Developing Smart Cities in China: An Empirical Analysis

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ABSTRACT
This article describes how being pushed and pulled by a variety of external and internal factors, the Chinese government had begun to adopt and implement its smart city initiatives. Despite the strong financial and institutional supports from the central government, the performances of smart city initiatives significantly vary across pilot sites. Considering smart city initiatives as government innovation and drawing on the government innovation diffusion theories, an explanatory model has been developed to examine their variance and test it with a cross-sectional dataset using multiple regression methods. It was found that although environmental pollution was a key driver for the development of smart city in China, such environmental pollution like air pollution in particular had a curvilinear relationship (bell-shaped) with smart city development. In addition, smart cities initiatives in China were driven not only by technical rationalities but also political rationalities. Political supports from local ruling party sectaries made a difference.

KEYWORDS
Government Innovation, Government Innovation in China, Innovation Diffusion, Modelling Smarty City Development, Smart City, Smart City in China, Urban Management, Urban Innovation

INTRODUCTION
Although “smart city” as a theoretical and practical concept is a very recent phenomenon, it has been considered an ideal model for future city development and management by urban planners and urban managers worldwide. Cities in America, Europe and Asia have developed their own smart city initiatives and have made impressive progress and achievements (Alawadhi 2012; Caragiu, Del Bo & Nijkamp 2011; Toh & Low 1993).

This trend is a natural response to the unprecedented urbanization worldwide. In the 21st century, the global urbanization process is accelerating. According to a recent report by United Nations, 54% of the global population lived in cities and this number would be growing to 66% by 2050 (United States, 2014). Although urbanization advances economic and technological developments, urbanization also imposes unprecedented challenges on the humankind. For example in 2012, although cities occupied only 3% of the global land area, they consumed 75% of natural resources and produced 60%-80% of all greenhouse gas (GHG) emissions (UNEP, 2012). In addition to energy consumption and global warming, urban illnesses such as diminishing biological diversity, environmental pollution, traffic

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jam, food security, economic disparity and social risks including low fertility and aging population threaten the economic sustainability and people’s quality of life (United States, 2014).

In 1990s scholars began to talk about smart governance and smart growth in order to address environmental and social substantiality issues caused by the unstoppable trend of industrialization and urbanization (Griffith, 2000). With the development and advances in IT-enabled technologies and the Internet, scholars and practitioners in urban planning and management began to propose the idea of taking advantages of these technologies to capture, analyze and share spontaneous information about every aspect of urban life and integrate them into the urban planning. Beyond E-government services, these include the management process for reducing energy consumption, streamlining city management, improving the accuracy and quality of decision making, providing customized services to city residents with diverse interest in a more efficient manner, addressing urban problems and improving the quality of life (Oberti & Pavesi, 2013). Capturing this new growth opportunity, savvy IT companies such as IBM began to promote the idea of smart cities and sell their smart city solution packages to cities worldwide since 2008. According to ABI Research, while in 2010 $8.1 billion was spent on smart city technologies, in 2016, that number would reach $39.5 billion (ABI Research, 2011).

In 2009, pushed and pulled by a variety of external and internal factors, Chinese local governments such as in Ningbo City, Zhejiang Province, had begun to embrace the idea of a smart city and initiate their own smart city projects. Since 2013, to further promote and regulate the development of smart city initiatives, China’s Ministry of Housing and Urban-Rural Development (MOHURD), which is the main authority in charge of the urbanization, urban planning, urban management, and public housing in China has been selecting cities to experiment and implement smart city initiatives. The MOHURD provides selected pilot cities with funding and technical support, as well as monitoring and evaluating their progress in smart city development (Johnson, 2014). Up to 2015, China has 296 localities including cities, districts, counties and townships having their own smart city initiatives (MOHURD, 2015).

Due to China’s unique political system and central-local government relationship, smart city development in China exhibits different features and developmental paths. Different from the Western development model of bottom-up, local autonomy and inter-sectoral collaboration (Dameri & Rosenthal-Sabroux, 2014), current smart city initiatives in China are primarily pushed forward by a top-down approach controlled by the central government. While smart city initiatives are guided, monitored and evaluated by the central government ministries, after several years of development the performances of smart city initiatives vary significantly across localities in China (Chinese Academy of Social Sciences and Beijing Govmade Smart City Research Centre, 2015, Zhang, Chen & Song, 2015). In this article, drawing on government innovation diffusion theories, we developed a model to explain the variance in the performance of smart city development in China and empirically test the model to explore its determinants through multiple linear regressions.

Current literature on smart cities mainly focuses on the definitions and dimensions of smart cities (Alawadhi et al., 2012; Chourabi et al., 2011; Jucevičius, Patašienė, & Patašius, 2014), evaluation framework of smart cities (Albino, 2015), rankings of smart cities (Giffinger, Fertner, Kramar et al (2007) and the status quo and challenges of smart city development (Kogan, & Lee, 2014). Literature review, conceptual analysis and case studies dominated the research methods in these smart city studies (e.g. Albino, 2015; Dameri & Rosenthal-Sabroux, 2014; Oberti & Pavesi, 2013). With few exceptions (Lombardi, Giordano, Farouh & Yousef, 2012), there is a lack of quantitative empirical studies. Therefore, this article provides significant theoretical and practical implications in enriching our understanding of smart cities, the rationales and logic underneath the development of smart city initiatives in China, and providing practitioners with ideas to further improve their management of smart cities initiatives.

The rest of this article has five sections. In the first section below, we review the literature on smart city and smart city development in China, providing background information for the later sections. In the second section, drawing on government innovation diffusion theories, we develop a
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