

Article

Delivering Smart Governance in a Future City: The Case of Glasgow

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Abstract

In 2013, Glasgow City Council received significant funding to develop innovative smart city applications, including the delivery of new electronic public services and the co-production of governance. This case study examines the processes that underpin the ways in which the ‘Future City Glasgow programme’ delivered ‘smart governance’, in the context of a regenerating post-industrial city. We assess the contribution of smart city technologies and data collection and monitoring processes designed to facilitate citizen engagement and sustainable governance practices. The Future City Glasgow programme ran from 2013–2015, and included the Open Glasgow project, and ‘Demonstrator Projects’ of: Energy Efficiency; Intelligent Street Lighting; Active Travel; and, Integrated Social Transport. Opportunities arose from these demonstrators for developing co-production and legacy initiatives. The case study provides insight into the ways in which citizens and local communities in Glasgow have been engaged in governance processes. This engagement has taken place via traditional and innovative smart city technologies, and in particular in relation to policy formulation, service design and delivery. It finds that the co-creation of governance is shaped by vested interests, that engagement is fragmented and partial, but at the same time new technologies, social media and shared learning opportunities offer innovative new ways for *some* citizens to influence local governance.

Keywords

citizen engagement; co-production; eGovernment; Future City Glasgow; Glasgow; post-industrial city; smart governance; sustainability

Issue

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1. Introduction

The city of Glasgow, population 615,000 (Glasgow City Council [GCC], 2018a), is the largest of the seven cities in Scotland, and lies at the centre of the much larger Glasgow city-region of approximately 1.8 million people (GCC, 2018b). In common with many other cities in the United Kingdom (UK) Glasgow aspires to become a ‘smart’ or ‘future’ city (GCC, 2011). In 2012, GCC won a UK-wide ‘Future cities demonstrator competition’ (United Kingdom Government, 2017). The competition, which was funded in part by IBM, was organised by the Technology Strategy Board (Technology Strategy Board,

2013), now Innovate UK (a non-departmental body which is part of the UK Government). Thirty cities took part in the competition and £24 million was awarded to GCC as the overall competition winner. The concept of the proposal which GCC submitted was to undertake a single city demonstrator project known as ‘Future City Glasgow’ (GCC, 2018c). The demonstrator would provide evidence of benefits to the economic performance, quality of life, societal cohesion, and environmental performance (including sustainability targets) of Glasgow. The infrastructural legacy of the 2014 Glasgow Commonwealth Games was cited as a strong example of Glasgow’s commitment to realise its potential as a lead-

ing innovative municipality. The Future City Glasgow programme (FCGP) ran from February 2013 to August 2015, and a team of around twenty-six personnel was established to manage all aspects of the programme, the key components of which were:

- the creation of an integrated Operations Centre, bringing together traffic management, security, and public space CCTV;
- construction of a City Data Hub to allow for easier access to open datasets (health, socio-economic, demographic and other information);
- individual demonstrator projects to facilitate innovation in: Active Travel (cycling and walking); Social Transport; Energy Efficiency, and Intelligent Street Lighting; and,
- investment in physical infrastructure to support integration of city systems.

This case study considers the extent to which there has been transition in Glasgow towards a ‘smart’ or ‘future’ city through the FCGP and from ongoing smart legacy projects, such as the transformation programme (GCC, 2015a). The analysis provides an opportunity to assess whether or not the city of Glasgow is delivering ‘smart governance’ to its citizens, and if so, how is this being achieved? By smart governance, we mean the opportunities which citizens have had to become involved in local decision-making processes through engagement (Gabrys, 2014), participation (Chourabi et al., 2012), co-production (Alford & Yates, 2015), and, the co-creation of value (Osborne, Radnor, & Strokosch, 2016). Importantly, we assess where these practices have occurred through the use of smart technologies, including social media. Table 1 sets out a timeline of key dates and activities in the evolution and development of Future City Glasgow.

Governance of the FCGP was provided through the FCGP Demonstrator Delivery Board and Executive Steering Group, and partnership infrastructures were established across the public, private and academic sectors (GCC, 2015b). The final evaluation report on the FCGP was submitted to GCC in 2017 (mruk, 2017), and analysis of this is provided at Section 4. Our case study findings reveal extensive use of online consultation mechanisms to solicit the views of citizens, on a wide variety of proposals affecting their neighbourhoods. These include, Facebook, Twitter and dedicated project web-pages to inform citizens of current events and projects. Citizens have been encouraged to participate in discussion, for example cycling groups have been engaged to shape cycling infrastructure investment via crowdsourcing techniques and apps. Schoolchildren were involved in using ‘code’ to improve their ICT skills and all latter-stage primary school children in the city were provided with a tablet (Paterson, 2017). Although a range of mechanisms have been used, online participation levels appear to be relatively low and further empirical investigation is required to determine the reasons for this. It would be

useful to understand more about the socio-demographic composition of participating citizens, the extent of their influence and community groups’ capacity for building social capital.

The remainder of the article is split into six main sections. Section 2 sets out the methods underpinning the research presented here, with specific reference to the ‘SmartGov’ transnational research project. Section 3 provides more information about the literature review conducted for this research. Section 4 evaluates three of the FCGP projects (Energy Efficiency, Active Travel and Open Glasgow). Section 5 discusses the FCGP in relation to how Smart governance is being delivered. Section 6 provides some concluding comments.

2. Methodology

The research underpinning this case study derives from the SmartGov ‘Smart Governance of Sustainable Cities’ research project, 2015–2019. SmartGov is a four-year collaborative transnational multi-disciplinary project, examining the value of information and communication technologies (ICTs) for engaging citizens in the governance of sustainable cities. The project involves research teams from the Netherlands, UK and Brazil. The research methodology incorporates a ‘systematic’ literature review, a comparative analytical framework, semi-structured interviews, practitioner engagement (co-production) in research design, case studies and networking and capacity building as a co-production technique. The SmartGov project considered legacy outcomes of the FCGP in terms of citizen engagement in using ICTs, sustainability and governance.

In September 2016, the University of Stirling approved the ethical structure for the empirical investigation to be carried out by SmartGov research team. This included proposals to undertake semi-structured interviews with officers (employees) and elected members (councillors) of GCC, and citizens and citizens’ groups within Glasgow. The interviews involving officers were agreed jointly with GCC on the basis of the officers’ prior involvement with the various Demonstrator projects of the FCGP. The interviews with elected members were arranged in accordance with their allocated responsibility through appointed Convenerships and committee memberships within the council. Interviews with citizens and citizens groups were organised in relation to their known participation in either the FCGP, or its legacy projects. The SmartGov research team has assisted GCC in the co-production of potential citizen-engagement mechanisms regarding the H2020 ‘RUGGEDISED’ innovative energy renewables project (EU, 2018), and GCC has participated in the annual virtual conferences of the SmartGov project, which has involved all three academic partners associated with the project and practitioner partners from the three respective case study cities. Several meetings have been held with officers from GCC to discuss the delivery of the different stages of the empirical work,

Table 1. Timeline: Future City Glasgow.

Date	Organisation	Activity
June 2012	Technology Strategy Board	Report announcing 'Future cities demonstrator' competition for large-scale demonstrator project funding.
14 November 2012	Glasgow City Council	Final Report to Technology Strategy Board proposing the establishment of a 'Glasgow City Management System' to manage the Future City Glasgow Demonstrator project.
January 2013	Department for Business, Innovation and Skills	UK Government Press release announcing Glasgow as the winner of the Technology Strategy Board's 'Future Cities Demonstrator', with £24m GBP to 'make Glasgow a city of the future'.
20 March 2013	Glasgow City Council	Report to Sustainability and Environment Policy Development Committee confirming Glasgow's successful bid for funding of £24m from the Technology Strategy Board (TSB) Future Cities Demonstrator competition.
26 November 2014	Glasgow City Council	Report to Sustainability and Environment Policy Development Committee advising on progress with the publishing of over 370 datasets on the OPEN Glasgow portal, and how these datasets might be analysed to assist with service planning.
26 November 2014	Glasgow City Council	Report to Sustainability and Environment Policy Development Committee providing an overview of the Future Hacks (Hackathon) events that took place as a component of the Future City Glasgow Programme.
18 March 2015	Glasgow City Council	Report to Sustainability and Environment Policy Development Committee with a progress update on the Future City Glasgow programme, including: the creation of an integrated operations centre; construction of a City Data Hub to enable easier access to open datasets, and showing the value of an integrated programme of digital activity in support of Glasgow's Strategic Plan 2012/17.
July 2015	Glasgow City Council	Overview of project reporting within the Future City Glasgow programme, summarising progress to date on the build phase of Open Glasgow and each of the demonstrators (<i>Energy Efficiency; Integrated Social Transport; Intelligent Street Lighting; Active Travel</i>) including recommendations to undertake further workstreams and proceeding to Phase 2 demonstrator phase.
October 2015	Innovate UK	Report on the impact of the £34.5m future city challenge, including focus on Glasgow's achievements, and how cities across the UK could take advantage of technology to be better places to live, work and play.
16 March 2016	Glasgow City Council	Report to Sustainability and Environment Policy Development Committee on GCC's role in the ERDF programme: 'Scotland's 8th City—The Smart City'.
2017	mruk	'Building a Future City': Future City Glasgow Evaluation, prepared for Glasgow City Council.

to ensure its practical value and the co-production of value. At the time of writing, historical research concerning the Future City Demonstrator has been completed, along with a series of detailed case studies and site visits. To date, 25 interviews have been completed. Ongoing empirical research is taking place around a number of legacy initiatives.

In relation to this article and its focus on smart governance and citizen engagement, three projects from FCGP were selected for detailed investigation: Energy Efficiency; Active Travel; and, Open Glasgow. The literature review pointed towards a potential gap in our

understanding of smart governance in three overarching and connected themes, citizens and ICT engagement (Albino, Berardi, & Dangelico, 2015), governance (Meijer & Bolívar, 2016), and sustainability (Hara, Nagao, Hannoe, & Nakamura, 2016). A case study analytical framework, emerging from the SmartGov project literature review, was used to analyse the three FCGP projects and is illustrated at Table 2. This framework is used in this article to describe and assess each case in relation to the three core themes of ICT engagement, governance and sustainability—the three core components of smart governance.

Table 2. Case study framework of analysis.

Case Study Selection	Overarching Themes		
	Citizens and ICTs	Governance	Sustainability
Energy Innovation (FCGP Energy Efficiency)			
Cycling and Walking (FCGP Active Travel)			
Connected Glasgow (FCGP Open Glasgow)			

3. Literature Review

Academic literature about the impact of Glasgow becoming a smart city is scarce and under-developed, which is perhaps understandable given how recently the FCGP concluded. Buck and While (2017, p. 502) argue that the core challenge facing policy-makers in Glasgow and elsewhere is to move the discourse from ‘the attractive but elusive imaginaries to tangible intervention’. Calzada (2017) identifies a strong commitment to partnership working, although concerns are noted about the benefits of making data publicly available and the vagueness of the transformation concept. O’Connor, Gurguc and van Dam (2016) point to the ‘data-centric’ strategy adopted for driving improvement and the low user utility of apps such as ‘MyGlasgow’. Contemporary studies of Glasgow have tended to focus on how the city is addressing the continuing challenge of emerging as a post-industrial city, for example in relation to urban regeneration (Boyle, 1990; Lever, 2017), social capital (Walsh et al., 2015), the possible existence of a detrimental ‘Glasgow effect’ on health (Walsh, Bendel, Jones, & Hanlon, 2010), the geography of deprivation (Pacione, 2013), housing tenure mix (McIntyre & McKee, 2012), the working class experience of gentrification (Paton, 2016), and sustainable transport and active travel (McCartney, Whyte, Livingston, & Crawford, 2012). There is very little contemporary research published on the governance of smart technologies and citizen engagement in Glasgow.

The SmartGov project literature review examined over 150 academic articles, assessing what is already known about smart governance using technologically mediated citizen-centric models of engagement, such as hackathons, living labs, maker spaces, gamification, the use of ‘open data’, and crowdsourcing (Webster & Leleux, 2018). Contemporary academic perspectives on smart cities/governance were reviewed in relation to urban growth and development (Albino et al., 2015), new urbanization environmental sustainability (Zygiaris, 2012), capacity-building within communities relating to quality of life and participation in society (Caragliu, Del Bo, & Nijkamp, 2011), participation by citizens in the governance of cities (Lombardi, Giordano, Farouh, & Yousef, 2012), and theories of social capital (Lin, 2017). Meijer and Bolívar (2016) argue that smart city governance

is not a technological issue, but rather a complex process of institutional change, and that further research should focus on the critical e-Government success factors, and build upon sophisticated theories of socio-technical change. The literature review was used to identify the elements and components of ‘smart’ governance, to develop analytical models, and to create frameworks to guide the project’s empirical research. Allied to academic literature, ‘grey’ matter, in the form of reports, minutes and media publications (etc.) were collected in relation to the Future City programme and its component case study initiatives. These documents provide an important evidence base for the cases studied and are referenced throughout this article.

4. Glasgow Future City Projects

Two of the four core Demonstrator projects at the heart of the Glasgow Future City project and the Open Glasgow project are explored in detail in this article using the cases ‘Energy Innovation’ (the Energy Efficiency Demonstrator), ‘Cycling and Walking’ (the Active Travel Demonstrator) and ‘Connected Glasgow’ (the Open Glasgow project). Each is presented and discussed in relation to the three core smart governance themes of ICTs and citizens, governance and sustainability.

4.1. Energy Innovation

Investment in innovative new technologies and new practices to achieve reductions in demand for energy and CO₂ emissions are sizeable challenges for the city of Glasgow, and have involved citizens, community organisations and the private/public sectors. Citizen engagement has been problematic due to the 34% of households that are estimated to be living in fuel poverty (GCC, 2016a) and which may be faced with the stark choice of whether to ‘eat’ or ‘heat’. In 2010, GCC established ‘Sustainable Glasgow’ to address the challenges of climate change and set a target to reduce the city’s CO₂ emissions by 30% by 2020 (GCC, 2017a).

Building on the work carried out as part of the Energy Efficiency Demonstrator, GCC was successful in 2016 with a bid to undertake the ‘RUGGEDISED’ EU Horizon 2020 research project (EU, 2018). This project will test,

implement and accelerate the smart city model across Europe. The 'RUGGEDISED' project, which includes the Glasgow Smart Street, has many innovative elements. These include the introduction of a roof-mounted solar PV canopy, ducted wind turbines, EV charging points, district heating proposals, and the use of stored renewable energy. GCC aims to lead the deployment of innovative technologies, helping to improve the quality of life for citizens by reducing CO2 emissions, improving air quality, reducing fuel poverty, improving infrastructure, and for developing opportunities to develop social capital within the city via citizen engagement.

The sub-projects which formed the FCGP Energy Efficiency Demonstrator are presented in Table 3 and

included proposals for commercial and domestic properties, and the use of integrated technology/data for citizen behaviour change. Core themes which emerged from the analysis of Energy Innovation, included the active participation of citizens in energy-saving practices, and the existence of a technical competence gap which impeded the achievement of real behavioural change amongst citizens. From interviews with GCC officers, it was evident that the behavioural change tool proved to be too complex for citizens to use effectively. This meant that the intended roll-out of the tool across Glasgow was not viable. GCC also interacted with citizens via community hubs, corresponding directly to citizens and using iPads for undertaking surveys, etc. GCC analysis found

Table 3. Energy innovation.

Individual Projects	Citizens and ICTs	Governance	Sustainability
1. Virtual Building Modelling/City Energy Model (development of an Energy app. for enhanced understanding of energy consumption).	The energy app was to be used by citizens, however, it did require some technical knowledge which limited participation.	Security requirements related to personal data, and development of Privacy Impact Assessments where identifying the data controller/data processor, limited the use of data collected.	The online virtual building tool and energy app for citizens and businesses, provide advice on actions which citizens and businesses can use to make their buildings more energy efficient.
2. Demand-Side Management Systems (installation of remote monitoring equipment in ten Council buildings to assist load shifting, peak shaving).	This project did not involve citizens.	Limited opportunities for engagement and participation of stakeholders in the objectives.	Controlling of electrical demand will lead to reduced energy consumption and CO2 levels.
3. Housing Tenement Retrofit (installation of sensors in 60 homes (of different types) to better understand the impact of retrofit—savings in energy, but potentially increased moisture levels).	Citizens had no direct control over the sensors, but were consulted on the trial, and with the help of Housing Associations, most were keen to participate.	Limited opportunities for engagement and participation of stakeholders in the objectives.	Database was developed of building types, insulation systems, to better inform future insulation decision-making.
4. Renewables—Photovoltaic (PV) Mapping (opportunities to host renewables such as PV on derelict sites).	The mapping exercise did not involve citizens.	Limited opportunities for engagement and participation of stakeholders in the objectives.	Improved coverage of PV renewable technologies will reduce electrical demand on the main grid system.
5. Behavioural Change (citizen engagement) (Better understanding of citizens' views and concerns around energy, and development of a gamified engagement tool, specifically aimed at schoolchildren).	'Gamified' engagement tool developed to shape behaviour of Glaswegians and schoolchildren to allow a 'trickle-down' effect amongst parents and families leading to reduced energy usage.	The requirement for some technical knowledge to use the app, and the lack of 'instant' results, impeded the development of the reach of this initiative.	Providing accessible and engaging platforms to access energy information, may encourage citizens to make changes to their energy consumption behaviour.

that the 'digital divide' in some areas did not relate to technical competence. Instead, some citizens whilst being technically competent did not have an iPad, laptop, or fixed Internet connection in their home and were therefore unable to participate in the technologically mediated governance mechanisms.

4.2. *Cycling and Walking*

The promotion of active travel for citizens involving cycling and walking for transport and leisure is a Scottish Government objective (Transport Scotland, 2018). Benefits of increased levels of cycling and walking are cited as easing congestion, reducing noise pollution, cutting exhaust emissions, improving health and cost savings. In the context of the city of Glasgow, these potential benefits have particular resonance, given the city's relatively high levels of poor health and wide variations of mortality between neighbourhoods (Walsh et al., 2010). GCC has supported cycling and walking in Glasgow, through for example the 'Connecting Woodside' project which aims to deliver world class walking and cycling infrastructure (GCC, 2018d). The FCGP Active Travel Demonstrator encouraged citizens and cycling/walking groups to engage with GCC about infrastructure initiatives, through the creation of new cycling and walking apps developed alongside an education website tool. The 'Glasgow Cycling App' was launched in November 2014, cycling organisations promoted the app through their networks and actively engaged with GCC by supplying recommendations about the upgrading of routes and proposals for establishing new ones. Marketing took place through peer-to-peer networks and through social media. As of January 2016, there had been 1,200 downloads on iOS and Android and 1,393 routes had been captured with a total distance of 9,138 km.

GCC's vision is to increase levels of cycling for leisure, sport and as a mode of transport. On 3 March 2016, the Executive Committee of GCC approved the city's Strategic Plan for cycling 2016–2025, and agreed to commit £2m for each of the next three years on the basis that match-funding is provided by other key stakeholders. Further investment by the GCC of £3m was announced in June 2016 for cycling, walking and road safety projects across the city. Funding of this new investment would be supplied by five public sector partners: GCC, Strathclyde Partnership for Transport; Sustrans Scotland; Paths for All; and, Transport Scotland—Walking Safer Streets Fund (GCC, 2016b). The sub-projects of the Active Travel Demonstrator are reviewed in Table 4. Core themes which emerged from the analysis of Cycling and Walking included active citizen participation and the co-design of new cycling and walking routes, improved infrastructure which could lead to healthier lifestyles for cyclists and walkers, the creation of new apps which has led to improved conditions for knowledge transfer capabilities, and successful community/business networking.

4.3. *Connected Glasgow*

Whilst GCC claimed to have one of the most popular council Twitter feeds in the UK, with over 26,200 followers (GCC, 2011), a survey by Citizens Advice Scotland (Anderson, Gijón, & Whalley, 2015) found clear links between age, deprivation and Internet use in Glasgow. The survey showed that 42% of residents had never used the Internet and almost half had no computer or Internet connection in their home. A core feature of Glasgow's aspiration to be a 'future city' was to increase citizen-engagement through the use of innovative new technologies. This presented unique challenges for Glasgow, as in comparison to other Scottish cities, it had the greatest percentage of households living in poverty (approaching 50%) (The Scottish Government, 2018).

The Open Glasgow project included proposals for empowering communities to allow them to engage in local affairs and decision-making, and to encourage citizens to contribute data 'rich with local knowledge'. The Open Glasgow project had a diverse range of sub-projects, including Hackathon events (Future Hacks) being held on the topics of public safety, energy, and health and transport. The creation of the Glasgow Operations Centre, provided an integrated multi-public service command and control centre for monitoring Glasgow's security, traffic management and public space CCTV systems. Open datasets were published so that citizens could access service and administrative data, and the creation of a MyGlasgow Smartphone app allowed citizens to access information and provide comments to GCC. The sub-projects of the Open Glasgow project are reviewed in Table 5. Core themes which emerged from the analysis of Connected Glasgow included the challenge of how to create sustainable engagement mechanisms which allow increasing levels of citizen awareness, engagement and participation, and how to improve data literacy skills, and reduce digital exclusion. Formal reporting by GCC and case study research for the SmartGov project suggests that whilst a number of data sets are now accessible there has been limited public interest in using them. This may be because of limited awareness of what data is available or because of limited data skills in how to access, process and use such data. Research also points to the Hackathon mechanism as a productive means to generate interest in using data and designing service solutions amongst small expert technical communities. The MyGlasgow app was also deemed a success and was widely used by Glaswegians for a variety of purposes, including providing feedback on local public policy initiatives.

5. Discussion

Unlike rapidly expanding cities in Africa, South East Asia and South America (Hoornweg & Pope, 2017), the drive to find sustainable smart solutions to urban problems in Glasgow has not been fuelled by increasing migration

Table 4. Cycling and walking.

Individual Projects	Citizens and ICTs	Governance	Sustainability
1. Mapped Current Infrastructure (for active and sustainable travel using spatial analysis).	This sub-project laid the groundwork for future online engagement with citizens.	Encouraging citizens to communicate with GCC using online tools, proved to be an effective engagement mechanism.	Promotion of healthier lifestyles and behaviour change through active travel, and improved quality of life is a GCC objective for Glasgow's citizens.
2. Development of 'Glasgow Walking App' and 'Glasgow Cycling App'.	Glasgow citizens actively participated in the co-design of new and upgraded cycling and walking routes, supplying information through online means.	The infrastructure investment decisions which GCC made were influenced by citizens supplying their views online, making this a tangible example of 'Smart governance'.	Encouraging the adoption of sustainable forms of active travel, has made Glasgow more pedestrian and cyclist friendly.
3. Creation of Administration Portal (to allow groups to upload and edit content for the apps.).	Engagement of citizens took place at the development phase of the technologies involved.	The development of the technologies used was carried out following stakeholder engagement with health organisations, universities, schools, and passenger transport bodies.	Promotion of healthier lifestyles and behaviour change through active travel, and improved quality of life is a GCC objective for Glasgow's citizens.
4. Integration of Online Mapping Tools to the developed apps.	Engagement of citizens took place at the development phase of the technologies involved.	Information generated from the apps has been used for academic and public health studies.	Promotion of healthier lifestyles and behaviour change through active travel, and improved quality of life is a GCC objective for Glasgow's citizens.
5. Administration Platform for innovative app development.	Engagement of citizens took place at the development phase of the technologies involved.	The development of the apps for cycling/walking has helped local businesses create networking opportunities and benefited the digital economy.	Knowledge transfer from the cycling/walking apps could see communities developing their own apps, and potentially helping to improve active lifestyles and wellbeing.

of the rural population from the surrounding city-region into the city. Instead, there have been declining population levels within Glasgow from a peak of over 1 million inhabitants in 1950, to approximately 615,000 today (GCC, 2018a). The focus for urban and societal change in Glasgow has been driven by its transition from a post-industrial city and dependence on shipbuilding and heavy engineering, to a 'future' high-tech city. Compared to other cities in Scotland, Glasgow has a disproportionately high number of disadvantaged communities (approaching 50%), which presents particular engagement challenges (The Scottish Government, 2018). Glaswegian's have the lowest life expectancy in Scotland and

the lowest levels of home broadband access. GCC has produced detailed neighbourhood profiles of the city, allowing GCC to make more informed decisions about the targeting of resources (GCC, 2018a).

The aim of the research presented here is to look beyond conventional eGovernment approaches, which have had a focus on the efficient delivery of services, and to look instead at how such technologies can be used to engage citizens (Meijer, 2012; Meijer & Bolívar, 2016). If citizens are interested in what is happening in their community, then there may be a greater chance of them participating in local decision-making. New technologies and new forms of engagement offer the pos-

Table 5. Connected Glasgow.

Individual Projects	Citizens and ICTs	Governance	Sustainability
1. City Data: City Data Hub (world-leading scalable big data platform); City Data Hub Integration; Open Data Catalogue; Open Datasets Published; Community Area Partnership Map; Open City Dashboard (online personalised dashboard presenting real time information).	Development of the ‘MyGlasgow’ smartphone app for citizens to report environmental and community issues. Over 400 open datasets published by the GCC and partner organisations.	Innovative technologies made available with the intention of informing and engaging citizens, creating closer relationships, while encouraging participation in local decision-making.	Sustainability benefits arising from the transition from paper-based to online systems are still to be quantified.
2. City Innovation: MyGlasgow App (smartphone app allowing residents to report issues to the City); Hackathons; Sensor Store; Open Data Publication Processes.	Four Hackathons involved 239 citizens, 192 hours of activity, 33 teams, 30 mentors, 22 judges, and 1030 tweets for #hackglasgow. The number of datasets presented to each ‘Hack’ increased from 18 to 143.	GCC considered the hackathons to be an effective tool for engaging citizens, business start-ups and SMEs, and for stimulating innovation.	One of the apps developed from the Future Hacks, ‘Health Walks Plus’, has a strong link to the Active Travel Demonstrator, by directing citizens to nearby walks with physical markers on the pavements.
3. City Engagement: Open Glasgow Website; Engagement Hub; Infographics; Case Study Videos; Day in the Life Video; Future Makers; Coder Dojo; Future Maps; Open Glasgow Social Media Presence; City Observatory (engagement space to analyse data using a range of technologies)	Numerous opportunities for citizens to use new technologies to engage with GCC. A challenge is to increase levels of digital literacy and reduce digital exclusion.	Citizens, including schoolchildren, can access information and contribute their views through dedicated project webpages, Facebook, Twitter and other online means.	Better informed citizens now have more information available about how they can take part in community life, and lead healthier and more active lifestyles.

sibility of creating the necessary conditions for smart governance, co-production and the co-creation of value. Elsewhere, Webster and Leleux (2018) have argued that such smart city governance opportunities are reliant on mutual reciprocity and trust. The Economic and Social Research Council (ESRC) funded integrated Multimedia City data project, co-ordinated at the University of Glasgow (Urban Big Data Centre, 2015), provides useful survey information on Glasgow citizens’ attitudes and behaviours relating to civic participation, transport, education, computer and mobile phone usage, and sustainability. It finds that active citizenry is most achievable in relation to local issues, as opposed to city wide initiatives and policy.

The FCGP has been heralded as a world leader in developing smart city solutions. In a relatively short period of time, between 2013 and 2015, a range of smart city initiatives were designed, commissioned, implemented and evaluated. This has been a significant undertaking and has required support at the highest levels within GCC. Glasgow has now entered a post-Demonstrator phase with legacy systems, new practices, and more information being generated than was previously available. This

has created opportunities for using data analytics for evidence-based decision-making and for the re-design and improvement of services. Many Demonstrator sub-projects have now become ‘mainstream’ core Council activities, including the gathering of information from intelligent street lights to reduce energy costs and carbon emissions. The increased targeting of active lifestyles has been supported through cycling and walking infrastructure investment. The development of innovative energy renewable solutions is ongoing as part of the H2020 ‘RUGGEDISED’ project. There are improved opportunities for citizens and businesses to communicate and engage with GCC online, through the MyGlasgow App, the walking app and via Facebook, Twitter and online consultation platforms. GCC has taken a holistic approach to creating a Future city by concentrating on several themes in the FCGP simultaneously—improving the quality of life, economic performance, societal benefits and the environment.

The legacy of FCGP is now being used to address fuel poverty, which is increasing in the city, by improving energy efficiency in homes and creating ‘space’ for new research into emerging renewable technolo-

gies. The multi-functional and multi-technology Glasgow Operations Centre is heralded as one of the best in the UK and has successfully integrated systems and practices from across a number of public service agencies. The active travel objectives are being adopted in Council regeneration projects, such as the proposal to create a pedestrian and cycle bridge over the M8 motorway, connecting the largely deprived and excluded Sighthill community to the city centre (GCC, 2016c). Traditional methods for citizens to communicate with GCC still exist, whether this is by telephone, letter, in person, or through elected members who represent the views of the local community. In 2017, the conditions for smart governance have been substantially improved through a new city charter for consultation (GCC, 2017b). Additionally, examples from the Demonstrator projects highlight there are more opportunities afforded to citizens for accessing information online and the use of apps and social media to engage, participate, co-produce and co-create with GCC. Whilst it is evident that the capacity for smart governance in Glasgow has been enhanced it is not clear how effective these mechanisms have been or the extent to which citizens have been empowered.

6. Concluding Comments

This case study of smart governance in the city of Glasgow involved an examination of the FCGP through an assessment of some of its key projects, using a mixed-methods research approach including document and literature review and semi-structured interviews. The contribution provides new knowledge to the academic discourse on the FCGP, its legacy outcomes, and how smart governance is being created in a city where a significant number of citizens live in deprived areas.

The FCGP project engaged citizens through a variety of mechanisms and included ‘coding for kids’ and the roll-out of a plan to provide every latter-stage primary schoolchild in Glasgow with a tablet device to help bridge the data literacy gap (Paterson, 2017). The importance of combining socio and technological structures to achieve co-production between government and communities is central to creating a smart city with legacy outcomes. In Glasgow this has been evidenced by the implementation of new smart services and the introduction of technologically mediated governance mechanisms. This has been achieved in a relatively short space of time and has only been realised with the availability of key resources and high-level political and administrative leadership.

At the outset of this article we raised the question of whether ‘smart governance’ is being delivered in Glasgow through its smart city initiatives? It is important to note the continuing and positive role played by political leaders in shaping the strategic direction of the city’s transformation. In 2011, under a Labour Party Administration, GCC launched a ‘Fifty Year Vision for the Future: Future Glasgow 2011–61’ (GCC, 2011), followed in 2012, by the bid to undertake the FCGP. In

2017, despite a change in Administration to the Scottish National Party (SNP), plans to deliver the Future City continued. Additional challenges arose due to personnel changes in the senior management of the FCGP at approximately the mid-way stage in its lifespan. These changes presented particular difficulties in delivering the project within a very tight timescale, given that GCC had committed to spending the entire project sum of GBP £24m within a twenty-four month period. It is also evident that GCC has actively encouraged citizen engagement through social media, online surveys and dedicated community and project webpages. Citizens can now contribute their views online about major policy issues, including suggestions on budget priorities, and options on how to make savings to meet future projected budget shortfalls (GCC, 2018e). Regarding youth engagement, GCC has encouraged participants to use an online tool where they can register with other users and exchange views (GCC, 2018f).

The legacy outcomes of FCGP include new ways of engaging citizens, SMEs and corporate partners, and new ways of using data analytics to inform policy and re-design services. Smart solutions are being sought to meet challenges in infrastructure, water management, bridges, city centre footfall, pollution, traffic and parking. Work is taking place with vulnerable citizens and a key challenge of how to engage and empower such citizens has become a Council priority (O’Hagan, 2018). GCC has committed to using the legacy of the FCGP to deliver a ‘Transformation Programme’ where digital and data are seen as key enablers. A centre of excellence has been created for using data analytics and visualisation, where data is used as an evidence-base for decision-making. Through these initiatives GCC are trying to bring about cultural change where service re-design and open innovation can take place. In the short-term, the future or smart city ambitions of GCC are continuing through further funding bids. The ‘RUGGEDISED’ H2020 innovative energy renewables EC research project (EU, 2018) is utilising pioneering work carried out through the FCGP Energy Efficiency demonstrator project. Other legacy outcomes from FCGP include GCC acting as a lead partner in the Scottish Cities Alliance and the submission of a successful bid to the ERDF programme to develop Scotland’s 8th city—the ‘Smart City’. The 8th city is a virtual city and has a focus on two key themes of ‘data’ and ‘technology’, including increasing citizen engagement through mobile technology and social media (GCC, 2016d). There are points of interest which may be drawn from a study of Glasgow as a ‘future’ city which might be relevant to other cities in Scotland and beyond. First, Glasgow shares close similarities with many other cities in Scotland, in terms of its socio-demographic composition, as evidenced through the Scottish Index for Multiple Deprivation (The Scottish Government, 2018). Here, lessons can be learned about how to use technologically mediated engagement practices to reach different parts of the citizenry. Second, is the existence of a

'digital divide' in Glasgow, evident from the low levels of Internet access (Anderson et al., 2015). This divide is likely to exist in other cities and mechanisms and practices to reach excluded elements of the population can be shared with other cities. The Scottish Cities Alliance and GCC's position as lead body for developing the Smart city allows GCC the opportunity to share its experiences of developing the Future City with other public agencies. From the research conducted for this study it is apparent that the FCGP created opportunities for citizen engagement via smart city technologies. This allowed citizens to contribute to local decision-making and influence local policy and services in a number of areas. This was achieved alongside traditional participatory mechanisms and in particular, processes associated with local representative democracy. One major challenge remains, that is for policy-makers and practitioners to reach-out and attract the interest and participation of disadvantaged communities.

Although the Glasgow Future City Programme successfully piloted a number of smart city initiatives, further empirical work is required to evaluate the efficacy of the approach to 'reaching' disadvantaged communities and for realising the full potential of smart governance. To date, a series of technologically-led smart city initiatives have been integrated with existing engagement mechanisms. These have demonstrated that an evolution to smart governance is possible, but that the key ingredients of political leadership, new financial resources, technological expertise and citizen and community engagement must be evident.

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Conflict of Interests

The authors declare no conflict of interests.

Research Data Policy

The research conducted for this article complies with the principles of the Economic and Social Research Council's Research Data policy, and will be deposited in the University of Stirling's DataSTORRE repository follow-

ing completion of the project. The research also complies with the Data Management Plan and Ethics approval granted by the University of Stirling, specifically related to the SmartGov research project.

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