



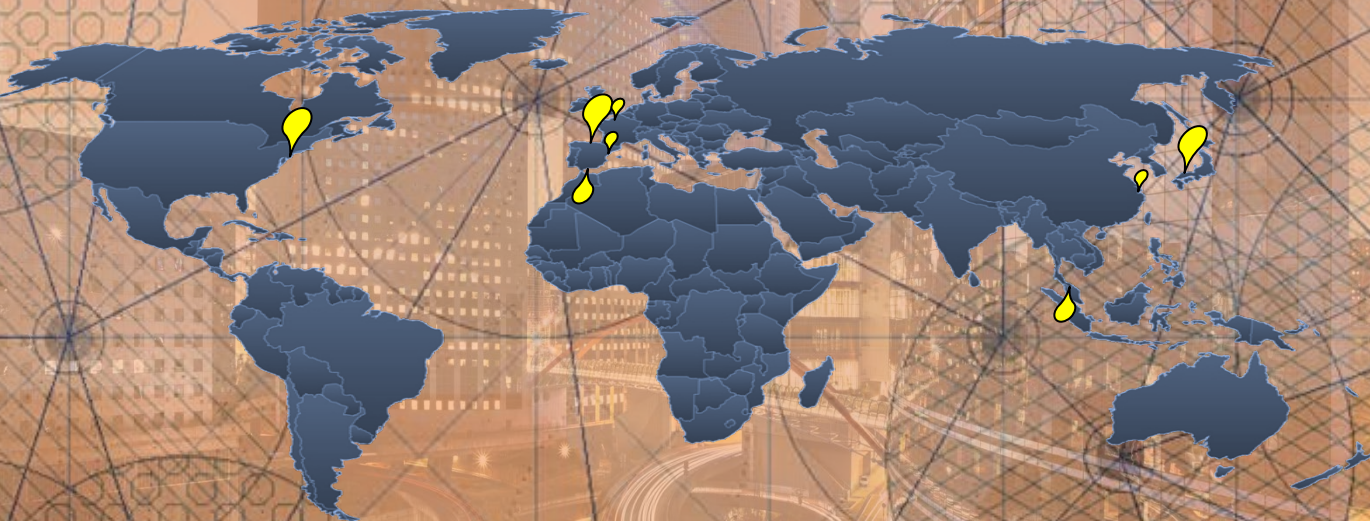
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BEHIND SMART CITIES WORLDWIDE

MODELS, PROJECTS, INNOVATIONS:
POLICIES FROM THE LOCAL TO REGIONAL AND
SUPRANATIONAL LEVELS



Shanghai – Japan – Iskandar – New York – Ámsterdam – Málaga – Santander – Tarragona

**accenture**

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ABSTRACT

We analyze and compare eight city cases in three continents to find out differences and commonalities in smart city governance and public policies globally: Shanghai (China), Japan, Iskandar (Malaysia), New York (United States), and Amsterdam, Málaga, Santander, Tarragona (Europe). The report shows different ways to address the definition of smart, followed by the particular implementation of the smart concept in particular settings. It shows models, projects and the policy innovations set in place today on smart grounds, as a baseline of opportunities for sustainable growth and to unlock the potential of both Spanish and European firms and Spanish and European talent worldwide. We explore the following variables: 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.

Keywords

smart, cities, governance, innovation, China, Shanghai, Malaysia, Iskandar, Japan, United States, New York, Europe, EU, #EU, Amsterdam, Málaga, Santander, Tarragona, Spain, infrastructure, Internet of Things, Internet with Things, smart grid, utilities, energy, infrastructure, #smartcities.

THIS IS A SCIENTIFIC REPORT BRINGING LIGHT UPON MODELS, PROJECTS AND POLICY INNOVATIONS AT THE LOCAL LEVEL WORLDWIDE. WE HAVE DRAW ON SCIENTIFIC WORK FROM –SMART- CITIES IN THREE CONTINENTS: ASIA, AMERICA AND EUROPE, TO STUDY INNOVATIONS --BOTH IN CITIES AND URBAN REGIONS IN COMPARATIVE PERSPECTIVE

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EXECUTIVE SUMMARY

2009 has marked the turning point where we find an equal number of population accommodated in cities and villages. The United Nations World Urbanization Report has estimated that over 70% of the world population will be living in cities by 2050. Over 80% of the population in our country, Spain, lives in cities already.

This trend is one of the biggest challenges for public policy, innovations in governance and business opportunities in the XXI century. This is happening at a time in which cities face mayor ecologic, economic and social challenges: Forecasts indicate that several thousand new cities will be built or rebuilt quickly -estimates set this number approaching 9.400 new cities by 2050. In the case of India, an expected increase in the urban population -about 600 million- forecasts the need to build 500 new cities --or tolerate "that today's cities become super-slums", as Prahlad has put it.

What are the challenges for cities in these new scenarios? Even though the trend is global, local governance responses are being diverse. What can we learn from different systems of governance? How are public agencies, firms, citizens and communities responding to the challenges? We are interested in understanding these differences, in theoretical and practical approaches, and we are eventually interested in applying a comparative framework to European cases, with a particular focus on Spain still more in depth in subsequent works.

Definitions of smart cities under three traditions: human capital, technology and digital literacy

Drawing upon the literature studying smart cities in the last two decades, we have founded three traditions and a first set of differences based on the definitions of smart cities. What makes a city smart? Differences in definitions in applied local contexts are important because these are translated into differences in governance locally, as we have later founded.

Theoretically we founded differences among three approaches. The first approach focuses on human capital. The second approach focuses on technological progress. The third approach is based on a normative question: What are the skills that people and citizens shall have to be digitally literate in the XXI century? Even though we very much focus on the second approach, we will also be testing whether the third approach -digital literacy- is present or absent in the eight cases addressed.

In the report we study the human capital literature, followed by theories focusing on technology as a main driver of changes. We complement the analysis with a new perspective, bringing about the question of what does it means to be a smart citizen in the XXI century, and so we talk of digital literacy.

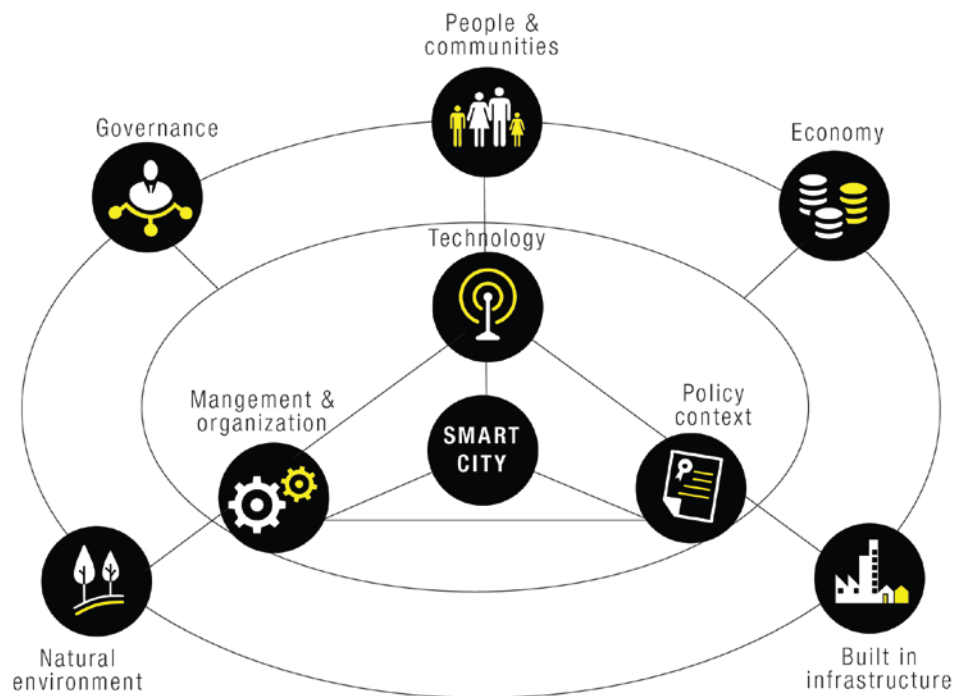
We have worked with the hypothesis that the factors to advance the smart plans are key to differentiate models of urban governance and we have widened the comparison to non European cases --in order to control for possible induced similarities.

Our choice of cases is driven by an interest to learn from innovation practices in different world institutional settings. In a first stage it has also been 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 where 5,2 % and Europe 3,8% (Komninos 2009). The report thus draws differences and similarities on development and sustainability both in OCDE and non OCDE countries. We explore cases in China, Japan, Malaysia (Iskandar), United States (New York) and the European Union (Amsterdam, Málaga, Santander and Tarragona –these last three in Spain).

We are interested to know whether there are cases in which smart might be a marketing claim for public managers, and whether in others -even if the term smart were not used- projects under the smart label are being carried out. Thus, we are interested in variations in the universe of cases. In previous work we presented in Baltimore and Twente we looked at management and organization, technology, governance, policy context, people and communities, economy, built infrastructure, and natural environment.

Figure 1: Smart cities initiatives framework: A visualization developed from the model by Chourabi et al. (2012) and our empirical research



From these previous works we conclude that governance could be a key overarching variable, embracing the rest as subcategories. For this reason we started to work analyzing governance as overarching category embracing the rest of variables.

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 first set of cases for analysis focuses on Shanghai in China, Iskandar in Malaysia, Japanese cases, and New York in the United States. This first part of the study selects four contexts as research cases, however, the unit of observation is each smart city initiative. In

the selection of cities and initiatives as cases for empirical research we have followed a purposive approach: we are interested in doing logical deductions from different world settings. As the challenge today is to gather and integrate knowledge from every available source all over the world and for global open systems of innovation.

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.

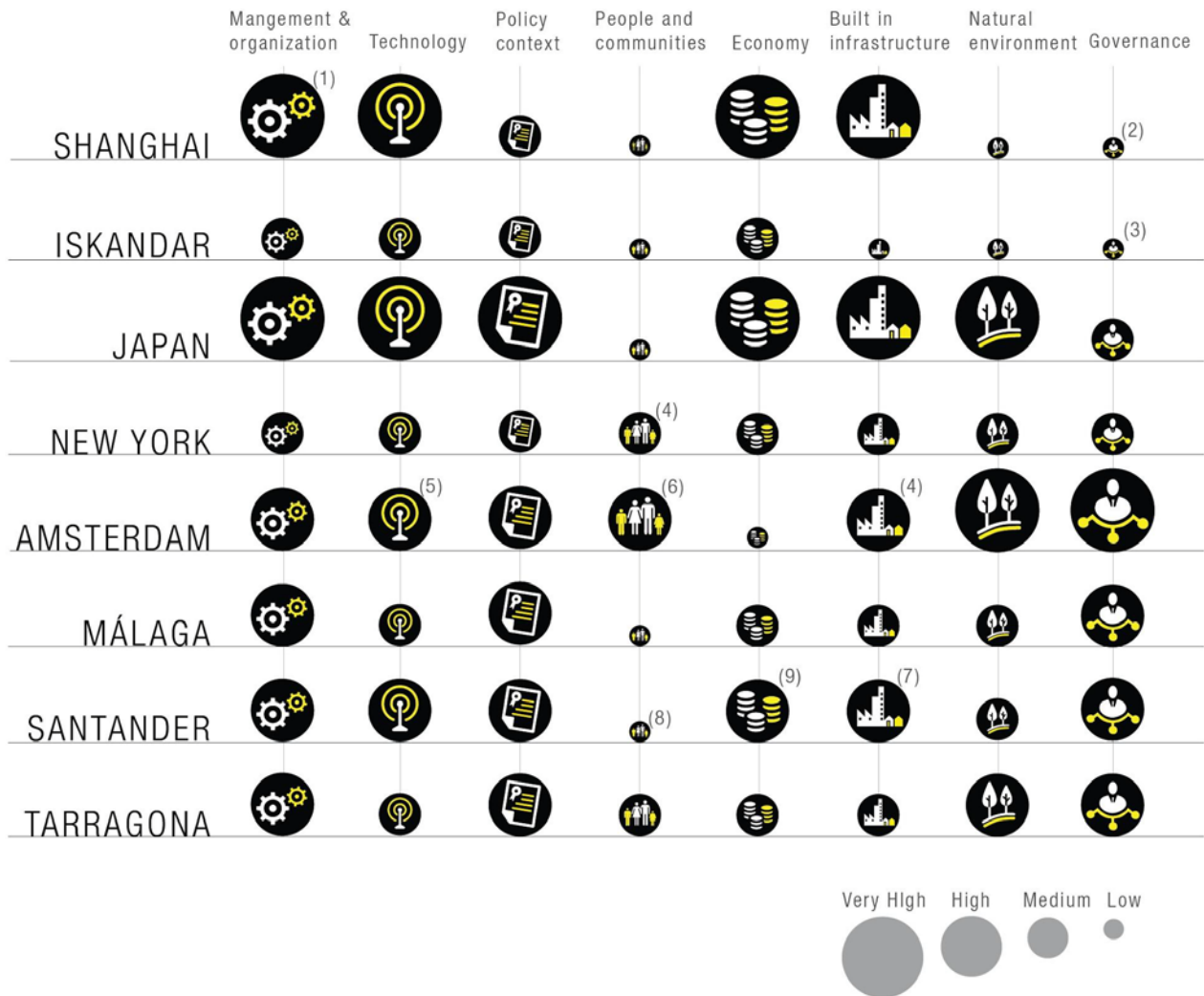
Main findings from our cases

In the report we go on suggesting directions and agendas for smart city policies and implications for professionals.

In our exploration of our set of eight world cases: Shanghai in China, Iskandar in Malaysia, Japan smart plans, and the case of New York in the United States; and Amsterdam, Málaga, Santander and Tarragona in Europe we analyzed the following factors: Management and organization, technology, policy context, people and communities, economy, built infrastructure, and natural environment. We did so in order to qualify differences and innovations in governance: To find out differences and commonalities in smart city governance and public policies globally. We coupled this analysis with attention the question on how to be digitally literate in the XXI century. Do cities and firms address such a normative question?

We have founded interesting similarities and differences among the cases. The report has shown different ways to address the definition of smart, followed by the particular implementation of the smart concept in particular settings. We show models, projects and policy innovations set in each of the eight cases on smart grounds. And we do so trying to highlight opportunities for sustainable growth unlocking the potential of firms and talent in local contexts.

We find that the multi faceted sides of the smart concept are being established locally, to a fundamental extent from local governments, except fro the particular case of Iskandar in Malasya, where the national government has been paramount in the grand-design. The stress on what smarts entails is very different and open to policy conceptualization and in some cases, society engagement, whit Amsterdam scoring higher in this particular ground. The governance models are also different, as we end-up presenting.



Looking at management and organization we find cases in which the central government fosters an investment-led model, such as the case of China and some municipalities follow suit. Shanghai in particular become leader in most projects, developing 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, as it is recalled. The 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 and networks, and intellectual property rights protection in the IT and industry --through a three-year action plan started in 2011.

In the case of Iskandar, the regional development agency furthers the goals set up by the government. We find a case such as the four smart pilots in Japan, where localities and regions work together with the industry to develop solutions with global application; the New York city model, in which the university and the city council cooperate mainly on smart data projects; the case of Amsterdam, where energy is paramount -and a new model is being tested where citizens might become producers leaking the remaining energy to the grid- the case of Málaga, focused mainly on efficiency; the case of Santander, with pilot projects focused on sensors and mobility; and the Tarragona case, where a Foundation has been set up to advance the defined smart goals.

Additional research would be very interested to further document case studies on the cities, local leaders, the over all context, project size, manager attitudes and behavior, 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 projects in each context would also be a fruitful path of research.

Technology concerns vary a lot among the selected cases. 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 the cases of both Shanghai and Japan the smart cities 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 Riffkin called the Third Industrial Revolution. A revolution having to do with the design and incorporation of new energy sources, waste treatment, new urban developments, changes in terms of management and leadership -as the first industrial revolution did. We have found a view on smart technology different from that derived from the industrial revolution in the exploration of ways to transport energy through smart grids in the cases of Shanghai, Japan and also Amsterdam in Europe. Would this have the capacity to overturn old firms' hierarchies in oligopolistic markets and alter the set of engaged players, from incumbent to new actors? This will be a question for the future.

Iskandar is concerned with traffic and CO2 emissions, and more recently, with the smart grid, however, we have found less partnerships with local firms for solutions; New York is focusing on big data management, Amsterdam is concerned with energy and experiencing with crowdsourcing, Málaga is developing modern metering, Santander is experiencing with sensors and the Internet of Things; and Tarragona is concerned with the chemical industry and transport efficiency. Thus, the search for solutions and the partnerships to attained them is widely varied in the eight cases examined.

We have found partners in the construction industry in the cases of Iskandar, Japan, Holland (Amsterdam) and Spain. The construction industry innovated little over the recent decades, and it lagged behind other industries in productivity gains. It is considered to be enormously wasteful. Thus, policy results from partnerships could contribute to major developments.

In the cases we have analyzed from Shanghai in China, Japan, Iskandar in Malaysia, New York in the United States, Amsterdam in Holland and Málaga, Santander and Tarragona in Spain, smart has to do with technologies that allow us to incorporate intelligence into systems to achieve efficiencies, reducing energy consumption and CO2 emissions. In all the cases incorporating new technology is linked to a discourse pledging for smart devices to curve energy consumption in buildings - providing a near-zero energy consumption.

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 to research to a higher level.

People and communities have a bigger say in the case of Amsterdam -where small size matters- and New York, where we find windows of opportunity for citizen developers and firms. Citizens participate mainly as users in the case of Málaga, Tarragona, Santander and Japan -residents are those specifically addressed to contribute in Japan. In the case of

Iskandar, city dwellers would participate in security issues according to the drafted plans. In China top participants are members of the party however, decisions are taken in a very consultative manner with groups in society and collaboration ranks high.

The use of open standards and open systems offer interesting ways for citizens-coders and small firms engagement and innovation. Evaluating whether cities are understanding or caring about those choices -with strong path dependence consequences for future development and citizen engagement- is very important.

Either through citizen engagement or tools to empower residents, the possibilities to engage communities on city challenges have grown. The scope for citizen participation -as shaper of policies or a passive target- will depend on the particular policies of cities and also the legacies of technologies and values underlying them when they are set. Proprietary technology will leave little room for citizen engagement and development, while open systems might allow citizens and firms engagement through new services and code development.

Other factors for further research for 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 plans of all the smart projects explored. However, constraints are different in each case. Shanghai is in better condition to fund smart projects, and the city as well as the country are pouring funds into this strategic area, as it is defined . Cineces banks are also willing to ease funds for. Japan, Europe and the United States are all affected by fiscal cliffs and economic downturn. Malaysia is in better shape, and is trying to gain momentum promoting Iskandar as an important trade hub in Asia, looking forward foreign capital as a main driver for Iskandar.

Built infrastructure has different scope in the cases we have explored. Following Hollands (2008) 'undergird' the social capital is critical to embed the required the informational and communicative qualities of smart cities. From this perspective New York would be the city rating higher. However, the focus that Shanghai and Japan are putting in the smart grid and Amsterdam on producing energy in households should not be down rated. Smart grids could represent an interesting and disrupting way to fuel energy to thirsty cities. Conceptually the possibilities for users and citizen engagement in built infrastructure are linked to the concept of Internet with Things, suggested by [Russell Davies](#). This is an evolved concept from the Internet of Things, with scope for citizen empowerment. It refers to developments driven by citizens in a distributed way, using programming based on [Arduino](#) open architecture.

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 to a different extent present in all the cases explored. Japan did set up the smart pilots in the aftermath of the nuclear accidents. Shanghai in China faces severe environmental concerns. Malaysia is also aware in Iskandar. New York has suffered the impact of climate change in november 2012. The European cities: Amsterdam, Málaga, Santander and Tarragona are also concerned. Smart policies here address transport issues in all cases, with a higher emphasis for the case of Japan, where research on electric batteries and electric cars is part of the smart pilots -we founded some partnerships between Japan and Málaga on these grounds. We find this field as one posing

the biggest challenges at a global level. Would local policies be enough to tackle this challenge?

Governance models are different in the cases explored. Shanghai local government partners with universities, firms, foreign firms as well as banks. It is also collaborating with Taiwan. Users are not part of the equation as developers. Shanghai, however has a very wide governance structure set to govern the smart plans: There is a municipal leading group responsible for building and deploy all 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.

In Japan local governments partner with firms in different industry sectors including the university, technological firms, power –including gas- as well as real estate firms. It is the only case in which evaluation of projects has been devised as part of the comprehensive smart strategy advanced. In Iskandar governance depends on the Regional Authority appointed for the development of the conceived smart city. In New York we find the leadership of the city government, the university as well as a general call to citizens developers through open technologies. Amsterdam has a Board created to steer the projects. Málaga is touched by the vision and drafts developed at CEMI, a local government data processing center. Santander's pilot projects are quite focused and in a pilot stage. Tarragona steering committee is a Foundation.

Governance models are affected by the policy context. We find a mayor leap of the central government in the cases of Iskandar and Japan, while New York, Amsterdam, Málaga, Santander and Tarragona respond 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.

Other steps for future research might be to study whether firms might become source of innovations that affect governance, how new business models foster new forms of public policy, how innovative partnership solutions are also solving the risk of discontinuation in public policies constrained by the fiscal cliff, and to what extent performance contracting might become public policy innovation to pay for the costs of smart projects.

This research of cases in different world settings brings us to reflections on innovations in governance:

We find that factors advanced by Chouraby et al. (2012) management and organization, policy context, people and communities, economy, built infrastructure, and natural environment as well as technology, are important in order to make urban living smarter in qualitatively different ways in our cases. We found technological advances transforming government responses to traditional urban problems in the five cases differently, with no homogeneous path towards a smart goal. This very much depended on the governance model pursued.

We have also founded that technology is not the only answer. Digital literacy for the XXI century should relate to technology, and we found a lack of plans reflecting or tackling the issue, except for a recent plan in New York city and for Tarragona.

We would suggest that in order to analyze how institutions and decision-making in networks of urban governance condition the introduction of innovations in city and regional governance the question of digital literacy for the XXI century shall be addressed. We would argue that digital literacy impacts on the public performance, quality of governance, democratic legitimacy, but also on the mode of production fostered by a local polity.

SHA - Shanghai, China
ISK - Iskandar, Malaysia
JPN - Japan

JFK - New York, NY, USA

AMS - Amsterdam, Netherlands
AGP - Málaga, Spain
SDR - Santander, Spain
TAR - Tarragona, Spain



THE REPORT Introduction

2009 has marked the turning point where we find an equal number of population accommodated in cities and villages. The United Nations World Urbanization Report has estimated that over 70% of the world population will be living in cities by 2050. Over 80% of the population in our country, Spain, lives in cities already.

This trend is one of the biggest challenges for public policy, innovations in governance and business opportunities in the XXI century. This is happening at a time in which cities face mayor ecologic, economic and social challenges: Forecasts indicate that several thousand new cities will be built or rebuilt quickly -estimates set this number approaching 9.400 new cities by 2050. In the case of India, an expected increase in the urban population -about 600 million- forecasts the need to build 500 new cities --or tolerate "that today's cities become super-slums", as Prahlad has put it.

What are the challenges for cities in these new scenarios? Even though the trend is global, local governance responses are being diverse (Ganapati 2013). What can we learn from different systems of governance? How are public agencies, firms, citizens and communities responding to the challenges? We are interested in understanding these differences, in theoretical and practical approaches, and we are eventually interested in applying a comparative framework to European cases, with a particular focus on Spain still more in depth in subsequent works.

Definitions of smart cities under three traditions: human capital, technology and digital literacy

Drawing upon the literature studying smart cities in the last two decades, we have founded three traditions and a first set of differences: the definitions of smart cities.

What makes a city smart? Differences in definitions in applied local contexts are important because these are translated into differences in governance locally, as we have later founded.

Theoretically we founded differences among three approaches. **The first approach focuses on human capital. The second approach focuses on technological progress. The third approach is based on a normative question: What are the skills that people and citizens shall have to be digitally literate in the XXI century?** Even though we very much focus on the second approach, we will also be testing whether the third approach –digital literacy- is present or absent in the eight cases addressed.

Human capital

From an economic and growth perspective, a seminal article by Shapiro (2006) draws the link among **quality of life, productivity and the growth effects of human capital** as main components of the smart cities definition. Winters (2011), in his study on “Why are smart cities growing? Who moves and who stays” in the US, 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 the idea **of inclusiveness and regeneration** linked to the smart cities concept: Digitally inclusive and regeneration are at the core of Deakin and Allwinkle (2007) work defining smart cities as those having an e-learning platform, knowledge management and library with the org-ware communities needed to support digital inclusive regeneration projects across Europe –meeting advanced visualization, simulation and benchmarking requirements.

For Hollands’ work (2008), **undergird the social capital** is critical to embed the required informational and communicative qualities of smart cities. Hollands is linked to an academic tradition that purposely **avoids defining intelligence limited to the world of devices and the Internet of things**. Such definition would constraint the smart concept to the artificial intelligence available (Kominos 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 (2001) highlight from Hollands' definitions the **emphasis on people and their interactions.**

In this view, **the most important thing about information technology is not its capacity to create smart cities, but the possibility it offers empower and educate citizens,** allowing them to become members of a society that engage in a debate about their environment and social aspirations. How citizens interact is key to any successful community, enterprise or venture.

In all contexts, following Deakin and Al Waer (2011), **smartest places combine the best of both the physical and virtual worlds,** where presence and tele-presence are fused together in a specific location. Physical locations would be pervasively penetrated by digital technologies to provide a collaborative meshing of physical and virtual environments. And this is so because

“irrespective of how digital technologies are developed to exploit the electronic opportunities they offer, the **physical places of urban spaces will retain their relevance** in society because people still care about meeting face-to-face and gravitate to places which offer particular cultural, urban, scenic or climatic spaces, unable to be experienced at the end of a wire and through a computer screen (Deakin, Al Waer 2011).”

In Europe Caragliu, Chiara Del Bo, and Nijkamp (2011) argue that a smart landscape is linked to the presence of a **creative class**, the quality and attention paid to the urban environment, the level of education, and the accessibility to and use of Information and Communications Technologies for public administration. They further show the positive correlation of these variables with urban wealth. Caragliu, Del Bo, and Nijkamp (2011) defend those aspects should be part of the formulation of a new strategic agenda for European cities to achieve sustainable urban development and a better urban landscape. Komninos (2009) also brings in **knowledge, creativity and social capital** as baselines for the definition of intelligent cities, in the tradition of Florida (2002, 2005): *the generation of prosperity would depend of the creative class, knowledge workers, scientists, artist, engineers, lawyers, entrepreneurs and innovators. They are the producers of new ideas, theories, products and strategies.* **However, how would the institutional settings constrain or allow the individuals and groups in society to grow creative, to produce and to innovate? This is a question for discussion in the conclusions, and for further research.**

According to Komninos (2009:352) three layers are needed in an intelligent environment: 1) the physical space, with agglomeration of people, innovative clusters and companies; 2) the institutional innovation mechanisms and policies needed for technology transfer, product development and innovation; and 3) the collaborative spaces and tools allowing for people collaboration and participation.

Li-Yin Shen et al. (2011) have conducted work doing a comparison of urban sustainability indicators, using the International Urban Sustainability Indicators List (IUSIL). IUSIL contains 115 indicators, formed into 37 categories. Indicators are structured within four sustainable development dimensions including environmental, economic, social and governance aspects.

Technology

In a step forward, based on literature from various disciplinary areas, from e-government, to information science, urban studies and public administration, we find scholars working from different geographic backgrounds. This research, by Chourabi et al. (2012), identifies eight critical factors in smart city initiatives that we find interesting to analyze and evaluate to understand innovations in 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.

We find Chourabi et al. (2012) factors very useful integrative framework to examine how local governments are envisioning and pursuing smart city initiatives and more generally innovation in local governance.

The framework devised by Chourabi et al. allows us to do an exploratory attempt at evaluating factors and success of smart city initiatives or projects. 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 can be used to characterize how to envision a city smart design initiatives, how initiatives are implemented and how to navigate emerging challenges.

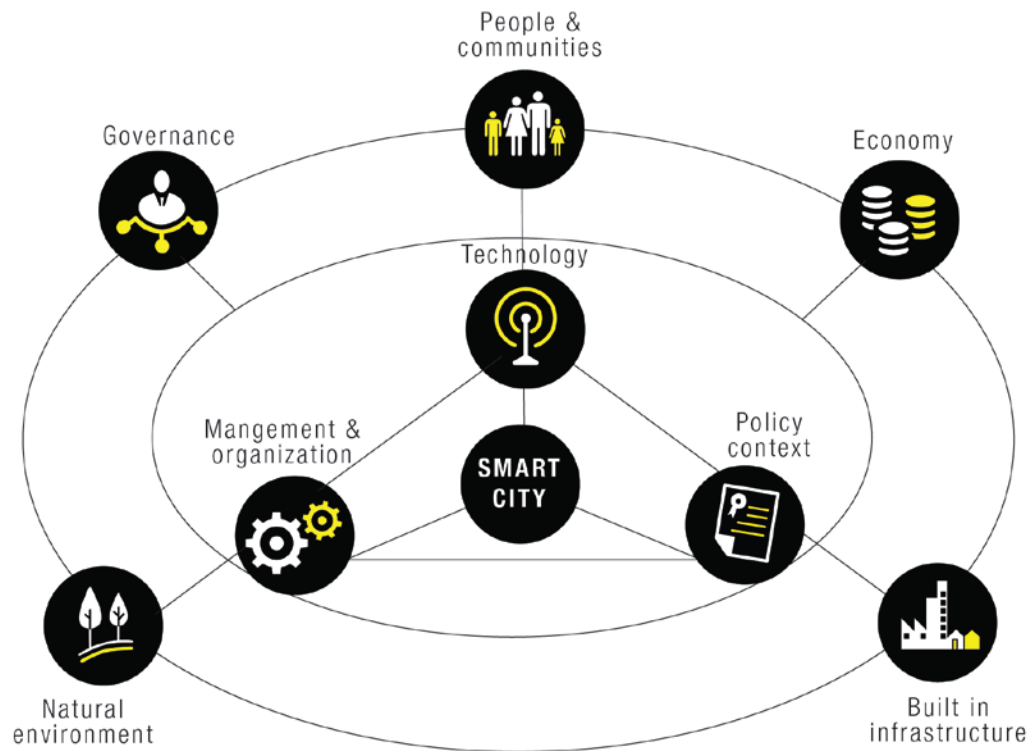
We have worked with **the hypothesis** that the **factors to advance the smart plans are key to differentiate models of urban governance** and we have widened the comparison to non European cases --in order to control for possible induced similarities.

Our choice of cases is driven by an interest to learn from innovation practices in different world institutional settings. In the first stage it has also been 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 where 5,2 % and Europe 3,8% (Kominos 2009). Thus, were driven away from a research design based on the most similar and most different cases, in order to explore a first set of cases, and later on tackling on cases within the European context.

The report thus draws differences and similarities on development and sustainability both in OCDE and non OCDE countries. We explore cases in China, Japan, Malaysia (Iskandar), United States (New York) and the European Union (Amsterdam, Málaga, Santander and Tarragona –these last three in Spain).

We are interested to know whether there are cases in which smart might be a marketing claim for public managers, and whether in others -even if the term smart were not used- projects under the smart label are being carried out. Thus, we are interested in variations in the universe of cases.

Figure 1: Smart cities initiatives framework: A visualization developed from the model by Chourabi et al. (2012) and our empirical research



In previous work presented in Baltimore and Twente we looked at management and organization, technology, governance, policy context, people and communities, economy, built infrastructure, and natural environment, following Chourabi et al. (2012) in Figure 1. -(see Annex 1 for more details on each factor).

From this previous works we conclude that governance could be a key overarching variable, embracing the rest as subcategories. For this reason, after the engagement on the first explorative study under the framework below, and that first version of the research,¹ we started to work analyzing governance as overarching category embracing the rest of variables.

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.

Digital literacy

¹ "Smart Cities Public Policy Keys to Build up New Cities and Reinvent Existing Ones," Paper presented at the [9th Transatlantic Dialog: Rebuilding Capacities for Urban Governance](#), Baltimore, June 12-15 2013.

Finally, how shall we understand digital literacy in the XXI century? We try to find data about how the issue is tackled in our set of cases. We did not find works on smart cities addressing the issue from a theoretical perspective. However, we did find references to **co-creation of smart cities** as a process in which citizens, people and communities might be part of the design tech project, and we study the phenomena.²

Co-creation and involving citizens is at the core of Arturo Muent-Kunigami (2013) framework on theoretical steps proposed to develop smart cities. Muent introduces the idea of a structured approach to develop interaction between authorities wanting to adopt methodologies of **co-creation with citizens for government service innovation**.

The process of co-creation with citizens would start with the identification of a need or problem faced by the citizens. Muent-Kunigami stresses the importance of incorporating problems or situations we are not even aware of or we don't know about. For that matter Muent-Kunigami mentions tools developed by consultancy firms such as IDEO³ and his human-centered design toolkit. Once the concept for solutions has been developed, it is time for a prototype and for the test of the prototype.

The living lab approach, testing it with actual citizens and consumers in a real world environment usually allows for more insights. In the case of services, testing prototypes in real world environments is useful to stream user experience and to gather feedback. Gathering citizen feedback entails that citizens, using the prototype, provide feedback about their experience using the service, and their feedback should be taken into account for next iterations of the proposed solution. This feedback should then be used to improve the service.

Muent-Kuginami proposes to repeat the last three steps in order to improve the proposed solution based on feedback received from potential users, until the identified issues are fully addressed. This iteration would be critical, as it allows for improvements based on actual usage by citizens. To drive this process, an innovation team needs to be established. Muent-Kunigami mentions examples of similar co-creation frameworks: at the national level the government innovation labs Nesta⁴ in the United Kingdom; At local level urban living labs such as Forum Virium⁵ in Helsinki. Muent-Kunigami explains how these institutions have ingrained the values of participation and a culture that allows for rapid prototyping and fail safe environments where the testing and prototyping of new ideas is allowed: "in fact, it is failure during the early stages of prototyping what allows for a better

² We found examples of collaboration among private firms, institutions and citizens: Michelle Bachelet at UN Women teamed up with Microsoft to find ways to use mobile technology to document, prevent and respond to violence, especially sexual harassment in public spaces in Rio de Janeiro. Mapping technologies were used to identify safety risks in city's high-risk slums. Trained women and adolescent girls used their smartphones to map safety risks, such as faulty infrastructure or services. The initial findings were presented to local authorities and were used to develop solutions.

²

³ <http://www.ideo.com/>

⁴ <http://www.nesta.org.uk/>

⁵ <http://www.forumvirium.fi/en>

outcome, in collaboration with early adopters that provide useful and meaningful feedback” (2013). These kind of teams are well prepared to be constantly looking for citizen service delivery gaps and propose solutions that are co-designed with citizens through feedback in iterative processes.

The context: setting the agenda for smart cities worldwide

In a work from 2002 Lin shows the **shortcomings of the growth model** to explain the change and development of Chinese cities –specifically for the case of China. 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), brings about 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. These ideas related to the smart agenda have been adopted by actors in the public and private sectors in the following years.

These, for instance, are landmarks in smart cities initiatives (Deakin, Al Waer 2011):

- Amsterdam Smart City initiative, drawing on the importance of collaboration among citizens, government and businesses to develop smart projects that will ‘change the world’ by saving energy.
- Southampton City Council using smart cards to stress the importance of integrated e-services.
- The City of Edinburgh Council setting a smart city vision in the action plan for government transformation.
- The Malta Smart City strategy promoting a business park as a way to leverage economic growth.
- Cities in the American continent, including Philadelphia, Seattle, Quebec city and Mexico city (Alawadhi et al. 2012).

Companies are marketing smart⁶ while **redistributing their product innovation in basic and**

⁶ IBM first, as well as Siemens, Cisco, Oracle and Ferrovial later on have developed visions of the Smart Planet. Technological firms have been advanced framing the discourse. IBM started identifying smart with the concept of **an operating system**. It made its smart concept a key to the reinvention of the company as a consultancy firm. According to IBM: “an operating system is the most vital piece of software in a computer. It makes the hardware components work together and, in large systems, it ensures that programs running at the same time do not interfere with each other. Operating systems are so useful that they are now being used in devices like mobile phones, tablets, televisions, washing machines and refrigerators. **They are now ready to migrate to a different kind of device: the city.**” IBM, had defined over two thousand micro projects under this concept by 2011.

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.

In Europe, European Union research and policy projects have emerged studying and dealing with aspects of the 'smart city' (Komninos 2008, 2010). 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, and 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).

SHA - Shanghai, China
ISK - Iskandar, Malaysia
JPN - Japan

JFK - New York, NY, USA

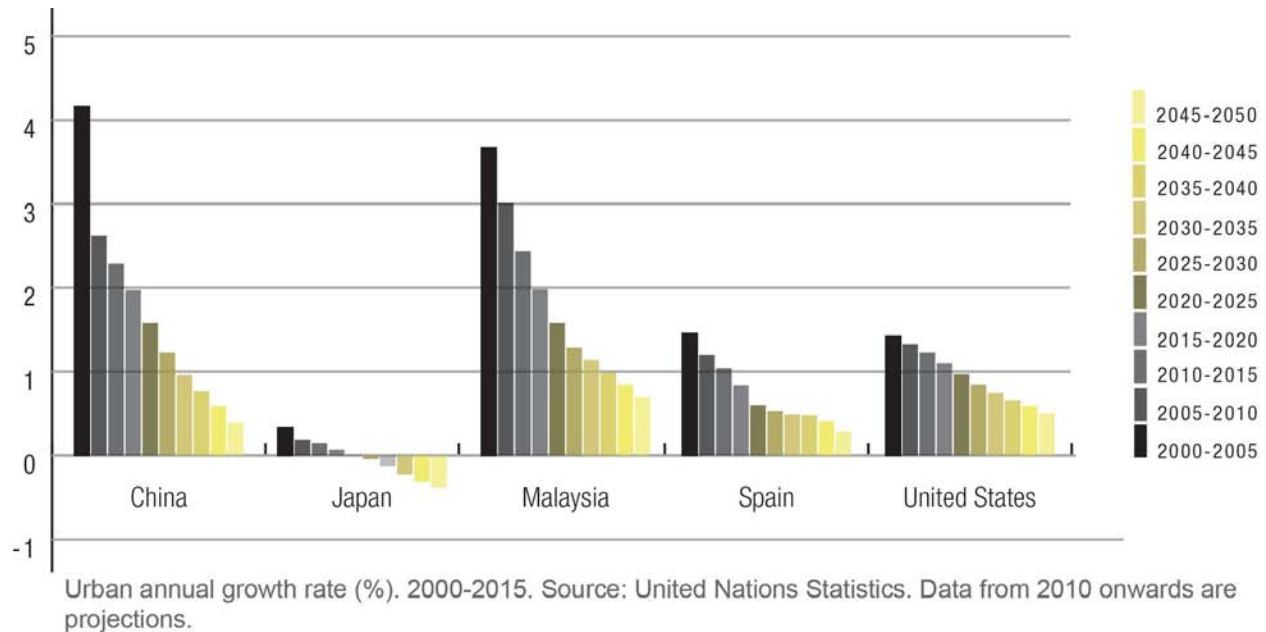
AMS - Amsterdam, Netherlands
AGP - Málaga, Spain
SDR - Santander, Spain
TAR - Tarragona, Spain



**The first set of cases for analysis:
Shanghai in China, Iskandar in Malaysia, Japanese cases, and New York in the United States**

The following sections focus on the first four cases: Shanghai in China, Iskandar in Malaysia, Japanese cases, and New York in the United States. In all these geographical contexts a variety of initiatives and efforts are being made in order to become smart.

Cities diverge widely in terms of many conditions such as demographics, economy, location, population growth and levels of urban development. The differences are reflected on urban annual growth rates, as shown in **Table 1**, and in the initiatives taken.



This first part of the study selects four contexts as research cases, however, the unit of observation is each smart city initiative. In the selection of cities and initiatives as cases for empirical research we have followed 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)” In this research we go on suggesting directions and agendas for smart city policies and implications for professionals.

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.

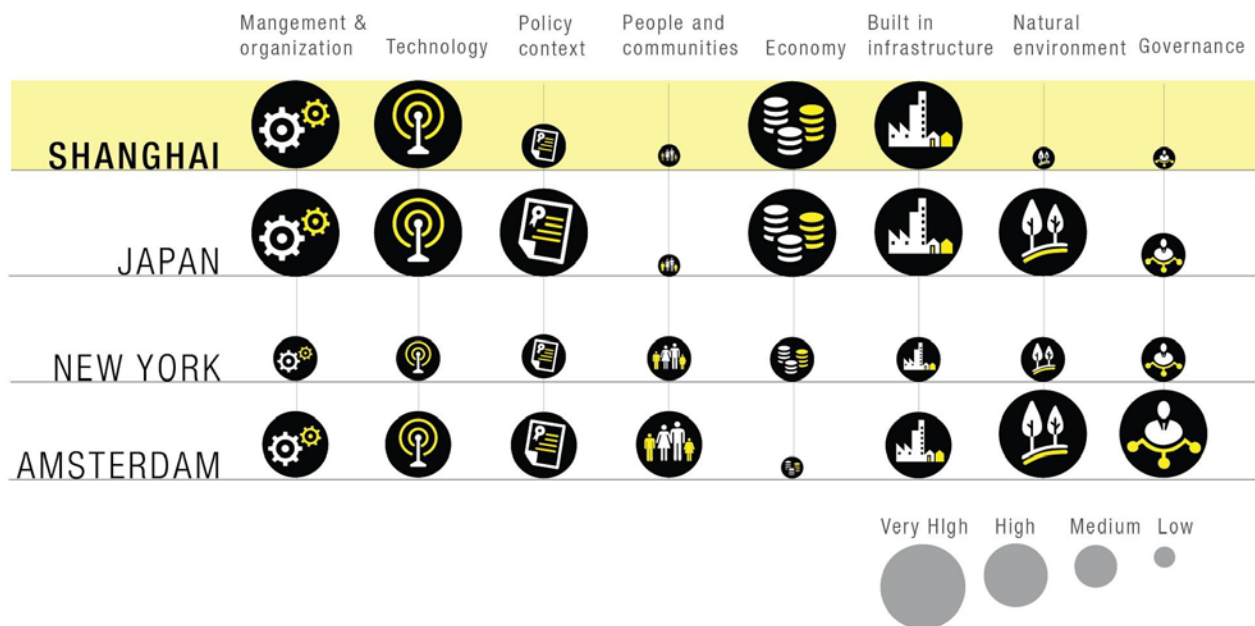
SHANGAI



The Chinese case: Shanghai

We built up our analysis from the factors suggested by Chouraby et al (2012) however, taking governance out of the list to make it an overarching category that we discuss at the end of each case. We also look at the rest of subcategories: the management and organization, technology, policy context, people and communities, economy, built infrastructure, and natural environment in the Chinese case. We find by 2011 fifty-one urban areas with plans and specific goals addressing smart cities (Liu, Peng 2013).⁷

The following table shows the comparison when we compare the case to other most different cases in each of the dimensions analyzed:



In China the **management, economy and built infrastructure** for smart cities is based on an investment led model. The roots are on the 12th Master Plan and a government budget that allocates substantial resources to the Internet of Things⁸ and sustainability sectors, keys to the

⁷ "According to the statistics of the Chinese Smart Cities Forum, by April 2012, 6 provinces and 51 cities have included Smart Cities in their government work reports. 36 cities are under concentrated construction. They distribute densely over the Pearl and Yangtze River Deltas, Bohai Rim. These three large areas account for 74% of the total, respectively 6, 11, and 9 cities. The Midwest area also represents a good image. Smart Cities spread in every first-tier cities such as Beijing, Shanghai, Shenzhen, are in 65% second-tier cities and in 18% third-tier cities (Liu, Peng 2013)."

⁸ "Research and employment of IOT in China in the next five years will mainly focus on the wireless sensor network node technology, the WSN Gateway, system miniaturization, UHF RFID, intelligent wireless technology, the communication and heterogeneous network, network planning and deployment,

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 in China marks at 500 billion yuan the investment for its 12th Five Year Plan. Liu, Peng (2013) highlights 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.

How is this translated to Shanghai? The technological and industrial support of the smart city in Shanghai has as a **main objective the upgrading of the traditional industry**. And in this light should be seen the focus on application and management standards in the areas of cloud computing, Internet of things, telecom and networks as well as strengthening intellectual property rights protection in the IT and industry.

The municipality (24 million inhabitants) put in place a three-year action plan in 2011 to build a smart city.⁹ The idea behind the plan is to attain an “innovation driven transformation.” It insist on the guiding 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. The tools to make the vision possible draw on:

“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, 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.”

Technology and energy are keys to smart developments in China (Liu, Peng 2013). Even though technology has a strong focus on standards, “technical standards are lacking or still not perfect in this field (Liu, Peng 2013).”

China has been the most 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 alone. 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

comprehensive perception and information processing, the middleware platform, code resolution service, search, tracking, and information distribution (Liu, Peng 2013).

⁹ 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.

9

populated areas on the coast. This project aims to tackle the challenge of an expected increase in electricity consumption reaching now 8.5% per year.

China 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.

Beyond intelligent nodes, projects in China also include adding intelligence in location sensing, identification, security, networking, processing and control. Applications, drafted from above include the operation of cities as well as other sectors such as agriculture, industrial processes and the health sector (electronic medical record).

In the case of 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, 3) building up operational bases and auxiliary facilities to improve application service level and expanding application service areas.

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.

On energy grounds, the Shanghai equation includes a grid-based management system. The city has seek 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 - was to achieve a leading effect: In so doing, the municipality seek actively the support of the State for the city’s trials in relevant areas.

Shanghai was also 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 the following special projects:

- 1) Cloud Computing with the “Yunhai Program”, -Gathering large foreign and domestic Internet businesses, exploring the building of cloud computing business models oriented to the

market in the financial, health and cultural areas.¹⁰ It also included the building up of an Asia-Pacific cloud computing center.¹¹

- 2) Internet of Things¹² --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, and enhancing the independent innovation ability of the businesses. Shanghai tried to become a State pilot city for the Internet of things application and industrialization building **Shanghai Internet of Things Center in Jiading**; constructing the Internet of things **industrial bases in Pudong** and other districts and county, with stress laid on service for product production and backstage operation; **building the Internet of things application demonstration bases in Yangpu** and other districts and county, with emphasis placed on application demonstration and talent training.
- 3) TD-LTE advancing the construction of pilot city for the State TD-LTE scale technology experiment network and enhancing the demonstrative effect, and giving special support to **the backing role of TD-LTE in areas like mobile Internet, Internet of things and cloud computing; applying it first in such important areas as high-end financial and business districts, shipping business area, high-tech parks, government offices, school campuses and hospitals.**¹³
- 4) 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, the development of integrated circuit equipment and materials sector, making breakthrough in

¹⁰ "Financial Cloud" , "Service Cloud for the Small & Medium Businesses", "Health Cloud", "Cultural Cloud", "Community Service Cloud" and "E-government Cloud".

¹¹ The means: The "Yunhai Innovation Investment Fund" to quicken the pace of industrial innovation; encouraging cloud computing companies to move to Zhabei Cloud Computing Industry Base and Yangpu Innovation Base; constructing Yunhai Start-up Mansion and planning for building a cloud computing demonstration and experiencing center from a high starting point; with the support of Yunhai Industrial Union; strengthening information communication and professional cooperation between the upstream and downstream businesses in the cloud computing sector; making cloud computing technological standards and specifications; establishing a joint laboratory of the industry, universities, research institutions and users and promoting institutional building and training cloud computing professionals to strengthen firms.

¹² Aims: enhancing the supporting role of the existing telecom and radio and TV network, achieving breakthrough in the core technology, implementing application demonstration projects, innovating commercial development patterns, pushing forward the coordinated development of the Internet of things product manufacturing sector and the information service sector, bringing along the Internet of things' application market and the relative industry chains, and enhancing Shanghai's lead in the Internet of things industry in the country.

¹³ It included building Zhangjiang TD-LTE professional verification platform to develop, verify, demonstrate and popularize TD-LTE end-to-end solution and providing backing to TD-LTE application demonstration in the city; actively pushing ahead the building of TD-LTE industrial alliance and strengthening the mechanism for the exchange and cooperation between the carriers and businesses related to the industry chain.

industrialization and commercialization.¹⁴ By 2013, the city's integrated circuit industry was targeted to reach a scale of RMB 85 billion and its designing sector will maintain its leading position in the country and gradually catch up at a world advanced level.

- 5) Next Generation Network: 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, with controllable core technology and internationally competitive.¹⁵
- 6) Internet of Vehicles: The development of a whole vehicle network system framework, software tools and the customized embedded software modules, forming a new vehicle-mounted service system solution. The aim is to become domestic leaders with effective business models and international influence.¹⁶
- 7) Information Service -with an stress placed on high-end and new service the aim is on the attraction of headquarters in order to become internationally competitive in network games and in domestic information service industry;¹⁷ Constructing a number of professional bases including Zizhu national network audio/ video industry base, Zhangjiang national digital publishing industry base, intelligent Dongtan data industrial park and digital interactive entertainment industrial park. 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. Intensifying governance of rights infringement and

¹⁴ Including the promotion of chip designing and whole set of machine -vigorously developing SoC technology- and encouraging superior companies to achieve the international mainstream level of 45-32 nanometer. Taking the opportunity of the 909 upgrading and renovation project to accelerate the building of a 12-inch wafer production line; seizing the opportunity of implementing the major State scientific and technological special project to achieve breakthroughs in major integrated circuit equipment technologies and their commercialization including the photo-etcher for packaging, through-silicon via etcher and strain-free polisher, and also making breakthrough in the highly pure raw materials.

¹⁵ Also supporting the research and development and commercialization of products such as GPON that supports the IPv6 standards, OLT of EPON, and ONU, and promoting the commercialization of IMS equipment. On the strength of the telecom and radio and TV carriers, speeding up the optical network deployment and the application experiment characterized by Internet Protocol version 6; through application demonstration, bringing along the coordinated development of the relevant electronic information product manufacturing and the information service industry.

¹⁶ It would include integrated wireless telecom, vehicle network distance access service, vehicle-mounted information service platform software middle-ware, making the research and development of application and products of vehicle-to-vehicle short distance communication, online whole vehicle fault diagnosis technology and intelligent navigation, and building up the whole industry chain.

¹⁷ Supporting the export of original national online game products, and supporting the platform opening and business model innovation of the social networking system; encouraging the research and development of original animated cartoon products, and supporting the development of derivative products. Promoting the common development of video sharing, video live broadcasting –VOD- and video portal, and supporting the research and development of network audio/video content and original network audio/video content using the transmission channels of new generation mobile telecom technology and NGB. Constructing an open digital content platform, encouraging integrated solution research and development and brand building of different reading terminals and accelerating content digitization and platform service building of Shanghai-based books, newspapers and periodicals.

piracy, and making efforts to solve the problem of rights infringement and piracy in the network.

- 8) Strengthening the building of financial data bank, and advancing the research and development and industrialization of economic information terminals, including the daily life information sector -food & beverage, leisure & entertainment, and shopping, building daily life information platform, consumption guide platform, information transmission and commercial marketing service platform, and strengthening tourist information resource development and service.
- 9) On Information Security Protection grounds the city decided to adhere to the policy of “active and comprehensive security maintenance”, making efforts to build a solid foundation 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 healthy and 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.
- 10) 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.
- 11) These project were completed with two others focused on monitoring harmful information on the Internet and crack down on network crimes.

The economy -as well as the technology and built infrastructure- are determined by this policy context. 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 current China's 12th Five-Year Master Plan. Among the shortcomings of the investment lead 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 Beijin, 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, 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.”

With regards to **people and communities**, they are incorporated through the political party in the smart city models of China.

Liu and Peng suggest that:

“attention must be paid to the cultivation and management of talented persons and professionals... education and training... build a high-end talent platform with famous university and scientific research institutes and carry out a mode of cooperation between colleges...local industries,...with the complementary of vocational training schools, providing coordination for producing, learning, studying, and researching (2013)”

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.”

Coordination of innovation of firms universities, research institutions and users is paramount in Shanghai in the new generation of IT industry, including cloud computing and the Internet of things. They also worked on creating what the plan calls a sound environment, from professional forums and conferences to exhibitions. The purpose has been to guide relevant businesses, social organizations, experts and scholars and the residents to participate in the building of the smart city. The sound environment attempted that the whole society supported the smart city developments.

The natural environment is a concern in smart city plans, and it is related in the Chinese case to the set up of a smart grid to transport energy to coastal cities in the east coast.

The organization and governance of smart city plans in China include the participation of local governments and universities, both lead by officials from the communist party. The cooperation is open to local governments, universities and foreign firms. Japanese firms as well as IBM, for instance, have developed strong win-win alliances with local governments. In all cases the party elected officials have a stronghold executive power.¹⁸ 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.

Urban regions adopt new modes of governance: Local governments lead smart cities projects. Local governments are also the node 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 11.0 billion RMB

¹⁸ Examples of smart cities include Beijing, Tianjin, Shanghai, Guanzhou, Nanjing, Shenyang, Wuhan, Dongying, Hangzhou, Wuxi, and Chengdu (Liu, Peng 2013).

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.

Shanghai has issued the “Smart Shanghai 2011-2013 construction Plan.” Liu and Peng state 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 (2013).”¹⁹

Policy context in Shanghai 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 set 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 county 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 built the smart city: Perfecting Policies, Laws and Regulations 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 informatization avoiding to lose time formulating rules and

¹⁹ Other Chinese cites: **Chongqing City** with Japanese NEC is another example of local government implication. NEC has established a local subsidiary focused on cloud business and a data center supporting cloud service platforms in Chongqing City, a laboratory for the development of cloud service applications for government, traffic, disaster prevention, energy, medical system and agricultural uses, in addition to the development of cloud computing technologies. Besides this, NEC develops human resources for the cloud industry and technical certifications in cooperation with the city. NEC regards Chongqing as a strategic base for its business in China. The **Beijing** University of Telecommunications launched in autumn 2011 PROBE-IT, an acronym for "Pursuing Roadmaps and Benchmarks for the Internet of Things." PROBE-IT is open to participating universities around the world, and suppliers interested. The aim is defining from evaluation methods, to standards to promote a framework called plug and play Internet of Things.

regulations to promote informatization;

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 county.

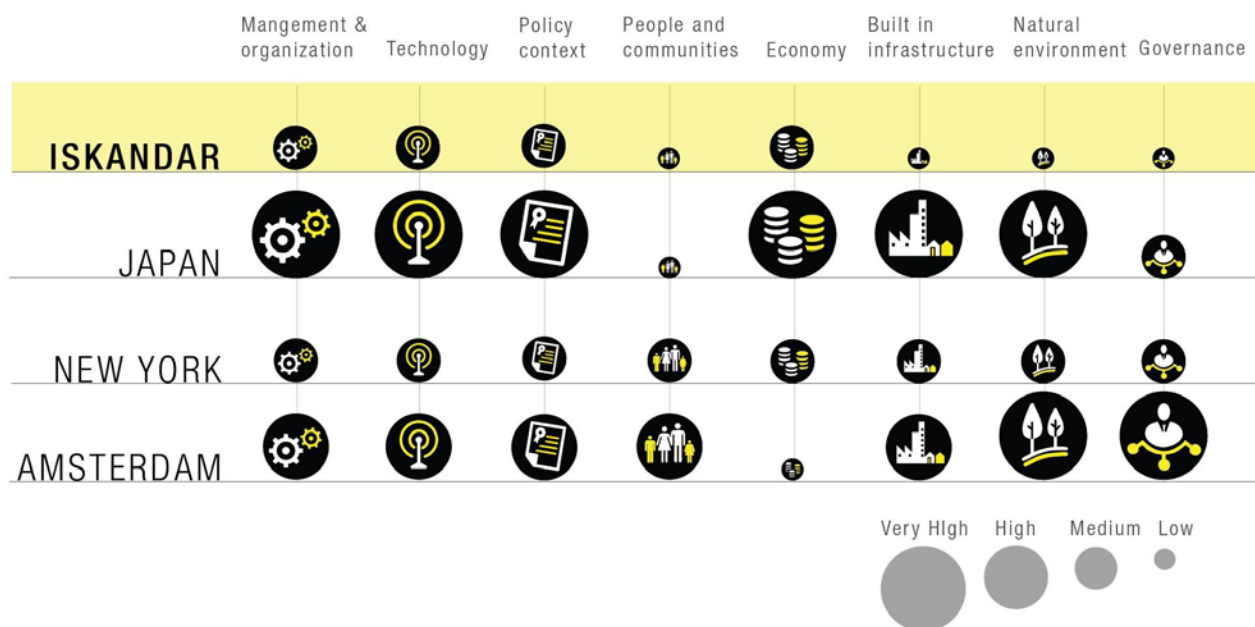
In the case of Shanghai we found at very early stages a conception about digital literacy in the XXI century that might give a broad participative role to people and communities in the development of the smart city.



Iskandar, Malaysia

We follow the same model in order to qualify the smart case of Iskandar in Malaysia: management and organization, technology, policy context, people and communities, economy, built infrastructure, and natural environment (Choubary et al. 2012), in order to understand more generally how the governance of smart city works in Iskandar.

The following table shows the results when we compare the case to other most different cases in each of the dimensions analyzed:



The management, and organization in Iskandar is affected by its geography. Iskandar in Malaysia is situated on South East Asia at the southern tip of Peninsular Malaysia, within minutes from Singapore. For the country, and the government in place -which has been just re-elected- the place is strategically located among major cross road of East–West trade routes countries growing fast, like China and India (Ho et al. 2013). The development of Iskandar goes hand in hand with increased linkages within Asia-Pacific countries by air and sea hubs. The government wants to strengthen a competitive edge for this Asian region and it creates a Iskandar development region plan in 2006 (Bhaskaran 2009). The Iskandar Regional Development Authority was later appointed to advance new smart goals.

The **technology** is mentioned as a pillar of smart Iskandar attempting a “strategic use of information technology for integration of every aspect of life.” However, further details are not addressed in

specific terms. The **economy of the model** is heavily linked to funds coming from abroad.

People and communities are addressed from the perspective of education in Iskandar. Ellis Rubinstein, president of the New York Academy of Sciences, has been appointed to work on the Iskandar university campus area. His mandate is to make the campus a reference in a city trying to accommodate the social and economic needs of fast-rising populations and environmental challenges. Several United Kingdom universities such as Newcastle and Southampton plan to open up campuses there. Support from the cultural industry's has been search for abroad at Pinewood Studios that has committed to build facilities in Iskandar, and from Legoland, that has already built its first Asian theme park in the city.

Built infrastructure is focused on new residential and business developments as well as educational and recreational areas. For **built infrastructure** we do not find in Iskandar Regional Development Authority reports clear strategies regulated by master planning of form-based design codes. We do not find a process of place-making rooted to participatory democracy either. There is no mention to electronic media to structure and extend democratic debate.

According to Iskandar Regional Development Authority reports, these are the pillars of smart Iskandar:

- Incentives for developers and investors for using green technology and infrastructure.
- The introduction of a green economy and carbon credits.
- A public transit system rather than more roads to improve easier movement.
- Smart education systems for producing leaders from the younger generation.
- Shared responsibility between business, police, and the public for safety and security.

In principle, the draft of Iskandar Regional Development Authority for the smart city includes active policies for the **natural environment** addressing sustainability: urban managers acknowledge the challenge of climate change and rapid urbanization for Malaysia. However, Iskandar Malaysia is currently experiencing population growth rate of 4% p.a. and economic growth rate of 6–8% p.a. and will continue to grow until 2025, the option of population reduction is difficult and remote. Planning for a low carbon region entails to reduce CO₂ emission by reducing three main variables: the per capita activity, energy intensity and carbon intensity of the region (Siong Ho, et al. 2013)

The policy measures for the reduction of per capita activity might include 1) promoting low carbon lifestyle and consumption, through behavioral change of the increasingly affluent population - including energy saving awareness program and promotion of policies of reuse and recycling campaigns 2) change of building and planning code that promote low energy building.

However, as Siong Ho et al (2013) explain measures used to reduce carbon intensity shall be taken at national level with policy actions:

- to reduce the use of fossil fuel and
- to provide tax incentive to increase use of renewable resources.
- to use biofuel, hybrid vehicles and buses and use of renewable sources of power in urban

areas.

These forward looking policies to reduce CO₂ emissions, however, have not been contemplated in Malaysia yet.

The governance and policy context: The Iskandar Regional Development Authority (IRDA), was established by a Federal Act of Parliament of Malaysia e IRDA Act 2007 (Act 664). IRDA has developed a Comprehensive Development Plan for Iskandar to steer the overall development framework (Iskandar Regional Development Authority, 2012). The purpose of Iskandar, providing a livable and sustainable conurbation, is defined in the plan. Development strategies have been set to ensure the balance between these needs against economic growth, environmental quality, social and community development (Shen et al. 2011). Five strategic pillars have been defined, including (1) International Rim Positioning, (2) Establishing hard and soft infrastructure enablers, (3) Investment in catalyst projects, (4) Establishing a strong institutional framework and the creation of a strong regulatory authority, and (5) Ensuring socio-economic equity and buy-in from the local population.

Iskandar is placed as a redevelopment area where a main focus is attracting international capital. The Iskandar Regional Development Authority has advanced figures over \$30bn for Iskandar development, and it is expecting more than a third coming from outside Malaysia.

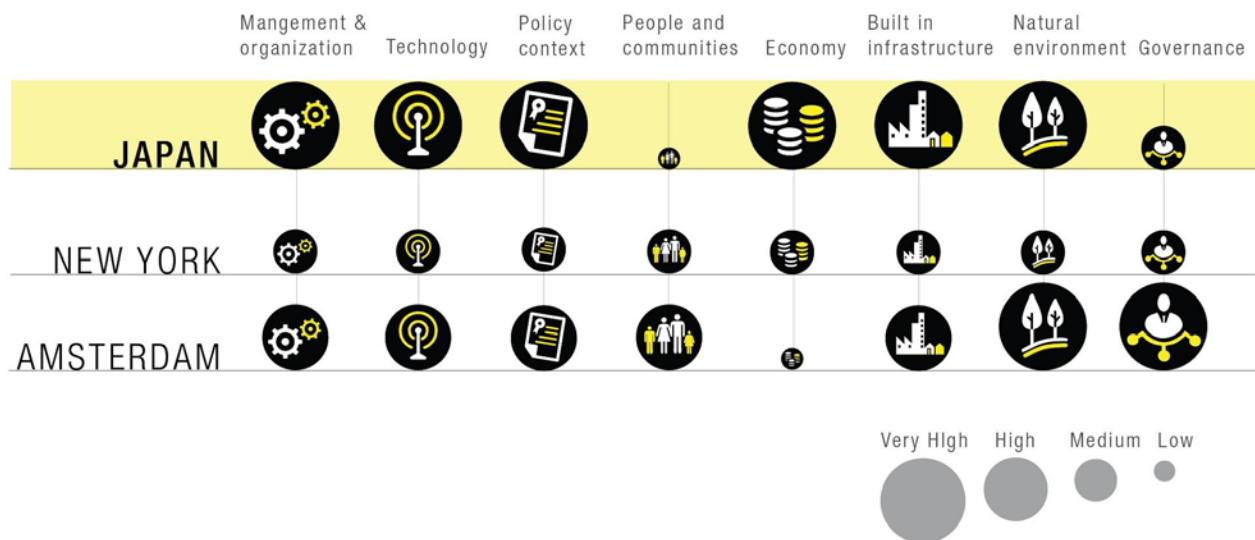
In the Iskandar case, we have able to identify main public policy issues related to the smart city concept. Main implementation problems in this particular case might are difficult to foresight, since the project is still in early stages. Information on technology partnerships is lacking, and local strengths in this regard are not salient. Thus, this is probably an issue to tackle for local officials and the development authority. Iskandar is engraining education in the smart development, as universities are being built and developed. However, digital literacy in the XXI century as a way to make citizens active in the smart project as such is not addressed in the model.

JAPAN



We apply the same model that help us explore the previous cases to the case of Japan and smart projects being developed there (Choubary et al. 2012): management and organization, technology, people and communities, economy, built infrastructure, natural environment and policy context.

The following table shows the results when we compare the case to other most different cases in each of the dimensions analyzed:



Management and organization in Japan's smart city model is based on four on-going -location experiments. They are known as smart city operational experiments.

The Japanese government acknowledges that social infrastructures, involving electricity -energy-, water, buildings, transportation, communications, administrative services and other elements, are "indispensable factors for ensuring that the lifestyles of the people and businesses can be supported." In order to have all of these established within short periods of time and in a way that makes them useful in the future, the national government set up the master plan for smart cities. The time period for the pilot projects contemplate operational experiments conducted for a five-year period from 2010 to 2014 in four cities.

Technology is key in the smart pilot projects as they aim to focus on technologies to develop the smart grid, smart cities and business models for the global market. Projects search ways to make power use visible, to control home electronic devices, hot water systems, demand response -which

involves the adjustment of energy demand that is encouraged from the supply side-, the linking of electric vehicles and homes, the optimal design of energy storage systems, electric vehicles charging systems, and transport systems.

Looking towards the construction of a next-generation energy society is ingrained in the vision of smart projects being developed in Japan:

“For resource-poor Japan, the large-scale introduction of renewable energies such as solar and wind power is absolutely essential to the nation's energy security and the reduction of CO2 emissions. The importance of these measures only increased in the wake of the Great East Japan Earthquake of March 11, 2011. However, in order to introduce these renewable energies on a large scale, we must also increase the efficiency of power use and balance supply and demand, and establish a smart grid as a power transmission and distribution network able to stably supply power.”²⁰

The smart grid and smart cities are considered related to each other in the Japanese model:

“If we are to utilize energy more efficiently than we have to date, we must not focus exclusively on the power system, but also reexamine our lifestyles looking towards, for example, the use of heat energy and transport systems. This means that it is essential for us to study the feasibility of new social systems, i.e. the ideal form of smart cities. If we take into consideration electric vehicles, the use of which is expected to expand in future, then the way we use energy will also change significantly, for example, electric vehicles batteries will be charged in ordinary households”²¹

The economy of the model in Japan comes hand in hand with the intention to develop a smart industry to market globally.

People and communities: The experiments designed in Japan include residents as active parts. In its statement of purpose of the plan “Japan Smart City” the government site claims that:

“the main aim should be to consider the lifestyles of the citizens, which in the end will determine the form the cities should take. Smart cities are not something that should be tackled by just governments and corporations and then presented to residents. The general public must also be actively involved in sharing their own ideas and helping to formulate the cities by throwing their own wisdom into the pot. That is what smart cities are all about.”

The natural environment is key driver to smart projects in Japan. Facing urbanization is an enormous issue for Japan, with agricultural land being converted into urbanized areas at the same pace as the rapid growth of developing nations. However, the origin of the smart city projects in Japan is the aftermath of the Great East Japan Earthquake that struck on March 11, 2011, and the subsequent nuclear power plant accident.

²⁰ Japan Smart City Portal <http://jscp.nepc.or.jp/en/>

²¹ Japan Smart City Portal <http://jscp.nepc.or.jp/en/>

The governance of the smart projects in Japan is an interesting experiment mixing decentralization of tasks and responsibilities to local and regional governments and the experimentation with modes of non-hierarchical coordination among public agencies and companies. However, the evaluation of the projects is centralized and assessed periodically. The axes of governance are four city pilots:

- The Yokohama project, embarked on a demand response deployment on six large commercial buildings to test the effects of drawing power from storage batteries and energy efficiency measures.
- Toyota City examines power demand increases as multiple electric vehicles are charged, the use of battery storage and an energy management system.
- The Keihanna project, evaluates the use of parked electric vehicles as storage batteries, combined with other recycled storage batteries to reduce power demand from factories.
- Kitakyushu project, conducts a dynamic pricing trial with residents as part of its smart communities creation Project, setting incentives to lower consumption and to share data with power firms.

Taking as an example the case of Yokohama city, partners of the project include the local government, the university, technological firms, power –including gas- and real state firms.²²

Governance in the case of Japan includes evaluation of the projects as part of the process towards smart goals: sub-projects carried within the selected cities are later supervised by the Community Energy Management System (CEMS), in charge of verification and evaluation.

We also find in Japan pilots a strong emphasis on the development of creative and symbolic analytical strategies coupled with jobs based on creative problem-solving (or the creative generation of new problems), using the words of Pekka Himanen (2005:338).

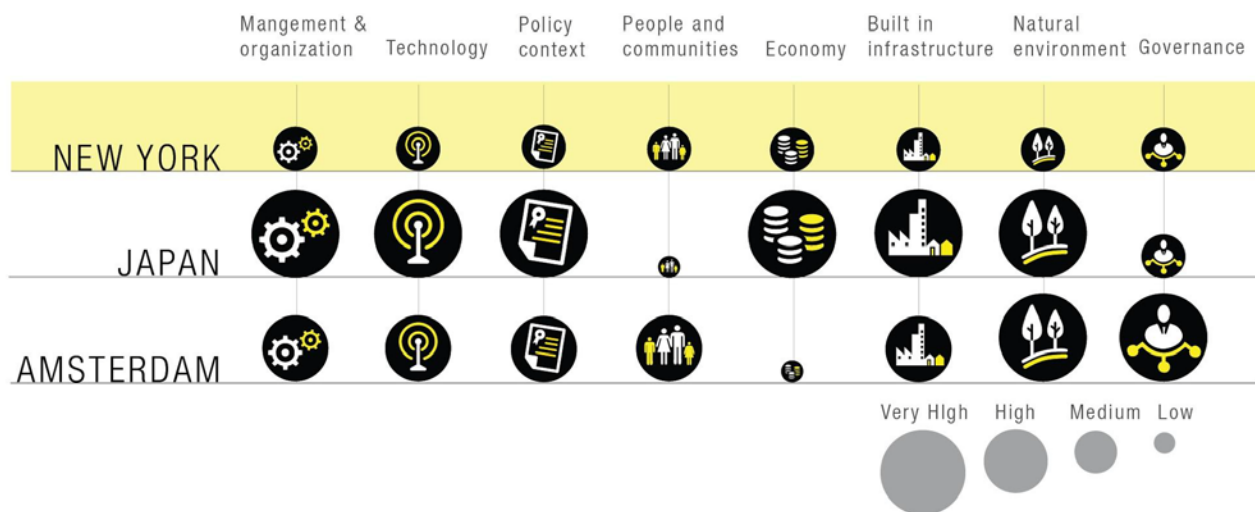
²² City of Yokohama, Tokyo Institute of Technology, Urban Renaissance Agency, MM42 KaihatsuTMK, Yokohama Smart Community, Accenture, NTT Docomo, NTT FACILITIES, INC, ORIX Corporation, ORIX Auto Corporation, Sharp Corporation, JX Nippon Oil & Energy Corporation, Sumitomo Electric Industries, Ltd., Sekisui House, Ltd., Sony Energy Devices, Corporation, DAIKYO ASTAGE, Inc., Taisei Corporation, Tokyo Gas Co., Ltd., TEPCO, TOSHIBA CORPORATION, NISSAN MOTOR CO., Ltd., JGC Corporation, JGC Information Systems Company Ltd., NEC, Nomura Real Estate Development Co., Ltd., Panasonic Corporation, Hitachi, Ltd., Misawa Homes Co., Ltd., Mitsui Fudosan Co., Ltd., Mitsui Fudosan Residential, MITSUBISHI ESTATE Co., Ltd., MEIDENSHA CORPORATION.

NEW YORK



New York, United States

We will now explore the case of New York in the United States looking at the same factors proposed by Choubary et al. (2012): Management and organization, technology, policy context, people and communities, economy, built infrastructure, natural environment, and governance.



Management and organization are linked to the two main smart projects carried out in the city. One of them is under the supervision of Dr. Steven E. Koonin, former under secretary for science in the Department of Energy in the Obama administration, who heads the research agenda in New York University's Center for Urban Science and Progress on smart cities. He has a background as a theoretical physicist and science policy expert.

A second smart project is developed from the city hall, focusing on smart data.

The approach to **technology** defined by Koonin at New York University goes from sensors to sociologists. Koonin speaks of science with a social dimension. The university aims to devise better ways to manage traffic and curb the consumption of water and electricity.

For former New York Mayor Michael R. Bloomberg, **technology** goes hand in hand with the use of data to guide operations. In 2010, the city set up a team of data scientists for special projects in the Mayor's office. The city government has committed to giving the N.Y.U. center access to all its public data. That is a rich asset, not only for research, but also for its potential to change government operations and, expectedly, public behavior.

For **built infrastructure**, the N.Y.U. center's partners include technology companies like [IBM](#), Cisco Systems and Xerox, as well as universities and the New York City government. There are also partnerships with government laboratories to tap their expertise in building complex computer simulations, like climate models for weather prediction.

People and communities have been embraced in data-driven approaches with Mayor Bloomberg. Experiments with data driven approaches in governance include:

- [citizensourcing smarter government](#), aimed at creating platforms for citizens to collaborate around information to improve outcomes
- [participatory budgeting](#) to embracing a broader [future as a data platform](#).
- New York City government data repository, the [NYC DataMine](#).

New York City government has been moving toward making more useful public data available, including 311 service -allows citizens to notify government about potholes and other issues-, geocoding, performance and regulatory data. Recently, [New York launched an online 311 service request map](#).

The local government is also working to grow its community of civic entrepreneurs and developers fostering a Big Apps program and releasing annual New York City's civic application contests known as [NYC Big Apps](#), open to public voting.

Smart plans continue in the agenda and the NY University is investing in urban studies and development with the recently created Urban Informatics School in Downtown Brooklyn in spring 2013. Industry partners include IBM, Microsoft, Xerox, Cisco, Consolidated Edison, Lutron, National Grid, Siemens, AECOM, Arup, and IDEO.²³ Institutional partners include nearly twenty offices at various governmental levels.²⁴

In the case of New York city, new policies in public schools benefit from the agreement between Republicans and Democrats on the importance of becoming literate in code though of as essential as being literate in language and math. Code day, a civil society initiative [[codeday.org](#)] and the hour of code are examples of widely supported initiatives showing the social and political agreement: [<http://code.org/hourofcode>]. The Internet is also being base of national programmes such as the president announced Computer Science Education Week via YouTube in december 2013.²⁵

²³ We found consultancy firm [IDEO](#) with his human-centered design [toolkit](#) participating in smart projects with NY University in New York.

²⁴ Analytics Unit, Office of Policy and Strategic Planning, Department of Buildings (DOB), Department of Citywide Administrative Services (DCAS), Department of City Planning (DCP), Department of Design and Construction (DDC), Department of Environmental Protection (DEP), Department of Finance (DOF), Department of Information Technology and Telecommunications (DOITT), Department of Parks & Recreation (DPR), Department of Transportation (DOT), Fire Department City of New York (FDNY), Health and Hospitals Corporation (HHC), Mayor's Office for Operations, Metropolitan Transportation Authority (MTA), New York City Economic Development Corporation (EDC), New York City Police Department (NYPD), Office of Long-Term Planning and Sustainability (OLTPS), The Port Authority of New York & New Jersey.

²⁵ President Obama encourages: "Don't just buy a new video game, make one!" "Don't just download the latest

The **built infrastructure** for the city of New York started with a focus on efficiency. In an example, the council reports that tapping into data it is possible to streamline the building inspections, increasing the efficiency of finding risky conditions to 70% of the inspections. Efficiency is also the axis of partnership with IBM from 2009 launching the IBM Business Analytics Solution Center to address “the growing demand for the complex capabilities needed to build smarter cities and help clients optimize all manner of business processes and business decisions.” IBM projects help the city prevent fires and protect first responders as well as identify questionable tax refund claims--a move that is expected to save the city about \$100 million over a five-year period.

Natural environment in public policy has been part of joint programs of the city council with the NY University regarding the consumption of water, electricity and computer simulations, such as climate models for weather prediction.

In the **governance and policy context** in New York we find a lot of non-hierarchical relations based on functional diversity. We have also founded horizontal networks based on negotiations and trust. Linked to the New York City University we founded more direct forms of people involvement experimenting with problems solving activities and applications based on open data. However we did not find any master plan.

Digital strategies are focused on access to technology, open government, engagement and industry, according to Rachel Haot, Chief Digital Officer for the New York city government and the responsible for New York digital plan²⁶: “Industry is important because we need to make sure the private sector has all the supports it needs to grow and thrive and help to create these solutions that will help the government to ultimately better serve the public” (Howard 2011). Haot explains that open government is important for the local government because if the data and the internal structure and priorities aren't completely open “we're not going to be able to enable increased [open] services, that kind of [open] exchange of information”. Engagement, according to Haot is crucial because “we need to be constantly gathering feedback from the public, informing and serving. And access is the foundation because everyone needs access to these technologies.” (Howard 2011).²⁷

In the case of New York, main public policy issues related to the smart city concept are linked to the marketing of the city as place for talent and efficiency issues. However, there are not main drafts of projects to tackle environmental issues from a smart perspective. New York has not education of the population as a part of the smart development; however, educated and skilled on IT individuals might participate in city contests. Again in this case, digital literacy in the XXI century as a way to

app, help design it! Don't just play on your phone. Program it.” Beside the White House encouraging people to code, Rep. Tony Cárdenas from Southern California has introduced a bill called 416D65726963612043616E20436F646520, a string of 34 letters and numbers that in hexadecimal, spells the words: [America Can Code](#). Cárdenas is hoping to classify computer programming as a foreign language in California, and allocate grants for schools to start teaching coding as early as kindergarten.

²⁵

²⁶ New York Digital Plan nyc.gov/digital

²⁷ <http://nyc.gov/html/datamine>

make citizens active in the smart project as such is not addressed in the model.

SHA - Shanghai, China
ISK - Iskandar, Malaysia
JPN - Japan

JFK - New York, NY, USA

AMS - Amsterdam, Netherlands
AGP - Málaga, Spain
SDR - Santander, Spain
TAR - Tarragona, Spain



European cases

A brief introduction on the European Union Level

Many cities in Europe are branding themselves smart. For some it is yet a new attempt by mayors to introduce an interesting dimension in their programs seeking for reelection. For others, it is being an attempt to re-construct the foundations of economic stagnant sectors, to build up new foundations for a thriving economy in the XX century, or just to tackle the complexity of local management in face of new challenges for cities that are in some cases centuries old.

On citizen grounds, we should remember that Europe has traditionally cradled movements towards greener and more resource-efficient cities.

At the supranational level, there is a pull aid kit that some cities are being able to tackle when they have the vision and the capacity to do it: the European Union has programs helping out to leap forwards on smart grounds.

The Smart Cities Stakeholder Platform initiated by the European Commission (<http://eu-smartcities.eu/>) has a dual aim:

- identifying and spreading relevant information on technology solutions and needs required by practitioners and
- providing information for policy support to the High Level Group and the European Commission.

It is both a web-based and physical Platform open to anyone who registers on it. The backbone are the contributions by stakeholders in a bottom-up way. The Platform is one of the two governance bodies of the **Smart Cities and Communities** European Innovation Partnership (EIP).

The **Smart Cities Stakeholder Platform** project is an initiative of the European Commission (DG ENERGY), in close cooperation with the Covenant of Mayors and the Smart Cities Stakeholder Platform consortium. Where we have not founded by 2013 agencies from Spain involved so far.

The Smart Cities Stakeholder Platform consortium is integrated by a communications agency based in Brussels, GOPA-Cartermill, the Centre for European Policy Studies (CEPS) based in Brussels: CEPS, ECN, a company from the Netherlands developing high-quality knowledge and technology for the transition to sustainable energy management (ECN); the University of Manchester, the The Regional Environmental Center for Central and Eastern Europe based in Hungary, REC and FRAUNHOFER, Europe's largest application-oriented research organization, with efforts geared to people's needs focusing on health, security, communication, energy and the environment. Actually, the Hospital Engineering Laboratory has recently opened at Fraunhofer's inHaus Center in Duisburg –on July 18, 2013 — This laboratory brings together four Fraunhofer Institutes and over 60 partner companies to develop and test solutions that explore their vision of the hospital of the future.

The Working Groups

The Platform has set up three thematic Technical Working Groups, each dedicated to one technology area (Transport & Mobility; Energy Supply & Networks; Energy Efficiency & Buildings and ICT) and two horizontal Coordination Groups (Finance and Roadmap Groups).

A fourth thematic Working Group on ICT has been added in spring 2013. The Technical WGs review and rate the submitted Solution Proposals (SPs) with a view of grouping them as Keys to Innovation (KIs). Results are visible for all stakeholders.

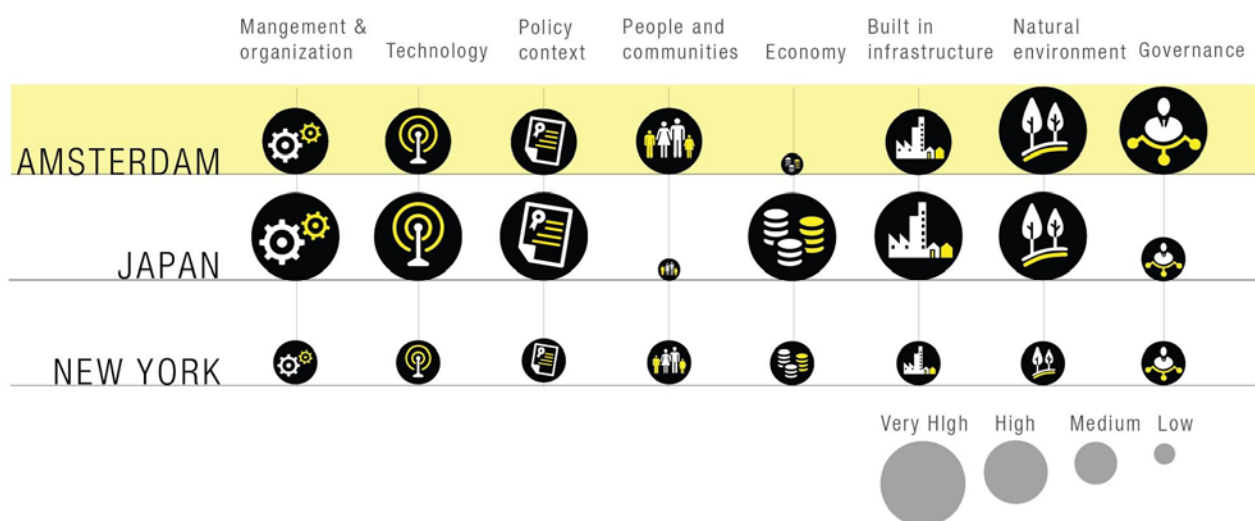
AMSTERDAM



The Case of Amsterdam

Different and uncoordinated projects in Amsterdam city –starting from grassroots initiatives linked to the cultural sphere with no leadership on the municipality- made the first smart city trade mark.

The following table shows the results when we compare the case to other most different cases in the dimensions analyzed:



Today the local municipality initiative links the concept of smart with **energy and open connectivity**, and through it, becoming one of the world's most sustainable cities by 2040. To achieve this goal a partnership called Amsterdam Smart City (ASC) among businesses, authorities, research institutions and the citizens of Amsterdam was set in place.

Since its inception in 2009 Amsterdam Smart City Partnership has grown into a broad platform, with more than 70 partners involved in a variety of projects focusing on energy transition and open connectivity. This bottom-up approach to sustainability encourages in particular the active involvement of citizens to test-drive new technologies.

The municipality ultimate goal is that these smart, sustainable projects reduce carbon dioxide emissions in line with the targets set at European, national and city levels. However, this aim is today more difficult, considering that nuclear the power moratorium in Germany is making bring carbon back to the equation. Nuclear power accounted for 22,4% of national electricity supply in 2010, descended to 17.7% in 2011 and the –still- growing difference is covered mainly with energy coming from carbon.

On the management and organization side

Amsterdam Smart City Partnership has led to a vast amount of innovative projects during its initial years. The projects are all in different scales and phases --although it seems difficult to evaluate their impact on long-term sustainability in the city. In any case, Amsterdam Smart City has functioned as a platform and an inspiration for small and medium enterprises in the search for sustainable options, and this alone makes for a good foundation for a broad change in the way of thinking about city development.

There are five cores on the 36 projects comprising Amsterdam Smart City: living, working, mobility, public facilities, and open data. And the Amsterdam Smart City Partnership website is full of schemes that have been adopted, including a sustainable platform allowing neighbors and friends to safely rent their cars to each other.

Other initiatives include Onze Energie -Our Energy in English-, one of Amsterdam Smart City Partnership largest projects, is being designed to supply 8,000 households with renewable energy, mostly through windmills.

Technology

The introduction of 21st century technology in listed buildings from the 17th Century of Amsterdam, is expected to reduce CO₂ emissions by 50%. By using this innovative decentralized generation technology - Ceramic Fuel Cells - the aim is to generate the electricity on site.

Cell manufacturer Ceramic Fuel Cells Limited has managed to create a higher powerfull cell yield than the modern gas-fired power plant, after 20 years of research and development in Australia. The CO₂ emissions are also reduced by 50%.

The fuel cell is currently being tested in nine locations worldwide. Fuel cell technology is very diverse with the experience of many disciplines -from chemistry to materials science to engineering and thermodynamics. Because fuel cells are highly efficient and in the process the fuel is not processed by combustion, fuel cells do not emit large amounts of greenhouse gases such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (NO_x). The only emission of fuel cells are in the form of water steam, and low levels of carbon dioxide.

Companies such as Coolendeavour, Eneco, Gasterra Liander find on Ceramic Fuel Cells a promising technology and have decided to introduce a 2kW fuel cell CFCL jointly a Proof of Concept in the center of Amsterdam: not in a laboratory, but in a 'living lab' environment.

With this living test, the so-called Green Bay buildings are fully equipped with self-generated electricity. In this model, electricity is generated at the place of consumption and transmission losses are just about 5%. The total return achieved on energy grounds amounts to 85%.

People and Community

Projects under the Amsterdam Smart City Partnership aim that citizens do a better use of clean and renewable energy. With the projects, the municipality is trying to gain a balanced among urban life and sustainable environment.

The municipality of Amsterdam experiments crowdsourcing on the [AmsterdamOpent.nl](https://amsterdamopent.nl) platform to learn how interaction with citizens can support local policies. In addition, a Facebook application allows users to submit their ideas through the social network.

Economy Context

The Amsterdam Economic Board was created to develop smart city Amsterdam. Established in 2011, the Amsterdam Economic Board is an advisory Board to the regional government in the Amsterdam Metropolitan Area on economic policy and innovation. The Amsterdam Metropolitan Area has several key assets to be an innovative, including several strong clusters. The aim of the Economic Board is to make Amsterdam Area a pioneer both nationally and internationally. In order to so, the collaboration between governmental agencies, research institutes and the trade and industry sector is being essential.

Built Infrastructure

From 2012 Amsterdam's department for Infrastructure, Traffic and Transportation (DIVV) has made available all its data on traffic and transportation to the public. Information about parking availability, taxi stands, cycle paths, and live traffic updates are available on main roads across the city. The data provided has allowed developers and entrepreneurs to create apps to improve the flow of people across the Dutch capital, giving Amsterdammers new insights and the chance to make decisions based upon facts and figures.

Another step of the project on infrastructure is to make it more eco-friendly. Other projects are expected to follow including 300 power hookups to recharge electric cars, solar panels on Amsterdam's historic 17th century townhouses, and infrastructure upgrades that allowing households to sell the energy they generate, from small-scale wind turbines or solar panels back to the city's electricity grid for a profit.

Natural environment

Nowadays, the bike in Amsterdam is the most common way of transportation, helping to reduce gas emissions. However, the most important trait to highlight is citizens' concern on care for the environment. Amsterdam citizens have internalized an in-depth respect and care for the environment. This makes the city to be considered among the healthiest cities in Europe.

Governance grounds and policy context

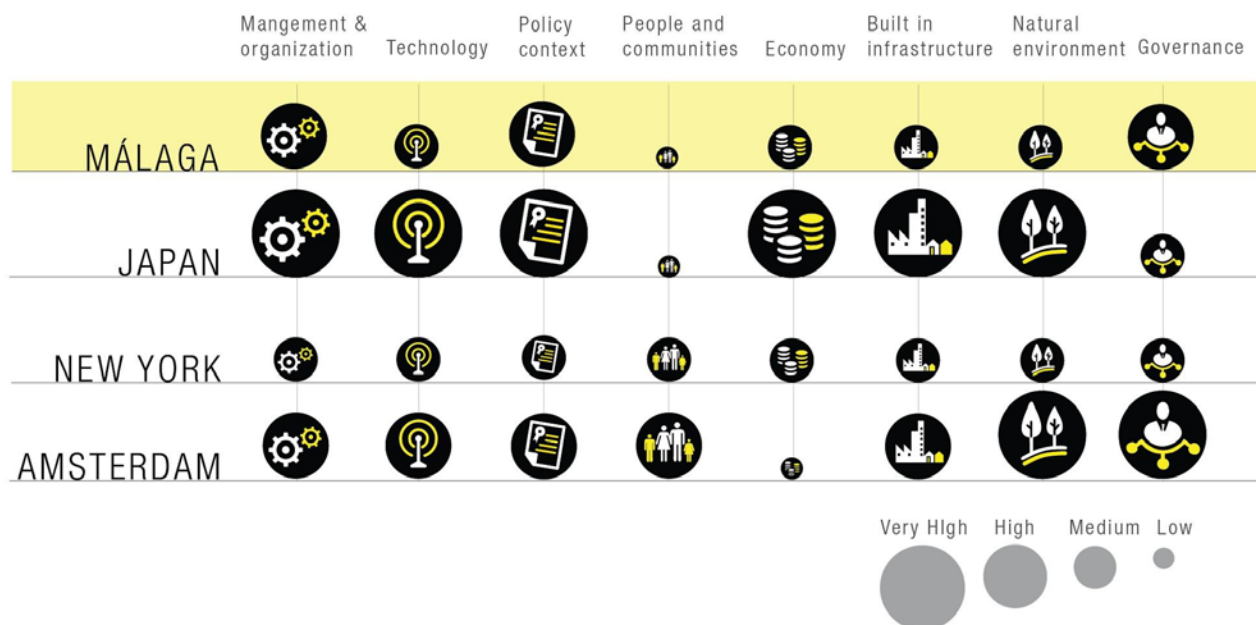
The main public policy issues related to the Smart City concept are linked to future investments and the well-being of its inhabitants. The idea of Amsterdam becoming more attractive, clean city and a magnet for investments inspired and motivated the local politicians of Amsterdam to develop the smart city program.



The case of Málaga

We apply the same factors proposed by Chouraby et al. (2012) to analyze Málaga's smart city model: The factors to address include management and organization, technology, policy context, people and communities, economy, built infrastructure, natural environment, and governance over all.

The following table shows the results when we compare the case to other most different cases in each of the dimensions analyzed:



On **management and organization grounds** there is a claim on the sustainability of the welfare society through the devise of new production models. Production models are mainly focused on Information and Communications Technologies (ICT). These models would be grounded on the local and regional cluster of industry at the Technological Park of Andalusia in Málaga as well as the knowledge and talent spill overs from Malaga University and The International University of Andalusia (UNIA). Major transport infrastructures developed and Club Malaga Valley are also of help for the development of the new production models in search of new relation models between the polity and the society.

On the technology side Málaga city projects are based on collaborations with private enterprises, their focus is mostly on efficiency of existing processes. There is also the FI-WARE project, an advanced hint on the Internet of the Future. Lets start with the public private collaborations. These are two landmarks:

- E-administration and the migration of data to the cloud are key parts of an agreement signed

with Telefonica in July 2013 that also includes the objective to advance on an open data framework.

- A payment method via phone terminal with near field communications technology was the result of the collaboration between Orange phone company and the Malaga Bus Transport Company. The method allows purchasing and validating tickets in Malaga municipal bus fleet: the charge is made to the customer's bank card, bank financial data is not needed in order to complete the payment.

Málaga is also host to the Fi-Ware project. Fi-Ware is an open cloud-based infrastructure for cost-effective creation and delivery of Future Internet applications and services at a high scale. Under Fi-Ware, API specifications are public and royalty-free, driven by the development of open source reference implementation. Fi-Ware is intended to accelerate the availability of commercial products and services. The creation of a sustainable innovation ecosystem around Fi-Ware is driven through FI-Lab. Fi-Ware is a meeting platform for a diverse group of stake holders, from application sponsors -application customers, public administrations, investors- to application developers, web entrepreneurs -individuals, SMEs and other companies. Fi-Ware also enables free experimentation with technology.²⁸

Projects developed withing the **economic context** include the following:

The Technology Park of Andalusia, with a tradition of innovation and environmentally sound products and projects . Established companies benefit from support infrastructure including heliport, fire safety, access control, centralized alarms, special safety and surveillance, an electrical substation and two water networks. An investment of 125 million euros in telecommunications completes the park infrastructure.

The infrastructure of the technology park is complemented by a private initiative: Club Málaga Valley and a public one: ProMálaga

Club Málaga Valley e-27 is formed by a of a group of presidents from companies in the IT sector. The group det action lines to turn Malaga into *the most important area of technological excellence in Europe*, an European Silicon Valley, attracting other companies from around the world. **Club Málaga Valley e-27 is one of the most important think-tanks focusing on technology in Europe**, aiming to contribute ideas and experiences to achieve the objectives above. Established working committees shape knowledge, make proposals and guidelines.

ProMálaga is a 100% owned public and municipal company. It is in charge of the constitution, participation, promotion and management of public companies to develop and improve the city of Malaga Fields include urbanism, housing conditions, road infrastructure... Among the aims of ProMálaga are fostering: 1) the economic and social development of the city and its surroundings; 2) enhancing employment generation; 3) wealth and social welfare 4) becoming an instrument to help different economic sectors 5) become a pillar to strengthen the contribution of the business sector through the promotion existing businesses and the support and creation of new ones, with special attention to SMEs. ProMálaga aid programs and incubator services have become tools to

²⁸ FI-WARE: <http://www.fi-ware.eu/tag/malaga/>

²⁸ <http://www.fi-ware.eu/2012/03/30/meeting-in-malaga-city-council-infoday-on-the-1st-open-call-of-fi-ware-and-fi-ware-concord-bilateral-meeting/>

support Malaga entrepreneurs. Start up companies can be housed in the Incubation Centres for three years.

Málaga includes the following **built in infrastructure**

CEMI, a local government data processing center. CEMI centralizes information and communications infrastructure. CEMI is also in charge of managing back-up services in the even of unexpected catastrophes.

Fiber Optic Network, which serves to empower local government by interconnecting municipal buildings with data, voice, and high speed video.

A local governmental wireless network including emergency police, fire and civil protection, tourism areas web cameras and fiber switching nodes.

A local WIFI network works in 100 offices of the corporate network of the City of Málaga. The network is served by 140 access points within the municipal buildings. Each of them offers coverage to users with wireless devices within a radius of about 30-100 m of the access point.

Municipal screens disseminate local government information from initiatives to calendar, news, announcements and projects in local offices for public attention.

From the **natural environment** perspective Malaga SmartCity project aims to be the largest European initiative for eco-efficient city. Has grounds to claim so?

On-going projects on natural environment are the following:

- V2G technology research (vehicle to grid) aims to develop a delivery system of electric vehicle batteries to the grid, and subsequent analysis of the technical and economic feasibility of the solution.
- PLC Communications between processing centers.
- Energy efficiency in public and private buildings . Possible energy management of Hospitals.
- Sensors for noise, pollution, surveillance, communications.
- Battery Management and storage facility in the generators.
- There has also been an agreement with Ferrovial, focused on efficient energy management in buildings.

Among Málaga objectives on eco-efficiency are: increase energy efficiency, reduce CO2 emissions and increase the use of renewable energies. A consortium of 11 companies led by Endesa, is deploying in the Malaga area technologies for smart metering, communications and systems, network automation , distributed generation and storage, and smart charging infrastructure vehicles.

The goal is better management of energy networks, efficient demand balances and the involvement of all actors in the power system, from generation to consumption. However, in opposition to the pilot developed in Amsterdam, houses and firms may not become producers rewarded for the energy produced within their own facilities. This is in part due to the fact that national regulations prevent so, measuring and charging citizens for the energy they might produce either at home or at work.

Thus, even though the project aims to meet the European guidelines for the energy sector that drive efficiency, use of renewable energy and advanced network storage capacity, the impact is limited for citizens to define their own consumption model. Reduction of CO2 emissions, automated meter

reading, visualization of data online and the reception of notifications in case of network disconnection are new services, focused on efficiency. Are these services, however, giving the citizens a role on defining a new model of energy democratization --further from changing habits of consumers by providing online data consumption? These are a questions for further research.

Other plans targeting eco-efficiency target established networks. Targets, however, a set from a hierarchical perspective. We have not founded focused groups working in a co-creative manner for the development of solutions. Form this perspective we raise the question that has been recently raised at the World Economic Forum 2014 in Davos: *"We know the technologies, but we do not know what you -the consumer- have in mind"* (Metayer 2014).²⁹

On **governance grounds**, Málaga smart city model aims at the automatization of urban services and infrastructures, to increase the quality of services and curb public expenditure. The municipality is being very active acting on looking for a recognition of the steps taken on smart developments -- and designed focusing on tech public policy: The Málaga smart city project has been awarded with a recognition at the Smart Expo Congress in Barcelona in the fall 2013.

Focus on services to citizens stress the efficiency of the administration context. On going projects include: The creation of a new office of citizen services and the modernization of the revenue management in the town planning department; Modeling and simplification of administrative processes and municipal procedures -SIRPAMA; The Computer Application and User Management of Social Services -GAUSS; The monitoring of provision of housing and related management in the Municipal Housing Institute; Modernizing the management of governing boards in the local government -from electronic notices of meetings to online access documentation; And a platform to receive and manage incidents and requests for municipal citizens.

Efficiency and knowledge is on the base of Gecor, a communication service integrating data for citizens, municipal management bodies -technical, municipal enterprises and policy makers- and knowledge management. Gecor aims to facilitate public management through the redesign of processes and the co-sharing of data on management, the city and its citizens among public firms. It could allow participatory budgeting, the maintenance of public spaces and gender violence control policies.³⁰

There are also other defined smart projects.³¹

People and community are addressed in Málaga with the creation of an open living lab, promoted and supported by Málaga City Council. The Living Lab has wide intentions: 1) It intends to be a tool to deliver efficient public services adapted to the citizens' demands making use of new technologies -including what is called termed Future Internet-, and 2) intends to be an efficient way to promote entrepreneurship in the city.³²

²⁹ Estelle Metaller. 2014. <https://twitter.com/Competia>

³⁰ GECOR [video in Spanish] <http://youtu.be/OZ0T93VWNLg>

³¹ A technology platform for citizens, a release of the Urban Plan of the city of Málaga in the Municipal Geographical Information System, the integrated management of local heritage, a knowledge management tool for social networking and Citizenship Education, a new Web page for the City www.malaga.eu running over OpenCMS -a content management technology open source; And a system for remote management of acoustic limiters -Telca.

³² Source of Málaga Living Lab: <http://www.openlivinglabs.eu/livinglab/m%C3%A1laga-living-lab>

Málaga Living Lab's main characteristics are:

- Multi-project and Multi-domain Living Lab (Energy, Smart Cities, Sustainable Mobility, eParticipation, Social Inclusion, Tourism and Social Innovation);
- Continuity; Openness and Flexibility (very light governance structure);
- Important technological infrastructure;
- Privately and Publicly funded projects;
- Territorial Living Lab (city of Málaga);

Málaga Living Lab has been created with the objective of harmonizing existing Living Lab related projects carried out in the city, taking advantage of the possible synergies. The Lab defines a common methodological framework for citizen and user involvement.

Among the objectives of the Málaga Lab: to define a roadmap towards a model of public-private-people-partnership (PPPP), with the claim to make citizen participation one of its main foundations. Further research would be needed to assess the institutional capacity of the LAB as well as the inner functioning of the public-private-people-partnership model.

Málaga is also putting focus on education defined as digital literacy. Literacy addresses the digital divide through educational projects implemented in 25 community centers --centers with access to computers and training on new technologies. The centers are focused on elder people and people at risk of social exclusion. Computers in the centers allow free internet access. The project Telecentros has so far involved the implementation of 40 telecenters in the municipality, with 184 computers, accounting for 70,000 accesses from citizens per month.

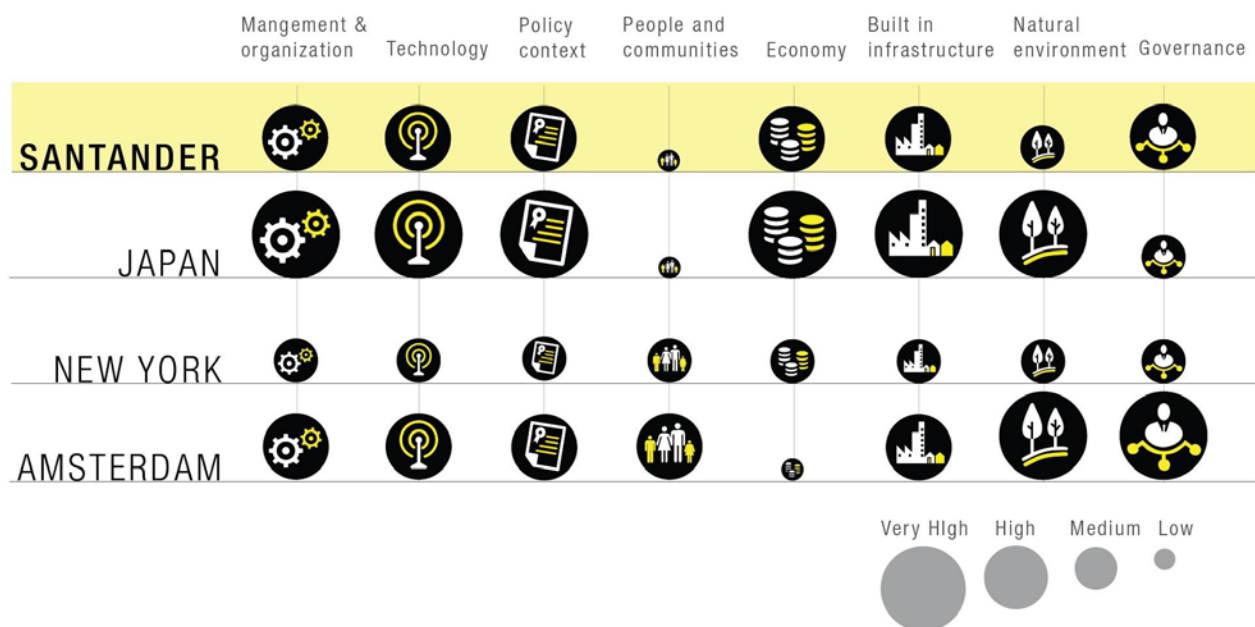
SANTANDER



The case of Santander

We apply the factors proposed by Chouraby et al. (2012) to explore Santander smart city model: These factors include management and organization, technology, policy context, people and communities, economy, built infrastructure, natural environment, and the over arching category of governance.

The following table shows the results when we compare the case to other most different cases in each of the dimensions analyzed:



On the management and organization side

Smart Santander starts up as a 36 month project in September 2010 under EC (European commission), call FP7-ICT-2009-5. This smart city project was conceived as a pilot Project, sensors would be installed in an area of six square kilometers --2.3 square miles:

“(an) experimental facility (...) sufficiently large, open and flexible to enable horizontal and vertical federation with other experimental facilities and stimulates development of new applications by users of various types including experimental advanced research on IoT technologies and realistic assessment of users’ acceptability tests.”

The project drafts the deployment of 20,000 sensors in partner cities that include Belgrade,

Guildford, Lübeck as well as Santander -up to 12,000 sensors-, using what is defined as a “large variety of technologies.”

Technology focus and partners in the projects include:

The Santander pilot focuses on both experimentation and the provision of services. Thus the idea has been to combine flexibility for researchers running experimental applications³³ and provision of services to the end-user.

In order to do so, The choice made has been a solution based on hardware independence for the first deployment. This means that all nodes (IoT nodes, repeaters and GWs)³⁴ are equipped with two IEEE 802.15.4 modules: one allowing network management³⁵ and service provision, and on the other, experimentation.

Service provision covers outdoor parking area control, and the monitoring of environmental parameters --temperature, CO, noise, and light, as well as augmented reality with tourist information on culture, services, commerce, sport events and traffic through smart phone applications –QR codes and NFC tags.³⁶ Parks and gardens irrigation is also starting to be covered as part of the smart project in 2013.

There are street signs equipped with digital panels that display real-time parking information for every block. In addition to sending data to Santander's command-and-control center, the sensors also send it to a suite of applications on citizens' smartphones. Santander residents can access up-

³³ Experimentation means in Santander that nodes can be flashed over the air in either a one-hop way (OTAP) or a multihop fashion (MOTAP) with different programs, allowing the researchers to test different experiments over the network. Further details over <http://www.smartsantander.eu/index.php/testbeds/item/132-santander-summary>.

³³

³⁴ Includes 2000 IEEE 802.15.4 devices in a three-tiered architecture including IoT nodes, repeaters and gateways. 1) The IoT node: Responsible for sensing the corresponding parameter (temperature, CO, noise, light, car presence, etc.). 2) The repeaters: These nodes placed high above ground in street lights, semaphores, information panels, etc, in order to behave as forwarding nodes to transmit all the information associated to the different measured parameters. 3) Gateway: Devices that gather all the information retrieved by IoT nodes and repeaters, acting as intermediate nodes between the sensor networks and the SmartSantander backbone.

³⁴

³⁵ Network management in Santander: to manage both experimentation and service provision, communication between IoT Nodes/repeaters and gateway nodes is performed through the Testbed Runtime (TR). A mux/demux functionality helps to manage these wireless devices. To support experiments, platform management and service provision in a joint way at the node level, a default program called golden image has been implemented.

³⁶ “Parking sensors (IoT nodes) provided with one transceiver (running the Digimesh protocol) send their parking state (free or occupied), to the corresponding gateway through the repeaters placed at the streetlights. At the same time, all these repeaters are equipped with temperature, CO, noise and light sensors, thus sending this information to the gateway. The received information is stored and processed in the gateway, in order to be used by different applications running over” more over. <http://www.smartsantander.eu/index.php/testbeds/item/132-santander-summary>

to-the-minute information on road closures, parking availability, bus delays or pollen count. Citizens can contribute, too — by uploading a photo of a pothole or broken streetlight, for example, and sending it directly to city hall. There's an app developed for that: and it is known as participatory sensing.³⁷

People and community have been addressed in Santander first form a survey and sencondly through a technological platform where ideas are posted via tech devices.

The survey for **SmartSantander** was aimed to hear the citizens's opinion on the applications and services to be deployed. This survey was placed at a web page and took 20 minutes to complete.³⁸

The tech platform Santander City Brain collects ideas for the development of Smart Santander The platform is powered by ideas4all, with the participation along 2013 of IBM and ISBAN (Grupo Santander). Ideas adhere to different categories, from energy to the environment. By mid august 2013 ideas collected for some categories where the following: energy (20 ideas), environment (60 ideas), citizen participation (46 ideas), Transport ranged first for ideas and suggestions (146 ideas) while government and transparency collected the least (eight ideas).³⁹

The **economy context** for the smart city project is set up under the backdrop of the \$11 million Grant awarded by the European Commission to Luis Muñoz, an IT professor at the University of Cantabria. Luis Muñoz has been at the helm of the team winning the \$11 million (9 million euro) grant from the European Commission to pay for the sensors installed throughout an area of 6 square kilometers (2.3 square miles).

This initiative has given Santander, a city of 180,000 residents, the opportunity to install and test devices for potential roll-out across other parts of the continent.

Investments are expected to bring savings up to 25 percent on electricity bills, and 20 percent on garbage bills, in Santander. The Project aims at cutting “costs while maintaining services for citizens”

The attraction of the city as a result of the move towards an smart definition made it attractive for multinational company Ferrovial, that has decided to invest in Santander and will build a smart city research center there.

The projects drafted include the following **built in infrastructure and natural environment**

³⁷ Partners include Telefónica R+D (leader), Alcatel-Lucent Italy s.p.a. (Italy), Alcatel-Lucent Spain S.A., Ericsson d.o.o. (Serbia), TTI#, University of Cantabria(Spain), University of Surrey (UK), Universität zu Lübeck (Germany), Lancaster University (UK), Commissariat à l'Energie Atomique (France), Computer Technology Institute (Greece), Alexandra Instituttet A/S (Denmark), Santander Council, Sociedad para el Desarrollo de Cantabria, University of Melbourne (Australia).

³⁸ By the time this web page was accessed august 2013] the Surrey was already closed:
<http://www.smartsantander.eu/index.php/component/content/article/35>

³⁹ <http://www.santandercitybrain.com/categories>.

concerns:

In the past, residents frustrated with potholes in Santander's streets called the city government or wrote a letter. Now they might open the "Pulse of the City" app and take a picture of the hole. One click sends this digital damage report, complete with GPS data, straight to city hall. From there, a computer forwards the information both to those who are responsible for the technical side of fixing the problem and to those who bear political responsibility for it -- a two-pronged approach to increase effectiveness. All of the data is made public, but the person who originally sent the complaint remains anonymous. City residents and local media can also use the app to follow how long it takes for the damage to be repaired.

Santanderinos have used the app to report more than 500 issues in five months since "Pulse of the City" was launched in 2013.

Luis Muñoz's computer informs the city exactly where new light bulbs are needed. The lamps can even adjust their brightness as needed, dimming when there is no one on the street, and emitting less light during a full moon than on a rainy night. This way environmental concerns are also addressed.

In the Parque de las Llamas, sensors will also be optimizing the amount of watering, so that no water is wasted.

Garbage collectors might eventually be able to avoid making unneeded trips, because sensors will inform beforehand which garbage containers need emptying.

From the **natural environment** point of view, the context of economic crisis is driving change in public policies, and the extent to which pilots might become widely available will very much depend on efficiency as well as to the response to the needs of citizens.

On **governance grounds**, Mayor de la Serna wants to open information that were previously confidential or difficult to access and make it public, including statistical data on demographic changes and real estate prices.

The mayor of Santander is now the president of the Smart Cities Network in Spain: Red de Ciudades Inteligentes Españolas (RECI), a national network of smart cities created in 2011 and comprising 41 other Spanish cities.

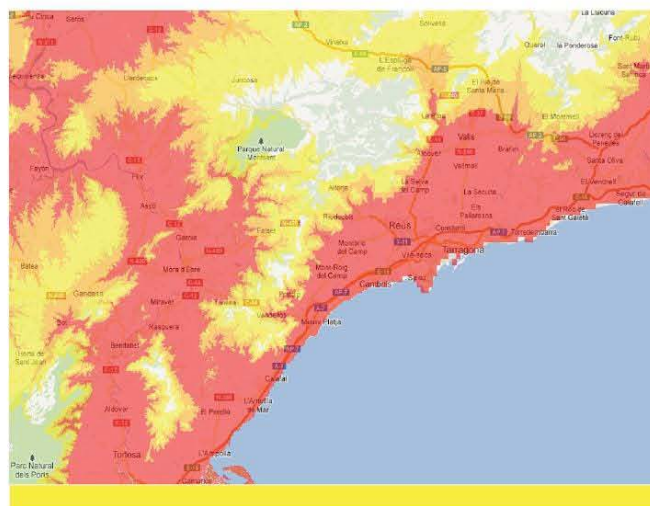
The network aims at the automatization of urban services and infrastructures, to increase the quality of services and curb public expenditure. This network is being very active exchanging information on energy, social innovation, urban mobility, governance and the environment.

The skills of the digital citizen

We did not find education as part of the equation of the smart plan. Further research has to be

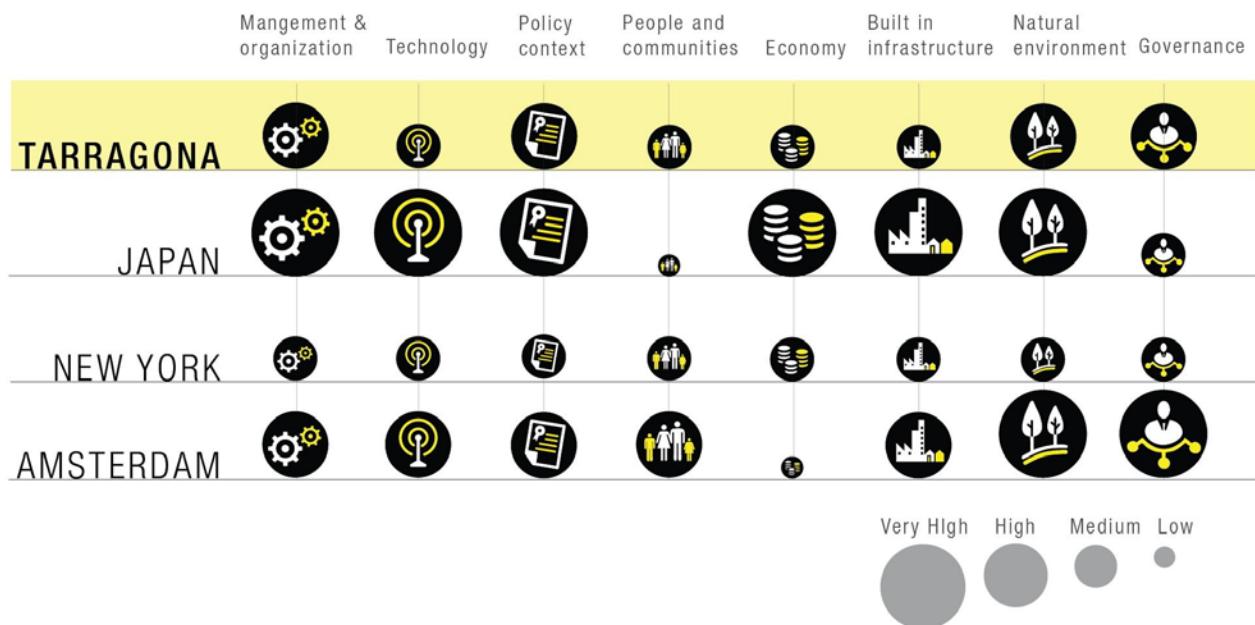
accomplished in order to understand whether there is room for digital literacy plans or they are being addressed in any way we are not aware of. A relevant question is how the digital divides are targeted in Santander.

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We will now apply the same factors proposed by Chouraby et al. (2012) to the exploration of Tarragona smart city model: The factors to address include management and organization, technology, policy context, people and communities, economy, built infrastructure, natural environment, and governance over all.

The following table shows the results when we compare the case to other most different cases in each of the dimensions analyzed:



On the management and organization side, a Foundation has been set up to follow up the smart city plan. The smart city projects are influenced by Richard Florida's concepts of thriving cities: based on talent, technology and tolerance. It also brings in the ideas of entrepreneurial spirit and collaborative organizations. The values underlying the projects are consensus and intelligence in the application of technologies –an intelligence that would be defined by universities, firms, public administration, and citizenship. Values are aimed at citizen's welfare, wellbeing, and social cohesion.

Technology focus and partners in the projects include both public and private companies.⁴⁰ Beside partnerships aimed at reinforcing and tackling the city strenghts Tarragona's smart plan, aims at enhancing city management and decision making.

⁴⁰ Tarragona Council, Repsol, Universitat Rovira I Virgili, Agbar, IREC Energy Catalonia, BDigital, Digivision, Telefonica, Aqualogy, CWP Water Catalonia, and Innoget Open Innovation.

People and community are addressed in Tarragona favoring the creation of a market for open innovation in software, with the partnership of Innoget, a project based on advertising as a business model. They are also addressed in an educative project “smart phones for smart people” to teach how to use smart phones in the civic centers in order to target the digital divide. There are also plans to install Video Wii games in nine civic centers to engage citizens on physical exercise and community entertainment.

The **economy context** for the smart city project is set up against the backdrop of the economic downturn, so that the smart city project is conceived as a seedbed to seek new opportunities for economic activation, jobs, and new productive possibilities within the great city area. Tarragona is also looking at internationalization and branding the city globally. Linked to this are plans devised to develop technology to favor tourism in historical heritage sites, focusing on Tarragona under the Roman Empire, and the use of geolocalized videos for tourist and cultural purposes with the partnership of Digivision.

The projects drafted include the following **built in infrastructure and natural environment concerns**:

- Thermal isolation pilot in school with BASF technology Termabead to measure the resulting energy savings.
- Environmental impact of public transportation, to be carried out by the Chemical and Tech Center of Catalonia, funded by Repsol.
- Pilot on the use of biofuels produced by seaweed, a research project application from Repsol laboratories.
- Smart metering for water in neighborhoods and public swimming pools, with AGBAR, EMATSA and AQUALOGY –expecting the results of a competitive project from the European Union on telemetry.
- New asphalt installed in zones of intensive use by heavy industrial vehicles. The properties allow capturing contaminated diesel particles, better water absorption, and fissure self repair.
- Water quality control of beaches in Tarragona accessible through mobile phone and tablets apps.

From the **natural environment** point of view, the point of departure of smart city projects in Europe is different to the one we find in Asian cases. First of all because urbanization is already affecting over 70% of the Spanish population. Smart cities in Europe are not new cities. Secondly, because the context of economic crisis is driving change in public policies. In Tarragona this is happening in a move that has been defined by the Town Hall as going “from improvisation to programming”.

On **governance grounds**, Tarragona is part of a national network of smart cities created in 2011 and comprising 41 other Spanish cities. The network aims at the automatization of urban services and infrastructures, to increase the quality of services and curb public expenditure. This network is being very active exchanging information on energy, social innovation, urban mobility, governance and the environment.

Plans for smart Tarragona have already started to be developed by the City Council under the umbrella of a Foundation and include the participation the public university and firms in the energy, water, health, mobility, digital contents and tourism industries. The Tarragona smart city project has been presented in spring 2013 and it is designed with the **policy context** of the Mediterranean Sports Games in mind. The games will be held in 2017 and this international gathering is the landmark for the plans drafted. Tarragona focuses on the Mediterranean region as and space with emerging opportunities, linked to the development of the northern Africa region and the importance of the sea port, the fourth in importance in Spain.

In the case of Tarragona, main public policy issues related to the smart city concept are linked to the marketing of the city for the Mediterranean Sport Games in 2017. Within this context, drafts of projects to tackle environmental issues from a smart perspective have been developed. Tarragona is the only city on which we founded education as part of the equation of the smart plan. Digital literacy is addressed through the educative project “smart phones for smart people” to teach how to use smart phones in the civic centers and target the digital divide.

SHA - Shanghai, China
ISK - Iskandar, Malaysia
JPN - Japan

JFK - New York, NY, USA

AMS - Amsterdam, Netherlands
AGP - Málaga, Spain
SDR - Santander, Spain
TAR - Tarragona, Spain



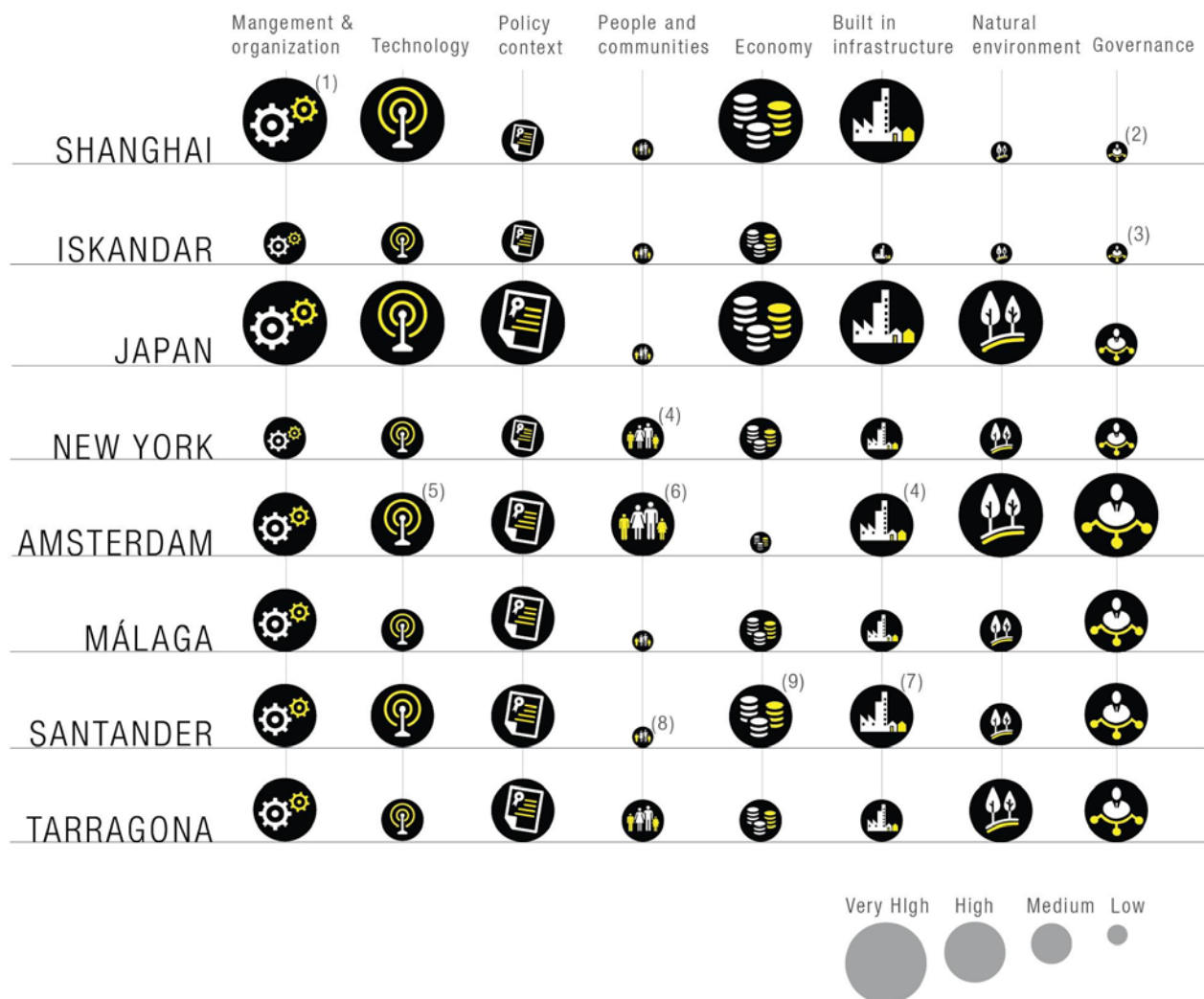
Analysis and findings from our cases

In our exploration of our set of eight world cases: Shanghai in China, Iskandar in Malaysia, Japan smart plans, and the case of New York in the United States; and Amsterdam, Málaga, Santander and Tarragona in Europe we have draw upon the analysis of factors highlighted by Choubary et al. (2012): Management and organization, technology, policy context, people and communities, economy, built infrastructure, and natural environment. We did so in order to qualify differences and innovations in governance: To find out differences and commonalities in smart city governance and public policies globally. We coupled this analysis with attention the question on how to be digitally literate in the XXI century. Do cities and firms address such a normative question?

From this exploration we have founded interesting similarities and differences among the cases. The report has shown different ways to address the definition of smart, followed by the particular implementation of the smart concept in particular settings. We show models, projects and policy innovations set in each of the eight cases on smart grounds. And we do so trying to highlight opportunities for sustainable growth unlocking the potential of firms and talent in local contexts.

We find that the multi faceted sides of the smart concept are being established locally, to a fundamental extent from local governments, except fro the particular case of Iskandar in Malasya, where the national government has been paramount in the grand-design. The stress on what smarts entails is very different and open to policy conceptualization and in some cases, society engagement, whit Amsterdam scoring higher in this particular ground. The governance models are also different, as we end-up presenting.

The following table shows the results when we compare the eight cases of the scientific study:



Looking at **management and organization** we find cases in which the central government fosters an investment-led model, such as the case of China and some municipalities follow suit. Shanghai in particular become leader in most projects, developing 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, as it is recalled. The **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 and networks, and intellectual property rights protection in the IT and industry --through a three-year action plan started in 2011.

In the case of Iskandar, the regional development agency furthers the goals set up by the government. We find a case such as the four smart pilots in Japan, where localities and regions work together with the industry to develop solutions with global application; the New York city model, in which the university and the city council cooperate mainly on smart data projects; the case of Amsterdam, where energy is paramount -and a new model is being tested where citizens might become producers leaking the remaining energy to the grid- the case of Málaga, focused mainly on efficiency; the case of Santander, with pilot projects focused on sensors and mobility; and the

Tarragona case, where a Foundation has been set up to advance the defined smart goals.

Additional research would be very interested to further document case studies on the cities, local leaders, the over all context, project size, manager attitudes and behavior, 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 projects in each context would also be a fruitful path of research.

Technology concerns vary a lot among the selected cases. 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 the cases of both Shanghai and Japan the smart cities 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 called the Third Industrial Revolution. A revolution having to do with the design and incorporation of new energy sources, waste treatment, new urban developments, changes in terms of management and leadership -as the first industrial revolution did. We have found a view on smart technology different from that derived from the industrial revolution in the exploration of ways to transport energy through smart grids in the cases of Shanghai, Japan and also Amsterdam in Europe. Would this have the capacity to overturn old firms' hierarchies in oligopolistic markets and alter the set of engaged players, from incumbent to new actors? This will be a question for the future.

Iskandar is concerned with traffic and CO2 emissions, and more recently, with the smart grid, however, we have found less partnerships with local firms for solutions; New York is focusing on big data management, Amsterdam is concerned with energy and experiencing with crowdsourcing, Málaga is developing modern metering, Santander is experiencing with sensors and the Internet of Things; and Tarragona is concerned with the chemical industry and transport efficiency. Thus, the search for solutions and the partnerships to attained them is widely varied in the eight cases examined.

We have found partners in the construction industry in the cases of Iskandar, Japan, Holland (Amsterdam) and Spain. The construction industry innovated little over the recent decades, and it lagged behind other industries in productivity gains. It is considered to be enormously wasteful.⁴¹ Thus, policy results from partnerships could contribute to major developments.

In the cases we have analyzed from Shanghai in China, Japan, Iskandar in Malaysia, New York in the United States, Amsterdam in Holland and Málaga, Santander and Tarragona in Spain, smart has to do with technologies that allow us to incorporate intelligence into systems to achieve efficiencies, reducing energy consumption and CO2 emissions. In all the cases incorporating new

⁴¹ Studies in the United States show that 75% of construction adds very little value. The industry wastes 60% of the materials and 30% of the cost of construction. According to the World Business Council for Sustainable Development, buildings use 40% of the world's energy. And the challenge is to have this figure substantially reduced by making them what is called smart.

technology is linked to a discourse pledging for smart devices to curve energy consumption in buildings - providing a near-zero energy consumption.

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 to research to a higher level.

People and communities have a bigger say in the case of Amsterdam –where small size matters- and New York, where we find windows of opportunity for citizen developers and firms. Citizens participate mainly as users in the case of Málaga, Tarragona, Santander and Japan -*residents* are those specifically addressed to contribute in Japan. In the case of Iskandar, city dwellers would participate in security issues according to the drafted plans. In China top participants are members of the party however, decisions are taken in a very consultative manner with groups in society and collaboration ranks high.

The use of open standards and open systems offer interesting ways for citizens-coders and small firms engagement and innovation.⁴² Evaluating whether cities are understanding or caring about those choices -with strong path dependence consequences for future development and citizen engagement- is very important.

Either through citizen engagement or tools to empower residents, the possibilities to engage communities on city challenges have grown. The scope for citizen participation -as shaper of policies or a passive target- will depend on the particular policies of cities and also the legacies of technologies and values underlying them when they are set. Proprietary technology will leave little room for citizen engagement and development, while open systems might allow citizens and firms engagement through new services and code development.

Other factors for further research for 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 plans of all the smart projects explored. However, constraints are different in each case. Shanghai is in better condition to fund smart projects, and the city as well as the country are pouring funds into this strategic area, as it is defined. Chinese banks are also willing to ease funds for. Japan, Europe and the United States are all affected by fiscal cliffs and economic downturn. Malaysia is in better shape, and is trying to gain momentum promoting Iskandar as an important trade hub in Asia, looking forward foreign capital as a main driver for

⁴² Arduino or Pachube would be examples. Arduino is a tool for making computers that can sense and control more of the physical world.. It's an open-source physical computing platform and a development environment to write software. It can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling lights, motors, and other physical outputs. It is open source and extensible software (<http://arduino.cc/en/Guide/Introduction>). Pachube (pronounced *Patch bay*) is an on-line database service allowing developers to connect sensor-derived data (e.g. energy and environment data from objects, devices & buildings) to the Web and to build their own applications based on that data. Pachube recently becomes Xively (2013), and it allows to develop open digital ecosystems.

Iskandar.

Built infrastructure has different scope in the cases we have explored. Following Hollands (2008) 'undergird' the social capital is critical to embed the required the informational and communicative qualities of smart cities. From this perspective New York would be the city rating higher. However, the focus that Shanghai and Japan are putting in the smart grid and Amsterdam on producing energy in households should not be down rated. Smart grids could represent an interesting and disrupting way to fuel energy to thirsty cities. Conceptually the possibilities for users and citizen engagement in built infrastructure are linked to the concept of Internet with Things, suggested by Russell Davies. This is an evolved concept from the Internet of Things, with scope for citizen empowerment. It refers to developments driven by citizens in a distributed way, using programming based on Arduino open architecture.⁴³

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 to a different extent present in all the cases explored. Japan did set up the smart pilots in the aftermath of the nuclear accidents. Shanghai in China faces severe environmental concerns. Malaysia is also aware in Iskandar. New York has suffered the impact of climate change in November 2012. The European cities: Amsterdam, Málaga, Santander and Tarragona are also concerned. Smart policies here address transport issues in all cases, with a higher emphasis for the case of Japan, where research on electric batteries and electric cars is part of the smart pilots -we founded some partnerships between Japan and Málaga on these grounds. We find this field as one posing the biggest challenges at a global level. Would local policies be enough to tackle this challenge?

Governance models are different in the cases explored. Shanghai local government partners with universities, firms, foreign firms as well as banks. It is also collaborating with Taiwan. Users are not part of the equation as developers. Shanghai, however has a very wide governance structure set to govern the smart plans: There is a municipal leading group responsible for building and deploy all 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.

In Japan local governments partner with firms in different industry sectors including the university, technological firms, power –including gas- as well as real estate firms. It is the only case in which evaluation of projects has been devised as part of the comprehensive smart strategy advanced. In Iskandar governance depends on the Regional Authority appointed for the development of the

⁴³ An example of Internet with things is [Homesense](#), created by Alexandra Deshamps. Two books that a reference for the concept Internet with things are: [Shaping Things](#) by Bruce Sterling and [Smart Things](#) by Mike Kuniavsky.

conceived smart city. In New York we find the leadership of the city government, the university as well as a general call to citizens developers through open technologies. Amsterdam has a Board created to steer the projects. Málaga is touched by the vision and drafts developed at CEMI, a local government data processing center. Santander's pilot projects are quite focused and in a pilot stage. Tarragona steering committee is a Foundation.

Governance models are affected by the policy context. We find a mayor leap of the central government in the cases of Iskandar and Japan, while New York, Amsterdam, Málaga, Santander and Tarragona respond 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.

Other steps for future research might be to study whether firms might become source of innovations that affect governance,⁴⁴ how **new business models** foster new forms of public policy,⁴⁵ how **innovative partnership solutions** are also solving the risk of discontinuation in public policies constrained by the fiscal cliff,⁴⁶ and to what extent performance contracting might become **public policy innovation** to pay for the costs of smart projects.

This research of cases in different world settings brings us to reflections on innovations in governance:

We find that factors advanced by Chouraby et al. (2012) management and organization, policy context, people and communities, economy, built infrastructure, and natural environment as well as technology, are important in order to make urban living smarter in qualitatively different ways in our

⁴⁴ A comparative endeavor, the Green City Index developed by Siemens in cooperation with the Economist Research Unit (2013) is interesting because it benchmarks 120 cities. We wonder whether future marketing efforts could make it a landmark to drive changes in the smart city governance models worldwide. The Green City Index measures factors such as energy consumption, transportation infrastructure, air and water quality, carbon emissions, and building sustainability in a timely basis and it aims at "continue to draw attention to these issues, creating competition between cities" (Siemens). The Green City index finds that in 120 cities, just over half of them had citizen involvement projects [http://www.siemens.com/entry/cc/en/greencityindex.htm]

⁴⁵ New business models by very innovative small firms might induce changes in public policies. I.e.: 1) Gowex, leading the creation of free Wi-Fi zones in cities in four continents, develops a business model for Wi-Fi networks sustainable for the City Council, users, franchises, associations and carriers. Libelium, a technological platform open for developers is another example. A technology firm in wireless sensor networks, measuring noise pollution, dust quantities, structural health and garbage levels, monitoring gas, radiation and smart parking.

⁴⁶ Baltimore offers us a good example with the creation of Rec2Tech, that allowed to maintain the local community center open. This has been the result of the joint efforts in 2012 from [Betamore](#), a technological entrepreneurship coworking space formed by [Sean Lane](#), and professor [Andrew Coy](#) (@AndrewCoy) a teacher at Digital Harbor High School. Andrew Coy had the vision to repurpose the recreational center to tech center to avoid closure and inspired Sean Lane to create the [Digital Harbor Foundation](#) (DHF, @DHF Baltimore) in the same location. The new venue is now serving three audiences: teachers can visit during the day, there's room for 40-50 kids after school, and the center is open to community in the evening.

⁴⁶

cases. We found technological advances transforming government responses to traditional urban problems in the five cases differently, with no homogeneous path towards a smart goal. This very much depended on the governance model pursued.

We have also founded that technology is not the only answer. Digital literacy for the XXI century should relate to technology, and we found a lack of plans reflecting or tackling the issue, except for a recent plan in New York city and for Tarragona.⁴⁷

We would suggest that in order to analyze how institutions and decision-making in networks of urban governance condition the introduction of innovations in city and regional governance the question of digital literacy for the XXI century shall be addressed. We would argue that digital literacy impacts on the public performance, quality of governance, democratic legitimacy, but also on the mode of production fostered by a local polity.

⁴⁷ In Tarragona the focus is on users, it does not entail development, at the coding level.

Framework for analysis and factors to explain smart cities development: Based on Chourabi et al. (2012)

Governance: Chourabi et al. (2012:2292)

Factors
• Collaboration • Leadership and champion • Participation and partnership • Communication • Data-exchange • Service and application integration • Accountability • Transparency

Managerial and organizational challenges and strategies

Source: Gil-García and Pardo in Chourabi et al. (2012:2291)

Challenges	Strategies
• Project size • Manager's attitudes and Behavior • Users or organizational diversity • Lack of alignment of organizational goals and project • Multiple or conflicting goals • Resistance to change • Turf and conflicts	• Project team skills and expertise • Well-skilled and respected IT leader (technical and social skills) • Clear and realistic goals • Identification of relevant stakeholders • End-user involvement • Planning • Clear milestones and measurable deliverables • Good communication • Previous business process improvement • Adequate training • Adequate and innovative funding • Current or best practices review

Technological challenges

Source. Ebrahim and Irani (2005)

Dimension	Challenges
IT skills	• IT training programs • Lack employees with integration skills and culture
Organizational	• Lack of cross-sectoral cooperation • Lack of inter-departmental coordination • Unclear vision of IT management • Politics • Culture issues

Factors of people and communities: Chourabi et al. (2012:2293)

Factor
• Digital divide(s) • Information and community gatekeepers • Participation and partnership • Communication • Education • Quality of life • Accessibility

Factors of built-in infrastructure: Chourabi et al. (2012:2294)

Dimension	Challenges
IT infrastructure	• Lack of integration across government systems • Existing internal systems have restrictions regarding their integrating capabilities • Lack of knowledge regarding interoperability • Availability and compatibility of software, systems and applications
Security and privacy	• Threats from hackers and intruders • Threats from viruses, worms and Trojans • Privacy of personal data • High cost of security applications and solutions • accessibility
Operational cost	• High cost of IT professionals and consultancies • High cost of IT • Cost of installation, operation and maintenance of information systems • Cost of training

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