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Viewpoint

Shaking for innovation: The (re)building of a (smart) city in a post disaster environment

Lukas Marek [a,*], Malcolm Campbell [a], Lily Bui [b,c]

[a] Department of Geography, University of Canterbury, Christchurch, New Zealand
[b] Comparative Media Studies, Massachusetts Institute of Technology, 160 Memorial Drive, Cambridge, MA 02139, USA
[c] Department of Urban Studies and Planning, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, USA

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ABSTRACT

This paper begins by exploring a smart city approach in post-earthquake Christchurch, New Zealand, by telling the city's story so far. We take the position of critical scholars who are engaged in a live smart cities project that involves the measurement of air quality by using sensor tools. As the project is still ongoing, the final results of the work are yet to be seen, but, nonetheless worth documenting. This article is composed as an early analysis of the air quality sensing project as a framework for the larger smart city story of Christchurch. It provides an overview of the experiences and lessons learned about the implementation of new technologies in a post-disaster environment. We examine how the narrative of the smart city is constructed, with focus on the terminology used by citizens, academicians, government and corporations. We then argue that top-down technocratic solutions to urban problems alone do not suffice to improve life in the city; rather, they can result in misaligned expectations or outcomes for stakeholders at the government and citizen level. We conclude by suggesting that citizen-led initiatives may be a way to promote more nuanced and inclusive ways of addressing local urban problems in a smart cities context.

1. Introduction

"After smart phones, smart TVs, smart windows and other smart products on the horizon, smart cities were the next logical step in trying to create a better, brighter, more sustainable and economically sound future. A relatively new term, "smart cities" conjures images of a cooperative, wired, prosperous utopia where citizens of all classes achieve a high quality of life." (Scientific American, 2014). These few sentences capture the construction of the smart city narrative. It points to the future, listing the possible opportunities to apply emerging technologies to solving longstanding economic and social problems. However, we must pause to consider the numerous issues that such approaches raise.

First, for the purposes of this paper, we define "smart cities" as cities in which ubiquitous sensors and devices allow for more efficient processes of city management, smoother flow of information systems, and/or optimized use of infrastructure (Hollands, 2008; Komninos, 2006). This has largely been influenced by the greater availability and decreasing cost of networks of devices and sensors in the market, which are often described more broadly as sensor networks or "Internet of Things" (Anderson & Rainie, 2014).

Existing research has shown that smart city projects in the past have been unsuccessful due to a lack of adoption of proposed technologies (Greenfield, 2013; Nam & Pardo, 2011b; Saunders & Baeck, 2015). Steep and Nabi (2016) argue that making data useful "requires a backbone of systems that integrate computation, networking and physical processes, and includes sensor networks, monitoring/collecting equipment, data analytics – and humans". This highlights the gap between the technology pioneered by smart cities proposals and the social and economic problems that the technologies are allegedly designed for. Greenfield (2013), in describing failed use cases of smart cities like Korea's New Songdo, the United Arab Emirates' Masdar City, and Portugal's PlanIT Valley, also points out that a techno-centric view of smart cities does not substantially take into account the social needs that the technologies should address. Granted, smart city research is still in its early days in terms of its theoretical development and empirical studies (Kitchin, 2014a, 2014b; Mattoni, Gugliermetti, & Bisegna, 2015). Consequently, the understanding of the opportunities, challenges, and implications of smart cities is limited, and thus more detailed examinations, such as the case presented here, are needed to further nuance and diversify the knowledge constructed around smart cities.

This paper begins by examining how smart city narratives are constructed through marketing materials and top-down conceptualisations of the smart city. It also aims to offer criticisms on how this narrative

* Corresponding author.
E-mail addresses: lukas.marek@canterbury.ac.nz (L. Marek), malcolm.campbell@canterbury.ac.nz (M. Campbell), lily.bui@mit.edu (L. Bui).

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may be misleading in their real-life application and expression in specific contexts. Secondly, the authors discuss post-earthquake Christchurch, New Zealand, as an example in order to illustrate the disconnection between this narrative and what actually occurs when a smart city project is deployed. Finally, the authors argue that failure to account for community-level needs in the top-down conceptualisation of the smart city necessitates inclusion of citizen-led initiatives to supplement more top-down agendas for city development and management.

1.1. Historical background

While contemporary treatment of terms "smart city" and "big data" is a product of technology corporations, the concept of data-driven governance is not new and can be traced back throughout history. The idea of *smart city* - the city, whose development is driven by technology, has been reappearing in urban planning literature since the midst 19th century. One can find references to industrial and technological concepts of new cities in the concepts of the Bauhaus movement, the work of Le Corbusier or 1960's inspired urban planners as P. Cook, R. Herron or T. Zenetos (Angelidou, 2015). For instance, the United States Census, which began in 1790, was designed to track the population of a growing nation (US Census Bureau, 2015). Collection of Census data primarily involved an inventory of people and property owners in the country, the final results of which determined how much representation each state would have in congress and how much in taxes would be collected based on these proportions. As the country grew, the time required to process and to tabulate Census data grew commensurately as well. In 1888, the U.S. Census Bureau held a competition to seek more efficient methods of tabulating census data. The first two contestants captured the data in 144.5 h and 100.5 h. The third contestant, a former Census Bureau employee named Herman Hollerith, completed the data capture process in 72.5 h. Hollerith's tabulator won him the contract to process and to tabulate 1890 census data. The machine consisted of electrically-operated components that captured and processed census data by "reading" holes on paper punch cards. In 1911, four corporations, including Hollerith's firm, merged to form the Computing Tabulating Recording Company (CTR), which later came to be known as International Business Machines (IBM). Incidentally, it is this same firm that, in November 2011, registered the trademark for "smarter cities" (Söderström, Paasche, & Klauser, 2014) a concept that, since its inception, has been met with controversial feedback from multiple factions.

IBM's original "smart city" referred almost exclusively to a small number of development projects over the past decade such as Korea's New Songdo, Masdar City in the United Arab Emirates (UAE), and Portugal's PlanIT Valley which relied on mobile, fixed, and remote sensing technology to provide feedback on environmental factors, information which would then be used toward urban planning, commerce, governance, and civic engagement. However, the aforementioned smart cities prototypes garnered significant criticism across disciplines. While the discourse of "smart cities" often employs utopian rhetoric (Greenfield, 2013), it is also based on polarizing paradigms that must be examined more closely. On the one hand, smart cities bear an agenda that is predicated upon automated, data-centric optimization of urban systems imposed from positions of power, and on the other hand, there is a simultaneous push for open-source, citizen-driven applications and initiatives (Hemment & Townsend, 2013) as the concept of Living Labs (Concilio, 2016; Ståhlbröst & Holst, 2016). The latter ideology has spurred the intervention and propagation of more grassroots data collection initiatives, returning agency and power to citizens as opposed to corporations, institutions, and governments. However, tension among these types of stakeholders remains a common thread within smart city initiatives.

Moreover, rural areas, less densely populated areas, and also the small and medium-size cities may provide suitable environment for the utilisation of smart technology pilot projects and experiments that can be launched in the (possibly) more demanding setting of densely populated cities. This 'distributed city' approach can potentially become an attractor for skilled workers as the countryside and smaller towns are converted into more attractive and digitally connected settlements, with new economic growth opportunities and better services, removing both, negative effects of living in the city (stress, noise, pollution, lack of green spaces, …) and negative connotations of rurality (Kamel Boulos & Al-Shorbaji, 2014). Examples of this transformation can be seen in Bornholm (Denmark) or Dubuque (Iowa, USA) (Naphade, Banavar, Harrison, Paraszczak, & Morris, 2011). The logic of making a link between the process and urbanisation and the necessity of a smart cities is far from crystal clear. The relative lack of self-reflexivity and critical debate in this area is still being slowly addressed, but perhaps after the smart city idea has gained a grip on government.

1.2. Corporate definitions of smart city

One of reasons why there is no clear definition of a smart city is that the idea and technologies are ever evolving, thus making the smart city concept malleable depending on the purpose, or the point of view or the narrator. There is no absolute definition because there is no end point, but rather a process, or series of steps, by which cities become more liveable and resilient and, hence, able to respond quicker to new challenges (UK Department for Business Innovation & Skills, 2013). Even IBM, a leading company in smart cities business (Frost & Sullivan, 2014; Woods & Goldstein, 2014), is ambivalent about the smart city definition of Smarter City®. As summarised in Kondepudi et al. (2014), IBM has been using several descriptions of the smart(er) city (see Table 1). The rhetoric of all definitions is skewed by the relevant marketing

Table 1
Corporate definitions of Smart City.

	Definition	Reference
IBM	Smarter city makes optimal use of all the interconnected information available today in order to better understand and control its operations and optimize the use of limited resources.	IBM (2009)
	Smarter city is connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city.	Harrison et al. (2010)
	Infrastructure, operations and people. What makes a city? The answer, of course, is all three. A city is an interconnected system of systems. A dynamic work in progress, with progress as its watchword. A tripod that relies on strong support for and among each of its pillars, to become a smarter city for all.	IBM (2015)
Cisco	Cisco's Smart + Connected Communities sees Smart Cities as those cities that will use the power of ubiquitous communication networks, highly distributed wireless sensor technology, and intelligent management systems to solve current and future challenges and create exciting new services. Smart City officials will be essential visionary leaders who drive Smart City progress using public-private partnerships to invest in scalable projects, smart regulation to connect city laws to new digital realities, and innovation clusters to create jobs and vibrant economies.	Clarke (2013)
Siemens	A city is smart if it makes use of the "Internet of Things" and other intelligent systems to use its resources more efficiently and thus improve the lives of its citizens and enhance its own competitiveness.	Siemens AG (2014b)
HP	Central Nervous System for the Earth (CeNSE) consists of a highly intelligent network of billions of nanoscale sensors designed to feel, taste, smell, see, and hear what is going on in the world … [and then] analyze and act upon the information in real time using a new breed of business applications and web services … [that] improve the way governments, businesses, and society respond to and manage environmental, biological, and physical/structural changes.	HP (2014)