Actually-existing Smart Dublin: Exploring smart city development in history and context

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Abstract

How does the 'smart city' manifest itself in practice? Our research aims to separate substance from spin in our analysis of the actually-existing smart city in Dublin, Ireland. We detail how the smart city has been brought into common discourse in the Dublin city region through the Smart Dublin initiative, examining how the erstwhile 'accidental smart city' until 2014 has been rearticulated into a new vision for Dublin. The chapter is divided into two parts. In the first part we map out the evolution of smart urbanism in Dublin by tracing its origins back to the adoption of neoliberal policies and practices and the rolling out of entrepreneurial urbanism in the late 1980s. In the second part, we detail the work of Smart Dublin and the three principle components of current smart city-branded activity in the city: an open data platform and big data analytics; the rebranding of autonomous technology-led systems and initiatives as smart city initiatives; supporting innovation and inward investment through testbedding and smart districts; and adopting new forms of procurement designed to meet city challenges. In doing so, we account for the relatively weak forms of civic participation in Dublin's smart city endeavours to date.

Keywords:

Smart cities, urban futures, technological innovation, place, governance, participation

Introduction

Initial empirical research concerning the development of smart urbanism focused largely on smart city rhetoric, the marketing materials of companies promoting smart city products and services, and the policy and visioning documents of lobbying bodies and city administrations (e.g., Soderstrom *et al*., 2015; McNeill 2015). This was accompanied by academic critique concerning the underlying political economy of the smart city that countered its supposedly pragmatic, non-ideological, commonsensical vision for future city-making (e.g., Greenfield 2013; Kitchin 2014; Vanolo 2014; Datta 2015). However, as Kitchin (2015) and Shelton *et al*., (2015) detail, until recently little in-depth studies had been directed towards how the smart city was unfolding on-the-ground in actually-existing initiatives, both in terms of locally-grounded rhetoric and materially manifested technological deployments (cf. Cugurullo 2017; Trencher and Karvonen 2017; Wiig 2017). As this book attests, this situation has been rectified to some degree in the last couple of years, with researchers starting to unpack and analyse specific initiatives and the socio-economic contingencies and consequences of smart urbanism in particular locales.

Our contribution to understanding the 'actually-existing smart city' (Shelton *et al*., 2015) has been to focus attention on the unfolding of the idea of the smart city and its supporting administration and initiatives in Dublin, Ireland and Boston, United States, conducted as part of the Programmable City project (http://progcity.maynoothuniversity.ie). This large project has involved conducting several hundred interviews and ethnographic fieldwork over a five-year period, producing smart city technologies (e.g., the Dublin Dashboard), and being actively involved in smart city initiatives (for example, conducting the smart lighting scoping study, running 'challenge' workshops, and being a member of the Smart Dublin steering group).

In this chapter, we examine how the smart city idea has been enacted through a set of smart city initiatives and brought into common discourse in the Dublin city region through the Smart Dublin programme. We chart how Dublin has moved from an 'accidental smart city' (Dourish 2016) to an articulated vision with its own projects. So successful has this re-articulation been that Dublin

was one of six shortlisted finalists for smart city of the year at the World Smart City Expo 2017. In mapping out Dublin as an actually existing smart city we identify and detail three principle components of smart city-branded activity in the city: an open data platform and big data analytics; the rebranding of autonomous technology-led systems and initiatives as smart city initiatives; and supporting innovation and inward investment through testbedding, the creation of a smart district, and adopting new forms of procurement designed to meet city challenges. We start, however, by tracing the origins of smart urbanism in Dublin and the creation of Smart Dublin.

A brief history of entrepreneurial and smart urbanism in Dublin

Dublin's path to becoming a smart city extends back much further than the creation of Smart Dublin in 2014. We would argue that its origins were in fact seeded in the late 1980s when there was a fundamental shift in economic, planning and development policy in Ireland towards neoliberal ideas and ideals. Throughout the 1980s Ireland suffered economic and political instability and crisis. Indeed, the country was relatively poor, with a weak indigenous economy and foreign direct investment (FDI) characterised by low-skilled, branch-plant manufacturing. In 1987, Ireland's GDP was 63 percent of the European Union average, making it the second poorest country in the union behind Portugal (Breathnach 1998). As result of economic instability and social hardship there was constant tension and conflict between state, employers and unions, with successive governments struggling to address high unemployment, inflation and spiralling debt, balance spending, reform taxation, and satisfy the electorate. This situation was transformed in the early 1990s by six factors: the introduction of social partnership to manage industrial relations; changes to the planning regime; the adoption of free-market principles, entrepreneurial freedoms and deregulation; strong foreign direct investment; subsidies and political support from the European Union; and the instigation of the peace process in Northern Ireland (Kitchin and Bartley 2007). These factors acted together to produce political and economic stability and encourage investment and economic growth.

3

A key factor in the revival of Dublin's fortunes was the adoption of entrepreneurial urbanism to stimulate property development and attract service-based foreign direct investment. This process started in 1986 with the initiation of new planning and regeneration policies designed to modernise and re-image key zones in the city and enhance international competitiveness (Bartley 2007). In that year, Ireland's first Urban Development Corporation (UDC), the Custom House Docks Development Authority (CHDDA), was established under new urban renewal legislation. Side-lining the local authority, central government sought to emulate a similar experiment to the London docklands by establishing an independent, single-task organisation for the purpose of rejuvenating the north-east inner city of Dublin. The CHDDA had its own planning powers, was supported by development tax breaks and exemptions, and could enter into partnership with companies to achieve its objectives (Bartley 2007). Crucially, the area was designated the site for a new International Financial Services Centre in 1987.

This entrepreneurial approach to planning and development paved the way for private companies to take an active role in shaping and delivering urban policies and projects (see MacLaran and Kelly 2014). Indeed, planning policy in general changed from a 'concern with integrated comprehensive planning for all areas within the planning authority's area of control to an approach based on planning for fewer, selected areas based on highest potential for success' (Bartley 2007: 36). In turn, local authorities were encouraged to become more entrepreneurial and business-friendly in their own operations, developing public-private partnerships with companies to deliver services, but also to drive and support entrepreneurial activity in the city. During the 1990s entrepreneurial urbanism in the city developed through a series of governance innovations. The Temple Bar UDC involved an independent agency (Temple Bar Properties) to manage the project, but the local authority was reintroduced to the process to control planning decisions. The Dublin Docklands Development Authority replaced the CHHDA in 1997 and implemented an Integrated Area Plan approach to regeneration that had to take more account of social needs and local participation (Bartley 2007). In all cases, development was designed to attract inward investment,

support business, and enhance competitiveness, with the state playing an active role in facilitating entrepreneurial activity.

This planning/property-led approach was complemented in the 2000s by the Dublin local authorities embracing the ideas of the creative city. In Florida's (2002) terms, a creative city is one that promotes an entrepreneurial approach to place-making and economic development centred on a tripartite set of policies relating to talent, tolerance, and taxation. By producing cosmopolitan, attractive places for creative workers and businesses to locate, cities could compete on the international stage for inward investment. Allied with an entrepreneurial approach to urban governance, Dublin rolled out a series of initiatives aimed at supporting creative and service industries and fostering an innovation economy, including the Temple Bar regeneration and the creation of the Digital Hub (Bontje and Lawton 2013). The Digital Hub was established in 2003 with the aim of producing a vibrant digitally-driven economy. It is managed by the Digital Hub Development Agency and housed in eight former buildings of the Guinness brewery to the west of the city centre. As well as supporting circa 90 companies at any one time (220 in total), it also houses the NDRC, a state-backed early stage investor and accelerator for tech start-up companies. It is also a key agent in local regeneration, using a public-private partnership model to redevelop and invest in local property stock. These endeavours were supported by the Creative Dublin Alliance, a collaboration between local authorities, universities and businesses, which promoted and marketed the creative sector through initiatives like Innovation Dublin. Moreover, the ideas of the creative city formed a key element of the 2009 Economic Development Action Plan for the Dublin region (DRA 2009; Bontje and Lawton 2013). The Irish Development Agency (IDA) and Enterprise Ireland both used the notion of creative place-making to drive inward investment of creative industries, particularly in the software sector, with several high-profile companies locating their European headquarters in the city, including Google, Facebook, Twitter, and LinkedIn. Dublin's dalliance with the creative city further deepened its commitment to entrepreneurial urbanism and a proactive role in involving and fostering the interests of business in urban development.

The shift to a smart city approach is the latest phase of entrepreneurial urbanism in the city, this time driven by technological solutions to urban development and encouraging a new wave of economic investment by attracting tech companies producing smart city technologies and fostering indigenous start-ups. While overlapping with the emphasis on innovation and the notion of Digital Dublin (https://digitaldublin.wordpress.com/), and leveraging on networked technologies that were being used to manage city services (such as the traffic control room and customer-relations management systems) that were subsequently enclosed within the notion of a smart city, this phase was perhaps initiated by the foundation of Dublinked – the city's open data portal – in 2011. Unlike other open data initiatives that were often framed as making city governance more transparent and accountable, Dublinked was created to try and produce an open data economy; that is, it was hoped that by making city data available companies would be able to build apps and services and create jobs in the wake of the 2008 financial crisis and its devastating effect on the country's economy (Kitchin *et al*., 2012). The data store covered planning, transport, environment, arts, culture and heritage, and other aspects of city life, including some real-time datasets. Dublinked was also significant because it was the first formal, long-term collaboration between the four Dublin local authorities that comprise the Dublin city region (Dublin City Council, Fingal County Council, South Dublin County Council, Dún Laoghaire Rathdown County Council). Importantly, Dublinked staff and the post of smart city officer for Dublin City Council, created in 2013, were active players in the creative city initiatives. Members of the steering group, such as the heads of IT, had been active in nascent smart city initiatives. As such, ideas and ethos have been carried through by the same public sector actors from earlier rounds of neoliberal city-making. Similarly, many of the private sector company and university actors active in fostering the creative city are also active promoting the smart city.

In 2014, the four local authorities decided to actively frame and coordinate its smart city initiatives through a single endeavour. Rather than create an entirely new entity, given the existing structure and smart city expertise it was decided to repurpose Dublinked into a shared unit that

encompassed the open data portal but also performed several other roles. Smart Dublin was formally launched in March 2016 but had been meeting and planning since the initial decision to found. Its mandate is to coordinate, manage, and promote smart city initiatives in the Dublin region. There is a very strong economic development function to their work, including working with companies to facilitate testbedding, running a smart city challenge-led innovation funding scheme, and supporting public-private sponsored hackathons. Given the trajectory of entrepreneurial urbanism in the city, from strategic planning to creative city to smart city it is perhaps no surprise that the new smart district is located in the Docklands SDZ (Strategic Development Zone) – colloquially known as 'Silicon Docks' and home to many global digital technology/software companies – and is actively supported and promoted by Smart Dublin working in conjunction with businesses in the area. Smart Dublin also acts as a key node in the advocacy coalition for smart cities operating in the city, liaising and working with international partners (Kitchin *et al*., 2017).

The key point from this brief history is that Dublin's path towards becoming a smart city is part of a much longer trajectory of city-making, including forms of networked urbanism (for example, see Breathnach 1998 and Dodge and Kitchin 2000 who detail how networked digital technologies were reshaping the space economy of Dublin in the 1990s), and the unfolding of a neoliberal urban political economy in Ireland (see Kitchin and Bartley 2007; Kitchin *et al*., 2012; MacLaran and Kelly 2014). As such, rather than simply mapping out smart city initiatives in a city, or their most recent history, it is important to trace out how they are rooted in larger and longer political and economic processes and ideologies.

The actually existing smart city

Having outlined the evolution of the smart city concept in Dublin from its origins in entrepreneurial urbanism, creativity, and local enterprise programmes like Digital Dublin, and the concomitant technological modernisation of services, we now proceed to examine how it is being enacted as the actually existing smart city. By analysing how smart is performed, we wish to draw together the

various technological cultures at play in the city and their interactions, thereby noting how technological change is driven by the city's position as the anchor point for foreign direct investment and local innovation networks.

Open data platform and data-driven applications

As already noted, Dublinked is the open data repository for the four local authorities in the Dublin city region. The origins of Dublinked are rooted in the confluence of a number of initiatives. The original proposal was first muted by the Creative Dublin Alliance as a suggestion for the Dublin Regional Authority's 2009 economic strategy. The idea was to produce an open data portal as a regional response to the unfolding economic crisis and the need to stimulate innovation and economic development. In part this was building on the initial success of the Fingal Open Data site, the first open data repository by a local authority in Ireland. The spark to transform from an initial idea to funded project was the process of attracting IBM's global smart city research team to Dublin. As well as the usual development grants and aid provided through the IDA, the city sought to provide data that IBM could use to develop new products. However, providing the data to a single company might have been construed as unofficial state aid, so the decision was made to make the data open for all. Relatively quickly a partnership was formed between the four local authorities who would provide the data; IBM who would supply the technology platform, and Maynooth University who would build the portal. The initiative had a strong economic development focus and the design for the portal divided the site into two separate domains: an open domain that anyone could access and a closed domain that could only be accessed by those paying a subscription fee. The open domain provided access to general datasets produced by the local authorities and other government agencies. The closed domain contained higher value datasets such as Ordnance Survey Ireland map layers and Geodirectory address databases that were usually licensed to users, but agencies and companies were willing to share with vetted users to create new products. The Dublinked portal was launched in 2011 with 30 open datasets, which increased in the

next couple of years as new datasets were made open. To encourage their usage, Dublinked ran a number of workshops and hackathons designed to produce apps and new businesses.

One initiative that sought to leverage the data was the Dublin Dashboard (http://www.dublindashboard.ie). Initiated in November 2013, the project started as a means to explore the politics and praxes of creating city dashboards by building one as part of the Programmable City project (Kitchin *et al*. 2016). Shortly afterwards, the project formed a partnership with Dublin City Council. The site sought to present the data provided by Dublinked and other sources using interactive maps and graphs. A series of modules were built that enabled users to answer a series of questions such as: How well is Dublin performing? How does Dublin compare to other places? What's happening in the city right now? Where are the nearest facilities/services to me? What are the spatial patterns of different phenomena? What are the future development plans for the city? and How do I report issues about the city? The site is one of the most comprehensive public city dashboards internationally and has recently received significant funding to undertake additional fundamental and applied research, including building virtual reality and augmented reality models for the city.

In 2015, Dublinked was incorporated into Smart Dublin and the partnership with IBM concluded. The website was transferred onto a CKAN platform, and the closed domain was discontinued. At time of writing, Dublinked contained 251 datasets about various aspects of the city. While Dublinked had some success in initiating economic development, the limited scope, quality and timeliness of the data has hindered the creation of the open data economy envisaged. Nonetheless, the initiative is seen as a vital aspect of the Smart Dublin initiative and a full review and overhaul of Dublinked, aimed at addressing its shortcomings, was initiated in late 2017 and conducted by a private start-up called Derilinks. In addition to Dublinked and the Dublin Dashboard, Smart Dublin partners have implemented a number of data-driven applications (such as Fix-Your-Street, Public-Realm Mapping, Community Maps, Dublin Economic Monitor) and have started to work with private data-rich companies (such as Vodafone and Mastercard) to undertake

data analytics aimed at better understanding the city. The aim is that over time, the city will increase its data offerings and tools to make sense of such data, and that the four local authorities will become more data-driven in terms of managing operations and formulating policy.

Rebranding of largely autonomous systems and initiatives

Prior to the initiation of Smart Dublin in 2015, few considered Dublin to be a smart city. This view was commonly held across our interview respondents, who were selected because of their alignment to initiatives commonly associated with smart city programmes and research. Moreover, Dublin did not feature in initial global smart city rankings. Instead, it was felt that smart city thinking and initiatives were highly fragmented across the local authorities and different agencies, accompanied by a piecemeal approach rather than a coordinated strategy, and lacking leadership and direction. In addition, while there were some parts of individual local authorities that were open to engagement and collaboration, as a whole the four authorities were seen as inflexible, conservative, lacking in key capacities and vision, and behind the times in both governance and technology. Nevertheless, there was a sense among interviewees that the city had deployed 'smart city' urban technologies, and held potential to become a smart city given the confluence of technology-focused multinationals and vibrant indigenous start-up community in the city.

We identified over fifty different projects and programmes in our 2015 survey of initiatives in Dublin that might be legitimately classified as fitting the profile of a smart city deployment. Many of these were institutional or support-orientated, such as accelerator programs for tech start-ups working on smart city solutions, rather than technical systems, or were pilot or research initiatives. Table 1 details 28 different, mainstreamed, operational smart city technologies used by the four Dublin local authorities to manage city services, classified using Giffinger and Pichler-Milanović's (2007) typology of smart city initiatives (although it should be noted that there is some overlap between categories). As the descriptions make clear, the systems are broad in scope and seek to address a diverse range of issues. What is clear from the table is that the city had been

procuring and developing digital technology-led solutions to urban management issues for quite some time, and in the case of the Traffic Control Room, since 1987 (coincidentally, the starting point for entrepreneurial urbanism in the city). Despite the rise of smart city rhetoric in recent years, many of systems detailed in Table 1 are still understood by their staff as domain-focused initiatives (e.g., transport, waste, economy) rather than smart city endeavours.

In many cases, the technical systems are extensive and mature. Again, with respect to traffic control the present system is a large, coordinated activity with data streaming into a control room from a fixed network of 380 CCTV cameras, 800 sensors (inductive loops), a small number of Traffic Cams (traffic sensing cameras), a mobile network of approximately 1,000 bus transponders, phone calls and messages by the public to radio stations and the operators, and social media posts, which is then processed by control room software (SCATS - Sydney Coordinated Adaptive Traffic System) to control in real-time the sequencing of traffic lights and the flow of traffic (see Figure 1) (Coletta and Kitchin 2017). This technical infrastructure has been used as a foundation onto which further 'smart' technologies can be integrated. Examples of this include the Horizon2020 project Insight ICT, and its successor, VaVel, which are local collaborations with IBM as part of a wider international European consortium that adds further algorithmic 'eyes' on city mobility. These projects have appended further data analysis functionality onto the existing SCATS implementation and conducted experiments with crowd-sourced data from a smartphone app and video analytics.

[INSERT FIGURE 1 HERE]

Figure 1: Part of the traffic control room in Dublin.

Smart Dublin has sought to corral together these various projects and rebrand them as examples of smart urbanism in Dublin. In practice this has meant little more than incorporating

them as examples in Smart Dublin's promotional material and placing the Smart Dublin office as a mediator for further enquiry. There is relatively weak operational coordination of smart city initiatives across the city, as none of the initiatives have been pulled into the managerial control or day-to-day operations of Smart Dublin aside from Dublinked. In contrast, there is now a quite well-developed narrative of Dublin as a smart city that is starting to take effect locally and internationally. In this sense, as we have noted previously (Coletta *et al*., 2017), Dublin has been transformed from an 'accidental' to an 'articulated' smart city. The articulated smart city, complete with its narrative, is directed towards a local advocacy coalition and an international network of cities competing in the knowledge economy while also, in rhetoric at least, responding to the sustainability challenges of the 21st century. The 'accidental city', in contrast, is comprised of, firstly, a broad range of largely independent and disconnected urban and national intelligence systems, and secondly, an incipient innovation-based economy seeking further collaboration and support from local and national government.

[INSERT TABLE 1 HERE]

Supporting innovation through testbedding, smart districts, and pre-commercial procurement
One of the key new roles of Smart Dublin and Dublin City Council's smart city coordinator is facilitating testbedding and establishing living labs in conjunction with local actors. A living lab is typically a spatially-delimited real-world experiment outside the confines of the traditional laboratory, where technologies can be tested against real-world conditions. Such testbeds aim to establish Dublin as a key site of experimental urbanism that will enable companies to test prototype technologies and prove market-readiness. For example, several start-ups have been provided with data and access to infrastructure in recent years to scale-up sensor-based technologies for bicycle safety (See.Sense) and footfall analysis via WiFi signals from smartphones (ThinkSmart Technologies). This enabled start-ups to build larger operations in other cities around the world

while retaining their status as Irish companies (or Northern Irish in the case of See.Sense), or less exultantly perhaps, be acquired up by multinationals scouting for new products (ThinkSmart was acquired by Cisco in 2012). Smart Dublin works in conjunction with the IDA to market and promote the country as a prime site to locate companies developing the Internet of Things and smart city technologies. It also acts as a first point of contact, aiding with identifying physical locations and negotiating infrastructure access, advising on risk and litigation, and brokering introductions to appropriate departments within the local authorities.

Given its outreach work and presence at tech events, Smart Dublin's personnel and its work are now reasonably well known within the tech-sector. However, given the limited agency of the Smart Dublin as a unit, being under the control of four local authorities and with no decision-making capacity outside of its steering group, its capability to push independently and authoritatively for technological change and experimentation is restricted (Coletta *et al.*, 2017). Therefore, Dublin City Council as the most powerful and wealthy of the four local authorities has progressed with 'coalitions of the willing' to advance specific testbeds where new technologies can be trialled. These are being created where opportunities arise, among which are the Dublin Docklands, the new Dublin Institute of Technology campus at Grangegorman, and Croke Park stadium.

The Dublin Docklands and Grangegorman sites are designated as 'Strategic Development Zones', exempt from individual planning control subject to being aligned to integrated and detailed strategic plans which incorporate physical and social infrastructure. As already noted, SDZs are a key feature of entrepreneurial urbanism and have proved an amenable entry point for testbedding smart technologies in urban environments. The Dublin Docklands is home to many technology and data multinationals, such as Google, Accenture and Facebook, as well several start-up incubators, who are keen to use their local environment to test their products and demonstrate the utility and value of smart urbanism in general. The 'Smart Docklands' formal testbed is now being prepared in terms of social organisation and stakeholder networks, access to infrastructure, and financing

(Heaphy, 2018). Croke Park is a more private venture between the stadium owners, the GAA, Dublin City University, and companies, and forms a more closed, controlled test-bed.

In addition to testbedding, Dublin has been at the forefront of rolling out pre-commercial procurement to help produce new smart city solutions and foster innovation and new company formation or new products in existing companies. Pre-commercial procurement is a means, on the one hand, of identifying new potential solutions to urban problems, and on the other, of encouraging economic development where a substantial amount of research and development is still needed to bring an idea to market. The process is challenge-led, in that the city authorities identify an issue that has long been a problem and where previous attempts to address it have largely failed. Rather than trying to pre-judge what might be a possible solution, a competition is established that invites the market to suggest possible new solutions. The solutions are then evaluated as to which are most likely to address the problem. Generally, 3-6 possible solutions are selected for seed-funding to research and develop their concept further and work on a prototype solution. After a few months, one or two of the projects are selected to receive further funds to develop their solution into a marketable product.

Smart Dublin, working with the four local authorities, has run several challenge workshops with city administration workers to identify issues that require redress. Based on the challenges identified it has then successfully applied for SBIR (Small Business Innovation Research) funds from Enterprise Ireland (the state agency responsible for developing and supporting indigenous companies) to run pre-commercial procurement schemes. SBIR operates under European Union pre-commercial procurement rules and is a pan-government, structured process, enabling the public sector to engage with companies, especially start-up companies operating in the high-tech sector. Smart Dublin is running four SBIR challenges focussed on increasing the modal share of cycling, tackling illegal dumping of waste, improving flood management, and providing assisted wayfinding. Several new start-up companies have been formed to take part in the challenges, and existing SMEs given the opportunity to expand their operations. Pre-commercial procurement is

inherently risky to both the procurer and developer as it is possible that no solution may be achieved for a given problem. However, in Dublin's case it has been deemed a success as it has acted as an economic stimulus and enhanced Dublin's reputation as a place where smart city innovation and development occurs.

Conclusion

Our aim in this chapter has been to map out the actually-existing smart urbanism being enacted in Dublin and to place the city's ambition to become a smart city into a longer historical context. As with all cities, Dublin has deployed various forms of networked technologies in its governmental regime of urban management since the 1980s. Contemporaneously, Dublin started adopting the ideologies and practices of entrepreneurial urbanism, reconfiguring its governance, planning regime and urban development to prioritise market-led policies. Initially, entrepreneurial urbanism focused on creating a new fast-track, pro-development planning system designed to stimulate property investment and attract service-based foreign direct investment. This enabled private companies to become more active agents in urban policy-making and development, and encouraged local government to become more entrepreneurial and business-friendly in their own operations, both of which are key ingredients for contemporary smart urbanism. During the 2000s, the city adopted the ideas of the creative city, taking an entrepreneurial approach to place-making and economic development that promoted the interests of creative and service industries and sought to foster an innovation economy. This phased into the era of smart urbanism, initially through the creation of Dublinked, then by Smart Dublin, in which a tech-led form of entrepreneurial urbanism is being pursued. The entrepreneurial nature of smart urbanism is well illustrated through Smart Dublin's main programmes and initiatives – an open data platform, the creation of a smart district testbed, and new forms of pre-commercial procurement – that have a strong emphasis on supporting economic development, fostering innovation and start-ups, and attracting foreign direct investment.

The emphasis on enacting a tech-led form of entrepreneurial urbanism favouring business interests and focussing mainly on realising economic development goals means that Dublin has largely ignored the views and desires of citizens, or has taken a stewardship (for citizens) and civic paternalism (deciding what is best for citizens) approach to smart city implementation (Cardullo and Kitchin 2017). The smart city challenges to date have been driven through consultation with staff from the local authorities and discussions with the tech community. Initiatives, then, are citizen-centric to the extent that they are delivered on behalf of citizens. Citizens are little if ever directly consulted in how initiatives are formulated or deployed. Indeed, in their analysis of smart citizenship in Dublin, Cardullo and Kitchin (2017) detail that across the various smart city initiatives deployed in Table 1, citizens largely play the roles of user, data-point, consumer, recipient, player and tester. More rarely are they participants or proposers, and very rarely co-creators, decision-makers, or leaders. The involvement of citizens then is to be steered, nudged and controlled; to consume, act and feedback; but not provide ideas, vision or leadership, or create their own initiatives. Their participation is thus narrowly framed in a very instrumental way. Even events such as hackathons are owned and run by companies and local government, who frame the aims and desired outcomes (Perng *et al.* 2017). The primary aim of such events is to stimulate innovation and to create viable prototypes for marketable products, and to promote the logic of smart city solutions to urban issues. Therefore, hackathons are a means to kindle and maintain business-led urban development and entrepreneurial urban governance (Perng *et al.* 2017), rather than producing citizen or community-led smart city solutions (Cardullo and Kitchin 2017).

Adding to the neoliberal ethos of smart urbanism in Dublin is a lack of strong oversight and accountability measures that open smart city initiatives to scrutiny and public debate. As we have argued elsewhere, the advocacy coalition promoting the idea and ideals of smart cities globally seem to little appreciate the need for democracy, openness and public consultation in city management and the technological solutions adopted to address urban issues (Kitchin *et al.*, 2017). This is also our impression of how smart urbanism operates in Dublin. Executive decisions to create

new programmes and procure and deploy smart city technologies are made largely outside of the democratic process and city managers green-light projects with little political, media or public oversight or feedback. Indeed, local politicians and the public have been ignored almost entirely in the formulation of Smart Dublin and the development and rollout of smart city initiatives. This is largely due to there not being a mayor or politician with responsibility for running the city; rather that is the remit of the CEOs of the four local authorities who are career bureaucrats, and such endeavours are seen as operational matters rather than strategic ones (Kitchin *et al*., 2017). It is worth noting that part of the appeal of the smart district area is that there are very few residents (<2000), many of whom are affluent and mobile, to oppose urban testbedding (the redrawn SDZ boundary in 2015 excludes more well-established residential areas to reduce opposition to planning decisions). Similarly, Croke Park is a wholly private space and has no residents.

Given the pro-market orientation of the two main political parties in Ireland, and the absence of a unitary mayor or amalgamated city region authority, it seems unlikely that an alternative model of smart urbanism will emerge in Dublin in the near future. Instead, Smart Dublin is likely to pursue a strategy that prioritises economic goals of supporting local innovation and attracting foreign-direct investment while justifying the approach through a framework of civic paternalism and stewardship. The logic and efficacy of this strategy is likely to be bolstered by the shift from an accidental to articulated smart city that has seen the city become more recognised internationally as an active site for smart urbanism and innovation. This has been a process of gaining recognition for intelligent management technologies and civic participation apps that have been retrospectively branded as 'smart', thereby responding to increasing pressure from an assertive local technology community for the city to accommodate and support economic growth. At the same time, Dublin City Council in collaboration with Smart Dublin, has moved independently to create partnerships and testbeds with little reciprocity from the other local authorities. While issues of governance will not change until there is sufficient pressure from central government, we expect that Dublin will continue to develop as a smart city in the years ahead through its maturing partnerships with the

broader research and development ecosystem and its close adherence to the momentum that has

driven economic policy over recent decades.

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References

Bartley, B. (2007) Planning in Ireland. In Bartley, B. and Kitchin, R. (Eds) (2007) *Understanding Contemporary Ireland.* Pluto Press, London. pp. 31-43

Bontje, M., and Lawton, P. (2013) Mobile policies and shifting contexts: city-regional competitiveness strategies in Amsterdam and Dublin, *Tijdschrift voor economische en sociale geografie* (TESG), 104, 4, pp 397-409

Breathnach, P. (1998) 'Exploring the "Celtic Tiger" Phenomenon: Causes and Consequences of Ireland's Economic Miracle'. *European Urban and Regional Studies* 5, 4: 305- 316.

Cardullo, P. and Kitchin, R. (2017) Being a 'citizen' in the smart city: Up and down the scaffold of smart citizen participation. *Programmable City Working Paper 30* https://osf.io/preprints/socarxiv/v24jn

Coletta, C. and Kitchin, R. (2017) Algorhythmic governance: Regulating the 'heartbeat' of a city using the Internet of Things. *Big Data and Society* 4: 1-16.

Coletta C., Heaphy L. and Kitchin R. (2017) From the accidental to articulated smart city: The creation and work of 'Smart Dublin'. Available from: https://osf.io/preprints/socarxiv/93ga5/download?format=pdf (accessed 19 June 2017).

Cugurullo F. (2017) Exposing smart cities and eco-cities: Frankenstein urbanism and the sustainability challenges of the experimental city. *Environment and Planning A* 0(0): 1–20. DOI: 10.1177/0308518X17738535.

Datta, A. (2015) New urban utopias of postcolonial India: 'Entrepreneurial urbanization' in Dholera smart city, Gujarat. *Dialogues in Human Geography* 5(1): 3-22.

Dourish, P. (2016) The Internet of Urban Things, in R. Kitchin and S.-Y. Perng (Eds.), *Code and the City*, Routledge, London. pp. 27–46.

Dodge, M. and Kitchin, R. (2000) *Mapping Cyberspace*. Routledge, London.

Dublin Regional Authority (DRA) (2009), *Economic Development Action Plan for the Dublin City Region*. Dublin: Dublin Regional Authority.

Florida, R. (2002), *The Rise of the Creative Class, and How it is Transforming Work, Leisure, Community and Everyday Life.* New York: Basic Books.

Giffinger R. and Pichler-Milanović N. (2007) *Smart cities: Ranking of European medium-sized cities*. October. Vienna: Centre of Regional Science, Vienna University of Technology.

Greenfield, A. (2013) *Against the Smart City*. New York: Do Publications.

Heaphy L (2018) Interfaces and divisions in the Dublin Docklands 'Smart District'. Programmable City Working Paper 36, *SocArXiv*. DOI: 10.17605/OSF.IO/Z2AFC.

Kitchin, R. (2014) The real-time city? Big data and smart urbanism. *GeoJournal* 79(1): 1-14.

Kitchin, R. and Bartley, B. (2007) Ireland in the Twenty First Century. In Bartley, B. and Kitchin, R. (Eds) (2007) *Understanding Contemporary Ireland*. Pluto Press, London. 1-26.

Kitchin, R., O'Callaghan, C., Boyle, M., Gleeson J. and Keaveney, K. (2012) Placing neoliberalism: The rise and fall of Ireland's Celtic Tiger. *Environment and Planning A* 44(6): 1302 – 1326

Kitchin, R., Maalsen, S. and McArdle, G. (2016) The praxis and politics of building urban dashboards. *Geoforum* 77: 93-101.

Kitchin, R., Coletta, C., Evans, L., Heaphy, L. and Mac Donncha, D. (2017, online first) Smart cities, urban technocrats, epistemic communities, advocacy coalitions and the 'last mile' problem. *it – Information Technology*

Maclaran, A. and Kelly, S. (eds) (2014) *Neoliberal Urban Policy and the Transformation of the City: Reshaping Dublin*. Palgrave.

McNeill, D 2015, 'Global firms and smart technologies: IBM and the reduction of cities' Opens in a new window, *Transactions of the Institute of British Geographers* 40(4): 562–574.

Perng, S-Y., Kitchin, R. and MacDonncha, D. (2017) Hackathons, entrepreneurship and the passionate making of smart cities. Programmable City Working Paper 28. https://osf.io/nu3ec/

Shelton T, Zook M and Wiig A (2015) The 'actually existing smart city'. *Cambridge Journal of Regions, Economy and Society* 8(1): 13–25.

Söderström, O., Paasche, T., Klauser, F. (2014) Smart cities as corporate storytelling, *City*, 18: 307–320.

Trencher G and Karvonen A (2017) Stretching "smart": advancing health and well-being through the smart city agenda. *Local Environment* 0(0): 1–18. DOI: 10.1080/13549839.2017.1360264.

Vanolo, A. (2014) Smartmentality: the smart city as disciplinary strategy, *Urban Studies*, 51: 883–898.

Wiig A (2017) Secure the city, revitalize the zone: Smart urbanization in Camden, New Jersey. *Environment and Planning C: Politics and Space*: 2399654417743767. DOI: 10.1177/2399654417743767.

Table 1: Selected smart city initiatives (28 in total) undertaken by or with local authorities in the Dublin city region.

	Name	Year initiated	Scale	Description
Smart economy (entrepreneurship, innovation)	Dublinked	2009	City	Provides access to city datasets, including some real-time data feeds.
Smart environment (green energy, sustainability, resilience)	Sonitus sound sensing	2007	Local Authorities	Network of sound sensors monitoring noise levels.
	EPA pollution monitoring	2008	Nationwide	EPA network of pollution sensors.
	Big Belly Bins	2010	Local Authorities	Networked compactor bins that use sensors to monitor levels; waste collection route optimisation.
	CODEMA + DCC energy monitoring	2012	City	Real-time monitoring of energy use in local authority buildings; publicly displayed on screens.
	Docklands 21	2015	Local Authority	Locality-based consortium seeking sustainability gains.
	Spatial Energy Demand Atlas (Codema)	2015	Local Authority	Energy use and district-heating feasibility mapping.
Smart government (e-gov, open data, transparency, accountability, evidence-informed decision making, better service delivery)	CRM workflow system	2004	Local Authority	Customer relations management system used to interface with the public and undertake workflow planning.
	Fleet Management	2010	Local Authority	GPS tracking of local authority fleets and route optimisation.
	Public realm operations map	2010	Local Authority	An interactive map that reports scheduled public works.
	Fix-your-street	2011	Nationwide	A website and app for reporting issues (e.g. vandalism, dumping, potholes) to local authorities.
	Map Road PMS	2011	Nationwide	National pavement management system for road maintenance.
	Lexicon Library	2014	Building	New build library with smart control systems and digital services.
Smart living (quality of life, safety, security, management of risk)	Map Alerter / Unfolding News	2010	Local Authorities	Real-time alerts for weather and flooding.
	Dublin Dashboard	2013	City	Comprehensive set of interactive graphs and maps of city data, including real-time data, as well location-based services.
	Smart Stadium	2015	Building	Sensor network monitoring different facets of stadium use.
Smart mobility (intelligent transport systems, multi-modal inter-op, efficiency)	Traffic Control Room	1987	Local Authority	A suite of different technologies including SCATS (transduction loops at junctions), CCTV, ANPR (automatic number plate recognition cameras), detection of breaking red lights at Luas (tram) lines, feeding into a centralised traffic control room.
	ANPR	2005	Local Authority	Automatic Number Plate Recognition for data analytics on traffic volumes, both local and passing through area.

	E-flow road tolling	2008	City	Automated roll tolling/billing using transponders.
	Dublin Bikes	2009	Local Authority	Public hire bike scheme.
	Leapcard	2011	Nationwide	Smart card access/payment for trains, buses and trams.
	RTPI	2011	Nationwide	Digital displays at bus and tram stops and train stations providing information on the arrival/departure time of services.
	Insight ICT	2013	Local Authority	Data analytics system with crowdsourcing, integrated into traffic system.
Smart people (creativity, inclusiveness, empowerment, participation)	TOG	2009	City	Civic hacking coding meetups.
	Fingal Open Data	2010	Local Authority	Local authority open data sets.
	CIVIQ / Citizenspace	2012	Local Authority	Web consultation for planning documents and other policy proposals.
	Code for Ireland	2013	Nationwide	Civic hacking coding meetups.
	Geohive	2015	Nationwide	Open spatial data website, facilitating customised maps.

Figure 1: