RE-CITY

Future City
– Combining Disciplines

Juho Rajaniemi (editor)

RE-CITY

Future City
— Combining Disciplines

CONTENTS

Tampere, 2014. Photo by Mikko Vares, used with permission.

The Development Process of Smart City Strategies: The Case of Barcelona

Luca Mora
Roberto Bolici

ABSTRACT

Smart cities are urban areas in which information and communication technologies are used to solve their specific problems and support their sustainable development in social, economic and/or environmental terms. In recent years, turning ordinary urban environments into smart cities has become a strategic priority for a growing number of municipalities around the world that have decided to launch specific strategies, characterized by different approaches, in an attempt to achieve this aim. However, the available knowledge concerning the possible ways in which the development of strategies for becoming smart can be faced is very low indeed. Within the literature concerning this topic, there is an evident lack of clarity and common approaches based on empirical evidence that can be used to guide the different actors involved in the construction and management of these strategies towards successful results. The research activities documented in this paper have been implemented in order to provide an initial response to this urgent need. Specifically, using case study research with a descriptive approach and focusing attention on large European cities, the strategy proposed by Barcelona City Council has been analyzed in-depth and a step-by-step roadmap in which all the phases and activities considered in this successful case has been defined and illustrated in detail. This roadmap can be considered a first and important step towards establishing a common and empirically valid theory for developing smart city strategies in this type of urban area, because it provides useful knowledge in the consideration of other similar initiatives as well as a possible conceptual framework for future comparative research and theory building.

Keywords: ICT-based urban development, smart city, roadmap, development process, Barcelona

1. INTRODUCTION

The industrial revolution has left a deep impact on urban contexts, causing numerous issues that limit their development, as well as individual and collective wellbeing. The solution to these problems requires the definition of new models of sustainable development and the implementation of urban regeneration or urban renewal initiatives. These are two terms which can be considered as synonymous, used for identifying a series of actions aimed at resolving the multi-faceted problems of urban areas and improving their physical, socio-economic and environmental conditions (Ercan, 2011; Zheng et al., 2014).

In this context, the belief that information and communication technologies (ICTs) can represent a useful tool for helping urban areas to solve these issues has begun to spread rapidly (European Commission, 2010a; 2010b; U.S. National Intelligence Council, 2012; Webb, 2008). In fact, as already observed by Aurigi (2003), "*many commentators [...] suggest that the new frontier [of information technology is] to provide solutions for overcoming most spatial and social problems [and] cities [look] like the ideal arena where this revolution would [...] show itself, changing economic development, services, and above all community life.*"

During recent years, local and national governments, academic research institutes, businesses and many other organizations have begun to observe and study this perspective with great interest. Over a brief period of time, this exploration has led to experimentation as numerous cities around the world have launched specific strategies with the aim of becoming smart cities, that is, urban areas in which ICTs are used to solve their specific problems and support their sustainable development in social, economic and/or environmental terms.

As a result, smart cities have become a growing phenomenon in the real world (Lee and Hancock, 2012; Manville et al., 2014), and a new but confused research territory that has attracted the attention of many researchers and scholars. This is an emergent and interdisciplinary research area within the field of urban studies (Graham, 2004) that has encouraged further research concerning the management of ICTs in urban contexts. But unfortunately, despite the growing interest and the continuous production of scientific publications (Wolfram, 2012; D'Auria et al., 2014), the level of knowledge concerning this subject is still underdeveloped and characterized by numerous open questions and multiple aspects to be explored. In particular, analyzing the literature produced to date, it is quite evident that there is a lack of clarity and common approaches based on empirical knowledge that can be used to guide the actors involved in the construction and management

of smart city strategies towards successful results (Abdoullaev, 2011; Angelidou, 2014; Chourabi et al., 2012; Frei et al., 2012; GSMA et al., 2011; Hollands, 2008; Kitchin, 2014; Komninos, 2011).

In smart city research the trend is to focus only on individual factors that characterize smart city strategies, rather than on the definition of explicit and holistic procedures to be followed during their development (see for example Beck, 2011; Belissent et al., 2010; Dirks and Keeling, 2009; Gil-Castineira et al., 2011; Hollands, 2008; Moss Kanter and Litow, 2009; Naphade et al., 2011; Paskaleva, 2009; Washburn et al., 2010; Webb et al., 2011). As a result, very few examples of guidelines and roadmaps can be found in the literature and most of them come from the business sector. Moreover, they are characterized by a very low level of detail and a lack of empirical evidence (Berthon and Guittat, 2011; Clarke, 2013; Dirks et al., 2009).

Considering this scenario, it can be stated that the knowledge framework associated with the development processes of smart city strategies must be expanded, and with particular reference to the need to provide a possible answer to the following questions: What are the essential steps to consider for developing successful smart city strategies? How are they organized? In order to provide an initial response to this urgent need, focusing the attention on large European cities,[1] the strategy developed by the City of Barcelona has been analyzed in-depth, and a step-by-step roadmap in which all the phases and activities considered in this successful case has been defined and illustrated. This roadmap can be considered a first and important step towards establishing a common procedure for developing smart city strategies in this type of urban area because it provides: 1) useful knowledge to consider in other similar initiatives; 2) and a possible conceptual framework for future comparative research aiming at building an empirically valid theory able to explain how to correctly develop smart city strategies in large cities.

2. METHODOLOGY

Descriptive case study research as defined by Yin (1984) has been identified as the most suitable research method. This method has been chosen considering the nature of the problem being investigated, the research aim and the present state of knowledge on the development processes of smart city strategies, which is quite limited.

The case of Barcelona has been selected using a theoretical sampling approach (Yin, 1984; Eisenhardt, 1989). With a number of inhabitants

that is slightly above 1,5 millions (Ajuntament de Barcelona - Àrea d'Economia, Empresa i Ocupació, 2013), the city of Barcelona falls within the category of large cities, and its success in the field of smart cities makes its strategy an ideal sample to analyze. This assertion can be easily demonstrated considering the multiple awards that the city has received during recent years and its international positioning as a smart city (Achaerandio et al., 2011; Ajuntament de Barcelona, 2014a; 2014g; Cohen, 2012a; 2012b; 2014; European Commission, 2014; Manville et al., 2014).

After being selected, the case study has been analyzed considering the qualitative data extracted from multiple sources of evidence identified with a series of searches performed in various online databases during the period between April and June 2015. A total of 991 sources has been collected. Archive records and documents produced by public and private organizations directly involved in the development of the smart city strategy have been considered as primary sources (agendas, minutes of meetings, press releases, news and newsletters, conference presentations and conference speeches, reports, brochures, videos, governmental acts, articles and webpages). In addition, a wealth of data has been acquired from other documents produced by organizations not directly involved in the smart city initiative of Barcelona. These sources have been considered as secondary (reports, interviews, journal and online articles, books, as well as research project deliverables). This strategy has allowed us to analyze the case considering the different perspectives of multiple observers. Moreover, the final description of the process and the conceptual framework have gained greater strength thanks to the triangulation made possible by the use of multiple sources of evidence (Yin, 1984; Eisenhardt, 1989; George and Bennett, 2005; Voss et al., 2002).

Coding analysis has been used to facilitate the management of the vast amount of data that has been collected. This phase of research has been developed following the procedure described by Voss et al. (2002) and Strauss and Corbin (1990). Through the coding process, raw data have been reorganized and the activities which characterize the development process of the Barcelona smart city strategy have been listed in a chronological order, allowing us to build a step-by-step roadmap. These activities have been identified thanks to a repeated reading and analysis of the available sources.

The roadmap has been described and illustrated through the production of a "*story*" (Bourgeois and Eisenhardt, 1988), a detailed report in which all the data associated with the case have been summarized and presented in a narrative form (within-case analysis) (Miles and

Huberman, 1994). This is a fundamental step for supporting future comparative research and cross-case analysis (Yin, 1984; Eisenhardt, 1989; Patton, 2012).

3. PRESENTATION AND DISCUSSION OF RESULTS

Through the knowledge accumulated during the analysis phase, a step-by-step roadmap which describes the development process of the smart city strategy proposed by Barcelona City Council has been created. The roadmap, which is composed of 5 main phases and 16 different activities (Figure 1), is described and discussed in the following pages.
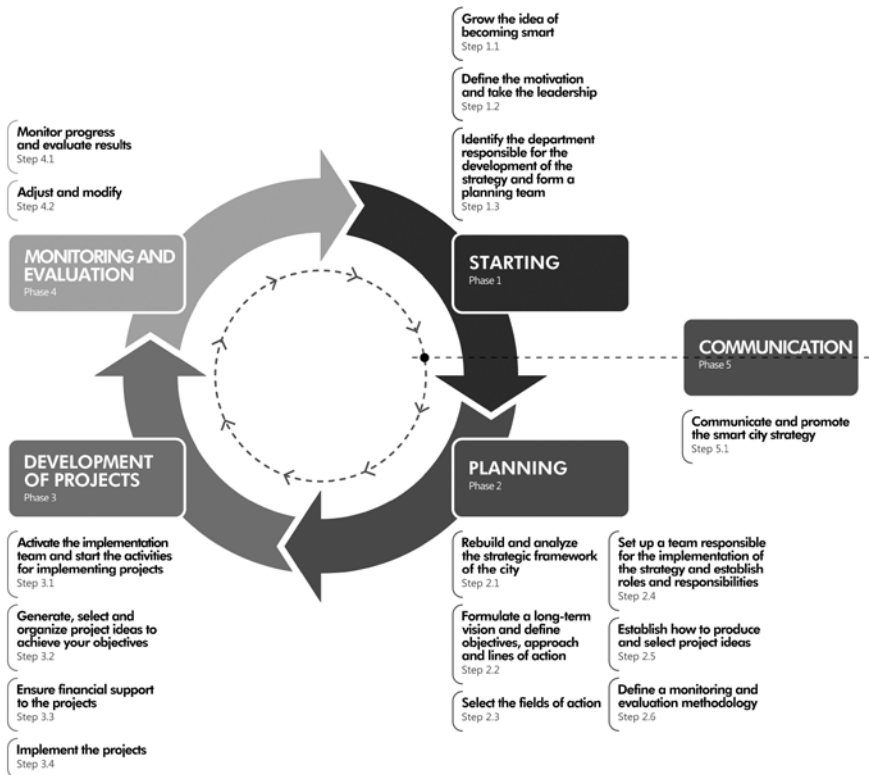
Figure 1: The development process of the Barcelona smart city strategy

3.1. Phase 1: starting

In 2011 the mayor of Barcelona, Xavier Trias, and his municipal administration decided to transform Barcelona into a smart city by developing a single strategy for the entire city, moving away from the risks of a fragmented approach. This intention has become official with the approval of two important governmental measures and the definition of a working group within the Area Urban Habitat, the organizational context in which the Barcelona smart city strategy has been developed.

Step 1.1 – Grow the idea to become smart

Confidence in ICT as a tool for supporting urban development was extremely widespread within the municipality before 2011, and the attempt to transform the city into a smart city were translated into a series of projects and initiatives managed by various executive units of the city administration. For example: the development of a new model for the management of services, relationships and interactions with citizens based on the principles of e-government (Conesa, 2009); the construction of the municipal wireless network called Barcelona WiFi (Ajuntament de Barcelona, 2014d); different pilot projects developed by both the private municipal company 22@ Barcelona and the Municipal Institute of Information Technology (IMI).[2]

This situation was characterized by an evident lack of coordination, a shared vision and a single strategy. There was a gap that various representatives of the city council interpreted as a possible risk of failure and a limit to overcome (Ajuntament de Barcelona - Comissió d'Hàbitat Urbà i Medi Ambient, 2012a; 2012b; Ajuntament de Barcelona - Comissió de Presidència i Règim Interior, 2012). In fact, as explained by Julia Lopez, Strategic Director of the Directorate for ICT Strategy and Smart City of the IMI, the real challenge from the end of 2010 was "*[to create] a global strategy, rather than siloed strategies in different departments*" (Buscher and Doody, 2013). This challenge was accepted by the entire municipality, which became the initiator of the Barcelona smart city strategy, a choice sustained through the political support and guidance of the new mayor Xavier Trias.

Step 1.2 – Define the motivation and take the leadership

During the first months of his term of office, Trias (2011) stated: "*we*

will drive a municipal smart city strategy in order to incorporate advanced solutions for service management within public spaces." This assertion highlights the central role of the municipal administration, which has decided to assume full responsibility for initiating and leading the process of developing a smart city strategy for the entire city of Barcelona. This was a strategy necessary, in Trias's words, "*to enhance citizens' quality of life and reduce the cost of government operations while revitalizing [the] whole community and creating long-term economic growth through high-tech innovation and entrepreneurship*" (Cisco System, 2012). Furthermore, "*Barcelona has a strong commitment to become a smart city and a show-case for the rest of the world in sustainable urban development*" (Cisco System, 2012), and this clearly emerges within the public statements proposed from 2011 by both the mayor and other local government representatives (see for example Ajuntament de Barcelona, 2011b; 2012a; 2012c; 2013c; 2014b; 2014c; Cisco System, 2012). Moreover, this commitment has been officially formalized with the drafting and subsequent approval of two important strategic documents: 1) the Municipal Action Program for the period 2012-2015; 2) the government measure MES (Mobility, E-government, Smart cities), in which the overall ICT strategy for the city has been defined (Ajuntament de Barcelona, 2012e; 2012f; 2012g).

The Municipal Action Program contains the vision, strategic commitments and objectives proposed at the political level, and also the goals and relevant actions defined at the executive level in order to contribute to the accomplishment of the political priorities. In this case, three strategic areas have been identified by the municipal administration in order to "*inspire the organization's actions*" between 2012 and 2015. One of them is called "*urban renewal*" and is associated with a precise strategic commitment: to transform "*Barcelona [into] a sustainable, smart urban model at the service of its residents.*" However, as reported in the document, in order to fulfill this commitment, the city has to achieve a significant objective: the definition of a new development model for a healthy and hyper-connected city with zero emissions "*where the environment, urban planning, and ICT infrastructures are fully integrated*" and characterized by "*productive neighborhoods at a human pace*". The responsibility associated with the development of the actions required to achieve this goal has been almost totally entrusted to the Executive Office for Urban Habitat and the various departments located within it (Ajuntament de Barcelona, 2012g).

Conversely, by approving the MES measure, the city administration has been able to: 1) reassert its willingness to use ICTs to contribute to "*the economic and social future of the city*"; 2) establish the cornerstones of a comprehensive ICT strategy defined for the entire city and based

on specific lines of action relating to *"mobility, e-government and smart cities"*; 3) entrust the strategy coordination and responsibility for the proper development of each course of action to the IMI, which has been identified as the point of reference for all the activities of the municipality linked to the ICT sector (Ajuntament de Barcelona, 2012f).

The strategic scenario defined by these two documents shows that the development of a smart city strategy is a priority and an objective of significant importance for the Barcelona City Council. This choice is motivated by the awareness that *"ICTs are with no doubts a fundamental factor to consider in order to come out from [the] crisis"* and *"[they] have become vital to the future of the city and its citizens"* (Ajuntament de Barcelona, 2012f).

Step 1.3 – Identify the department responsible for the development of the strategy and form a planning team

Modifying the organizational structure has been one of the first actions proposed by the new administration. Specifically, a new area called Urban Habitat was set up in 2011 (Ajuntament de Barcelona, 2014f). This area *"works as an umbrella to facilitate departments that used to work in isolation to come together"* (Buscher and Doody, 2013) and consists of two organizational elements: 1) the Executive Office for Urban Habitat, which combines all the departments dedicated to planning, infrastructure, housing, urban services, and environment; 2) the IMI, which encompasses the field of ICTs. This important change has allowed the municipal administration to create an area for interdepartmental work under the supervision and control of the Third Deputy Mayor's Office (Ajuntament de Barcelona – Comissió d'Hàbitat Urbà i Medi Ambient, 2012b).

As previously mentioned, in accordance with the directives of the government, the activities associated with the development process of the smart city strategy have been carried out in the Area Urban Habitat, thanks to the collaboration between the IMI and the various departments brought together in the Executive Office for Urban Habitat. Furthermore, from an observation of the affiliation of the authors of the conference presentations and documents in which the characteristics of the Barcelona smart city strategy have been described, it is possible to argue that the main working group involved in its development and implementation is represented by the Directorate of ICT Strategy and Smart City (Buscher and Doody, 2013; Ferrer, 2013; 2014; Lopez, 2014; Sanromà, 2013).

In addition, it is necessary to consider the support of the strategic partners selected by the municipality which have been involved in specific phases or activities. Indeed, some external subjects have worked as consultants in the planning phase. These certainly include: the multinational company Cisco Systems, which signed an agreement with the city administration committing itself to providing support and advice regarding the approach for developing the strategy (Ajuntament de Barcelona and Doxa Consulting, 2012); and Doxa Consulting, a Spanish consulting firm which has been mentioned in some presentations describing the features of the smart city strategy.

3.2. Phase 2: planning

The first documents describing the Barcelona smart city strategy were drafted between late 2010 and mid-2011. Each presented an initial conceptual model and listed several ICT-based initiatives developed within the city by various working units from the municipal administration. The strategy was poorly defined and characterized by a few reflections of a technological nature (Ajuntament de Barcelona, 2011c; Battle, 2010a; 2010b; 2011). However, it underwent substantive changes during the period between February and October 2012, the same period in which the MES measure and the Municipal Action Program were approved (Doncel and Pons, 2012). During these seven months, the whole strategy was planned within the Area Urban Habitat, and analyzing different documents developed from this period onwards, it has been possible to identify and describe the different activities carried out during the planning phase.

Step 2.1 – Rebuild and analyze the strategic framework of the city

The Barcelona smart city strategy has been properly included in the strategic framework of the city, in line with the objectives, priorities and directives that characterize it. This framework has been reconstructed and analyzed, and represents the result of the convergence of several strategies proposed at the local and European level (Ajuntament de Barcelona, 2013b; Ajuntament de Barcelona and Doxa Consulting, 2012; 2013a; 2013b; Lopez, 2014)

Step 2.2 – Formulate a long-term vision and define objectives, approach and lines of action

The strategic framework has become the point of reference for developing a vision statement that identifies the city's most important principles and values, as well as for defining objectives and lines of action that will make it a reality. According to this vision, the smart city strategy will allow Barcelona to become "*a self-sufficient city, made of productive neighborhoods at human speed, inside a hyper-connected metropolis, of high speed and zero emissions.*" In this long-term vision, ICTs have become an enabler of actions "[*for improving] citizens' welfare and quality of life [and supporting] economic progress*" (Ajuntament de Barcelona, 2013a).

The possibility to build the Barcelona of the future has been associated with two important objectives to be achieved through the implementation of the smart city strategy: 1) the development of a new city model in which ICTs are used "*to provide the city with technological infrastructures [and services] of high added value for Barcelona*" (Buscher and Doody, 2013); 2) "*to acquire the global leadership on the development of smart cities*" (Ajuntament de Barcelona, 2012f), which are considered a "*driving force behind a new urban service economy*" (Buscher and Doody, 2013).

In order to achieve these objectives, three complementary lines of action have been defined (Sanromà, 2013): 1) promotion: the on-going communication and promotion of Barcelona and its approach through participation in international conferences organized by the municipality or other external parties. This course of action is not only aimed at the dissemination of information but also at activating new partnerships with public and private actors; 2) international projection: the development of international projects. The documents cite various projects funded by the European Union, along with other international projects such as the City Protocol (Ajuntament de Barcelona, 2013a; Ferrer, 2014); 3) projects: the implementation of local projects developed primarily on a neighborhood scale, which is the spatial unit of reference for the entire strategy. As suggested by the vision, starting from the neighborhood, the benefits of technology can gradually be extended to the entire city and, with time, to the entire metropolitan area. All this is achieved through a strategy characterized by a transversal approach (working and producing impacts in all areas of the city) and by sharing (collaborating with the private sector and with cities throughout the world) (Ajuntament de Barcelona, 2012f).

Step 2.3 – Select the fields of action

The individual initiatives and projects that characterize the three lines of action have been divided in two categories (cross-cutting and vertical) and grouped into various programs. In turn, these programs have been linked to 14 fields of action associated with the achievement of specific objectives (Ajuntament de Barcelona, 2013a; Ferrer, 2014; Lopez, 2014). The first two are "*network*" and "*platform*" and contain the cross-cutting projects developed for building a "*unified data management platform [and a] unified network covering the entire city and connecting each service*" (Ajuntament de Barcelona and Doxa Consulting, 2012). The technological equipment that results from these projects serves as an enabler for all the vertical projects: "*smart services developed by different City Council […] departments or […] companies operating in the city [that] are independent but work in the same environment*" (Ajuntament de Barcelona and Doxa Consulting, 2012). The vertical projects fall within 11 fields: "*open government, social impact [which include education, health, commerce, security, culture, tourism, sport, and government], public space, built domain, ICT, water cycle, matter cycle, energy, mobility, nature [and] environment*". The cross-cutting projects also include the international initiatives, which are linked to the field of action called "*international*".

This approach makes it clear that the "*international projection*" and "*projects*" lines of action form the cornerstone of the smart city strategy. Both are linked to the implementation of initiatives that allow ICT-based services and infrastructures to be developed and integrated within the city in the short to medium term. In fact, the objective of these projects is "*to provide an infrastructure that guarantees the development of a range of services*" linked to multiple fields of action (Ajuntament de Barcelona and Doxa Consulting, 2012). As reported by Buscher and Doody (2013), in Barcelona "*the smart city movement started in energy, but now is spreading across all the sectors. […] The city describes this as a transversal approach.*" This is a response to the directives of the MES measure.

Step 2.4 – Set up a team responsible for the implementation of the strategy and establish roles and responsibilities

In order to ensure that the steps linked to the implementation of the strategy are carried out properly, it has been necessary to define "*a new organization oriented towards the goals and objectives of a smart city*" (Ajuntament de Barcelona, 2013a; Lopez, 2014). This implementation team was subsequently activated and characterized by a political com-

ponent and an operational structure. The former is represented by the Third Deputy Mayor's Office, which is responsible for coordinating and supervising the Area Urban Habitat. The latter consists of a series of commissions and a Project Management Office (PMO) (Ajuntament de Barcelona and Doxa Consulting, 2012).

Step 2.5 – Establish how to produce and select project ideas

During the planning phase, the procedure leading to the production, selection and implementation of project ideas has been defined (Ajuntament de Barcelona and Doxa Consulting, 2012). Its description is provided in the section devoted to the implementation phase.

Step 2.6 – Define a monitoring and evaluation methodology

The municipality has decided to use a unified methodology for evaluating the impact of the services produced with the various projects and for monitoring the progress. This methodology is based on the development of two technological tools: the "*situation room*" and the platform called "*Bigov Better City Indicators*" (Ajuntament de Barcelona, 2013a).

3.3. Phase 3: development of projects

The Barcelona smart city strategy is based on the continuous implementation of projects and initiatives in the short-medium term that allow the introduction of ICT-based services and infrastructures within the city.

Step 3.1 – Activate the implementation team and start the activities for implementing projects

According to the Barcelona City Council, "*the definition, deployment and management of projects imply the need to organize a wide range of actions in a multidisciplinary, complex and technologically innovative environment, which includes a variety of activities and multiple agents. This requires comprehensive coordination by a Project Management Office (PMO)*". The PMO supports the activities carried out by the IMI and the various departments of the Area Urban Habitat for all the projects and subjects linked to the smart city initiative. The direction of this office has been entrusted

to Doxa Consulting, but the team of people working in it is comprised of staff from both the company and the municipality. The functions of the PMO include: ensuring the alignment of the projects with the objectives of the smart city strategy; coordinating and monitoring the project development activities; dealing with the project management activities; developing quality and improvement plans; producing informative reports about the progress of the various projects; evaluating the activities and providing recommendations; and resolving any contingencies (Ajuntament de Barcelona and Doxa Consulting, 2012).

Data show that the kick-off meeting of the PMO took place on 30 June 2012. During the first six months, the staff of this office held more than 60 meetings, many of them with business partners or representatives of the various departments of the Barcelona's municipal administration. All these actors were directly involved in the development of projects and activities associated with the smart city strategy. This also includes the projects started before the activation of this new office. In fact, the *"many smart city projects dispersed in various departments across the city"* (Buscher and Doody, 2013) initiated prior to the development of the unified strategy have been mapped, collected and subjected to checks and supervision by the Project Management Office (Ajuntament de Barcelona and Doxa Consulting, 2012).

Step 3.2 – Generate, select and organize project ideas to achieve your objectives

Within the Barcelona smart city strategy, the procedure leading to the implementation of any project is structured in a precise manner (Ajuntament de Barcelona and Doxa Consulting, 2012). The first step is the definition of a proposal. The project idea is formed within the PMO, in which a series of meetings are held in an effort to identify and clearly define the needs to be met, as well as the objectives, scope and functional requirements. In the case of cross-cutting projects, these meetings are only conducted with the representatives of the IMI. For vertical projects, conversely, collaboration and comparison takes place with the departments of the municipal administration and any other external subject. All other phases remain the same for both types of projects, and start by identifying and contacting potential external partners in an effort to form a working group and to analyze the possible technological solutions to be used. The possible partners are selected through specific sector analyses. Whatever the composition of the working group, the IMI is always included as a *"technology consultant"* in all vertical projects (Sanromà, 2013). Upon completion of this phase, it is possible

to proceed with drafting the project and all the documentation related to the planning and preliminary estimate of the budget necessary to implement the project. Finally, by analyzing the documentation, the political component has the task of deciding whether to select or reject the proposal based on the strategic priorities of the city.

The proposal may also be produced by subjects outside the public administration. For example, in the case of the company Schneider Telvent, the agreement included the clause "*selection of pilots by the City Council between 21 proposals made by Telvent*" (Ajuntament de Barcelona and Doxa Consulting, 2013b). In addition, citizens are also called on to propose and carry out project ideas. In this respect, the municipal administration has proposed many initiatives aimed at creating a collaborative environment based on open-innovation. The creation of the OpenData BCN web-portal is a good example to cite, a digital place in which anyone can use public data for producing new services (Ajuntament de Barcelona, 2010b; 2014a). But the most important role has been played by the organization of awards, events to raise awareness of the smart city topic, and hackathons (Apps4citizens, 2014; Ajuntament de Barcelona, 2015a; 2015b).

Step 3.3 – Ensure financial support to the projects

By approving the MES measure, the city administration has been able to allocate 1,2 million euros for the development of the city's ICT strategy, which included the smart city line of action (Ajuntament de Barcelona, 2012f). Other resources have been acquired through the Municipal Action Program, as "*urban regeneration for a sustainable smart city*" (Doncel and Pons, 2012) is one of three strategic commitments approved and funded by the local government (Ajuntament de Barcelona, 2012g). However, these public funds only provide part of the resources needed to support the transformation of Barcelona into a smart city. In fact, by analyzing the key points established during the planning phase it is clear that the financial strategy defined by the city is based on a combination of public and private investments (Lopez, 2014; Olivella, 2012; Sanromà, 2012).

As pointed out by Josep Ramon Ferrer, head of Directorate for ICT Strategy and Smart City at the IMI, the possibility to develop a smart city strategy requires "*changing the traditional model of financing used by the municipality to a model based on collaboration between the public and private sectors in which both assume risks, but it is private enterprise that*

makes the investment" (Col·legi d'Ambientòlegs de Catalunya, 2013).
For this reason, the municipality has launched a specific program in
an effort to promote *"collaboration with private companies for the creation
and development of new and innovative products for a more efficient urban
management"* (Ajuntament de Barcelona, 2013a): *"Barcelona has developed
a collaborative company-City Council model for companies wishing to carry
out research on the provision of services and the smart management of urban
space. […] The City Council provides human and material resources that
depend on the company's nature, scope and contribution, and the importance
of the proposal"*. The private partners guarantee their commitment and
resources by signing an agreement with the city government (Ajunta-
ment de Barcelona and Doxa Consulting, 2012)

Step 3.4 – Implement the projects

The last step of this phase is the implementation of the selected projects,
an activity that has continued to grow over time. In early 2012, the list
of projects included in the strategy was extremely limited, comprising a
total of just 10 initiatives (Olivella, 2012; Sanromà, 2012). But this num-
ber has increased very significantly following the planning phase and
the activation of the Project Management Office. A report published
in October 2012 by the City of Barcelona and Doxa Consulting refers
to a total of 40 projects, of which 26 were under development and the
remaining 14 were in the starting phase (Ajuntament de Barcelona and
Doxa Consulting, 2012). Moreover, according to the estimate proposed
at the end of 2013 by the Department for Business, Innovation and Skills
of the United Kingdom Government, *"there are over one hundred projects
considered to be part of the smart city work in Barcelona, and this number is
growing"* (Buscher and Doody, 2013).

3.4. Phase 4: monitoring and evaluation

The monitoring of the progress and evaluation of the results achieved
through the projects are performed periodically, in part through the
use of specifically created technological tools. Furthermore, the strategy
constantly undergoes changes aimed at improving its structure and
functioning.

Step 4.1 – Monitor progress and evaluate results

During the planning phase, the procedures for monitoring progress and evaluating the results achieved have been defined with each single project. In this regard, a specific program named *"intelligent data"* was launched in 2012, in which the two initiatives that made it possible to develop some technological tools used to conduct these activities have been included (Ajuntament de Barcelona, 2013a).

Step 4.2 – Adjust and modify

The Barcelona smart city strategy is managed with a dynamic approach and characterized by a cyclical trend. This means that the various phases that compose the strategy are never definitively closed but are subjected to a continuous process of review and change, oriented towards on-going improvement. This cyclical trend is particularly evident in the phase of the development of projects, which is constantly active but influenced by possible changes in the strategic objectives or directives from above. For example, following the approval of the city's Master Plan for ICT, a number of standards associated with the technological component of the various projects have been introduced, resulting in a modification of the selection criteria for the possible initiatives to be implemented (Ajuntament de Barcelona – Tercera Tinència d'Alcaldia d'Hàbitat Urbà, 2014). The same consideration can be applied to the fields of action selected by the municipality, with a specific focus on energy and environmental sustainability in the first period, and then the extension to multiple areas of intervention (Buscher and Doody, 2013).

3.5. Phase 5: communication

The communication of data and information connected to the smart city strategy represents a transversal and continuous activity that the municipal administration has performed since the starting phase. The aim is to disseminate and share knowledge, but also promote the strategy in an attempt to attract new potential partners. This phase is linked to the *"promotion"* line of action and its implementation is ensured by an approach that combines three complementary activities: the organization of international events in collaboration with other partners; the participation in international events proposed by other public or

private subjects; and the continued production of informative documents disseminated through the use of web platforms.

Step 5.1 – Communicate and promote the smart city strategy

Conferences are the main communication tool used by the municipality. Through the organization of conference events and participation in those proposed by other entities, the city has been able to disseminate the contents of its strategy and promote its initiative throughout the world, acquiring high visibility within the smart city field. Indeed, these events represent an opportunity for providing information about the activities carried out, but also serve as a promotional tool for *"attracting investment, strengthening economic ties and establishing Barcelona as an example of smart city"* (Ajuntament de Barcelona, 2013c).

Reviewing the various sources of evidence, it is clear that a very high number of international events has been organized by the municipality since the arrival of the new administration. The situation is quite similar with regard to participation in international conferences organized by other entities (see for example Ajuntament de Barcelona, 2011b; 2012b; 2012d; 2014a; Navarro, 2012). However, this is only a part of the efforts made by the city to promote and communicate its smart city initiative outside the administration. These efforts are also sustained through the continuous and steady production and dissemination of different types of informative documents which describe the contents of the strategy, the activities in progress, the achievements made, and much more. All these data and information are transmitted using different digital platforms, such as the website developed specifically for the smart city strategy or the *"e-headquarters"* of the City of Barcelona (Ajuntament de Barcelona, 2014a; 2014e).

4. FINAL REMARKS AND CONCLUSION

According to Aurigi (2006), one *"major limit of far too many ICT-based regeneration initiatives in Western cities has been a somehow enthusiastically deterministic way to see the effects of information technology on urban functions."* In the late 1990s, Graham and Marvin (1999) reached the same conclusion after analyzing a series of international strategies and projects developed by different cities in order to use ICTs for supporting urban development. As pointed out by these two authors, in fact,

these types of initiatives *"are often intimately connected with utopian and deterministic ideas of technology's beneficial and linear impacts upon the social, environmental and spatial development of cities [and their] real benefits […] to localities may be dubious or massively overblown because they remain inappropriate to real local needs."* This situation seems to be caused by difficulties in understanding that integrating ICTs in urban areas is much more than a technological matter and placing too much emphasis and preoccupation on infrastructures and devices can be misleading and dangerous (Aurigi, 2005; 2006; Graham, 2000; Mino, 2000).

For this reason, cities aspiring to become smart need to proceed with great caution and adopt an approach that allows them to look beyond technology and consider other non-technical yet crucial factors. This is what the City of Barcelona has done during the development of its smart city strategy, thanks to an approach in which the technological component has been rightly combined with several *"human factors"* (Nam and Pardo 2011a) that have been essential to the success of the initiative. These include leadership and political commitment (Alawadhi et al., 2012; Chourabi et al., 2012; Hill et al., 2011), which have been provided by the municipal administration since the starting phase. In this way, it has been possible to manage the complex organizational context that has allowed for the planning and implementation of the strategy. And this has taken place within an interdisciplinary environment in which sectoral and departmental separation has been eliminated in favor of cross-collaboration.

The need to create a collaborative and participative environment for supporting the development of smart city strategies has been extensively discussed in scholarly literature (Beck, 2011; Kakderi et al., 2012; Naphade et al., 2011; Manville et al., 2014; Nam and Pardo, 2011a; 2011b; Paskaleva, 2009; Zygiaris, 2012; European Commission, 2012), and it has become clear that in these initiatives, *"success is […] a product of collaboration between a wide range of […] organizations and individuals"* (Kakderi et al., 2012). In fact, the positive results achieved by Barcelona are linked to the continuous stimulation of public-private collaboration, together with citizens' involvement. By using this approach, the Catalan city has created an ecosystem for ICT-based urban innovation. Moreover, it has benefited from *"the enormous innovative potential of grass-roots efforts"* (Ratti and Townsend, 2011), avoiding the risks of an excessively top-down oriented view (Komninos et al., 2012; Townsend et al., 2011).

In addition to leadership, political commitment and collaboration, others important factors discussed in smart city research and successfully managed by Barcelona City Council are: 1) selectivity: defining

procedures for the selection and development of the best project ideas in order to channel resources and efforts more effectively (Dirks et al., 2009); 2) vision: formulating a long-term vision that will help to draw up an action plan (van Beurden, 2011); 3) motivation: defining how to use technology in term of problems to solve and strategic priorities to achieve (Berthon and Guittat, 2010; Zygiaris, 2012); 4) identification and capitalization of past ICT initiatives: mapping and integrating projects initiated or concluded before the launch of the strategy (Angelidou, 2014); 5) monitoring: using performance metrics to measure and evaluate results achieved by projects (Moss Kanter and Litow, 2009); 6) financial sustainability: developing new business and operating models, and attracting external funding to support the progressive implementation of projects (Belissent et al., 2010). This is one of the greatest issues linked to the construction of smart cities (Anderson et al., 2012) and Barcelona has solved it by combing the use of public and private resources, an essential mix which can ensure the long-term sustainability of smart city strategies (Alusi et al., 2011; Schaffers et al., 2012; Singh et al., 2009).

To manage the complex scenario just described, the municipal administration has adopted an approach strongly geared towards strategic urban planning principles. This is the most important lesson to be learned from Barcelona on how to develop smart city strategies in large cities, a lesson which is in line with the results of research proposed by Komninos (2014). According to him, traditional planning processes based on the production of masterplans and comprehensive planning are inadequate to support the development of smart city strategies. On the contrary, strategic planning seems to be the most suitable tool. The analysis of the case of Barcelona confirms this assumption, demonstrating the effectiveness of strategic urban planning when used to govern the complexity of smart city strategies in large urban areas.

However, this is only a single-case analysis, insufficient to fill the lack of knowledge concerning the development process of smart city strategies, but very useful in providing a robust knowledge base and new research perspectives for further investigations. The roadmap presented in this study represents a useful tool for both future comparative research aiming at obtaining a broad generalization of the results achieved and building an empirically valid theory able to explain how to approach the development of smart city strategies in large cities. However, it will be very important not to forget that the absence of procedures and development methodologies is not an issue limited to large cities. On the contrary, it is valid for any type of urban areas, whether small, medium or large in size, precisely as observed by Kitchin (2014): "*presently* [research on smart cities] *has four shortcomings*

[including] an absence of in-depth empirical case studies of specific smart city initiatives and comparative research that contrasts smart city developments in different locales." This means that the field of investigation linked to the development process of smart city strategies will have to be further expanded in the near future.

ENDNOTES

1. In this study, large cities are urban areas with a population of between 500 000 and 1500 000 inhabitants, a definition aligned with the classification system of urban areas proposed by the Organization for Economic Cooperation and Development (OECD) (Brezzi et al., 2012).

2. The Municipal Institute of Information Technology (IMI) is an autonomous local body created by the City of Barcelona which is integrated in its executive structure and has the task to develop and manage all the ICT systems and infrastructures of the city administration (Ajuntament de Barcelona, 2010a).

REFERENCES

Abdoullaev, A. (2011). "A smart world: a development model for intelligent cities". In: *Proceedings of the 11th IEEE International Conference on Computer and Information Technology (CIT-2011).* Paphos, Cyprus. 31 August-02 September, 2011. Piscataway, NJ.: IEEE. pp. 1-28.

Achaerandio, R. et al. (2011). "Smart cities analysis in Spain" http://www.idc.com [Accessed 25.06.2015].

Ajuntament de Barcelona - Àrea d'Economia, Empresa i Ocupació. (2013). "Barcelona data sheet 2013" http://w42.bcn.cat [Accessed 30 September 2014].

Ajuntament de Barcelona - Comissió d'Hàbitat Urbà i Medi Ambient. (2012a) "Acta de la Comissió d'Hàbitat Urbà i Medi Ambient. Sessió de 16 de febrer de 2012". http://governobert.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona - Comissió d'Hàbitat Urbà i Medi Ambient. (2012b). "Acta de la Comissió d'Hàbitat Urbà i Medi Ambient. Sessió de 18 d'octubre de 2012". http://governobert.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona - Comissió de Presidència i Règim Interior. (2012). "Acta de la Comissió le Presidència i Règim Interior. Sessió de 21 de març de 2012". http://governobert.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona - Tercera Tinència d'Alcaldia d'Hàbitat Urbà. (2014). "Mesura de govern. Pla Director de les TIC: Desplegament d'In-

fraestructures 'Smart' a l'Espai Públic (PDTIC)". http://governobert.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona and Doxa Consulting. (2012). "Barcelona Smart City: the vision, focus and projects of the Ajuntament de Barcelona in the context of smart cities". http://ibarcelona.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona and Doxa Consulting. (2013a). "Barcelona Smart City. La visió, l'enfocament i els projectes de la Ciutat de Barcelona cap a les smart cities: estrategia". http://www.eic.cat [Accessed 25.06.2015].

Ajuntament de Barcelona and Doxa Consulting. (2013b). "Vision, approach and projects of the Barcelona City to smart cities: executive version". http://ibarcelona.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2010a). "Ajuntament de Barcelona: informe anual de les empreses i institucions municipals". http://governobert.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2010b). "Projecte d'obertura de dades publiques de l'Ajuntament de Barcelona: OpenData BCN". http://www.slideshare.net [Accessed 25.06.2015].

Ajuntament de Barcelona. (2011a). "Ajuntament de Barcelona: informe anual de les empreses i institucions municipals". https://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2011b). "Barcelona to hold an international summit on urban innovation". http://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2011c). "Smart City Barcelona: BCN model". http://www.slideshare.net [Accessed 25.06.2015].

Ajuntament de Barcelona. (2012a). "Antoni Vives exposa a Singapur davant de més de 100 ciutats d'arreu del món el model d'Smart City que impulsa l'Ajuntament de Barcelona". http://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2012b). "Barcelona acollirà el 6è Urban Research and Knowledge Symposium Rethinking Cities: Framing the Future, entre el 8 i el 10 d'octubre". http://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2012c). "Barcelona acull el XXè Congrés de CIDEU, la xarxa iberoamericana que promou el desenvolupament estratègic urbà". http://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2012d). "Barcelona hosts the CitiSense smart cities forum". http://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2012e). "Marc estratègic i full de ruta 2012-2015". http://www.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2012f). "Mesura de Govern MES: l'estratègia TIC de l'Ajuntament de Barcelona al servei de la ciutat i dels ciutadans". http://governobert.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2012g). "Politics and management deal: strategic framework and roadmap 2012-2015". http://governobert.bcn.cat

[Accessed 25.06.2015].

Ajuntament de Barcelona. (2013a). "Barcelona Smart City: the vision, focus and projects of the Ajuntament de Barcelona in the context of Smart Cities". http://www.slideshare.net [Accessed 25.06.2015].

Ajuntament de Barcelona. (2013b). "Barcelona Smart City". http://cityclimateleadership.com [Accessed 25.06.2015].

Ajuntament de Barcelona. (2013c). "The Mayor promotes Barcelona in the United States" http://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2014a). "The Barcelona Smart City website". http://smartcity.bcn.cat/en [Accessed 25.06.2015].

Ajuntament de Barcelona. (2014b). "Barcelona, a benchmark smart city". http://w110.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2014c). "L'Alcalde Trias assegura que la principal prioritat del que queda de mandat és crear llocs de treball". http://premsa.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2014d). "The Barcelona WiFi website". http://www.bcn.cat/barcelonawifi/en/ [Accessed 25.06.2015].

Ajuntament de Barcelona. (2014e). "The Barcelona City Council website". http://www.bcn.cat [Accessed 25.06.2015].

Ajuntament de Barcelona. (2014f). "The Hàbitat Urbà website". http://w110.bcn.cat/portal/site/HabitatUrba [Accessed 25.06.2015].

Ajuntament de Barcelona. (2014g). "The iBarcelona website". http://ibarcelona.bcn.cat/en [Accessed 25.06.2015].

Ajuntament de Barcelona. (2015a). "The Bracelona Smart City Hack App website". http://barcelona.smartcityapphack.com [Accessed 25.06.2015].

Ajuntament de Barcelona. (2015b). "Barcelona acull dos Hackathons sobre smart cities aquest cap de setmana". http://premsa.bcn.cat [Accessed 25.06.2015].

Alawadhi, S. et al. (2012). "Building understanding of smart city initiatives". In: Scholl, H.J. et al. (eds.) *Electronic Government. 11th IFIP WG 8.5 International Conference, EGOV 2012.* Krostiansand, Norway. 03-06 September 2012. Berlin: Springer-Verlag. pp. 40-53.

Alusi, A. et al. (2011). "Sustainable cities: Oxymoron or the shape of the future?". http://www.hbs.edu [Accessed 24 January 2012].

Angelidou, M. (2014). "Smart city policies: a spatial approach". Cities. 41/Supplement 1. pp. S3-S11.

Apps4citizens. (2014). "Apps4citizens website". http://apps4citizens.org [Accessed 25.06.2015]

Aurigi, A. (2003). "Foreword". In: Firmino, R.J. (2003). *Defining and understanding the virtual cities phenomenon: Briefing document.* https://www.academia.edu [Accessed 03.10.2012].

Aurigi, A. (2005). "Competing urban visions and shaping the digital city". *Knowledge, Technology & Policy.* 18/1. pp. 12-26.

Aurigi, A. (2006). "New technologies, same dilemmas: policy and design issues for the augmented city". *Journal of Urban Technology.* 13/3. pp. 5-28.

Battle, J. (2010a). "Barcelona Smart City: paving the way". http://www.xipi.eu [Accessed 25.06.2015].

Battle, J. (2010b). "Barcelona Smart City". http://cefims.eu [Accessed 25.06.2015].

Battle, J. (2011). "Smart City Barcelona: BCN model". http://www.major-cities.org [Accessed 25.06.2015].

Beck, F. (2011). "The modern city: from vision to reality". http://www.ibm.com [Accessed 12.06.2013].

Belissent, J. et al. (2010). "Getting clever about smart cities: new opportunities require new business models". http://www.forrester.com [Accessed 20.03.2012].

Berthon, B. and Guittat, P. (2011). "Rise of the intelligent city". http://www.accenture.com [Accessed 12.04.2012].

Bourgeois, L. and Eisenhardt, K.M. (1988). "Strategic decision processes in high velocity environments: four cases in the microcomputer industry". *Management Science.* 34/7. pp. 816-835.

Brezzi, M. et al. (2012). "Redefining urban areas in OECD countries". In: OECD (ed). *Redefining "urban": a new way to measure metropolitan areas.* Paris, France: OECD Publishing. pp. 19-58.

Buscher, V. and Doody, L. (2013). "Global innovators: international case studies on smart cities". https://www.gov.uk [Accessed 21.11.2013].

Chourabi, H. et al. (2012). "Understanding smart cities: an integrative framework". In: Sprague, R.H. (ed.) *Proceedings of the 45th Hawaii International Conference on System Sciences (HICSS).* Maui, Hawaii. 04-07 January 2012. Piscataway, NJ.: IEEE. pp. 2289-2297.

Cisco System. (2012). "Barcelona and Cisco announce strategic initiatives to transform the city into a global urban reference model". http://newsroom.cisco.com [Accessed 25.06.2015].

Clarke, R.Y. (2013). "Business strategy: smart city essentials. Six ways to drive innovation in your city". http://www.idc.com [Accessed 20.08.2014].

Cohen, B. (2012a). "The 10 smartest cities on the planet". http://www.fastcoexist.com [Accessed 25.06.2015].

Cohen, B. (2012b). "The 10 smartest european cities". http://www.fastcoexist.com [Accessed 25.06.2015].

Cohen, B. (2014). "The 10 smartest cities in Europe". http://www.fastcoexist.com [Accessed 25.06.2015].

Col·legi d'Ambientòlegs de Catalunya. (2013). "Entrevista: Teresa

Franquesa i Josep Ramon Ferrer". http://www.coamb.cat [Accessed 25.06.2015].

Conesa, P. (2009). "Barcelona Smarter City". https://www.ibm.com [Accessed 25.06.2015].

D'Auria, A., et al. (2014). "From digital city to smart city: different perspectives overlapping or misinterpreted?" In: Mokrys, M. et al. (eds.) *Proceedings of the 2nd International Global Virtual Conference (GV-Conf 2014).* Zilina, Slovak Republic. 7-11 April 2014. Zilina: EDIS. pp. 603-608.

Dirks, S. and Keeling, M. (2009). "A vision of smarter cities: how cities can lead the way into a prosperous and sustainable future". http://www-03.ibm.com [Accessed 03.02.2012].

Dirks, S., et al. (2009). "How smart is your city: helping cities measure progress". http://www.ibm.com [Accessed 27.12.2011].

Doncel, M. & Pons, M. (2012). *Municipal Action Progamme is approved by the Full Council.* [news] 08 October 2012. Barcelona: Ajuntament de Barcelona. http://w110.bcn.cat [Accessed 25.06.2015].

Eisenhardt, K.M. (1989). "Building theories from case study research". *Academy of Management Review.* 14/4. pp. 532-550.

Ercan, M.A. (2011). "Challenges and conflicts in achieving sustainable communities in historic neighborhoods of Istanbul". *Habitat International.* 35/2. pp. 295-306.

European Commission. (2010a). "Communication from the Commission on Europe 2020: a strategy for smart, sustainable and inclusive growth". http://eur-lex.europa.eu [Accessed 02.02.2014].

European Commission. (2010b). "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Digital Agenda for Europe". http://eur-lex.europa.eu [Accessed 02.02.2014].

European Commission. (2012). *Digitally driven smart cities: moving forward to smarter communities.* Brussels: European Union.

European Commission. (2014). "Barcelona is iCapital of Europe". http://europa.eu [Accessed 13.03.2014].

Ferrer, J.R. (2013). "Estratègia TIC de l'Ajuntament de Barcelona". http://www.socinfo.es [Accessed 13.03.2014].

Ferrer, J.R. (2014). "Barcelona 2014". http://www.slideshare.net [Accessed 25.06.2015].

Frei, B. et al. (2012). "Smart cities in Italy: an opportunity in the spirit of the Renaissance for a new quality of life". http://www.ambrosetti.eu [Accessed 09.09.2012].

George, A.L. and Bennett, A. (2005). *Case studies and theory development in the social sciences.* Cambridge, MA: MIT Press.

Gil-Castineira, F. et al. (2011). "Experiences inside the Ubiquitous Oulu

Smart City". *Computer.* 44/6. pp. 48-55.

Graham, S. (2000). "Introduction: cities and infrastructure networks". *International Journal of Urban and Regional Research.* 24/1. pp. 114-119.

Graham, S. (ed.) (2004). *The Cybercities Reader.* New York, NY.: Routledge.

Graham, S. and Marvin, S. (1999). "Planning cyber-cities? Integrating telecommunications into urban planning". *Town Planning Review.* 70/1. pp. 89-114.

GSMA et al. (2011). "Smart mobile cities: opportunities for mobile operators to deliver intelligent cities". http://www.accenture.com [Accessed 20.04.2012].

Hill, D. et al. (2011). "The smart solution for cities". http://www.arup.com [Accessed 17 July 2011].

Hollands, R.G. (2008). "Will the real smart city please stand up?" *City.* 12(3). pp. 303-320.

Kakderi, C. et al. (2012). "A planning roadmap for intelligent cities: enabling communities with smart environments and open innovation". In: *Proceedings of the Regional Studies Association European Conference 2012.* Delft, Netherlands. 13-16 May 2012. Seaford: Regional Studies Association.

Kitchin, R. (2014). "Making sense of smart cities: addressing present shortcomings". *Cambridge Journal of Regions, Economy and Society.*

Komninos, N. (2011). "Intelligent cities: variable geometries of spatial intelligence". *Intelligent building international.* 3/3. pp. 172-188.

Komninos, N. (2014). *The age of intelligent cities: smart environments and innovation-for-all strategies.* New York, NY.: Routledge.

Komninos, N. et al. (2012). "Special issue on smart cities and the Future Internet in Europe". *Journal of the Knowledge Economy.* 4/2. pp. 119-134.

Lee, J.Y. and Hancock, M.G. (2012). "Toward a framework for smart cities: a comparison of Seoul, San Francisco and Amsterdam". http://iis-db.stanford.edu [Accessed 26.01.2013].

Lopez, J. (2014). "Barcelona Smart City". http://www.slideshare.net [Accessed 25.06.2015]

Manville, C. et al. (2014). "Mapping smart city in the EU". http://www.europarl.europa.eu [Accessed 05.02.2014].

Miles, M.B. and Huberman, M.A. (1994). *Qualitative data analysis: an expanded sourcebook.* 2 ed. Thousand Oaks, CA: SAGE Publications.

Mino, E. (2000). "Experiences of european digital cities". In: Ishida, T. and Isibister, K. (eds). *Digital cities: technologies, experiences and future perspectives.* Berlin: Springer-Verlag. pp. 58-72.

Moss Kanter, R. and Litow, S.S. (2009). "Informed and interconnected: a manifesto for smarter cities". http://www.hbs.edu [Accessed 24.01.2012].

Nam, T. and Pardo, T.A. (2011a). "Conceptualizing smart city with di-

mensions of technology, people and institutions". In: Bertot, J. et al. (eds.) *Proceedings of the 12th Annual International Conference on Digital Government Research: digital government innovation in challenging times.* College Park, Maryland. 12-15 June 2011. New York. NY.: ACM Press. pp. 282-291.

Nam, T. and Pardo, T.A. (2011b). "Smart city as urban innovation: focusing on management, policy, and context". In: Estevez, E. and Janssen, M. (eds.) *Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance (ICEGOV2011).* Tallinn, Estonia. 26-28 September 2011. New York, NY.: Association for Computing Machinery (ACM). pp. 185-194.

Naphade, M. et al. (2011). "Smarter cities and their innovation challenges". *Computer.* 44/6. pp. 32-39.

Navarro, R. (2012). "Barcelona is to host the world's most important smart city congress". http://w110.bcn.cat [Accessed 25.06.2015].

Olivella, L. (2012). "Barcelona urban habitat: the vision, approach and projects of the Ajuntament de Barcelona towards smart cities". http://www.theinnovationgroup.it [Accessed 25.06.2015].

Paskaleva, K.A. (2009). "Enabling the smart city: the progress of city e-governance in Europe". *International Journal of Innovation and Regional Development.* 1/4. pp. 405-422.

Patton, M.Q. (2012). *Qualitative research and evaluation methods.* 3rd ed. Thousand Oaks, CA: SAGE Publications.

Ratti, C. and Townsend, A. (2011). "The social nexus". *Scientific American.* 305/8. pp. 42-48.

Sanromà, M. (2012). "Barcelona Smart City: the vision, approach and projects of the Ajuntament de Barcelona towards the smart city". http://www.majorcities.eu [Accessed 25.06.2015].

Sanromà, M. (2013). "MESSI: la estrategia TIC del Ayuntamiento de Barcelona". http://www.csuc.cat [Accessed 25.06.2015].

Schaffers, H. et al. (2012). "FIREBALL white paper: smart cities as innovation ecosystems sustained by the future internet" http://hal.archives-ouvertes.fr [Accessed 24 August 2011].

Singh, I.B. et al. (2009). "Designing and implementing the smart city". In: Pelton, J.N. and Singh, I.B. (eds). *Future cities: designing better, smarter, more sustainable and secure cities.* New York: Intelligent Community Forum. pp. 53-86.

Strauss, A. and Corbin, J.M. (1990). *Basics of qualitative research: grounded theory procedures and techniques.* Thousand Oaks, CA: SAGE Publications.

Townsend, A., et al. (2011). "A Planet of civic laboratories: the future of cities, information and inclusion". http://www.iftf.org [Accessed 08 December 2011].

Trias, X. (2011). "Barcelona, capital economica del sud d'Europa i de la mediterrania". http://w110.bcn.cat [Accessed 25.06.2015].

U.S. National Intelligence Council. (2012). "Global trends 2030: alternative worlds". http://www.dni.gov [Accessed 30.06.2012].

van Beurden, H. (2011). *Smart city dynamics: inspiring views from experts across Europe.* Amsterdam: HvB Communicatie bv.

Voss, C. et al. (2002). "Case research in operations management". *International Journal of Operations & Production Management.* 22/2. pp. 195-219.

Washburn, D. et al. (2010). "Helping CIOs understand "Smart City" initiatives". http://www.forrester.com [Accessed 20.03.2012].

Webb, M. (2008). "SMART 2020: enabling the low carbon economy in the information age". http://www.smart2020.org [Accessed 05.06.2014].

Webb, M. et al. (2011). "Information marketplaces: the new economics of cities". http://www.accenture.com [Accessed 03.01.2013].

Wolfram, M. (2012). "Deconstructing smart cities: an intertextual reading of concepts and practices for integrated urban and ICT development". In: Schrenk, M. et al. (eds.) Proceedings of the REAL CORP 2012. Schwechat, Austria. 14-16 May 2012. Wien: CORP. pp. 171-181.

Yin, R.K. (1984). *Case study research: design and methods.* Thousand Oaks, CA: SAGE Publications.

Zheng, H.W. et al. (2014). "A review of recent studies on sustainable urban renewal". *Habitat International.* 41/1. pp. 272-279.

Zygiaris, S. (2012). "Smart city reference model: assisting planners to conceptualize the building of smart city innovation ecosystems". *Journal of the Knowledge Economy.* 4/2. pp. 217-231.