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From my perspective

## Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America

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## ABSTRACT

Smart cities are increasingly advocated by governments and the private sector as the primary means to deliver urban sustainability. Particularly in Europe and North America, the smart city is envisioned as a place where digital technologies are deployed to 'solve' urban sustainability problems. Such visions have been broadly critiqued in the urban studies literature for reflecting techno-utopian, neoliberal approaches to urban development that exert corporate control over cities, but there has been little empirical verification of these critiques. More recently, a disparate and interdisciplinary body of literature has emerged documenting the impacts of smart city initiatives in practice. This paper provides a state-of-the-art, empirically informed analysis of smart-sustainability, which considers established critiques of smart city policy and visions alongside the increasing body of evidence concerning the actual experiences of smart city initiatives. Through a systematic review of the smart city literature pertaining to Europe and North America, we identify and test five tensions between the smart city and the goals of sustainable urban development. These tensions involve: (1) reinforcing neoliberal economic growth; (2) focusing on more affluent populations; (3) disempowering and marginalising citizens; (4) neglecting environmental protection; and, (5) failing to challenge prevailing consumerist cultures. On the basis of these findings we propose how digital technologists, urban developers, municipalities and citizens might address these tensions. A key finding is that the potential to empower and include citizens represents the key to unlocking forms of smart-sustainable urban development that emphasise environmental protection and social equity, rather than merely reinforcing neoliberal forms of urban development.

## 1. Introduction

There are growing expectations that the emergence of smart cities will drive sustainable development (Hollands, 2008; Viitanen and Kingston, 2014). The neoliberal, techno-centric smart city vision advanced in industry-policy discourses in Europe and North America is primarily entrepreneurial and digital. This vision typically includes ultra-efficient and digitally optimised urban infrastructure, and a population of highly educated, affluent worker-consumers; a combination that is expected to fuel global economic competitiveness and growth. The smart city is a place where previously intractable social and environmental problems, such as social exclusion and climate change, are solved through the deployment of digital technologies. Based on such visions and expectations, the smart city concept has rapidly risen to prominence within the industry-policy discourses of urban development and is "on its way to becoming the] leading driver of urban

sustainability and regeneration initiatives" (de Jong et al., 2015: 12). Stoked by speculative estimates that the global smart city market will be worth \$1.56 trillion by 2020 (Frost and Sullivan, 2014), municipalities and private companies are allocating considerable resources to implement smart city initiatives in the hope of promoting urban growth, citizen participation and decarbonisation.

Urban studies scholars have developed a collective critique of the neoliberal vision of the smart city and questioned whether digitisation can actually deliver sustainability, especially from the perspective of environmental protection and social equity (Hollands, 2008, 2014; Gabrys, 2014; Viitanen and Kingston, 2014; Glasmeier and Christopherson, 2015; Shelton et al., 2015). This critique derives from high-level analysis of the industry-policy discourses within Europe and North America, and questions whether the environment can be protected by making economic growth the primary goal of the smart urban development (March, 2016; Viitanen and Kingston, 2014). Meanwhile,

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it is unclear if these critiques are applicable to actual smart city initiatives (Kitchin, 2014; Shelton et al., 2015). A broader and less critical literature has emerged to analyse actual smart city initiatives on the ground (Bakici et al., 2013; Garau, 2014; Grimaldi and Fernandez, 2015; Komninos and Tsarchopoulos, 2013; Maier, 2016; Nam and Pardo, 2014; Paroutis et al., 2013). The primary focus is again on initiatives being implemented in Europe and North America (with notable exceptions of studies focused on Brazil (Gaffney and Robertson, 2016), South Korea (Kim et al., 2016; Yigitcanlar and Lee, 2014) and Australia (Bulkeley et al., 2016)).

This paper tests the extent to which the critique of the neoliberal smart city vision is applicable to smart city initiatives being implemented in specific cities, regions and countries. In other words, it asks whether the current empirical evidence base supports or rejects the critiques of smart city visions. We do this by identifying five key smart city critiques from the literature, and then testing them against the empirical evidence base. The literatures we draw upon primarily focus on Europe and North America where the majority of research has been conducted. We begin by describing the rise of the neoliberal smart city vision and how sustainability, particularly environmental protection and social equity, have been addressed in this vision. We then identify five key tensions between the neoliberal vision of the smart city and the goals of sustainable urban development,<sup>1</sup> which we refer to in this paper as smart-sustainability tensions. Based on a systematic review of 32 empirical case studies focused on smart city initiatives, we test how the five smart-sustainability tensions are playing out in practice. We conclude by considering how digital technologists, urban developers, municipalities and citizens might address these tensions by emphasising environmental protection and social equity, and indicate key topics for future comparison with other regional contexts.

## 2. Background

The neoliberal smart city vision is a product of the convergence of three visions of the future city: the digital city, the entrepreneurial city and the sustainable city. In combination, these visions suggest that digital innovation can integrate urban infrastructure systems and drive gains in operational efficiency that will be beneficial to economic development, environmental protection, and social equity. In the following section, we trace the convergence of these visions to outline the particular form of smart-sustainable development that is advanced within neoliberal smart city visions. This then provides the basis for identifying five key smart-sustainability tensions.

### 2.1. The rise of the smart city vision

The smart city emerged as the successor to visions of first the information city (Hepworth, 1990), and then the digital city (Couclelis, 2004). The information city, prominent in the urban development discourses of the 1990s, was critiqued for adopting a narrow focus on how digital technologies – including the internet and virtual public spaces – could transform the city (Allwinkle and Cruickshank, 2011; Hollands, 2008). The digital-centric vision of the smart city that subsequently emerged was intended as a paradigm shift in digital urban development, a move away from a techno-centric perspective towards a socio-technical perspective of the city (Lee et al., 2014). This shift in framing emphasised the ability of digital technologies to solve economic and social problems, such as low levels of citizen participation in local democratic processes (Schuurman et al., 2012) and social exclusion (Tranos and Gertner, 2012).

From the late 1990s onwards, this digital-centric vision converged

with visions of the entrepreneurial city (Mahizhnan, 1999), resulting in a vision of the smart city in which digital technologies would boost competitiveness and create new engines of economic growth. This vision layers the digital-centric vision of the smart city over the neoliberal orthodoxy that cities are engaged in a global competition with winners and losers (Kitson et al., 2004) and must compete to attract residents, workers and businesses.

More recently, this vision of the smart (digital-entrepreneurial) city has been connected to visions of the sustainable city. For example, Caragliu et al. (2011) highlight that smart city visions offer a mode of governance in which social equity and environmental protection can be achieved in parallel with digitally catalysed economic growth. The smart city with its digitally mediated, efficient and integrated infrastructure is positioned as a facilitator of sustainable development by aligning the aims of environmental protection, social equity and economic development. This framing is prominently featured in the European Commission's smart city policy (Haarstad, 2016a; Marciano, 2013; Russo et al., 2016) as well as in the marketing materials of global technology companies such as IBM (Viitanen and Kingston, 2014). However, reviews of the literature suggest that the concept of the smart city as a whole does not emphasise concerns of sustainability (de Jong et al., 2015).

This latest incarnation of the smart city vision can be understood as advancing an amended sustainable development paradigm, in which the logic of economic development is replaced with the compound entrepreneurial and digital logic of smart urban development (see Fig. 1). In effect, this smart city vision reinforces the emphasis of sustainable development on neoliberal economics and capitalist growth under the guise of digital innovation.

### 2.2. Five smart-sustainability tensions

The techno-centric and neoliberal vision of the smart city has been widely critiqued by scholars of urban studies on the basis that it positions *economic growth* as the primary, or even sole, imperative of urban development (Glasmeyer and Christopherson, 2015; Hollands, 2014, 2008; March, 2016; Söderström et al., 2014; Wiig, 2016). Growth is envisioned through *digital innovation*, which creates both new markets as *urban infrastructure is digitised* (e.g., smart energy and mobility systems) and new *consumer cultures* are created (e.g. consumption of smart home technologies). Each of these dynamics creates tensions which undermine the hopes, expectations and claims that the smart city can and will deliver urban sustainability. Below we identify five of these smart-sustainability tensions that appear most prominently in the literature critiquing the smart city vision, before examining the empirical evidence base for each.

#### 2.2.1. Tension 1: economic growth is unsustainable

Critics have argued that economic growth as the primary objective of the smart city vision is incompatible with promoting social equity and protecting the environment (Glasmeyer and Christopherson, 2015; Hollands, 2008; March, 2016; Viitanen and Kingston, 2014). From the perspective of social equity, the distribution of financial gains from economic growth is left to the market, which tends to increase economic inequality rather than promote social equity (Piketty, 2014). In the case of the envisioned smart city, critics expect this tendency to result in the benefits of growth primarily being accrued by technology corporations, investors in the digital economy and highly skilled workers (of which more below) (Hollands, 2014; Söderström et al., 2014).

From the perspective of environmental protection, critics argue that economic growth relies on, and creates, increased demand for material resources, accelerating environmental degradation. Viitanen and Kingston (2014) argue that smart city advocates vastly overestimate the potential of digital innovations and technologies to decouple consumption and associated demand for material resources from economic

<sup>1</sup> In this paper we consider sustainable development, as first advanced by the Brundtland Report, to be the simultaneous pursuit of economic development, environmental protection and social equity (Holden et al., 2014).

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