Chapter 5
Sociotechnical Issues

Abstract The influence of technology in smart cities is inevitable and continues to emerge from an entrepreneurial approach stemming from the business model. Both hardware and software components of technology are part of technical advancements in technologically advanced cities. Although more work has been published on smart cities, especially since the early 2010s, there remain uncertainties and challenges posed by smart cities that, in practice, could pose problems for society. This chapter addresses some of these social issues, including democratic governance opposed by monitoring and control in these technocratic (rather than democratic) cities. Security is addressed as Big Data and Open Access information amasses on the Internet and can be accessed worldwide. This represents one of the key areas, especially with the diffusion of the public-private boundary caused by continued monitoring and the accumulation of information on people, their movements and behaviours.

Keywords Technology · Economic/entrepreneurial approach · Governance · Democracy · Surveillance · Cybersecurity · Big Data · Internet of things/IoT · Networks · Social engagement

The emphasis on technology as providing solutions to growing cities is a double-edged sword. On the one hand, technology is capable of organising cities and ensuring that energy expenditure is controlled, so that efficient cities are preferred due to savings on resources—from an environmental business model. On the other hand, technology costs and not all cities around the world can afford to invest in advanced technology to solve their problems of rapid urban growth, environmental degradation, and socioeconomic issues. A technological fix cannot remedy all issues facing cities, although they can provide a means of enhanced efficiency, monitoring, and control.

In a previous publication, Thornbush et al. (2013) examine the sociotechnical dimension to urbanism, including the potential of cities to their reduce energy demand either through a technological approach, as by improving building energy performance or alternatively through behaviour change, as by reducing the need for motor vehicle use (see their Table 1, p 4). The authors also espouse (in Table 2, p 6) potential ways towards achievinglow carbon urbanism, conveying social-technical dimensions that include the technical dimension, which incorporates urban energy infrastructure; building, urban design, and planning; and urban transport. Building on this study, it

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is possible to discern a common trend towards an integrated approach, so that smart cities actually encompass more than just components and rather aim to be integrative, targeting all aspects of these dimensions—including the human (social) dimension.

As addressed by other authors, such as Rose (2017), digitally-mediated urban spaces rely on software and digital hardware that operate as a technological non-human entity at the cost of human agency in what she terms 'post-human agency'. Sociotechnical agency can be spatial-temporally differentiated, according to her, in the way that it is organised as both diverse and innovative. As such, people can connect with such post-human agency, so should not be disenfranchised in current developments associated with the 'reinvention' of the modern city encompassed in smart city development. This development will, of course, be affected by who is in charge of shaping the modern city and how they intend to use technology to that end. Technology itself can be limiting in its advancement, accessibility, and acquisition, being restricted byinnovation and the milieu of its development that can restrict production and consumption, including the ability of people to operate it—as for instance in the case of computer software. A balance is, therefore, required between hardware and software (technology and human capital) to improve the quality of life for citizens in the smart city. This necessitates a holistic approach, rather than an unintegrated sector-based approach, where system components or subsystems do not communicate with each other (Mattoni et al. 2015); instead, these authors have advocated for an integrated system that operates much like a whole (human) organism.

It has been argued that elites are responsible for smart technologies coming to cities and causing them to function as platforms for the Internet of Things (IoT) through connections with sensors and computers of various 'intelligence', capable of connecting, communicating, and transmitting information through the Internet (Sadowski & Pasquale 2015). These authors caution against an ensuing 'web of surveillance and power' that results from biometric surveillance capabilities contributing to monitoring and automated policing as part of a 'spectrum of control' that guides governance through 'pervasive surveillance and control mechanisms'. This aspect of the emerging smart city will be considered in more detail in the next chapter, and this chapter will address a broader plethora of problems stemming from the technical dimension. In the next section, technology will be considered as a market-based solution in a technical-entrepreneurial approach to understanding the popularisation of the smart city.

5.1 Technology as a Solution

Computer systems are leading the operation of cities, with their commission stemming from the need to reduce energy consumption and emissions (Lombardi et al. 2017). According to these authors, spatial decision support systems (MC-SDSS), for example, need to be retrofitted, and there is a lack of knowledge and evaluation criteria needed to assess and deliver urban energy using this tool as part of a long-term

socioeconomic-environmental approach. Nevertheless, smart technologies are being increasingly deployed in cities for various reasons, including for urban infrastructural control through the integration of urban services with information technology (Luque-Ayala & Marvin 2016). Circulatory flow is managed through networks, such as Rio de Janeiro's Operations Centre (COR)—a control-room scenario (media platform) that has emerged since 2011 to provide logistics at the city-scale from the everyday to emergency situations, such as the traumatic rainfall and flooding experienced in April 2010 that led to the enlistment of IBM to deal with the problem through COR, which operates 24 hours a day and seven days a week and interconnects the information of several municipal systems for visualisation, monitoring, analysis, and response in real-time (Luque-Ayala & Marvin 2016). These authors have defended the 'urban governmentality' that COR represents in addition to offering the novelty of urban vision and engagement.

Wireless technology has now developed well and beyond wired CCTV cameras emplaced to enhance surveillance and, thereby, security, with entire wireless sensor networks capable of (low-power) remote sensing and monitoring a variety of dimensions in the smart city (Ramirez et al. 2016). Data acquired through sensing are stored in compact devices that, according to these authors, do not consume much power and can greatly improve data management in terms of both storage and transmission. In this way, different information can be gathered on various aspects of the environment (and natural hazards), but also accidents and transport, logistics, and healthcare as well as security. Such ICT-led transformations are influencing contemporary responses to global environmental change. As also mentioned by others, such as Sadowski and Pasquale (2015), the role of 'technocratic elites' and that of private capital investing in boosting a techno-environmental fix are recognised, which is part of a wider politico-economic context, so that elites can act to prevent alternative politico-ecological transitions from taking place.

Even though technology, and ICT or information and communication technology in particular, represents a technical approach to evolving cities, urban geographers (Wiig & Wyly 2016) and interdisciplinary networks, such as the Smart Cities Innovation Network (Villanueva-Rosales et al. 2015), have contributed towards understanding smart cities and the rationale for them. Geographers, such as Wiig (2015), have examined IBM's Smart Cities Challenge as an example of policymaking in the smart city. The author portrays initiatives as case studies (also see other publications, e.g. Anthopoulos 2017 for 10 smart city cases)—an approach also adopted in this brief, deployed by various smart city initiatives. He has also addresses the role of city governments as key actors in a multi-stakeholder arena of players responsible for the advancement of the smart city paradigm. Wiig (2015) identifies entrepreneurial governance involved in policy mobility in part of the globalised economy (what he terms as a 'globalised business enterprise' that has attracted corporations like IBM) and digital governance as part of redevelopments to realise the smart city. In a subsequent publication, Wiig (2016) presents the technological solutions provided by the case study of the Digital On-Ramps initiative based on IBM's policy consultation in Philadelphia (also see Wiig 2014), where residents were trained to enter the information and knowledge economy using a workforce education App. He argues that

rather than addressing urban inequalities, such programmes work more to sell cities in the global economy. Such a social media style approach to training can become commonplace in the green economy that is still struggling to emerge.

Also relating to policymaking and governance, authors (e.g. Zotano & Bersini 2017) relay opportunities involving Open Data accessible by businesses as well as citizens. According to the authors, Open Data portals can be deployed to develop new business models as part of a holistic approach that they have applied to the Brussels Capital Region. These authors have found that cities, such as Brussels (Belgium), are not fully capable of exploiting the 'real intelligence' provided by smart cities and that the 'maturity' required to achieve this ambition may be attained in the coming years through the implementation of smart city strategies, such as Brussels' Smart City Strategy.

Smart cities can be seen as a contagion that once expelled into cities cannot be reverted and undone. In other words, there is potentially no going back from the smart city craze that has inflicted cities around the world. Should technology be implicit in all, as evidenced by Chourabi et al.'s (2012) smart city initiative framework (see their Fig. 1, p 2294), that recognises two levels of influences: outer factors (natural environment, infrastructure, economy, governance, people, communities) and inner factors (technology, policy, management) that are more influential than the outer factors. The authors consider technology as a 'meta-factor' in smart city initiatives, as it greatly sways all of the other success factors in the framework.

What drives technology, of course, is energy, which is also deserving of consideration, as with smart energy cities (presented in Chap. 6)—a concept that has developed in the literature at least since the early 2010s and is arguably rooted in a sustainability framework. A case-in-point is Milano, Italy as a smart energy city. Smart cities appeared in Italy after 2008, with particular preparation being made heading into Expo 2015. This involved multiple sectors: buildings (domestic, heating); lighting (public, private); transport (public, private); energy use; and energy sources: electricity, natural gas, fuel oil, gasoline, and thermal fluid. Evaluations of energy smartness have been constrained by low-data quality and the availability of energy flows in cities (Causone et al. 2017). The initiative sharing cities accelerated the take-up of smart city solutions; it identified three business models that proved the acceleration of uptake (e.g. refurbishment, smart lamp posts), which was part of doing more with less: smart cities for the age of austerity (Pollio 2016) as part of a technological solution that was supposed to adapt to annihilated fiscal budgets.

Another example of an actually existing smart city is Barcelona, Spain, which has been imagined as a smart and self-sufficient city (smart transformation). Barcelona City Council merged the planning and infrastructure, housing, environment, and ICT departments into a single department called 'Urban Habitat'. A new urban model adopted the vision of Barcelona's chief architect, Vicente Guallart (during the Euro Crisis of 2011–2012) involving the notion of the 'multi-scalar city' as a distributed network, with a vision of empowering citizens through technological improvements. According to March and Ribera-Fumaz (2016), its architecture operates much as a model of networked habitats.

In Portugal, part of connected urban development (CDU) is a leading initiative with CISCO that aims to demonstrate how to leverage ICT above all high connectivity and collaboration. Part of the Portuguese National Plan of Action for Energy Efficiency and National Strategy for Energy, one of these programmes (ECO.AP 2011), aims for an increase of 20% in energy efficiency in public buildings in Leiria, Portugal by 2020.

These cities (Lisbon, also San Francisco, Amsterdam, Seoul, Birmingham, Hamburg, Madrid) will spearhead the implementation of projects aimed at reducing urban emissions of carbon dioxide (CO_2), subsequently acting as references for the widespread implementation of such projects in other cities around the world (CISCO 2008, European Commission 2011; see Galvão et al. 2017). This has been one of the predominant approaches in the emergence of smart cities, which has included the following two main approaches:

- Environmental: sustainable cities, 'green' economy, including energy-efficient buildings; smart mobility—part of a multifaceted, interdisciplinary approach
- Economics: entrepreneurialism, where the business model is used to account for vendors and smart development

The latter encompasses an entrepreneurial approach to digital spaces and Big Data embodies 'spaces of accumulation' that represent commodified digital information.

In a post-capitalist urban and neoliberal context, profit generation is at the forefront of many initiatives building up the notion of smart cities. This is evident through continued efforts since around the time of the European economic crisis and previous to this at a global scale. Technological solutions, although they may not resolve contemporary economic problems, work to support technical groups, as in computing, corporations, and elites that ultimately benefit from this type of urban rebranding and regeneration.

5.2 Social Issues

Although governments have been supporting advancements towards the smart city, there are social issues needing address that provide caveats to such a technological approach. Smart cities are being set up to gather information that can be used to inform decision-making, policymaking, and management. This information is necessary for officials who need to make sensible decisions, as in evidence-based decision-making; in addition, the devices used to collect information have many benefits in that they can be low-energy and their use lead towards energy saving. These platforms have provided an organisation that could even lead to urban economic renewal. As part of an economic development policy, smart cities have been supporting innovation and even included participatory innovation platforms (Anttiroiko 2016). This author, for instance, has written concerning enabler-driven innovation platforms and living labs (e.g. Bates & Friday 2017 based on IoT) that are apparent in Finnish cities, such as Helsinki, Tampere, and Oulu. Such platforms are deployed to support urban

revitalisation and economic development even when operating at the level of local governance, where they have stimulated public engagement in the production of local public services and participation in the making of cities. According to the author, participatory innovation platforms help to procure social inclusion, among other things, through platform-based citizen engagement, which is considered to be a 'soft' strategy to counteract social polarisation and socioeconomic segregation and, therefore, inequalities.

Public engagement with smart cities and their growth is evident in various forms. One piece of evidence are the publications that have proliferated recently, as for example special issues addressing smart city technology (e.g. He et al. 2014) and sustainable urban transformation (Zhang et al. 2016) as well as the aforementioned special issue by Wiig and Wyly (2016)—based on an Association of American Geographers meeting that addressed the question: What does the smart city, as a digital turn in urban governance, tell us about cities today? that acknowledged the transformative process demonstrated by smart cities—plus the special section on rapid urbanisation by Wigginton et al. (2016), to name a few. Another example is that of university training courses based on an innovative learning system in entrepreneurship using mass open online courses to support policy learning (Holotescu et al. 2016). As already mentioned, an entrepreneurial approach is evidenced in smart cities, with markets recognised—as for example hydrogen as an electric carrier and for storage over electric batteries (Marino et al. 2015); additionally, Sadowski (2016) recognises the need to 'sell smartness' and, by so doing, conveys its commodification where there is wealth in cities. In fact, niche markets are apparent, engaging all business sectors (and multi-stakeholders) and headed by local governments in conjunction with vendors (Anthopoulos & Fitsilis 2015). So, in addition to the predominantly economic driver of smart cities, there are also social systems of consumership that are both affected by as well as driving change where there is wealth. Renewable energy, such as solar energy and PV (Menniti et al. 2017), has been advocated to fuel sustainable and smart cities (e.g. Barragán & Terrados 2017), conveying an environmental approach guiding their development (e.g. Katra town, India; Sharma & Dogra 2017). Such 'urban entrepreneurialism', which is part of the corporate smart city model, allows for urban competitiveness, driven by hi-tech companies and city governance (referred to by Hollands 2015) as corporate and entrepreneurial governance, but according to the author constrains public participation in the smart city.

Among this growing body of data are the issues of data mass capture and surveillance that emerge with spatial data that are possibly tracked by digital technology (Cho 2017). Digital data can also relay anytime-anywhere information, providing access and control over people's movements (Cosgrave et al. 2013). These authors also mention 'information marketplaces' that point to the potential for commodified information, with implications for national private security. In addition to issues of hackers and accessibility issues, there are also robotics to consider in keeping security. As for example witnessed by Odendaal (2006), who recognises the socioeconomic fragmentation of South African cities and the potential for manipulation by corporations, such as the South Africa company Desert Wolf that discharged the Skunk—a riot-control drone armed with sublethal capabilities (fires paintballs,

pepper-spray, rubber bullets, blinding lasers)—to disperse or mark people in crowds, such as protestors (Doctorow 2014). According to the author, this technology, used by mining companies against strikes in South Africa, has potential to be deployed to subdue those who seek to interrupt and change the current structures of power and capital. So, there are other social issues that are mixed up with technological approaches to security as well as other aspects of smart cities.

By implication, more research is needed to address how smart cities fit into a democratic society. Democratic governance is counterposed by elitism and potentially automated processes (e.g. e-government) and such top-down organisations that have potential to police human behaviour. The amassment and use of Big Data, including as for example Big Data analytics (e.g. Al Nuaimi et al. 2015), pose a challenge to privacy due to a lack of public consent. This could act to sharpen the private-public boundary, as by recognising that by stepping outside one's house is stepping into the monitored, public domain. However, through smart houses themselves, human behaviour can be monitored even within the private sphere (e.g, smart home monitoring systems), so that the notion of privacy is once again superseded by constant observation, monitoring, and potentially control.

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