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# Smart cities through the lenses of public policy: the case of Shanghai

*Ciudades inteligentes analizadas desde la perspectiva de las políticas públicas: el caso de Shanghai*

*Olga Gil*

Universidad Autónoma de Madrid/ Universidad Complutense de Madrid  
olgagil@olgagil.es

*Tian-Cheng Zheng*

Universidad Autónoma de Madrid  
tian.zheng@estudiante.uam.es

## **Abstract**

This article explores the applicability of the model developed by Chourabi *et al.* (2012) to the urban reality of Shanghai, China. The eight variables of the model: 1) governance and public urban planning 2) management and organization 3) technology 4) policy context 5) people and communities 6) economy 7) built-in infrastructure, 8) and natural environment, are examined against the Shanghai case. The findings are that for Shanghai the smart city plan inherits a process of transformation in place from the beginning of 1990s in four areas of public policy: governance, technology, built-in infrastructure and economy. The smart city plan, however, develops specificities for management and organization and shows a built-in capacity to develop a favorable policy context with the central government more recently. We have found a limited scope for people and communities and the natural environment shaping changes which are so-called smart. The framework applied allows us to show the significant role that the local government plays in the city through public policy. This framework contributes to extend the scope of comparative urban theory and analysis beyond the western world, in the East Asian context, allowing further comparison across cities. Final results might be used to complete new research programs, as we conclude.

*Keywords:* public policy, smart cities, Shanghai, technology, environment, Internet of Things, grid, utilities, energy.

## **Resumen**

Este artículo explora la utilidad del modelo desarrollado por Chourabi *et al.* (2012) para explicar la realidad urbana de Shanghai en China. Se examinan las ocho variables incluidas en el modelo, para el caso de la ciudad de Shanghai: 1) gobernanza y planificación urbana, 2) gestión y organización, 3) tecnología, 4)

contexto político, 5) personas y comunidades, 6) economía, 7) infraestructura construida y 8) medio ambiente. Los resultados destacan que para Shanghai, el plan de ciudad inteligente es heredero de un proceso de transformación que tiene lugar desde comienzos de la década de 1990 en cuatro áreas de políticas públicas: gobernanza, tecnología, infraestructura construida y economía. El plan de Shanghai ciudad inteligente es peculiar para la variable gestión y organización y muestra capacidad para desarrollar un contexto político favorable respecto al gobierno central. Sin embargo, se encuentran limitaciones en la capacidad de cambio que inducen las variables personas y comunidades y medio ambiente. El modelo contribuye a ampliar la aplicación de la teoría y el análisis urbano comparado más allá de casos en Europa occidental y Norteamérica, al contexto de Asia, permitiendo ampliar la comparación entre ciudades. Se concluye avanzado que los resultados alcanzados pueden ser punto de partida para completar nuevos programas de investigación.

*Palabras clave: políticas públicas, ciudades inteligentes, Shanghai, tecnología, medio ambiente Internet of Things, grid, utilities, energía.*

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## INTRODUCTION

The United Nations World Urbanization Report estimates that over 70% of the world population will be living in cities by 2050. What are the challenges for cities in these new scenarios? Even though the trend is global, local governance responses are diverse (Ganapati, 2013). China is emerging as the world's most important economy and, potentially, a key world power, with its own approach to public policies (Lin, 2015). However, research on Chinese cities is not commensurate with China's (re) emergence on the global scene. This paper investigates the particular response of Shanghai, where Lin finds a "pressing need for the formulation of innovative policies to co-ordinate land use and promote smart growth in a rapidly industrializing, urbanizing and globalizing regional economy" (2007: 1846). The choice of Shanghai is justified by city size and importance as global city.

There is an interesting literature on Shanghai from the perspective of global cities (Yusuf and Wu, 2002). However, most of these fail to adopt a comparative approach using the smart city concept to allow for comparison across cities and public policies. In order to study the city from this comparative perspective, we identified theories which combine both a particular focus on the smart concept, and the capacity to contribute to knowledge on world case studies within a comparative framework. To do so, we build on previous research such as Liu (2012: 1141) who states that Shanghai, as a mega city, is "struck by the same forces of globalization, economic restructuring and advances in information technology as cities in the Western world". Liu shows that comparisons are meaningful, even with different urban forms, in particular for the case of Shanghai. By understanding smart city governance in this case we are interested in making a contribution to public policy and comparative urbanism with a global scope, as suggested by Robinson (2014).

We also build on the finding by Lin (2007: 1847) that large and super large cities tend to expand and upgrade the urban built environment in China from the 1980s, "so that they could distinguish themselves from the numerous small cities [...] experiencing rapid

industrialization and urbanization”. In particular, superlarge cities experience a dramatic increase in land areas, which is “extraordinary and unprecedented” (Lin, 2007: 1840). What are the specifics of the upgrade in the built environment in the case of Shanghai? This is also one of our concerns.

We find that for Shanghai the smart city plan inherits a process of transformation in place from the beginning of 1990s in the public policy areas of governance, technology, built in infrastructure and economy. We also find that the Shanghai smart city plan presents specificities for management and organization and shows a built-in capacity to develop a favorable policy context with the central government. We have found, however, a more limited scope for people and communities and the natural environment shaping changes so-called smart. We have also found the variable governance down-rated for normative reasons, since the political party may not be contested through elections.

This article proceeds as follows: In the first part, the two main theoretical traditions addressing the smart city concept are explained. In this part the hypothesis and the theoretical model that will underlie the analysis are also advanced. We then briefly introduce the context: origins of the agenda for smart cities worldwide. The analysis of Shanghai, using the chosen theoretical model follows suit. Finally, we present conclusions and findings, including suggestions for future research.

## SMART CITIES UNDER TWO TRADITIONS: HUMAN CAPITAL AND TECHNOLOGY. DEFINITIONS

The purpose of this first section is to show and review the two main theoretical traditions addressing the smart city concept: The first approach focuses on human capital, and the second approach focuses on technological progress. We also explain why we choose one of these traditions to analyze the case of Shanghai.

We start by the stream of theory drawing on human capital as a main component of the smart cities definition, starting with Shapiro (2006) and further enriched by other authors. First, Shapiro (2006) draws the link among quality of life, productivity and the growth effects of human capital in cities. Winters (2011) considers a smart city as a “metropolitan area with a large share of the adult population with a college degree, often small and mid-sized metropolitan spaces containing flagship state universities”. In the European tradition we find a refinement, with the idea of inclusiveness and regeneration linked to the smart city concept (Deakin and Allwinkle, 2007).

For Hollands’ work (2008), undergirding social capital is critical to embed the required informational and communicative qualities of smart cities. Holland’s definition is linked to an academic tradition that purposely avoids defining intelligence limited to the world of devices and the Internet of things. Such a definition would constrain the smart concept to the artificial intelligence available (Komninos, 2009), and would

neglect two other forms of intelligence: human and collective, from the —collective— skills of population to the social institutions articulating cooperation. Allwinkle and Cruickshank (2011) highlight from Hollands' definitions the emphasis on people and their interactions. Deakin and Al Waer (2011), Caragliu, Chiara Del Bo, and Nijkamp (2011), Komninos (2009), and Florida (2002; 2005) are also within this academic tradition drawing on human capital as a main component of the smart cities. Shen *et al.* (2011) also include urban sustainability indicators, taking into account environmental, economic, social and governance aspects.

The wealth of these approaches has been shown in the study of cities in more developed countries. However, from our perspective it is interesting to understand the nuances of cities where the developmental role of the government is substantial, as it is for Shanghai (Liu, 2012: 1128).

Thus, for the purpose of this article, we draw on the literature from various disciplinary areas, from e-government, to information science, urban studies and public administration, where we find scholars working from different geographic backgrounds and bringing different mindsets in the research advanced by Chourabi *et al.* (2012). This academic tradition focuses on technological progress. However, it also brings tools to evaluate critically the impact of this progress from a comparative perspective.

Chourabi *et al.* identify eight critical factors in smart city initiatives that we find interesting to analyze and understand smart cities' governance: management and organization, technology, governance —as a different variable in Chourabi's approach— policy context, people and communities, economy, built infrastructure, and natural environment. Beside the capacity as evaluation tools, we find Chourabi *et al.* (2012) factors a very useful framework to examine how a local government envisions and pursues smart city initiatives, and more generally innovations in governance and public policies.

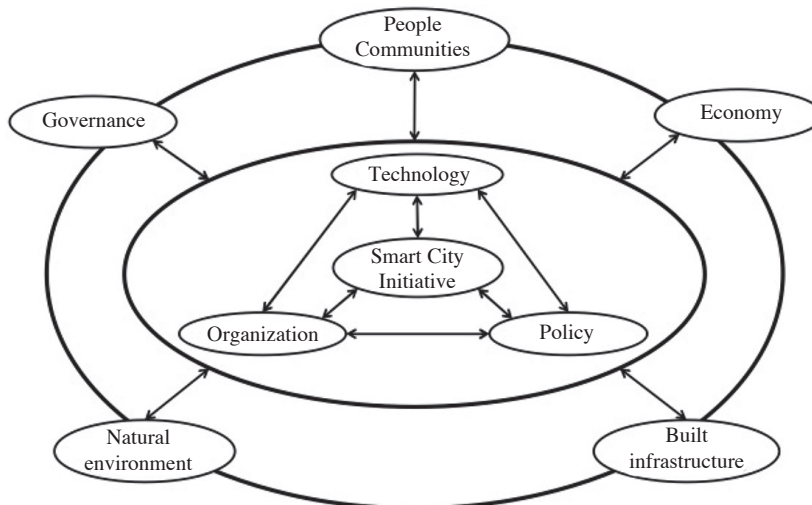
The framework devised by Chourabi *et al.* allows us to evaluate factors and success of initiatives for the case of Shanghai. It addresses sustainability and livability, as well as internal and external factors that affect design, implementation of smart cities initiatives. Instead of producing a set of components to rank smart cities, the framework and the focus on governance allows to characterize a city smart design initiatives, how initiatives are implemented and how to navigate emerging challenges. It allows us to suggest areas for further research and potential areas for new policy recommendations.

Our hypothesis is that the factors to advance the smart plan are key issues to differentiate a model of urban governance. Our choice of Shanghai as a case study is driven by an interest to learn in depth from innovation practices in different world institutional settings. In the first place it is driven by the fact that innovation in Asia has been growing at very high rates: from 2000 to 2005 the growth rate in research and development in China rose by 17% while figures for north America were 5,2% and Europe 3,8% (Komninos, 2009).

Previous work presented (Gil and Navarro 2013) analyzed the eight factors proposed by Chourabi *et al.* (2012) in Figure 1 in five world cases.

FIGURE 1.

SMART CITIES INITIATIVES FRAMEWORK IN CHOURABI ET AL. (2012)



In previous work, we conclude that governance could be a key overarching variable, embracing the rest as subcategories. We also concluded that the case of Shanghai was an interesting one to explore as a case study on its own, due to the wide plans and endowments founded in this Chinese city. Within the governance category, we are particularly interested on the identification of public policy issues and implementation problems that will be the focus of further research.

#### THE CONTEXT: LOCAL GOVERNMENTS, OCDE, THE EUROPEAN UNION AND FIRMS. SETTING THE AGENDA FOR SMART CITIES WORLDWIDE

Once the theoretical traditions on the smart city concept have been presented, and hypothesis and the theoretical model underling the analysis have been advanced, we turn to briefly introduce the origins of the agenda for smart cities worldwide. This agenda runs in parallel to the shortcomings of the growth model to explain the change and development of cities. In particular, the shortcomings of the growth model to explain change and development in Chinese cities, as Lin shows (2002). These shortcomings become more apparent in the last decade, where policies different from population concentration trigger change in local governance.

In 2005 the Organization for Economic Cooperation and Development (OCDE), uses the concept of smart cities as being environmentally sustainable, competitive and cohesive to meet an emerging quality-of-life agenda (OECD-EUROSTAT, 2005).

Both in Lin (2002) and the OCDE approaches we may find a qualitative change towards urban development concepts and policy makers perspectives. Actors in the public and private sectors have adopted these ideas related to the smart agenda in the following years. These, for instance, are landmarks in smart cities initiatives globally (Deakin and Al Waer, 2011): Amsterdam Smart City initiative, Southampton City Council, The City of Edinburgh, the Malta Smart City strategy, and cities in the American continent, including Philadelphia, Seattle, Quebec city and Mexico city (Alawadhi *et al.*, 2012).

In Europe, European Union research and policy projects have emerged studying and dealing with aspects of the ‘smart city’ (Komninos, 2009; Paskaleva, 2009; Schaffers *et al.*, 2011). The recently concluded pan-European research project IntelCities, for instance, found that governance, as a process and outcome of joint decision making, has a leading role to play in building the smart city. IntelCities also found that cities should develop collaborative digital environments to boost local competitiveness and prosperity by using knowledge networks as a means to integrate the governance of e-service delivery. The Smart Cities INTERREG project is also using an innovation network between academic, industrial and governmental partners to develop the triple helix of e-services in the North Sea Region by a novel customization process (Deakin, 2010).

Companies are marketing smart while redistributing their product innovation in basic and applied research —and this is new— across global and development networks (Komninos, 2009). This is a relevant trend both for large and small innovative companies.

TABLE I.  
URBAN ANNUAL GROWTH RATE

Year	China	Japan	United States
2000-2005	4,16	0,34	1,43
2005-2010	2,62	0,19	1,33
2010-2015	2,29	0,15	1,23
2015-2020	1,97	0,07	1,10
2020-2025	1,58	0,01	0,97
2025-2030	1,23	-0,04	0,85
2030-2035	0,96	-0,12	0,75
2035-2040	0,77	-0,22	0,66
2040-2045	0,59	-0,31	0,59
2045-2050	0,40	-0,38	0,5

Urban annual growth rate 2000-2015 (%).

Source: United Nations Statistics. Data from 2010 onwards are projections.

Under this global context for smart cities, the following section focuses on the case of Shanghai in China. Table 1 gives us data on urban annual growth rates in China, in comparison with Japan and the United States. In choosing Shanghai as a case study, we follow a purposive approach: we are interested in doing logical deductions from different world settings. Following Komninos, “the challenge today is ... to gather and integrate knowledge from every available source all over the world (and) for global open systems of innovation” (2009: 352). For the purpose of the research, we have relied on academic articles, web pages as well as government documents and articles from the press, helping us to identify new issues.

#### THE CASE OF SHANGHAI: WHICH PUBLIC POLICIES? MANAGEMENT AND ORGANIZATION, TECHNOLOGY, POLICY CONTEXT, PEOPLE AND COMMUNITIES, ECONOMY, BUILT INFRAESTRUCTURE, AND NATURAL ENVIRONMENT

We have covered the theoretical traditions addressing the smart city concept, and advanced our hypothesis and the theoretical model that underlies the analysis of Shanghai. After a brief reference to the origins of the smart cities agenda worldwide, we now turn to the analysis of Shanghai.

Our analysis is built on the factors suggested by Chouraby *et al.* (2012). We analyze the following subcategories: management and organization together with policy context and built in infrastructure; then we follow with technology, the economy, people and communities and natural environment. As explained, we make governance an overarching category, and we discuss it at the end of the case. In the definition of governance we include the normative question of democracy — which would not be involved in the variable management and organization.

#### *Management and organization, policy context and built infrastructure. Grand design in Shanghai*

In China we find by 2011 fifty-one urban areas with plans and specific goals addressing smart cities (Liu and Peng, 2013). The management, policy context and built infrastructure for smart cities are based on an investment-led model in the country. The roots are on the 12th Master Plan<sup>1</sup> and a government budget that allocates substantial resources to the Internet of Things and sustainability sectors, keys to the development of smart cities in the country, together with cloud computing. The White Paper on Internet of Things published by the Academy of Telecommunications Research of the Ministry of Industry

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1. Master Plans are drafted on a four-year basis by the central government to direct the Chinese economy.

in China marks at 500 billion yuan the investment for its 12th Five Year Plan. Liu and Peng (2013) highlight the high focus on embedding “sensors into all corners... through power grids, railways, bridges, tunnels, highways, buildings, water supply systems, dams, oil and gas pipelines”. This investment led model developed under fierce competition, however. In 2012 half of the 47 sub provinces with central government city status had developed smart city plans.

Shanghai has issued the “Smart Shanghai 2011-2013 construction Plan”. Liu and Peng indicate that the goal for a wireless and broadband city has been completed and a new generation of information technology industries has become a strong support of smart Shanghai, information security overall has been credible reliable and controllable (Liu and Peng, 2013).

In terms of management, the focus of Shanghai smart plans has to do with three axes: International trade and becoming a global financial and economic center by 2020. These axes have been targeted from 1992 under different action plans, before the label smart was used. Remarkably, local leaders render some of the former plans obsolete because they were able to succeed expectations on planning and execution One related question is whether there is underestimation, and if so, whether underestimation of targets is done purposefully.

In 2011 the municipality —24 million inhabitants, and second in the ranking of Chinese cities for global connectivity, after Hong Kong (Taylor *et al.*, 2013: 872)— puts in place a three-year action plan to build a smart city<sup>2</sup>. The idea behind the plan is to attain an “innovation driven transformation”. It insists on the principle of socialism with Chinese characteristics guided by Deng Xiaoping Theory. With the aim, however, to become an international economic, financial, trade, and shipping center as well as a socialist modern international metropolis, as it is recalled. In practice, the plan builds up on measures taken from the decade of 1990, when informatization was the basis of modernization in three consecutive five year plan periods. Thus, the three-year plan is limited to explain the whole process developing in over a decade, as it leaves out the vision of President Jiang Ze Min to make of Shanghai an international financial, economic and trade center as soon as possible (1992)<sup>3</sup>.

These are tools to make the vision possible:

*“Improving the Internet broadband and intelligent application level, build an information infrastructure system of international level, a convenient and highly effective information sensing and intelligent application system, an innovative new generation of IT industry system and a credible and reliable regional information security protection system. [Giving] full play to market mechanism and enterprises,*

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2. Action Plan 2011-2013 of Shanghai Municipality for Building Smart City. See also the Outline of the 12th Five-Year Plan for the Economic and Social Development of Shanghai.

3. 14<sup>th</sup> Congress Party Records.



*attach importance to government guidance, improve market supervision, vigorously promote the building of future-oriented Smart City carrying mainly digital, network and intelligent features... to raise the city's all-round modernization level and let the citizens share the benefits offered by [a] Smart City" (Shanghai Smart City Plan).*

We are also building on the finding by Lin (2007: 1847) that large and super large cities tend to expand and upgrade the urban built environment in China from the 1980s, "so that they could distinguish themselves from the numerous small cities [...] experiencing rapid industrialization and urbanization". In particular, superlarge cities. Let us see the specifics of the upgrade in the built environment in the case of Shanghai, which is one of our concerns.

In 2013 the Shanghai Pilot Free Trade Zone was created with the purpose of allowing foreign and national industries to prosper in a law-oriented market environment and to attract foreign investment. Shanghai People's Congress, the city's legislative body, has voted the legal ground for the Pilot Free Trade Zone unanimously in a new law and it has been enacted from August 1, 2014. The zone builds up in previous initiatives set in place since 1984, such as the free trade zone of Pudong (Yusuf and Wu, 2002: 1227). The free trade zones in Shanghai show a specificity of the urban built environment. Beside a dramatic increase in land areas, extraordinary and unprecedented, as noted by Lin (2007: 1840), we find this capacity to experiment with special zones.

#### *Technology: from the grid to the quest to generate 210 billion RMB with special projects*

Fields in which Shanghai is also innovating are technology and energy, key components to smart developments in China (Liu and Peng, 2013). Technology and energy also include plans on urban development, smart buildings and smart lighting. Even though technology has a strong focus on standards, technical standards are lacking or still not perfect (Liu and Peng, 2013).

China has been active investor in infrastructure that incorporates intelligence into networks, making them smart in a technological sense -the so-called smart grids. A report by Zpryme, the largest state-owned power producer in China estimated an annual expenditure of \$ 7,3 billion in smart grid projects. The development of a smart grid for energy purposes is an attempt to leap forward the model of energy production and distribution: China is focusing on building a smart grid capable of generating and transporting energy from remote inland areas to populated areas on the coast. This project aims to tackle the challenge of an expected increase in electricity consumption reaching 8,5% per year. Interest on smart grids focuses on technical aspects such as the transmission, standards, integration of renewable energy and electric vehicles, and the implementation of systems that support bidirectional power flows. Challenges include basic questions such as standard network sockets, since there are three different types within the country.

In terms of energy, Shanghai includes a grid-based management system. The city has sought to make applied demonstrations of the smart grid: “building Shanghai into a Smart Grid demonstration city”. The objective of pilot demonstrations —including the Shanghai World Expo— has been to achieve a leading effect. In so doing, the municipality sought actively the support of the State for the city’s trials in relevant areas.

In Shanghai, the municipality targets efforts for scientific and technological innovation. They do so strengthening the cooperation between Ministries and Shanghai Municipality and by 1) relying on network integration, broadband network as well as intelligent analysis and decision making; 2) introducing a super computing mainframe system ranking at the forefront internationally; and 3) building up operational bases and auxiliary facilities to improve application service level and expanding application service areas. In fact, from 1999 the largest gains in output value are registered in telecommunications equipment, computers, integrated circuits, bio-medical equipment and new materials (Wusuf and Wu, 2002: 1227).

Among the projects promoted are the following: the high-precision positioning service platform based on Shanghai GPS comprehensive information network, the construction and renovation of compatible stations with BeiDou —Compass— Navigation Satellite System, GPS and GLONASS; Shanghai regional CROS wireless broadcasting platform; and the multi-position application service. Shanghai has been interested on exploring new popularization patterns, focusing on the new generation of information technology like cloud computing and Internet of Things and stepping up the building of application demonstration points and commercialization bases.

Shanghai set in place a target: generating an annual business income of over RMB210 billion just with the software industry by 2013. It also put in place special projects, some of which might be good foundation for e-government success factors (Gil-García and Pardo, 2005).

The first special project has to do with cloud computing with the “Yunhai Program” —gathering large foreign and domestic Internet businesses, and exploring the building of cloud computing business models oriented to the market in the financial, health and cultural areas. It also included the building up of an Asia-Pacific cloud computing center. The second special project is related to the Internet of Things —in particular the development and manufacturing of the advanced sensors, gateway chips and products, short-distance wireless telecom chips and modules, and core control equipment. Shanghai tried to become a state pilot city for the Internet of Things application and industrialization building the Shanghai Internet of Things Center in Jiading; the Internet of Things industrial bases in Pudong and other districts, and building the Internet of Things application demonstration bases in Yangpu and other districts and counties —with emphasis placed on application demonstration and talent training. The third special project involves TD-LTE in areas such as mobile Internet, Internet of Things and cloud computing; applying it to the areas of high-end financial and business districts, shipping business, high-tech parks, government offices, school campuses and hospitals. The fourth special project relates to

high-end software integrated circuit in the packaging industry, encouraging foreign investment, including Taiwan investment, in the packaging sector and building a packaging industry that will suit and interact with the city's integrated circuit industry chain, aiming at making a breakthrough in industrialization and commercialization. By 2013, the city's integrated circuit industry was targeted to reach a scale of RMB 85 billion and a designing sector aimed to maintain a leading position in the country and gradually catch up at a world advanced level, the fifth special project is known as Next Generation Network, aimed at conducting pilot demonstration by the government and telecom carriers, and promoting the evolution of the entire upstream and downstream of the industry chain to next generation network — from system equipment, to terminals, professional platform and content, internationally competitive, with controllable core technology. The sixth special project involves Internet of Vehicles: the aim is to become domestic leaders with effective business models and international influence. The seventh special project tackles Information Service — with a stress placed on high-end and new services. The aim is on the attraction of headquarters in order to become internationally competitive in network games and in domestic information service industry. A number of professional bases promoted include Zizhu national network audio/ video industry base, Zhangjiang national digital publishing industry, Dongtan data industrial park and the digital interactive entertainment industrial park. This project focuses on setting up professional technological support platforms for network games, network audio/video and copyright transfer, making industrial standards for network games, e-book and e-textbook and intensifying governance of rights infringement and piracy, and making efforts to solve the problem of rights infringement and piracy, the eighth special project seeks to strengthen the building of a financial data bank. It also seeks advancing the research and development and industrialization of economic information terminals, including the daily life information sector -food & beverage, leisure & entertainment, and shopping, building a daily life information platform including a data base for urban public infrastructure, a consumption guide platform, information transmission and commercial marketing service platform, and strengthening tourist information resource development and service, the ninth special project focuses on Information Security Protection grounds: the city decided to adhere to the policy of “active and comprehensive security maintenance”, making efforts to build solid foundations for security protection, strengthening future-oriented information security studies, taking the initiative to deal with the new issues and circumstances in information security, and striving for a safe network environment, so as to ensure the synchronized planning, advance and implementation of information security and Smart City building and that information security is controllable. The tenth special project tackles Infrastructure Construction: Unifying public infrastructure construction including network credibility system and emergency basic platform, improving the support function for information security of basic network, and enhancing the basic protection and emergency handling capability of information security. These projects were completed with two others focused on monitoring harmful information on the Internet and crack down on network crimes.

*The economy. A heavily local government led model*

Under the investment-led Chinese model, the central government and local governments are working on industry supply chains and applications with the intention to develop an industry worth more than 500 billion yuan in 10 years. This is part of the China's 12th Five-Year Master Plan (2010-2014).

Among the shortcomings of the investment-led models in China, Liu and Peng (2013) suggest that we may find widespread construction where quantity and quality might not be satisfactory, waste of funds, repeated or redundant constructions becoming information islands —citing the case of Beijing, where over 700 operation systems face difficulties of integration— and a lack of laws, regulations and technical standards. They also remark that smart cities risks associated to technology out of control may cause disaster, which can affect the national level (Liu and Peng, 2013).

In Shanghai there has been a specific focus on the optimization of the market mechanism:

*“Giving further play to the role of the market in resource allocation and attracting businesses of all kinds to join in project construction; improving a multi-source investment and financing mechanism, expanding financing channels and actively introducing venture capitals and private funds; encouraging financial institutions to strengthen their product and business innovation, beefing up credit support to those businesses that participate in the construction of major information infrastructure facilities and key projects; exploring an equity incentive mechanism for on-the-job scientific and technological achievements to fully mobilize the enthusiasm of the scientific and technological talents for innovation and entrepreneurship” (Shanghai Smart City Plan).*

However, aspects related to the shortcomings of the investment led model, as shown by Liu and Peng (2013) will have to be addressed when the analysis of the implementation of the smart city plan is undertaken.

*People and communities. The Achilles heel of the system*

With regard to people and communities, they are incorporated through the political party in the smart city models of China. The fact that the political party may not be contested through elections downgrades the case of Shanghai with regard to this variable, despite advances on open data policies, for instance —the government starts to work on open data policies on public budgets from 2013, according to the statistics office.

In Shanghai the three year plan has attempted to render more support to people able to participate on building the smart city: “introducing leadership, compound and professional talents,” and to raise talent for the development of “smart city building”.

However, beside the central role of the party, as Liu and Peng (2013) suggest, there is also room for improvement, recommending to pay attention to the cultivation and management of talented persons and professionals, education and training, to build a high-end talent platform with universities and scientific research institutes, and to carry out a mode of cooperation between colleges and local industries with the complementary vocational training schools. The aim would be to provide coordination for producing, learning, studying, and researching (Liu and Peng, 2013).

Attempts have been made at coordination of innovation of firms, universities, research institutions and users in the new generation of IT industry, including cloud computing and the Internet of things. The smart city plan mentions on this realm the need for a sound environment, from professional forums and conferences to exhibitions.

#### *Natural environment, or the absent public policy in the smart city plan*

The natural environment is a concern in smart city plans and it is part of the model developed by Chourabi *et al.* (2012). However, in the Chinese case the focus is on energy, and the setup of a smart grid to transport energy to coastal cities in the east coast. Environmental pollution and congestion has been a problem, with highly inefficient factories abounding, but it is not addressed as such under the smart city plan—and we wonder why. This is a question for further research.

Out of this smart city plan, policies in Shanghai have focused on relocation of factories from the central city to the new industrial districts. Figures from 1991 to 1998 show 12.000 work units moving from downtown to the city outskirts (Yusuf and Wu, 2002: 1225).

#### *The governance of the smart city, a down rated variable on democratic grounds*

The governance of smart city plans in China includes the participation of local governments and universities, both led by officials from the communist party in the actors' realm. The cooperation is open to local governments, universities and foreign firms. Japanese firms as well as IBM, for instance, have developed alliances with local governments. In all cases the party elected officials have a stronghold executive power. Thus, we find higher level governments that decentralize tasks to local authorities. This shows a shift in traditional patterns of allocation of functions and responsibilities in the local domain in China. This shift is consistent with the institutional reforms undergone in the 1980s, as observed by professor Jean C. Oi from Fudan University, who theorizes about local state corporatism in China. These reforms continue in the 1990s, giving greater managerial autonomy to public utility agencies, as Yusuf and Wu document: "municipal service departments have been given full responsibility for planning, investment, operations and

maintenance. These departments are also adopting an independent cost-accounting system to facilitate sector management and financing (Yusuf and Wu, 2002: 1230)". We shall advance conceptualizing these new political arrangements out of conversations with Chinese scholars and public managers<sup>4</sup>.

Urban regions adopt new modes of governance: Local governments lead smart cities projects. Local governments are also the nodes for foreign firms interested in local collaboration.

Shanghai Municipal Government, acting through YIDIAN — a large state owned company directly under the umbrella of the municipal government— brands itself as the “only information company under the Shanghai State-owned Assets Supervision and Administration Commission”. This group of companies — YIDIAN— has 120 or more firms under its umbrella, including 22 consolidated companies, of which 5 are publicly traded. Its total assets surpassing 29,1 billion RMB, net assets of 11 billion RMB and net sales over 40.267 billion RMB (2011).

Banks are also important actors in the smart landscape, as 440 billion yuan are likely to be granted to smart city projects across the country. A commercial bank, China Development Bank announced in January 2013 over 80 billion yuan in credit for building smart cities over the 2103-2016 period, an announcement followed by other commercial banks.

Governance in Shanghai in the institutional realm is based on the strengthening of organization and leadership. There is a municipal leading group responsible for building the Smart City, and unified deployment of the work on smart city construction. This group has under her supervision an office responsible for daily coordination of the work related to the smart city overarching project. Shanghai also sets up a Smart City Expert Committee and an expert policy advisory mechanism. Together with organizations considered relevant, they also set up a Smart City Promotion Center.

The relevant commissions, offices and bureaus are responsible for detailed implementation of the tasks in different areas. In accordance with their respective responsibilities, districts and counties within the city also set up corresponding mechanisms to propel Smart City building in their respective areas under the deployment of the city.

Shanghai seeks to actively create a sound policy environment to build the smart city. The policy environment includes: 1) formulating — through studies— policies relative to the development of new technology, applications and trade for the smart city; 2) making detailed implementation rules and regulations for the policies of the State Council in order to encourage the development of the software industry and the integrated circuit industry; 3) developing breakthrough in policies for integrated circuit tax bond and Internet service; and 4) publicizing the implementation opinions on the Rules of Shanghai on the Promotion of E-commerce. The general aim is to accelerate the development of software and the integrated circuit sectors. The means are advancing *local law making* in the area of

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4. We are visiting Shanghai and presenting this work at FUDAN University on May 2015. We will also have interviews with scholars and public officials that will allow to advance on this conceptualization.

informatization avoiding —according to the city plan— to waste time formulating rules and regulations.

The original three-year-plan contemplates conducting statistics evaluation: Establishing a complete statistical system and social evaluation system to building up the smart city, to strength the capacities of professional institutions by regularly conducting tracking and analysis and releasing the evaluation results. It contemplates as well establishing a follow-up and assessment mechanisms for the coordination and implementation of the three-year Action Plan, incorporating it into the annual performance appraisal system of the relevant departments and districts and counties.

The discussion of governance in Shanghai allows us to make a contribution to comparative urbanism with a global scope, as Robinson suggests (2014) by setting the specificities of this case. These specificities allow us to confirm Ganapati insight (2013) that even though estimates find over 70% of the world population living in cities by 2050, local governance responses are diverse.

## FINDINGS AND CONCLUSION. SHANGHAI, WHAT PUBLIC POLICIES?

This paper explored the particularities of the smart city model in the case of Shanghai. Thus, we inquired into the applicability of the theoretical model developed by Chourabi *et al.* (2012) and the particular variables akin to public policy within it. In the first part of this article we have presented the two main theoretical traditions addressing the smart city concept. After presenting these theories, we have introduced the hypothesis and the theoretical model mentioned that later underlies the analysis of the case of Shanghai. Before the analysis, we have briefly described the context on the origins of the agenda for smart cities worldwide. The analysis of Shanghai, using the chosen theoretical model has followed in detail. To explore the applicability of the model developed by Chourabi *et al.* (2012) to the urban reality of Shanghai in China, we have analyzed the eight variables in the model against the Shanghai smart city plan: management and organization, technology, policy context, people and communities, economy, built in infrastructure, and natural environment- are each examined together with the overarching variable: Governance. We now turn to present the conclusions and findings, including suggestions for future research.

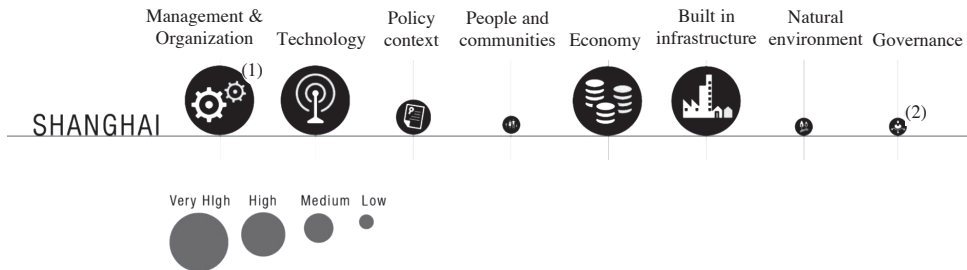
Liu (2012: 1141), claiming that Shanghai is “struck by the same forces of globalization, economic restructuring and advances in information technology as cities in the Western world”, might be qualified stating the particular shape these forces adopt in Shanghai. From the analysis conducted of the case of Shanghai we build up on the works of authors inspiring our study (Hall, 1988; Lin, 2007; Harrison and Donnelly, 2011; Shen *et al.*, 2011; Mossberger, 2013, 2012).

We have shown that the forces of globalization are qualified in Shanghai through the policies pursued by the local government. Specifically, in variables where the city ranks particularly high: management and organization, technology, economy and built



infrastructure. On these variables Shanghai outperforms other cities analyzed by Chourabi *et al.* (2012). We may also qualify the effect of globalization where the city ranks medium, such as the policy context. And, finally, we may identify the three variables ranking lower in level of development: people and communities, natural environment and governance. Table 2 illustrates these results that we explain further below:

TABLE 2.  
THE VARIABLES RESULTS FOR THE CASE OF SHANGHAI



(1) Policy context varies along cities and neighborhoods in China, as the central government decides which neighborhoods may experiment with smart city development.

(2) Even though Shanghai scores high in management and organization, it scores low on democratic foundations, and this shows on a low result on the governance variable.

We find that for Shanghai the smart city plan inherits a process of transformation in place from the beginning of 1990s in the public policy areas of governance, technology, built in infrastructure and economy. The Shanghai smart city plan, however, presents specificities for management and organization and shows a built-in capacity to develop a favorable policy context with the central government. We have found a more limited scope for people and communities and the natural environment shaping changes so-called smart. We have also found the variable governance down-rated for normative reasons, since the political party may not be contested through elections. From these findings we have proved the hypothesis that the factors to advance the smart plan do differentiate the model of urban governance, as they do in our case.

Looking at management and organization we find a case in which the central government fosters a strong investment-led model in the case of China and some municipalities follow suit. Shanghai in particular becomes leader in most projects. The city develops a vision of innovation driven transformation with the aim to become an international economic, financial, trade, and shipping center as well as a socialist modern international metropolis through a three-year action plan started in 2011. A main objective is upgrading the traditional industry and the focus is wide enough to comprise application and management standards in the areas of cloud computing, Internet of things, telecom, networks, and intellectual property rights protection in the IT industry. Additional research would be very interesting to further document the case of study on the city local leaders, manager



attitudes and behavior, the alignment of organizational goals, resistance to change, conflicts and organizational diversity. This would help to carry out the research to a next level. The evaluation of the smart project in Shanghai on these grounds would be a fruitful path of research.

In technology grounds Shanghai places utmost importance on the smart grid, standards for the smart devices and the development of a local and global industry from these developments. In Shanghai the discourse is also linked to defending urban design and optimized services -based on distributed power generation. This is related to concepts such as smart grid, smart heating/ cooling and smart metering, waste management, and efficiency of the water cycle. These technologies could be the basis of what Jeremy Rifkin calls the Third Industrial Revolution (Rifkin, 2011). A revolution having to do with the design and incorporation of new energy sources, waste treatment, new urban developments, and changes in terms of management and leadership —as the first industrial revolution did. Would this have the capacity to overturn old firms' hierarchies in oligopolistic markets and alter the set of players, from incumbent to new actors? This will be a question for the future.

Here further research addressing information technology skills (talent, training programs) and organizational challenges (cross sectoral cooperation, inter-departmental coordination, clear IT management, culture and politics issues) would help to drive research to a higher level.

With regard to people and communities, in China top participants are members of the party. Even if decisions are taken in a very consultative manner with groups in society, and collaboration ranks high, the fact that democracy is not in place puts restrictions on people and communities participation. As a result, Shanghai ranks low on people and communities. We find bottom-up approached lacking generally. Other factors for further research on people and communities include: digital divides, education, participation and partnership, information and community gatekeepers, communication, quality of life and accessibility.

An intended economy boost underlines the plan of the Shanghai smart project in the period researched. Shanghai has been in a good condition to fund smart projects, and the city as well as the country has been pouring funds into this strategic area, as it is defined. Chinese banks have also been willing to ease funds for to gain momentum.

As for built-in infrastructure, following Hollands (2008) “undergirding” social capital is critical to embed the required informational and communicative qualities of smart cities. From this perspective the focus that Shanghai puts in the smart grid should not be down rated. Smart grids could represent an interesting and disrupting way to fuel energy to thirsty cities. Interoperability of IT infrastructure, security and privacy, as well as operational costs would be factors for further exploration in research aimed at explaining developments in built infrastructure.

Concerns about the natural environment are not present. In the case of Shanghai smart has to do with technologies that allow us to incorporate intelligence into systems to achieve efficiencies, reducing energy consumption and CO<sub>2</sub> emissions. Incorporating new

technology is linked to a discourse pledging for smart devices to curve energy consumption in buildings —providing a near-zero energy consumption. However, the environment as such is not tackled in the smart city master plan.

The governance model in Shanghai shows cooperation and one normative limitation: democracy is limited —and this down rates the city on this particular variable. On cooperative grounds the local government has partnered with universities, firms, foreign firms as well as banks. It is also collaborating with Taiwan. Aside from the normative limitation, Shanghai has a very wide structure set to govern the smart plans. There is a municipal leading group responsible for building and deploying the smart city build up. Under her supervision, there is an office responsible for daily coordination. There is also a Smart City Expert Committee, an expert policy advisory mechanism and the Smart City Promotion Center —set together with organizations considered relevant for the matter. The relevant commissions, offices and bureaus are responsible for detailed implementation of the tasks in different areas. In accordance with responsibilities, districts and counties within the city also are called to propel smart city building in their areas. Governance models are affected by the policy context. We find a mayor leap of the central government in the case of Shanghai. However, the model also heavily responds to autonomous local policies. Shanghai combines the two. Refining the research on governance would have to address factors that include collaboration, leadership, participation and partnership, communication, data exchange, accountability, transparency and service and application integration.

The framework applied allows us to show the significant role that the local government plays in the city through specific public policies. This framework extends the scope of comparative urban theory and analysis beyond the western world, in the East Asian context, allowing the comparison across cities while taking into account this in-depth study. In all, with this case study we make a contribution to comparative public policy and urbanism. Final results might be used to complete new research programs. We have suggested above some paths to do so.

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OLGA GIL, Universidad Autónoma de Madrid/Universidad Complutense de Madrid  
olgagil@olgagil.es

Dr. Olga Gil read her DPhil. in Political and Social Science at the European University Institute in Florence in 2000 working under the direction of Professor Colin Crouch. Gil completed a Masters in Political Science at the University of North Carolina in Chapel Hill working on Brazil and Latin America, under the direction of Professor Jonathan Hartly in 1994. Currently Gil is Professor of Comparative Public Policy at the Universidad Autonoma de Madrid, and *profesor asociado* at Universidad Complutense de Madrid, Spain. Dr. Gil is currently working on smart cities and comparative public policies at the local level in Shanghai, Iskandar, New York, Amsterdam, Málaga, Santander and Tarragona, Gil is author of award winning book Telecommunications Policy in the U.S. and Spain (1875-2002) edited by CIS and S.XXI [AECPA best book 2003].

TIAN-CHENG ZHENG, Universidad Autónoma de Madrid  
tian.zheng@estudiante.uam.es

Tian-Cheng Zheng is a Ph.D researcher at Universidad Autónoma de Madrid completing his thesis on “Global cities: Change in Sociological and Economic Processes in the new Chinese Cities.” He defended his Master thesis of Sociology in Universidad de Granada working on “Nuevas ciudades globales: Impacto del proceso de globalización en la estructura urbana de China, y el modelo de Shanghái”. He pursued his degree on International Economy and Trade at the Lixin University of Commerce in Shanghai, China.