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Smart cities: A conjuncture of four forces

Margarita Angelidou

Aristotle University of Thessaloniki, School of Architecture, Department of Urban Planning and Regional Development, Urban and Regional Innovation Research Unit (URENIO), Greece

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ABSTRACT

Despite the ongoing discussion of the recent years, there is no agreed definition of a 'smart city', while strategic planning in this field is still largely unexplored. Inspired by this, the purpose of this paper was to identify the forces shaping the smart city conception and, by doing so, to begin replacing the currently abstract image of what it means to be one. The paper commences by dividing the recent history of smart cities into two large sections – *urban futures* and the *knowledge and innovation economy*. The *urban futures* strand shows that technology has always played an important role in forward-looking visions about the city of the future. The *knowledge and innovation economy* strand shows that recent technological advancements have introduced a whole new level of knowledge management and innovation capabilities in the urban context. The paper proceeds to explicate the current *technology push* and *demand pull* for smart city solutions. On one hand, technology advances rapidly and creates a booming market of smart city products and solutions around it. On the other hand, there is demand on the side of cities that seek to address the problems of efficiency and sustainability, making the ground fertile for a smart city product economy. The research route of this paper eventually allows the identification of the underlying – and often forgotten – principles of what it means to be 'smart' in an urban context and yields conclusions about strategic planning for the development of smart cities today.

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1. Introduction

Smart cities represent a conceptual urban development model on the basis of the utilization of human, collective, and technological capital for the development of urban agglomerations (Angelidou, 2014). At present, tens of different descriptions of what a smart or intelligent city is can be found in the literature. Despite the ongoing discussion of the recent years, there is no agreed definition about smart cities, whereas strategic planning in this field is still largely unexplored (Hollands, 2008; Komninos, 2011a; Nam & Pardo, 2011; Wolfram, 2012). What is certain, though, is that smart cities represent a multidisciplinary field, constantly shaped by advancements in technology and urban development. In this sense, by tracing the history of smart cities up to the current smart city idea, one may hope to achieve a better understanding of what it means to be 'smart' in a city context.

The purpose of this paper was therefore to identify the shaping forces of the 'smart city' conception and, by doing so, to begin restoring the current abstract image of what it means to be one. It will do this by exploring the recent history of smart cities, identifying the principal drivers of the current smart city discourse and reaching conclusions about smart city planning today.

The paper is structured accordingly. Section 2 identifies the shaping forces of the 'smart city' conception. It explores the *urban futures* strand, highlighting the past 100 years' visions about the city of the future, as it was envisaged to become under the influence of state-of-the-art technology. It proceeds to explore the *knowledge and innovation economy* strand, highlighting how it gradually became realized that urban agglomerations can be purposefully designed to induce the development of 'knowledgeable' and innovative cities. Section 3 analyzes the current *technology push* and *demand pull* for smart city solutions. It also shows how recent technological advancements have affected *urban futures* and the *knowledge and innovation economy* and how thanks to those developments, and the smart city narrative is becoming transformed into a reality. Based on the previous observations, Section 4 illustrates examples of integrated smart city strategies and highlights the underlying principles of what it means to be 'smart' in a city context. Section 5 of the paper discusses the conclusions that emerged from the previous review.

2. Two long-lasting phenomena

2.1. Urban futures

The history of cities has shown that the social, economic and spatial structure of cities reflects their underlying production

E-mail address: mangelidou@urenio.org

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systems. Although the inertia of physical structures impedes quick transitions within the physical space, it does not hinder utopian visions about the ideal future city from running in a 'fast-forward' mode. These visions connect the future of cities with a lavish utopia of a forthcoming mechanized age, inspired by the latest developments in science and industry. The first ones appeared in the late 19th century, but they gained popularity from the early 20th century and on.

The first coherent ideas about the future of society, economy and urban settlements under the effect of the advancing technology appeared in the 1850s. The most well-known one is the vision of a healthy and functional city, as an answer to the acute cities of the early industrial revolution, which was illustrated by E. Howard in 1898 in his book '*The Garden Cities of Tomorrow*' (Hall, 2002). This work was the first to put forth the conception of an ideal city in the industrial era. Howard's ideas sought to balance individual and community needs in the context of a capitalistic economic system and influenced planning practices for many years thereafter.

Functionalist T. Garnier's drawings for an ideal industrial city, called '*Une cité industrielle*' (Fig. 1) were first exhibited in 1904 (Hall, 2002). Hydroelectric power, automobile production, air navigation, photography and cinema, i.e. the latest technological advancements of that era, were central elements of the vision. The architect, through his work of a lifetime, demonstrated clearly his belief that the cities of the future should embrace industry and its technological achievements.

Only a few years later, the Futurist movement (around 1909–1916) was vividly propagated through ideas about speed, violence, machinery, industry, the car, the airplane and the industrial city – namely all that which represented the technological triumph of humanity over nature. In 1913, the Italian futurist A. Sant'Elia, architect and prominent member of the Futurist group, started work on his large project for the '*Città Nuova*' (New City, Fig. 2). Sant'Elia imagined the city as an efficient, fast-paced machine. He visualized it as highly industrialized and mechanized, comprising vast skyscrapers, grandiose multi-level traffic routes, bridges and aerial walkways.

The Bauhaus movement (1919–1932) in Germany also drew some of its ideas from the notion of mass industrial production. The movement did not produce plans about whole cities, but Walter Gropius, founder and prominent figure of the movement, stated in 1923 that '*We want an architecture adapted to our world of machines, radios and fast motor cars*' (Honour & Fleming, 2005).

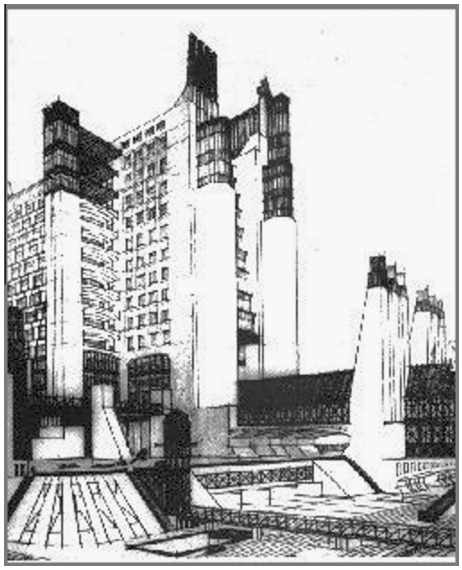

Fig. 2. Image from Sant'Elia's '*Città Nuova*'. Grandiose structures frame the future city once again (http://www.essential-architecture.com/STYLE/STY-069.htm).

For Bauhaus, the machine and modern technology were considered positive elements, and therefore its proponents engaged extensively in industrial and product design.

Le Corbusier, the famous modernist architect, designer, urbanist and writer, also produced a very rich variety of works, through which the importance of machines, industry and rational thinking emerges very eloquently. It is not by accident that Le Corbusier named some of the buildings and cities he designed after manufacturing brands: '*Maison Citrohan*' (after the French Citroën automaker) and '*Plan Voisin*' (after the French aircraft manufacturing company). He clearly implied that houses and cities ought to encompass modern industrial methods and work as effortlessly as machines. In 1922 Le Corbusier produced his plans for the '*Ville Contemporaine*' (contemporary city) for a population of three million. In the city's heart lied a group of sixty-story skyscrapers for residential and office use, built with steel and glass – the latest revolution in the construction industry at that time (Fig. 3).

The Second World War (WWII) was naturally a period, during which construction and future visioning subsided. However,

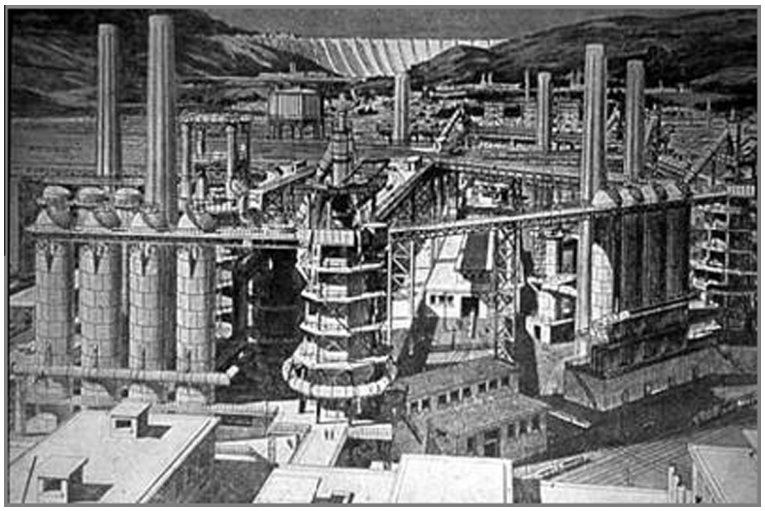

Fig. 1. Image from Garnier's '*Une cité industrielle*'. Grandiose structures frame the future industrial city (http://www.essential-architecture.com/STYLE/STY-069.htm).

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