wangel, 2015), with an underlying belief that new technologies will contribute directly to a more sustainable future. The emergence of the SSC also identifies a role for active citizenship as a critical success factor to achieve sustainable outcomes: *'The primary way in which sustainability is to be achieved within smart cities is through more efficient processes and responsive urban citizens participating in computational sensing and monitoring practices'* (Gabrys, 2014, p.32). Sustainability is directly embedded in the concept of the smart city (Chourabi *et al.*, 2012; Batty *et al.*, 2012; Hancke, Silva & Hancke, 2013) and increasingly the term the SSC is being used as a label to capture the new technologically advanced city environment.

At the core of this article is an exploration of how SSCs are conceptualised and understood. This includes an analysis of the different components of a SSC and how they interact and have evolved together over time. The three dominant components explored here are (1) sustainability, (2) new digital technologies, and (3) citizen participation, as illustrated in Figure 1. In public policy terms, and in the rhetoric around smart cities, these three components appear to be compatible, despite each being associated with its own logic, public policy and academic literature. In this article, we argue that these three perspectives - the sustainability perspective, the technological perspective and the participatory perspective - all promote certain features and characteristics, and that whilst they may be conflated within the term the SSC, they are actually rarely completely compatible.

Insert Figure 1 here.

The remainder of the article is split into 7 main sections. Section 2 sets out the methodology and research supporting the development of this article. Sections 3, 4 and 5 set out the key components of the sustainability, technological and participation perspectives, including their key focus and institutional logic. Sections 6 and 7 set out a new SSC conceptualisation that captures the divergence and compatibility of the different perspectives, and highlights the conditions required for a 'true' SSC - namely where the three perspectives discussed here overlap and are fully intertwined. The final section, section 8, offers concluding comments.

2. Methodology

The research presented in this article derives from the *'SmartGov: Smart Governance of Sustainable Cities'*¹ research project. SmartGov is a four year (2015-2019) collaborative

¹ SmartGov research project website, URL: <http://smartgov-project.com>

transnational multi-disciplinary research project on the value of ICTs for engaging citizens in the governance of sustainable cities. Funding Councils in the United Kingdom (ESRC); Netherlands (NWO), and Brazil (FAPESP) have co-funded the research. The three project partners are Utrecht University (Netherlands), University of Stirling (United Kingdom) and Fundação Getulio Vargas, Sao Paulo (Brazil), working alongside practitioners in the case study cities of Utrecht (Netherlands), Glasgow (UK) and Curitiba (Brazil). The research undertaken in this project has critically examined governance arrangements in smart city contexts and has challenged traditional models of service delivery dominated by eGovernment perspectives. The research brings new insight to the role of citizens and service users in the processes that co-create value and the co-production of service delivery and policy formulation. Core design elements of the project are its international comparative approach, the importance of contextual and institutional factors, in-depth case study research, and extensive practitioner involvement in research design and implementation.

The focus of this article is not the practice of delivering smart governance, nor differences in the way technologies are used in different local and institutional settings, although both are significant, instead the focus here is on teasing out what it meant by the term ‘the smart sustainable city’. In this respect, the article emerges primarily from the literatures reviewed and concept building associated with the SmartGov project, and also the exploration of these concepts through in-depth case study research. An extensive literature review was conducted by the three research teams in 2016 using a shared literature review template and protocol. The review focused on three key areas: (1) technology, including smart cities, eGovernment and co-creation, (2) engagement, participatory mechanisms and practices, especially where they used new digital technologies (such as eParticipation), and (3) sustainability, in relation

to urban governance practices. The review used an iterative approach using online search engines and through which further articles were identified through snowballing techniques (Baltar & Brunet, 2012; Periera *et al.*, 2016). In total, over 150 academic articles were selected for analysis. Of these approximately 80% were published between 2010 and 2016, with most authors and cities studied being located in Europe. The literature reviewed included academic articles and books, government and practitioner reports, media publications and other 'grey' matter. The articles selected for detailed analysis differed in a number of ways. They adopted different methodological approaches, from case studies, to surveys, theory building, and web analysis, etc. They also differed in the technologies being explored, ranging from living labs, citizen observatories, eParticipation applications, as well as a number of other digital initiatives.

Issues relating to governance were embedded in many of the articles, particularly in the discourse on eParticipation and eDemocracy. Some of the articles had a specific focus on a particular form of governance, usually civic engagement, and many of the articles promoted the value of technology for urban development and enhanced service provision. Very few articles addressed the combination of sustainable urban governance using citizen-centric smart city technologies directly. From this systematic literature review a conceptual model of smart city governance emerged based on three academic bodies of work and practitioner agendas, notably around sustainability, new technology and citizen engagement. The literature review was augmented by an in-depth qualitative case study examination of the transformation of Glasgow into a 'Future City' (Leleux and Webster, 2018), which included an assessment of the contribution of smart city technologies and data collection and monitoring processes designed to facilitate citizen engagement and sustainable governance practices.

The case study included examination of three micro-cases: (1) 'Energy Innovation'; (2) 'Active Travel' (cycling and walking), and (3) 'Connected Glasgow' (city data, city innovation, MyGlasgow App, city engagement using new technologies); site visits, and 30 in-depth semi-structured interviews. This case study approach allowed the research team to test and explore the validity of the conceptual model presented in this article. In the following section the first of the three core perspectives, the sustainability perspective, is set out.

3. The Sustainability Perspective: Delivering Environmentalism

The contemporary discourse on sustainability is widely acknowledged to have been influenced by the report of the World Commission on Environment and Development (Brundtland, 1987). The Brundtland report raised awareness amongst policy-makers and practitioners of their societal responsibilities to ensure that the needs of the present day would not compromise the needs of future generations (Baker *et al.*, 2012 p.3). Against a backdrop of massive urban population growth sustainable development became a policy priority at local, national and supra-national levels, the latter involving the World Bank (Kahn, 2014), the United Nations (United Nations, 2015), and the European Union (Lazaroiu & Roscia, 2012). The European Union considers the concept of the smart city as one that supports environmental sustainability, through the use of innovative technologies, for example in the reduction of greenhouse gas emissions (Ahvenniemi *et al.*, 2017). Sustainability and environmentalism have both grown as social phenomena in their own right, as evidenced in academic approaches developed in the 1990s through the work of Gray (1992), Elkington (1994) and others. Elkington's (1994) seminal work on accounting for sustainability, introduced the term the 'triple bottom line' (TBL), which has been used as a method for introducing greater corporate social responsibility for organisations with regards to

accounting for their impact on sustainability (Henriques & Richardson, 2013). The TBL has been referred to as '*economy, social (people, citizenry), and environment*' (Kondepudi & Kondepudi, 2015, p.10) and as a method for full cost accounting for individual and collective social, economic and environmental sustainability (Larsson & Grönlund, 2014). The 'full cost accounting' approach involves the addition of '*technology*' as a fourth category to Elkington's model, which is used as a basis for improving the analysis of sustainability in eGovernment applications (Larsson & Grönlund, 2014, p.139). Underpinning the sustainability perspective, in both policy and academic discourse, is a link between sustainable practices and their positive impact on the environment.

Of particular interest here is the development and merging of separate phenomena - smart cities and sustainable cities - into what is now referred to as the SSC. Critical factors in the formation of the SSC concept include the pressures of growing urbanization, population growth, management of finite energy resources and the potential offered by new digital technologies to offer smart solutions to these challenges. The role of the private sector has had considerable influence as business approaches have drifted from Smart city discourses into SSC solutions and applications (Deakin, 2013). Kitchin (2015) makes a strong case for the commercial interests of the private sector being the reason why private sector IT companies have changed their corporate language from a managerially-focused approach, to an inclusive and citizen-centred one, with more emphasis on social, economic and environmental challenges. Ahvenniemi *et al.* (2017) in their analysis of the differences between sustainable and smart cities, and their respective performance monitoring systems, point to the limited use of environmental indicators, compared to the more extensive use of economic and social indicators, when analysing smart city frameworks. They argue for the integration of

sustainability and smart city frameworks and make a case for the use of a more accurate term, SSC (instead of smart cities).

As a response to deficiencies in measuring 'smartness' Al-Nasrawi, Adams & El-Zaart (2015) propose a multi-dimensional model that is context sensitive, whilst Hara *et al.*, (2016) propose KPIs based on well-being and the quality of life. The United Nations Economic Commission for Europe provide a strategic vision for improving sustainability of communities and offer their own definition of an SSC: '*A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects*' (United Nations, 2015, p.3). In relation to the empirical research conducted for the SmartGov project around Glasgow's transformation to a 'Future City' (Leleux and Webster, 2018 p.167) it is evident that sustainability issues were central to the framing and delivery of the initiative. Here the 'smart future city' was designed to be more energy efficient and environmentally sustainable. For example, The Energy Innovation Demonstrator encouraged the adoption energy saving practices, such as smart meters, and this was allied to the development of less polluting transport policies across the city, the adoption of energy efficient LED lighting and electric car charging stations². Here the aspiration was for a greener more resilient city.

² Glasgow City Council's sustainability strategy can be found at, URL: <https://www.glasgow.gov.uk/index.aspx?articleid=18318> [accessed on 20 June 2019]

The sustainability perspective plays an important role in shaping Smart cities. It provides a focus on environmental issues and a normative belief structure that organisations and services should be environmentally friendly, and that embedding environmental considerations into societal structures and processes will lead to sustainable societies. This is the institutional logic at the heart of this perspective and which permeates public policy and service delivery in urban environments. The normative assumptions and core arguments underpinning the sustainability perspective have dominated political and policy agendas around smart cities and encouraged cities to pursue environmentally friendly policies. Inherently allied to this perspective, but at the same time competing with it for primacy is a perspective focusing on the transformative potential of new digital technologies, especially in relation to the more efficient use of scarce resources.

4. The Technological Perspective: Transformative Potential of ICTs

At the heart of the smart city vision is the notion that new technologies can be utilised to transform the way that services are delivered and citizens live their lives. In this respect, new technology is the engine room of the smart city phenomenon. The rhetoric around technological potential is extremely positivist and very deterministic. This is shaped by the main actors involved, the technological companies wanting to sell their 'kit' and municipalities attempting to sell the concept to make life better, healthier and more sustainable for their citizens. Technology and data is being used as the core of a powerful argument about transforming society for the better (Nam & Pardo, 2011; Angelidou, 2015). Tensions that may exist where new technologies interact with traditional forms and structures of democratic decision-making are underplayed in this vision. Meijer (2017, p.2), for example, provides a theoretical model of the relationship between technology and urban governance, exploring

the complexities around the interface between the 'political community of citizens and urban data infrastructures'.

The transformative potential of ICTs is well recognised and has been credited with facilitating a 'digital revolution' and a new social order often referred to as the 'Information Society' (Castells, 2011). Public policy and services have not been immune to this revolution and have harnessed the characteristics of new ICTs to deliver new and enhanced public services, often referred to as eGovernment, or eGov (Taylor & Webster, 1996). Here it is argued, that new information flows, embedded in new ICTs allow for the delivery of new electronic services that are more timely, personalised, commoditised, more accessible, integrated and more cost efficient (Heeks & Bailur, 2007). At the heart of this vision are information flows and how these flows are changing society, including in the 'Information Polity' (Bellamy & Taylor, 1994). Municipal decision-making has traditionally followed a vertical and arguably bureaucratic hierarchy (Bonsón *et al.*, 2012), and municipalities operating within established decision-making structures, have often interacted with historically recognised groups operating within already established neighbourhoods and policy domains. The proliferation of social media and other new digital technologies has opened-up the possibilities for municipal engagement. New 'virtual' and often previously unrelated 'communities' can be created, where there are no pre-determined or spatially-defined geographical boundaries, or indeed a 'sense of place' which might connect them (Albino, Berardi and Dangelico, 2015). Traditional political and decision-making processes are therefore being supplemented and simultaneously undermined by new information flows facilitated by new digital technologies.

Whilst there has been the widespread adoption of digital technology to deliver eGovernment services and electronic citizenship, often utilising the Internet, there are still concerns about how to apply universally acceptable criteria for assessing how these technologies will improve public services for all parties involved, namely, policy-makers (elected representatives), service providers (practitioners) and service users (citizens). Successful transition from paper-based systems to ones dependent upon new technology may not be universally beneficial, particularly for disengaged citizens, the elderly, and those who do not possess basic Internet skills. Successful deployment of new digital systems may be judged using criteria determined by practitioners and IT companies, rather than by the citizens who are consuming and using services. The assessment criteria of the impact of eGovernment initiatives becomes a central issue to understanding the rhetoric which surrounds the deployment of new electronically-based public services. Kumar *et al.*, (2007, p.73) argue that citizens are the focal point of eGovernment, and that citizens' user characteristics need to be properly understood, including perceived risks, data security, privacy, and their perceived control over the processes involved. Scott, DeLone & Golden (2016) emphasise the importance of the value realised by citizens in the engagement process, and point to the impact which new social media technologies can have by changing the ways in which users interact with organisations, and the potential for the co-creation of value between citizens and governments. Meijer & Bekkers (2015) refer to eGovernment as being an important driver for the modernisation of the public sector, where the use of new digital technologies can re-design existing information processing and communication practices to achieve better output, especially in relation to electronic service delivery.

Empirical evidence from the Glasgow case study of the SmartGov project highlights the centrality of technology to the development of the Glasgow Future City. All of the Demonstrators that formed part of the initiative had a technological component. For example, the analysis of 'Connected Glasgow' (Leleux and Webster, 2018, p.168) shows how a large number of data sets were made publicly available, alongside a number of App's and a city 'dashboard' to provide citizens with access to information about services in the city. The focus of these initiatives was either to adopt technology in order to replace outdated infrastructure and facilities (for example new LED lighting) or to streamline an existing administrative process, including eGov applications (Leleux and Webster, 2018).

The technological perspective is central to the smart city phenomenon. It focuses on the potential benefits deriving from technological deployment and promotes a belief structure that the optimal use of technology will lead to better societal outcomes, including more sustainable societies. At the core of the technological perspective is the idea that technologies are the vehicle for 'transformation', that they encourage efficiency and the better use of scarce resources. Here the institutional logic is that technology can be harnessed for the good of society. Alongside the technological oriented paradigm is a more specialised literature and set of ideas associated with citizen participation and engagement, realised with or without the mediation of technology. This perspective offers up an alternative logic to the sustainability and technology perspectives and promotes the idea that engaged active citizenship will lead to more sustainable societies. The vision competes with and sits alongside the two dominant perspectives already discussed.

5. The Participation Perspective: Citizen Engagement

As smart city agendas have evolved it has become apparent that sustainable approaches to public policy and services should include some form of citizen engagement. In this perspective citizen participation is important because it ensures that services meet the requirements of local needs, and that it provides legitimacy for the institutions involved in policy and service provision. In this respect, the resilience and sustainability of local communities and institutions demands some form of citizen engagement, including in smart city environments.

It has long been recognised that involving citizens in decisions about public services and policy can foster legitimacy for services and can ensure that provision is tailored to needs of local communities. Arnstein (1969) introduced a hypothetical model of differing 'levels' of citizen engagement and participation ranging from tokenism to full citizen engagement, where there was a redistribution of power and control over decision-making processes. Yang and Pandey (2011, p.880) emphasise the importance of effective citizen participation to democratic governance, focusing on the values which can be achieved: *'fostering citizenship values; enhancing accountability; improving trust in government; maintaining legitimacy; achieving better decisions; building consensus'*. Michels & De Graaf (2010, p.488) also emphasise the positivistic democratic effects of citizen participation on the quality of democracy, for example through participatory projects where there is the potential for giving citizens some influence, and *'inclusion, civic skills and virtues, deliberation and democracy'*.

There have been long-standing claims that traditional eGovernment approaches have focused more on service delivery than on meaningful citizen engagement and democratic participatory processes (Bekkers & Homburg, 2005). Furthermore, not only has the focus

been on service delivery at the expense of citizen engagement, there is also limited evidence that services have been improved or that cost savings have been on the scale imagined (Bekkers & Homburg, 2005; Norris & Reddick 2013). Government bodies, public agencies and ICT-providers have not delivered change on the levels anticipated and it has been argued that new digital technologies have reinforced existing power inequalities and relationships (Chadwick & May, 2003; Bannister, 2010). Part of the reason for these adverse outcomes is due to service providers having values that are at odds with citizens and that it is difficult to find common ground on which to move forward (Bannister, 2010). One of the drivers for the creation of eGovernment was *'to create a more citizen-focused government'* (Reddick & Turner, 2012, p.1), where the emphasis was on citizens' values including trust, leadership, fairness of treatment and competence, leading to the concept of the citizen-centric approach (Nam & Pardo, 2011). Nevertheless, it is apparent that with the advent of smart cities the extent to which engagement is developing and diversifying is now being seen on more sophisticated levels than previously witnessed. This transformation is attributable, in part, to the role which new digital technologies are playing in changing public life (Hollands, 2015), and the Internet in particular, which promises levels of co-production on an *'unprecedented scale'* (Linders, 2012).

Delivery of, and access to, public services and information through electronic methods, reflect the growing opportunities for citizens generated by the Internet, social media and smart devices (Morgeson, VanAmburg & Mithas, 2010, Clarke, 2013; Ellison & Hardey, 2014). This transformation has been facilitated by the normalisation of electronic communication in society, through mobile phones, social media and the increasing prevalence of online transactions. In the smart city context there is a plethora of new *'apps'* and platforms to

report potholes, arrange the collection of garden waste and building materials, or to reserve a seat at a municipality-owned theatre (Höffken & Streich, 2013). Here it is argued that improved levels of trust between citizens and government, and greater transparency, can be achieved through improved levels of citizen use of social media in government activities (Song & Lee, 2016), alongside an increasing expectation from citizens that access to e-services and e-information will be available on a 24/7 basis (Lofstedt, 2012). Whilst there is general agreement about the transformative potential of new technology in relation to service delivery, less clear is the extent to which these technologies provide opportunities to genuinely engage and empower citizens to participate in local affairs: *'If e-government is to be truly transformative of government in terms of citizen engagement and participation, then e-government must be citizen-centred in its development and implementation'* (Jaeger & Bertot, 2010, p.4).

Citizen engagement and participation in the smart city or SSC may be influenced by the ability or motivation of citizens, depending upon their affluence and education, to articulate their views. Some studies have shown that citizens who live in more affluent areas and are better educated may be more inclined to engage (Hastings *et al.*, 2014). The co-production literature also suggests that citizens are more inclined to engage when they are given opportunities to address issues which are of particular to their own neighbourhood (Alford, 2009). Driskell (2017) offers the view that children and young people are frequently excluded from decision-making when it comes to matters concerning their city or neighbourhood, even in relation to local issues where they are likely to know more than the policy-makers. He argues that children have a legitimate right to be regarded as active and valued partners, and to ignore their views can jeopardise the 'social, economic and environmental quality of communities

and neighbourhoods' in the development of policies for poverty reduction, increased equality and social cohesion. Successful outcomes, in terms of citizen engagement and participation, could be defined as both greater levels of participation, and improved public services and policy. However, any assessment of what constitutes 'success' may depend upon the ability of municipalities and governments to incentivise citizens to engage and participate. There will have to be meaningful devolution of some aspects of municipal/central government decision-making apparatus, to a more decentralised and citizen-centric model, in which there will be benefits and rewards for both parties, in an environment of reciprocity (Webster & Leleux, 2018). In relation to the empirical research conducted in Glasgow for the SmartGov project it is evident that the Glasgow Future City Demonstrator offered citizens opportunities for enhanced engagement with public policies and services. This took the form of technologically mediated consultation and discussion and more radical use of citizen social media data. Webster and Leleux (2018) offer up for a full account and analysis of the technologically mediated participatory mechanisms used in the Glasgow Future City programme.

The participation perspective promotes active citizenship and the need for citizens and service users to be involved in policy and decision-making and the co-production of services. It provides a focus on the formation of effective engagement mechanisms and has a normative belief structure that more citizen engagement will lead to better services and policy. In the smart city, this perspective encourages the use of innovative citizen engagement and co-production mechanisms (Webster & Leleux, 2018). Here the institutional logic is that better and more citizen engagement will lead to more sustainable societies and social structures. These three perspectives, competing yet interrelated, highlight the multi-faceted nature of the SCC concept and how conceptually the term and its associated practices are

driven by different logics and arguments. Whilst it is analytically possible for these perspectives to be compatible, in practice a smart city initiatives may well be more closely aligned to one perspective than the others. The points to an empirical research agenda where smart city initiatives are assessed and categorised by their institutional logics and defining components.

6. Perspectives and Institutional Logics

Framing the development of SSCs around three perspectives, each with their own institutional logic (Friedland & Alford, 1991), demonstrates the multifaceted nature of the concept and that the origins of the SSC are embedded in pre-existing perspectives with their own activities, organisations, processes, beliefs and norms. Each of the three perspectives identified here - the sustainability, technological and participation perspectives - are absolutely core to the development of SSCs, each has its own logic, promotes certain beliefs and is independent of the others. They each tell us something about how the world around us should be organised and how to deliver sustainability effectively. In many ways, the SSC can be seen as the convergence of these three perspectives in an integrated approach to urban development. Table 1 captures the three perspectives discussed here with a particular focus on their core messages and entrenched beliefs. Presenting the perspectives in this way allows us to untangle the foundations of SSCs and to think about how the different constituent parts fit together.

Insert Table 1 here

7. The Sustainable Smart City: A Multifaceted Concept

Conceptualising the SSC around a series of dominant perspectives highlights the multifaceted complex nature of the concept, and in particular that SSCs are not just focused on environmental sustainability, they are equally concerned with new technologies and citizen participation. Sustainability here is not just about the environment, it is also about organisational and societal resilience, stability and longevity. The relationships between each of the perspectives are complicated and are shaped by diverse institutional and local settings. Of course, deconstructing complex social phenomena into a simple heuristic device may aid understanding, but it will not be a complete picture of practice or reality. Under scrutiny, the relationships are neither simple, and nor can they be easily compartmentalised. Instead, as smart cities have evolved, the relationships between the perspectives have become more dependent upon each other and are fused together.

Figure 1, presented earlier in the article, offers a visual representation, in the form of a Venn diagram, of the three constituent perspectives that make up the SSC. Illustrating the SSC in this way highlights the simultaneous independence and interdependence of the three perspectives, and that the SSC is constituted from its core elements. The 'real' SSC is at the heart of the Venn diagram where the institutional logics of the three perspectives converge. This is where the demands of the institutional logics and belief systems are satisfied and coexist. For many smart cities this convergence cannot be assumed and it may be the case that many smart city applications meet the needs of two of the perspectives but not the third, illustrated on the Venn diagram by 'dual' overlaps. This may be where a particular perspective is entrenched in a particular local setting and is resistant to the competing logics of the other perspectives. In this way it is possible to map and assess the characteristics of an individual

smart city application to see if it meets the criteria of a SSC application. In this practical sense the perspectives and any smart city application have to be rooted and understood in their societal and institutional contexts. This line of argument is evidenced by the many demonstrator projects embedded in the Glasgow Future City programme (Leleux and Webster, 2018). Whilst they all had components relating to new technology, only some focussed on sustainability issues directly, usually through a reduction in resource use and energy consumption, and only a few directly engaged citizens in the formation of public policy and service delivery. There were notable exceptions, where demonstrator projects satisfied all three perspectives, such as the Cycling and Walking app, where sustainability was realised by encouraging healthy lifestyles and citizen data was used to inform and shape public policy relating to cycle lanes. However, the overall view is that most of the demonstrator projects were focussed on the development of new digital technologies for the purpose of enhanced service delivery and consequently a more efficient use of resources (Leleux and Webster, 2018).

8. Concluding Discussion

The SSC offers substantive change in citizen-state relations, it points to new relations being formed around the use of new technologies with an aspiration that local governance and services will be enhanced at the same time as facilitating more sustainable futures. Transition is being assisted by greater citizen-awareness of sustainability issues, for example in recycling initiatives and the adoption of home smart meters. There are sizeable challenges for citizens and policy-makers if widespread citizen engagement in the SSC is to be realised, particularly in connecting with 'hard to reach' groups which may be disconnected from mainstream society, and societal values such as sustainability. Academic literature shows that engagement

works better when citizens are incentivised to participate and when there is a redistribution of power to communities (Alford and Yates, 2015). New mechanisms of engagement mediated by new digital technologies are helping this transformation, for example; hackathons, living labs, maker spaces, gamified public services, 'open data' and crowdsourcing (Webster & Leleux, 2018). However, it must be recognised that these new mechanisms may appeal to 'niche' groups in society which have specific and perhaps transient 'local' interests, and that there will not necessarily be potential for the scalability of these mechanisms to reach wider participatory audiences. Leleux and Webster (2018) in their case study of the city of Glasgow's transformation to become a 'future city' offer new insight to the academic discourse on how smart governance is being created in a city where a significant number of citizens (approaching 50%) live in deprived areas.

The SSC is a multifaceted and contested concept which at its core has a number of competing intertwined discourses and logics. The move from smart cities to SSCs signals the importance of integrating sustainability in governance approaches that utilise technology and citizen engagement. Ahvenniemi *et al.* (2017) point to a 'gap' in the use of environmental indicators when assessing Smart city frameworks and make a strong case for the use of the term SSC, instead of smart cities. Sustainability approaches tend to focus on environmentalism at the expense of sustainable societies, whilst technological solutions have concentrated on functionality and service improvement, at the expense of citizen participation. Conceptualizing the SSC in this way suggest that smart city aspirations are likely to be constrained if they are driven by technological solutions. If they are merged successfully with citizen engagement mechanisms and sustainable practices, then it is possible to imagine governance and organisational structures that will facilitate sustainable futures. True

sustainability and hence the SSC is realised at the nexus of technological use, citizen engagement and sustainable outcomes. It is an aggregate concept which takes into account the sustainability aspirations of a city and the importance of new digital technologies to achieve sustainability goals (Höjer & Wangel, 2015). This is a more nuanced conceptualisation of the smart city, one that emphasises the human and organisational aspects of smart cities, yet at the same time recognises the primacy of technology and sustainability.

In this article, we have reframed the concept of the sustainable smart city to place a greater emphasis on three established bodies of thought which underpin its development and emergence as a commonly used narrative. Here, we argue that these bodies of thought, which we refer to as 'perspectives' - sustainability, technology and participation - whilst appearing to converge around the term the SSC actually have a degree of independence and as such are supported by different literatures, norms and values. We have shown at the convergence and intersection of the three perspectives, that the SCC concept is complex, multifaceted, and that SSCs are not merely concerned with environmental sustainability, as they are connected equally to new technologies and citizen participation. Presenting SSCs in this way also reveals how inherently interdependent they are, and tellingly, it should not be assumed that smart city initiatives which claim to be 'smart' can in fact demonstrate the convergence of all three perspectives, as they may only be able to meet the needs of two of them.

Each perspective tells us something about how organisations and societies *should* be organised, and more importantly that we should not assume that the perspectives are compatible or mutually exclusive. Conceptualising the SSC in this way draws our attention to how the different components 'fit' together in a particular organisational context and

whether one perspective is more entrenched and dominant than the others. At a normative level, this conceptualisation of the SCC also suggests that in order to secure long-term sustainable futures the norms and beliefs of each perspective have to be balanced and satisfied. Of course, this is an empirical question requiring further investigation.

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Table 1. Sustainable Smart Perspectives

Perspective	Emphasis & Logic
The Sustainable Perspective	<ul style="list-style-type: none"> • Focus on the climate and environmentalism • Organisations / services should be environmentally friendly • Establish mechanisms and processes to ensure sustainable outcomes • Environmentalism leads to sustainable societies
The Technological Perspective	<ul style="list-style-type: none"> • Focus on potential of new technology (ICTs) • Promotes the deployment of ICTs • New ICTs will lead to enhanced services • Technology will improve society
The Participation Perspective	<ul style="list-style-type: none"> • Focus on citizen participation / engagement • Promotes new mechanisms for participation • Greater levels of participation will lead to better public services and policy

Figure 1. The Real Sustainable Smart City

