

Massive Data Integration for Service Gain: IoT and the Smart City

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1.0 Introduction: Setting the context

In this paper the focus is on a human perspective with respect to the digital transformation. It is very much an ongoing paper open for comment. The specific elements of interest to us here are the Internet of Things (IoT) and the development of Smart Cities - which we use here as a live experiment of how the IoT can be seen operating in a real context. We go on explore some alternative scenarios where both the IoT and the Smart City can play a part in adding a more significant public value dimension to the urban development process.

The big debates around the IoT at the present time are how to drive value from it and how to make it work better – largely from a business viewpoint. But there is fast-growing concern about how the IoT fits into the identity capture debate and whether allowing a small set of giant companies so much power in the capture of massive data through the IoT is to be unquestioned (Chaudron and Eichinger, 2018) (CCE, 2018) (Couldry and Yu, 2018) (Srnicek, 2019). These sorts of concerns have been with us for a long time - as each epoch of the information society has experienced orders of magnitude growth in the growth of data. Paul Levison, 20 years ago - writing about Al Gore's concern about the credit referencing industry and its accumulation of our personal data, could just as easily be talking about today. He was suggesting that regulation needs to move beyond principles to action: *"Calling for an "electronic bill of rights" to protect our privacy is like calling for a Declaration of Independence to protect us from invasion"* (Levinson, 1999).

However, while many of the issues (data ownership, data volumes, privacy, rights to data, and the use of data) are long-standing, their contemporary context is very different. We now face massive real-time data production, massive integration of data, and the dramatic shift in data production away from governments to the commercial sector. Data flows are global and, increasingly, security threats to our data and identity are also supra-national in their scale. Turning to the city component of our theme, whereas data in the 1970s for a city was mostly 'officially' produced, it now streams in from multiple sources - many of them in private hands. At the same time, human agency in processing the data is also shifting from people (analysts, statisticians, researchers etc.) to automated algorithms developing and being applied within the context of 'artificial intelligence' (AI). This can lead to a:

"situation of 'distributed irresponsibility' ... This would happen mainly when the damage occurs by the involvement of different agents, within a complex sociotechnical system, in which the liability will not be obvious, possibly involving at the same time the actions of the intelligent thing itself, of natural persons, and of a legal entity, all linked. This reflects a serious responsibility challenge called by some scholars as the 'problem of the many hands'". (Magrani, 2018)

'Smart' has long been a beguiling discourse for the development of cities as a way to try to use advanced technologies to cope with a concern to reduce the disadvantages of agglomeration in an increasingly complex urban setting. The argument of this paper is that, while the 'smart' concept has its undoubted successes, it needs to be more closely interrogated at a time when the data and the algorithms that that drive it are becoming subject to challenging questions. Governance, under these conditions, involves better regulation but, more than that, it should be about opening the door to new ways of reaping the benefits of the technologies in the interests of society as a whole. The IoT and AI together offer enormous possibilities for economic, social and environmental improvement in the city context but, as yet, only a limited bandwidth of possibilities has been brought into use. We offer some suggestions for other pathways to explore.

2.0 Massively integrated data: the IoT and AI

2.1 Connecting data from multiple devices over the internet

The IoT is primarily about machines talking to machines over the internet and letting them talk to us, to applications and to other third parties¹ (OECD, 2018). At the level of the devices involved, the possibilities are endless. It can be Alexa/Siri listening into what is asked and adding in background audio. It can be 'smart' home devices that say things about internal layout and security arrangements, can undertake an automatic stock-state of your fridge, or be able to monitor the use of water and power utilities. It can be traffic sensors or car-based information about where you go, how often, and how you drive. It can be devices that say things about your health or physical activities such as Fitbit and intelligent devices for blood pressure, heart rate etc. (Rainie and Anderson, 2017), or even children's toys (Chaudron et al., 2017).²

Assembled together and integrated with other data, what is retrieved from these devices can say things, at various levels of abstraction, about you, the household you live in, upwards to the neighbourhood, to the city and on to the nation. A particular feature of interest for us here is the way the data can be scaled up, networked and integrated to underpin the base concept for the Smart City. It is mostly at these more aggregated, spatially defined, levels like the city that we tend to hear about the power of the IoT. We learn from the promoters of the idea about the massively detailed, socially referenced and spatially coded information at our fingertips that can help us plan, design and manage the urban habitats we live in to improve our quality of life. We shall explore this in more detail later.

2.2 AI and machine learning

Massively integrated data is the lifeblood of the IoT. Devices are simply the means by which data is captured, transmitted and received. For those concerned with making the IoT work and driving value from it, the biggest challenge comes from the sheer scale of the mass data involved. The possibilities that come from connecting data from multiple devices are endless. This where AI comes in. Analysing and making sense of the volumes of data means that the IoT would simply not be able to function in its modern form without the algorithmic capability of AI and the general ability of machine learning to *review, analyse and to look for the patterns, correlations and interesting outliers that will enable value to be extracted from the data*.

This is, of course, consistent with what is happening across the Digital Transformation as a whole – a mass of complex, interrelated and linked data with considerable possibilities for those who can successfully separate out a segment of it from which to extract value. The rise of Platform Capitalism is the phenomenon of our age (ECONOMIST, 2018, Naughton, 2019, Wu, 2019, Srnicek, 2019). Those 'themes' that we identify

¹ <https://www.postscapes.com/internet-of-things-handbook/>

²The question of whether or not the smartphone is an IoT device is debatable. Some believe that IoT devices - to qualify for the label - have to be 'dumb' and that a human interface where data is transmitted to the internet that transmits to and stores on the cloud does not qualify. Others say that the smart phone qualifies by being "part of the ecosystem" just like any device that uses internet to provide you with or let you share information". It is clear that the definition is both fluid and evolving. As a "*chaotic conception*" SAYER, A. 1984. *Method in social science: a realist approach*. London: Hutchinson. it can be acceptable for descriptive purposes but questionable when assigned some causal power as coherent entity.

within it, such as the IoT, smart cities, digital health (New et al., 2018, Neville, 2018, Topol, 2019) and the like, are heuristics through which we as human observers try to impose some order for our understanding. In reality, they all coalesce and interact – coming together and pulling in data across a massive and complex ecosystem that integrates devices and data. In turn, these go on to spawn even more complex data resources to fuel the further development of AI.³

2.3 Keeping a sense of human perspective

Going forward, it is clear that big data, the IoT and AI are destined to play an increasing role in our lives and that we will struggle to make sense of the huge amounts of raw data they end up capturing. We are already faced with this, of course. With the sort of massive integration that we can confidently predict, there are no doubt huge advantages to be gained. But there are also some serious things to worry about as AI takes on more of the burden of automatically interpreting the data that is captured. At the most basic level, the age-old adage ‘garbage in, garbage out’ applies as much to big data now as it did to ‘small’ data before. The concerns about balancing the risks and opportunities⁴ of AI have led to 42 countries signing the legal text from the OECD on May 22 (OECD, 2019a, OECD, 2019b), with a need to develop consistent and comparative metrics.⁵

But as we become more distanced from the data, using algorithms to handle it, sense-checks are less effective as a human-centred way to spot error and bias.⁶ The new technological wave of the IoT has presented us with devices and data that move us into wholly new areas of concern in this respect. Facial recognition is a case in point. This particular ‘bonus’ is beginning to capture widespread media attention, such as in the context of the unreliability of algorithmic prediction (Hodgson, 2019, White, 2019, Veale, 2019) in crime detection (very much based on the ‘training’ data for the algorithms being themselves biased), or where the use of facial recognition in public places voids the right of people to be ‘anonymous’ (Shadwell, 2019). As a consequence of such concerns the city of San Francisco has recently moved to ban its transportation authority and police force from using it (Lee, 2019).

The IoT is, then, the material vector (audio or air quality sensor, smart tv, car diagnostic monitor, surveillance camera etc.) that can capture and transmit to an internet-based network, cloud or platform

³ Recognising the power, range and influence of AI, the European Commission has been prescient at focusing on it and developing a policy, along with an observatory to help support evidence-led policy. This can then support governance which is fit-for-purpose at the EU and national levels. https://ec.europa.eu/knowledge4policy/ai-watch_en

⁴ For example: “*RECOGNISING that AI has pervasive, far-reaching and global implications that are transforming societies, economic sectors and the world of work, and are likely to increasingly do so in the future; RECOGNISING that AI has the potential to improve the welfare and well-being of people, to contribute to positive sustainable global economic activity, to increase innovation and productivity, and to help respond to key global challenges; RECOGNISING that, at the same time, these transformations may have disparate effects within, and between societies and economies, notably regarding economic shifts, competition, transitions in the labour market, inequalities, and implications for democracy and human rights, privacy and data protection, and digital security*”;

⁵ As with the EU, the OECD has established an ‘AI Observatory’.

⁶ A current example of the latter is where algorithmic forecasting of crime has led to concerns that the data input to ‘train’ the algorithms might be racially or socially biased HAO, K. 2019a. *AI is sending people to jail—and getting it wrong*. Technology Review. Published January 21. Available: <https://www.technologyreview.com/s/612775/algorithms-criminal-justice-ai/>. [Accessed January 23 2019], HAO, K. 2019b. *Police across the US are training crime-predicting AIs on falsified data*. Technology Review. Published February 13. Available: <https://www.technologyreview.com/s/612957/predictive-policing-algorithms-ai-crime-dirty-data/>. [Accessed February 25 2019], HODGSON, C. 2019. *AI tools in US criminal justice branded unreliable by researchers*. Financial Times (London). Published April 26. Available: <https://www.ft.com/content/7b6c424c-676e-11e9-a79d-04f350474d62>. [Accessed April 27 2019]. Profiling on an area basis is also subject to scrutiny as simple, geographically represented, features such as crime hotspots are used to make policing ‘more efficient’.

directly useable intelligence about you as an individual and your social networks plus ‘data exhaust’ – a valuable by-product of the data gathering process where data can be further analysed to understand even more things about, you or people like you, and your group(s) and the environment you live in.⁷ One dimension of this, the debate about identity capture and *surveillance capitalism*, is very much a live one at the present time – especially since the publication of Shoshana Zuboff’s book (Zuboff, 2019a, Zuboff, 2019b).

But if we are to focus our attention on the IoT and, in particular, on the Smart City context, we need to add in a different kind of debate that has longer roots. A number of the threads of critique are common – particularly concerns about where data resides, who ‘owns’ it, who has rights to use it, what else is it being used for and in whose interests. Nothing is really new here, since this has been a digital concern for many decades: see (Branscomb, 1994). But we also need to frame today’s rapidly growing concerns about big data, internet privacy and the emergence of surveillance capitalism against the higher context of a requirement to re-appraise the costs and benefits of the digital transformation through a more human-centred frame of reference of what sort of society we would wish to live in.

Consider the following two statements:

“Several decades from now, cities will have countless autonomous, intelligently functioning IT systems that will have perfect knowledge of users’ habits and energy consumption, and provide optimum service ... The goal of such a city is to optimally regulate and control resources by means of autonomous IT systems.” (Siemens GMBH)⁸

“We shall be living in a state of being in which “computation and data communication {are} embedded in, and distributed through, our entire environment” where there is a “colonisation of everyday life by information processing” {Mike Kuniavsky quoted by (Greenfield, 2017)}.

A careful consideration of these, admittedly extreme, positions should make it clear why a debate outside the technological frame of reference is also necessary. Is this the world we would choose to live in without serious qualification? The questions we might want to ask might be as follows: While we clearly have much to gain from this, what will we lose? What will we find ourselves having to forego to retrieve the benefits on offer? What other things about our ‘everyday lives’ outside ‘optimum service’ would we insist on retaining outside the ‘colonisation’ by information processing? What other things could we deploy the technologies to achieve? Perhaps most important of all, how should we set ourselves up as citizens in a democratic society to try to get answers to these questions?

⁷ Defined by dictionary.com as “unstructured information or data that is a by-product of the online activities of internet users - collecting and analyzing data exhaust can provide valuable insight into the purchasing habits of consumers”.

⁸

http://web.archive.org/web/20150725033932/http://www.siemens.com/innovation/en/publikationen/publications_pof/pof_fall_2008/gebaeude/vernetzung.htm

3.0 The Smart City Concept

3.1 The Smart City– systems design and effective urban management

To develop these issues further, let us turn to a real and practical project that has history and context and that will offer a realistic opportunity to *ground* discussions on the wider issues of the IoT and AI. The Smart City is not, of course, a new concept. Its history is revealed as a set of stages along a journey of using digital technologies to provide better services to citizens. Indeed, the Smart City was already a live discourse in the 1990s (Pigg, 2001) at that time through an emphasis on enterprise resource systems and eGovernment solutions.⁹ What the arrival of the ‘Internet of Things’ has done is, as we have just shown, is to add to it the scope for extreme integration of devices and massive data. (MIT, 2005, Biddlecombe, 2005).¹⁰

The Smart City is, then, a domain where we hear frequently about the benefits that can come from the massively assembled and integrated data arising from the IoT. This covers everything from traffic management, energy conservation, personal security, policing, to rented bicycle provision and Uber-style taxi services and beyond: see for example, (Hollands, 2015, Kitchin, 2014, Batty et al., 2012).¹¹ All these undoubtedly good things are now available to us through the power of supercomputing and the cloud to assemble together the ‘big data’ - much of it from IoT sensors – that we now have at our disposal. It is no surprise then to see the scale and speed of growth internationally of the Smart Cities movement with its associations, emerging indicators¹² (Huovila et al., 2019), and league lists of ‘success’.¹³

To capture these huge benefits, it may seem a small price to pay that the data needed to fuel the process is derived from close monitoring of individual people’s lives – either voluntarily offered by the people themselves or captured from sensors that watch their individual and aggregate behaviours and movements. The declared aim of ‘smart’ is to help us improve the life-spaces – in this case in the city - that are important to us. The sheer range of the possible beneficial applications that can come from this is both demonstrably progressive and certainly persuasive. From a strictly technological viewpoint, then, there is much to be

⁹ Interestingly, even in the 1970s the risks of security and privacy in information integration in urban information systems was already on the agenda FLAHERTY, D. H. 1979. *Privacy and Government Data Banks: An International Perspective*. London: Mansell, GOLDBERG, E. M. 1980. *Urban information systems and invasion of privacy*. *Urban Affairs Quarterly*, 5, 3, 249-264.

¹⁰ This was highlighted early on as an opportunity in the development of Web 2.0 TRENDWATCHING. 2007. *Top 5 Consumer Trends for 2007*. Trendwatching.com. Available: <http://www.trendwatching.com/trends/2007top5.htm>. [Accessed May 23 2007], COMMISSION. 2007. *i2010 - Annual Information Society Report 2007*. European Commission. Available: http://ec.europa.eu/information_society/eeurope/i2010/docs/annual_report/2007/comm_native_com_2007_0146_f_en_acte.doc. [Accessed April 27 2007].

¹¹ https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en

¹² And a city should not just be ‘smart’, but needs also to be ‘sustainable’ – yet another discourse with its cluster of indicators and metrics. COMMISSION. 2018. *Indicators for Sustainable Cities*. European Commission. Published March. Available: http://ec.europa.eu/environment/integration/research/newsalert/pdf/indicators_for_sustainable_cities_IR12_en.pdf. [Accessed June 4 2019].

¹³ For example, and with no attribution that the methodology is robust: <https://www.johnsoncontrols.com/insights/2018/thought-leadership/smart-city-indicator-survey>

positive about with innovations that can make the places we mostly choose to live in more healthy, safer, easier to get around in, more ecologically friendly, more sustainable in resource use, and so on.

What is becoming more widely discussed, however, is how far this “*one-size-fits-all, smart-city-in-the-box paradigm*”, as Calzada 2016 calls it, is: i) a caricature of what must surely be a much more varied reality; and; ii) really a suitable way to understand and devise urban policy. We resort to examining the Smart City here because the IoT and AI have the capability to take the concept into realms and ethical issues previously unthought of and - regardless of the critiques of the basic concept. We also need to position the current Smart City debate more firmly in the *context of the surveillance society* (Zuboff, 2019a). This might make us wonder about its potential to act as a *Trojan Horse* for society in general – where for that 63 percent of the global population who live in cities, supposedly neutral and passive instruments are capable of drawing the citizenry into a wider world where data they have little control over can be expropriated to some uses that, given the chance, they would seek to challenge. The IoT and AI have clearly brought about a transformation that can generate considerable benefits - but it is one that needs to be carefully considered from a *human-centred* as well as a technological perspective - while the devices themselves are neutral, it is in the application of those devices that outcomes can be judged as positive or negative.¹⁴

3.2 Vastly enhanced technological tools but with expanded challenges for governance

In today's world, the technological resource pack for the development of the Smart City is, then, very significantly richer than ever before, not least with voice and face recognition being so much more advanced and with computing power being so readily available, miniaturised, and affordable. As a corollary, the challenges and problems this brings with it are also more complex, ranging not just across mass surveillance but bringing into play issues like fake news, electoral manipulation, cyberwarfare and cybercrime. In the contemporary Smart City, we are looking at greater information integration, at greater velocity, with ever more diverse portfolios of interconnected devices. Indeed, we could consider (by ignoring those complex issues such as privacy, human rights and anonymity) that some of the ‘smartest’ and most ‘interconnected’ cities are those in the Chinese surveillance state (Jia and Wildau, 2018, Mozur, 2018, Lucas and Feng, 2018, Larson, 2018). Furthermore, integration opens up urban data environments to greater vulnerability of cyber-attacks (Unal, 2019) Such issues are of direct concern at the European level (Council, 2018, Commission, 2019c, ESMA, 2019).

Inevitably, then, we are faced with serious questions as to *what governance actions at which geographical or administrative level* would be best deployed best to harness the good impacts of the IoT and the Smart City. In a human-centred design sense, we need first to understand the power of the technologies then to apply sensitive, well-informed regulation - or even make different socio-economic choices altogether. The process of understanding and re-thinking has already begun and, in respect of data and its ownership, a number of cities have already pioneered new approaches to data management. We look at this in the next section before going on to widen the discussion to look at ways to deploy the new technologies in a creative context.

¹⁴ A device becomes a ‘technology’ only when it is used in a human context.

4.0 Playing the Story Back – the ‘Smarter’ City as Data Guardian

4.1 The city as the crucible for the information revolution

In trying to cope with the runaway nature of the IoT and AI and the economic, social and political transformations that they can bring about for cities and society at large, the real challenge is then *how to intervene and where* – both in the structural and the geo-administrative sense. There are undoubtedly roles to be played at supranational or intergovernmental level to counter the global reach of the monopoly platforms.¹⁵ This is beginning to happen with the EU in particular taking the lead with the GDPR. National governments are beginning to respond, for example policy and regulatory developments in the UK (CABINET, 2018, COMMONS, 2019, DDCMS, 2019, ICO, 2019), and the USA (USA, 2019, BBC, 2019), but of particular interest here, are those in cities that are taking their own steps to intervene (Nicolaou, 2019, Cellan-Jones, 2019).

For the last 30 years, as we have seen, the idea of cities getting smarter and using the technology of the time to do this has been on the agenda. The Smart City idea has had its critics but much of the critique has been around the term itself – how meaningful as a category, how capable of capturing the real variety of urban form and function – and about its elitist and exclusive overtones and so on. But what we now have to confront is a different kind of challenge where the cities become the *front line* of an information revolution. This involves the IoT and AI in feeding mass data into privately owned repositories from which, what Zuboff calls prediction products, are sold into a marketplace that trades in reading and manipulating future behaviour (Boyle, 2019, TECHREVIEW, 2019).

In this context, citizens are repositioned as ‘users’ Their lives are “*rendered as data and repurposed in new forms of social control*” (Zuboff, 2019a, p.54). As Rob Kitchen observed, “*the data within these systems are not neutral and objective in nature. Instead, they are situated, contingent and relational, framed by the ideas, techniques, technologies, people and contexts that conceive, produce, process, manage, analyse and store them*”.¹⁶ We are facing an entirely new form of power asymmetry in the digital age but one clearly situated within a frame of reference where markets, financialisation and the primacy of private capital take precedence.

The cities have generally been where radical views have tended to foment and where social movements have had their revolutionary moments (from the Paris Commune of the 1870s to the 2019 protests of the Gilets Jaunes perhaps). It is no coincidence that what Haussmann gave to Paris was the boulevards as a ‘smarter’ infrastructure - but one that also gave the military under Napoleon III quick access to the city in times of civil strife (Harvey, 2005). So, it is with the Smart City concept of the digital age. Along with the undoubtedly valuable service and infrastructure gains, there comes a tool which has the power to hand to those who control it an ability to influence society and the political discourse - not just in cities but in society

¹⁵ In this respect, what the actions of the European Commission have shown clearly, is that a supra-national body, representing a large sector of global humanity, has the power to influence the global information society behemoths and to impose cost penalties for regulatory infringements that are of a level that can make a difference BBC. 2018. *Google hit with €4.3bn Android fine from EU*. British Broadcasting Corporation (BBC). Published July 18. Available: <https://www.bbc.co.uk/news/technology-44858238>. [Accessed July 18 2018], COMMISSION. 2019b. *Antitrust: Commission fines Google €1.49 billion for abusive practices in online advertising*. European Commission. Published March 20. Available: http://europa.eu/rapid/press-release_IP-19-1770_en.htm. [Accessed March 20 2019].

¹⁶ <http://mural.maynoothuniversity.ie/7323/1/smart>

as a whole. Slowly, this awareness of what is being conceded for the gains of convenience and access is breaking through and the first signs of playback are in process of emerging. Pockets of resistance are appearing and the focus of the best known tend to be in the major cities. We cannot attempt to be comprehensive here on an evolving movement but we can point to some instructive examples.

4.2 Reclaiming the Smart City: Personal data, trust and the new commons

DECODE is a project supported under the European Union's Horizon 2020 research and innovation programme.¹⁷ It is based on city governments and makes the point that, while normally data protection issues are dealt with at national level, the city has a particular importance as the site for intervention. It asserts, along with this paper, that "*Cities are emerging as new battlegrounds over personal data. As cities hold concentrations of people, the growth of personal data has inevitably led to cities becoming central to the data economy*" (DECODE, 2018, p.7). It also takes to task simplistic, technology-driven notions of the Smart City. Its three other key justifications for a city focus are that: cities are closer to the everyday lives of people; city governments are more flexible; and that cities are a well-known focus for entrepreneurial systems.

Two cities are adopted by DECODE as prime pilots for the experimental work – Barcelona and Amsterdam with New York as a third participant. All are described as "*leading in combining grassroots movements and communities with the smart city agenda*". The essence of DECODE is to create a 'commons' of citizen generated data which can be used by city governments, innovators, researchers and citizens alike. The technical core lies in a distributed ledger approach. This is a "*type of database which is spread across a network of computers, known as nodes, which is not controlled by any single actor and is immutable*". Through this, "individuals are able to pool their data together to leverage its collective value" and to "*put individuals in control of whether they keep their personal data private or share it for the public good*". Beyond the two cities that lie at the core of the Horizon research programme, the 2016 report lists New York, Seattle, San Francisco, Sydney, Gent and Zug as examples where similar movements are in play.¹⁸

Spinning out from a principled position on the promotion and protection of people's data rights, the DECODE cities have moved to create whole new approaches both to the assembly and protection of data and to ways in which data so protected can be used to create additional public value. This ranges from a means openly to engage citizens in dialogue about policy choices (DECIDIM in Barcelona¹⁹ for example) and to the assembly and use of data as a positive resource for the enhancement of city life and development (DATALAB in Amsterdam²⁰).

In the USA, when the Federal Communications Commission (FCC) of the United States backed away from protecting net neutrality in 2018, a network of city mayors formed to use their combined purchasing power to support internet providers who continued upholding net neutrality. Their leverage was to come from the \$600 million annually in the combined budget for the procurement of internet services. The initial coalition

¹⁷ <https://decodeproject.eu/>

¹⁸ At the [Smart Cities Expo World Congress in Barcelona](#) in November 2018, the chief technology officers of Amsterdam, Barcelona and New York together launched the [Cities Coalition for Digital Rights](#) in partnership with UN-Habitat, a United Nations program to support urban development. Cities who join the coalition agree to a declaration of just five principles that center on respect for privacy and human rights in use of the internet. They pledged to see 100 cities join in 100 days (before July) and 35 cities have joined so far.

¹⁹ <https://www.decidim.barcelona/>

²⁰ <https://www.amsterdam.nl/bestuur-organisatie/organisatie/overige/datalab-amsterdam/>

has now, it is suggested, grown to cover over 130 cities. The purpose was set out by Max Sevilla, the Director of External Affairs for the NYC Mayor's Office of the Chief Technology Officer as follows:

"The core of the digital rights agenda is to reframe how we think about and deploy technology in cities. The idea is to recapture the dignity and purpose of technology as a public good." (Mozilla, 2019)

Net neutrality, open data, and access to data relating to ourselves, has become ever more important. Since its inception in 2012 By Berners-Lee and Shadbolt, the Open Data Institute (ODI) has championed open data as a public good, stressing the need for effective governance models to protect it, and now provides links to activists, training, and projects worldwide.²¹ The ODI proposes, for example, that mapping data companies should be compelled to share geospatial data with rival firms and the public sector, to stop data monopolies from forming and to create better opportunities for innovation.²²

As well as empowering citizens through transparency, open data initiatives are important capacity building activities for cities and their administrations. For over a decade, cities have encouraged citizens to analyse data and share results: Baltimore CITISTAT²³ has been one, as has Amsterdam City Data.²⁴ However, while open data helps cities in their ambition to become smarter (through better intelligence and better decision making), some serious conundrums have to be resolved.

- Do we put all our data in one integrated place (taking some form of ownership through a data trust for example) and then licence its use (hoping that it is all secure and safe from cybercrime or technology failure)? Intermediary operations such as data trusts²⁵ aim to be trusted agents 'care' for our data, and where we decide what can be used (NIC, 2017, Hardinges, 2018);
- Do we aim to keep data where it is produced or owned, and promote 'smart' solutions that link across data domains (the approach of interoperability)? Both such approaches produce challenges to the IoT, since as yet it is not clear how the many actors in the IoT would be able to negotiate access to all of the data required for wholly integrated services;
- Do we take a pragmatic approach and accept that 'things happen' and that data security is fragile, hoping instead that regulatory structures at least minimise the risk, and penalise the failures? We cannot simply withdraw our data from the governance arena, and we should not allow the big corporates to continue controlling our data.

4.3 Coping with messiness and diversity in data: Integration to Interoperability

In reminding ourselves that it is people, not technologies, that design and consume the digital transformation, we need approaches to cope with its 'messiness' and diversity, not just to applying

²¹ <https://theodi.org/global-network-directory/>

²² <https://theodi.org/wp-content/uploads/2018/07/ODI-Strategy-for-web.pdf>

²³ <https://moss-citistatsmart.baltimorecity.gov/>

²⁴ <https://amsterdamsmartcity.com/projects/dataamsterdamnl>

²⁵ We should also emphasise that data trusts are not a new concept, and we cited them in a 2007 project for the Commission, but it may be that the newer internet tools allow them to be developed more readily. WILSON, F. & BLAKEMORE, M. 2007. *Think Paper 8: Technology Futures - and why Government should Care*. European Commission. Available: <http://www.ccegov.eu/Downloads/Paper%208%20-%20Technology%20Futures%20v2.pdf>. [Accessed June 1 2007]. KABLE. 2007. *Studies stress data trust challenge*. Kable Government Computing. Available: <http://www.kablenet.com/kd.nsf/Frontpage/4BEE27205D18014A8025739A003BDE76?OpenDocument>. [Accessed November 26 2007].

reductionism to either reify or demonise it. We should also ask ourselves whether individuals really do want to have agency on their data simply because an integrated access is required for commercial or public expenditure efficiency. In this context, there is an alternative proposition that is not new, and has long been promoted by DG Connect (and its previous existence as DG INFSO). It is the promotion of positive integration of data through data *interoperability* and not by means of wholesale integration. Interoperating is a political and moral, not a commercial choice; it involves a process of facilitating a service while still respecting privacy and data segmentation

Two examples illustrate how integrated services can be delivered without integrating the information. For nearly three decades the Crossroads Bank for Social Security²⁶ in Belgium has worked with over 3,000 “*actors in the social sector, under coordination of the CBSS, a maximum number of social benefits and subsidiary rights are automatically granted without citizens or their employers having to make declarations anymore and the administrative burden for citizens and companies has been drastically reduced*”. Crossroads achieves this not by taking the data from all of the actors, but by sending information requests (xml messages) to each of their databases (knowing the data structures etc.) and receiving information back about the status of a particular information item.

There is a clear regulatory driver for this in that “*all the social security institutions are connected to a network for the electronic data traffic managed by the Crossroads Bank for Social Security and have the legal obligation to electronically ask one another for all information available in the network*”. The role of government in this process is to provide the regulatory environment for something to happen, and then facilitate a solution that enables each actor to maintain their data, and only ask questions to the data.²⁷

Another interoperability solution, emerging out of an European Commission funded project, is Riser-ID.²⁸ Germany has one of the most conservative attitudes to the protection of personal data, and each of the federal regions (Länder) maintain their own official population registers, with no feasibility to integrate all of them. The business question was simple: where does a person live? Riser communicates with the population registers, maximising security and privacy,²⁹ and has now extended its coverage to include Germany, Austria and Switzerland.

The interoperability approach poses the question as to *why we need to integrate data, and whether our data are best left in a federated environment*. However, that poses further questions, notably the one; ‘where are my data’? Having all the data in one place poses a systemic security risk, but we do know where the data are. All the data federated across the internet mean it is difficult to find who has our data, and how we maintain ownership of it (ECONOMIST, 2017). Consequently, there is a role for some form of intermediation where a service or agency could provide individuals with a trusted and secure mechanism to manage their data – hence, as noted above, the consideration of ‘data trusts’ (Hardinges, 2018, NIC, 2017).

One example of a governmental data trust exists in the context of smart energy meters (one of the devices that populate the IOT) in the UK, where the Government has set energy companies a target to install smart

²⁶ <https://www.ksz-bcss.fgov.be/en>

²⁷ Contrast this with examples of IT ‘vanity’ projects where politicians with limited IT competences are easily seduced by ‘big bang’ information technology integration projects: KING, A. & CREWE, I. 2014. *The Blunders of our Governments*. London: Oneworld Publications.

²⁸ <https://www.riserid.eu/en/company/>

²⁹ <https://www.riserid.eu/en/data-security/data-security-seals/european-privacy-seal/>

meters in all houses by 2020.³⁰ The latest smart meters are compatible across all energy (gas and electricity) suppliers, and the data collection is undertaken by an intermediary Data Communications Company (DCC), that is formally licenced³¹ by the government, and is called Smart DCC.³² Smart DCC then distributes data to authorised “*energy suppliers, network operators and other authorised service users*”.³³

³⁰ <https://www.gov.uk/guidance/smart-meters-how-they-work>

³¹ <https://epr.ofgem.gov.uk/Content/Documents/Smart%20DCC%20Limited%20-%20Smart%20Meter%20Communication%20Consolidated%20Licence%20Conditions%20-%20Current%20Version.pdf>

³² <https://www.smartdcc.co.uk/about/>

³³ <https://www.ncsc.gov.uk/>

5.0 Technology for Inclusive Public Value

5.1 Responding to a changing economic and social context

What we have learned up to here is that we should clearly be less naïve about matters of data ownership and identity surrounding the Smart City. There is, however, a powerful argument that we should also be looking at the wider context for what the IoT and AI might bring to an upgraded and more socially useful Smart City idea. The Smart City as it stands is a real and practical project set in a particular history and context. It has emerged at the high point of the consumer society and at a time of Neoliberalism where value is normally monetised and private and where exchange value in the capitalist marketplace drives the economic system (Harvey, 2007) (Peck, 2010).

What makes the current version of the Smart City concept so attractive against this context is that it opens a pathway to market for the established industrial and financial capital corporations that have built their reputations and shareholder value from city development. Smart is clearly already working closely in accordance with corporate business interests. The IoT and AI take this to another level. It would be wrong to take a negative position on this. What is there not to like about having the opportunity from the new technologies to generate private investment, bring in jobs and raise the global city profile of those adopting it? Smart provides an aura of being ready for re-envisioning, for being hi-tech, for being up-to-the-minute, and at the same time offers huge business opportunities on top of the digital transformation bonus. It can give cities competing with each other for jobs and investment the extra competitive advantage they need for place marketing.

However, post-2008 and the economic crisis, this context has been changing. Attachment to the principles of Neoliberalism is coming under review as the evidence for a polarising and unequal society becomes more pressing (Piketty, 2019) (Delhey et al., 2018, Commission, 2019a). The challenges cities face are always considerable but inequality and social exclusion rank high among them. Being 'development ready' addresses only one dimension of this problem through the 'trickle down' hope of creating new jobs. But if what we see is that these are for the high skills segment of the labour market and do little for the wider population, the place-marketing approach that served well in the past may have its limits. Looking to tackle a wider range of urban problems that citizens would prioritise - without challenging the dominance of the private sector – can, however, stray into areas both of adequately defining needs and finding the right sort of stakeholder partnership.

5.2 Opening the door to a wider application of IoT and AI

Under the rubric of asking questions not just about the supporting data for the Smart City but also of the intent of those deploying it - where it sits, who owns it, who has rights to use it - we need to look more closely at those questions about *what else* we could be using the new technologies to do.³⁴ To move to a wider agenda, we would need to appraise the costs and benefits of the new technologies against a *wider, more balanced, frame of reference*. It is not necessarily a bad thing if corporate interests are being served, but we should also ask *whose interests are not being served and how should we seek to address this?*

³⁴ For those who are to become full adopters of the Smart City model in the IoT/AI era or just for those who buy into the IoT there are some salutary lessons from the history of IT security they need to understand. There is no means of achieving 'perfect' IT security. The public realm, as well as the private, is becoming increasingly 'leaky' in the matter of identity protection as efficiency and value for money become the guiding principles in times of austerity – with moral and ethical considerations increasingly observed in the breach.

Could we, for example, use the same sort of data to 'sense down' to get a more grounded level, citizen generated, understanding of the needs that those who live in the cities as opposed to (or in concert with) those who design, build and manage them? The DECODE cities have already set out along this track.

As Francesca Bria recently argued:

"The heavily centralised, platform-knows-best model of the smart city that has conquered many localities in the past decade is a perfect testament to this predicament. It promises so much in terms of involving citizens in policy-making, democratising access to important infrastructure – and yet such plans often yield only more centralised institutions, transferring power to Big Tech rather than the citizens and making public decision-making even less transparent than before". (Bria, 2019)

Pushing on with 'platform-knows-best' to address these wider, more socially relevant, issues of city life is an obvious route for many already committed to and configured to deliver the current 'smart' model. This can, however, present its challenges. The City of Toronto "*Sidewalks Project*" is a bellwether example of where things might be going as 'smart' in the age of big data, the IoT and AI presses into areas more clearly associated with public value (Nicolaou, 2019). The joint venture between Sidewalk Labs and Toronto Waterfront was set up in 2017 and charged with revitalising a small area of the city's dockside. It promised great things. Sidewalk Labs is, however, a Google Affiliate with obvious links to the wider debate about big data platforms and the dominance of the major corporates. The suggestion in some quarters that Google wanted a share of property taxes, development fees and increased value of city land in Sidewalks in return for its investment set off an intense debate in Toronto. As Saskia Sassen put it in an interview with the BBC;

"In principle, having a private corporation doing public work is fine and a lot of the time it works out. But when you are dealing with them installing a complex system, then chances are they will also do the next steps - thereby further privatising the work,"; "Google is already master of the online domain, so having a company affiliated to them as masters of the offline one as well could be problematic." (Wakefield, 2019)

It is this slippage ('function creep') between the private and the public realm that is causing concern. Behind this lies the IoT with its monitoring devices and sensors - raising serious questions about rights to ownership and disposal of the massive data asset that inevitably emerges. This should, of course, make us more aware of the wider debate about 'surveillance' on the terms that Zuboff is encouraging us to think about - but set properly in terms of the wider framework of costs and benefits. It would be helpful to re-position the Smart City concept away from a dominant focus on the advantages of the technology toward one that sees it as a much broader scope 'experiment in progress' for improving the *wider urban condition*.

The door can then be opened to human-centred perspectives for using the new devices to meet pressing issues like inclusive housing, more participatory communities, more productive businesses, more sustainable jobs, better education and training systems and so on. This would inevitably need to involve discussions about governance in the very widest sense to assemble and incentivise the necessary stakeholders.

In the context of this debate, the current discourse surrounding the Internet of Things (IoT) and Smart Cities shows how we have to achieve a balance between what a technology-led appraisal of service benefit provides (energy efficiency, efficient utilisation of transportation systems, food sustainability, automation and technology intelligence for systems management and so on), and what might be acquired to serve

others' *unexamined interests* in the city re-conversion process³⁵ itself. Few cities will have the benefits of being designed from new, and most will be struggling to 'modernise' legacy systems and make themselves 'smart' (FCO, 2016) so re-invention will almost certainly a degree of *dis-invention* (the history of urban redevelopment is littered with failures in this domain). In addition, we need to take into account of how far the claims of the technology-led approach can be sustained both in terms of what real, individually-sensed needs are out there and what the complex and confused realities of things like voice and democratic rights do for algorithmically derived so-called 'solutions'.

5.3 Governance Considerations and the IoT

A key question is, then, how do we develop wider governance approaches that respect and respond to the *complexity* of the digitally transforming 'spaces' that we live in? As we have indicated, the issues of the Smart City go well beyond those of administration and infrastructure. For any space we care to map and put a label to there will be domains of human diversity, such as health, (dis)ability, ethnicity, socio-economic status, and inclusion/isolation, politics, populism and new 'tribes' of association and identity.³⁶ Outside the cities – smart or otherwise - there are also spaces that are important to European Union policy, rural development³⁷; mountains, islands and sparsely populated areas.³⁸ *All will be impacted by the issues – positive and negative – that we have been exploring in earlier sections.* For each then, there will be opportunities to be grasped from the digital transformation and threats to require mitigation.

In each case there is an *experimental terrain* to be explored, testing to see what can be achieved and what should be challenged. It is no coincidence that the Smart City has, up to here, been a strong focus of attention. As we have shown, set in context it is a project functional to the interests of big business and where the advantages of the IoT and AI in fostering the rise of massively integrated data platforms have been grasped with enthusiasm. But as Mazzucato points out – and consistent with what has been set out in the previous section - we could start from another position (Mazzucato, 2018). We could assert that, at this point, 'smart' priority should be given to the *creation of public value* - shifting attention to "*what the public values*" (*the democratic component*) and; ii) "*what adds value to the public sphere*" (*the production/producer component*). This is already a position already being promoted in the most socially motivated of the Smart Cities – Barcelona is the exemplar we most hear about along with the DECODE group described earlier.³⁹ But what is needed is scale and profile – at the very least to offer a counter-discourse to the more traditional Smart City.

To understand better the governance challenges in complex societies we need *theory, evidence and real-world simulation*. One of the crucial advantages that cities have in helping with this is the geographical containment (bounding) of a large and diverse population and of economic activity. Cities can be ideal testbeds to undertake large-scale experiments in making the cities 'smarter' for us, the citizens, and to understand better the tensions between; a) data proliferation and service benefit versus privacy loss; and b) algorithmic sophistication and analytical risk versus human agency. The lessons, models, and tools could

³⁵ By 'reconversion' we argue that most cities in the EU are legacy ecosystems, with legacy transport infrastructures, energy supply systems, buildings etc. Making them smart involves significant re-engineering of the urban ecosystem.

³⁶ "Social media and the Internet have facilitated the emergence of self-contained communities, walled off not by physical barriers but by shared identities" FUKUYAMA, F. 2018. *Against Identity Politics: The New Tribalism and the Crisis of Democracy*. Foreign Affairs, 957, 5, 90-114.

³⁷ https://ec.europa.eu/agriculture/rural-development-2014-2020_en

³⁸ https://ec.europa.eu/regional_policy/en/policy/themes/sparsely-populated-areas/

³⁹ There are funds available to support this (such as Horizon 2020 and the European Social Fund).

then be adjusted for the spaces beyond the cities, since given the primacy of cities and their containment of the majority of the population, focusing strongly on them is logical. This essentially bottom-up approach would be part of and supplementary to those necessary steps that taken at other levels in the governance hierarchy.⁴⁰ But re-invention as a technical fix, while feasible technically, will still run headlong into those vested interests and power structure questions we explored in earlier sections. It will also involve users in what most will see as a 'loss of convenience' that may make them poor allies. The technical fix will, as we argue, need to follow or at least be accompanied by a socio-political awakening to the dangers the current system presents for economy, society and above all for democracy;

Certainly, we need to argue strongly for a 'fix' *on the data* that is driving the new revolution. What we need are 3 v's – Veracity (accurate and authoritative), Verification (recognised) and Value (delivering us personal, social as well as market value). We have also to decide on the most *appropriate platforms* for both security and effectiveness. We need to understand not just how new, *innovative and socially inclusive* 'smart cities' can be constructed, but also understand how we can achieve the *re-engineering of legacy systems* and legacy 'spaces' More widely, we can use the digital transformation to support and renew societal values from the bottom-up, and design new local futures and begin to build upwards more powerfully to challenge the top-down order of current society.

From a general governance perspective, we might want to shift the tone of the debate more from one that emphasises the need to control the negative features of big data, identity and privacy (which should of course continue) toward a more *constructive-creative* position. We need to learn about and promote more new ideas about how IoT and AI could be doing more for citizens and – crucially - how could we organise ourselves better administratively, politically and democratically, to move the innovative process in the direction of *public value creation*.

In Mazzucato's terms we should encourage turning attention to "*prioritising value creation over value extraction*" (Mazzucato, 2018). This is, of course, a project for 'big politics' - but where better to position such a debate than in the Smart City context. This would presuppose a very different role for forward-looking city governments – encouraging them (with central support of course) to generate *big investment funds* of their own and to have incentives programmes capable of steering private sector partners creatively toward those less profitable but socially necessary projects that make for inclusiveness and citizen well-being.

The technology is there. What is lacking is a system of incentives that acknowledges what is profitable to the private sector and what is not and that brings them on board in driving a mission *democratically set by the city authorities*.⁴¹ As Mazzucato emphasises, new governance forms that emphasise *co-creation*

⁴⁰ For example, supranational approaches, so that trading blocs show greater regulatory strength, as the European Union Commission, 2018 #60675; Commission, 2019 #60958; Commission, 2019 #61110] or California FROOHAR, R. 2019. *California leads the way on data regulation*. Financial Times (London). Published February 24. Available: <https://www.ft.com/content/3406505e-36b9-11e9-bd3a-8b2a211d90d5>. [Accessed February 25 2019]. are doing. It is of interest that although there is a current USA political atmosphere of withdrawing from supra-national structures, the European Commission has been engaging in cooperation with US Authorities JOUROVÁ, V. 2019. *Speech by European Commissioner Vera Jourová on the EU-US digital cooperation : a common response to tech challenges at the Brookings Institute*. European Commission. Published April 11. Available: http://europa.eu/newsroom/rapid-failover/speech-19-2119_en.pdf. [Accessed April 12 2019]. about many of the issues facing the IoT.

⁴¹ A version of this is already in play across 130 cities in the US who see their \$400 billion combines procurement budgets as a lever to pull private business into areas of urban investment where returns are lower but where people-priorities demand action.

between the private, public and third sectors could be a new engine of change consistent with the shift in political preferences as views on Neoliberalism evolve.

In conclusion, the technological developments of the IoT, exciting and impressive as they are, and with the potential to deliver significant societal value, cannot proceed in the absence of an understanding of the potential frailties of technological security, and the human dimensions of the digital transformation. At the same time, citizens and wider society cannot simply reject the IoT – it is here to stay, and both individuals (through better information behaviours) and institutions will need to play a role in self-regulation and formal regulation. For the EU there is a clear role to continue engaging with the widest range of stakeholders in the digital transformation, and through its support for research and innovation through foresight, to fund forward-looking and large-scale experimentation and to build both evidence-led governance and a turn toward the creation of public value. It will be the delicate balance between empowerment and governance of the interaction between IoT technologies and ourselves as humans that will determine whether it is possible to both have the benefits and maintain ‘European values.’⁴²

⁴² https://ec.europa.eu/commission/commissioners/2014-2019/vestager/announcements/future-european-values_en

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