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**THE WAY TO MAKE CITIES SMARTER: EVIDENCES FROM
EUROPE**

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Trabalho de Dissertação submetido ao Programa de Pós-Graduação em Administração da Universidade Federal do Rio Grande do Sul como um requisito parcial para obtenção do título de mestre em Administração.

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ABSTRACT

Industrial cities still maintain structures for a mass production and consumption dynamics, which result in several issues such as unemployment, homeless, traffic jams, pollution, diseases, violence and so on. This urban industrial configuration no longer fits with the value creation principles of the new techno-economic paradigm. The dynamics of the new techno-economic paradigm demand that cities redeem their very essence in order to start a new cycle of wealth creation. In order to overcome this crisis and encompass this new dynamics, cities of the future must find suitable trajectories to become smart cities. However, there is no consensus about what really makes a city smarter. What is a smart city? What are the driving elements that can enhance the smartness of a city? The objective of this study is to propose an integrated framework in order to understand the process to make cities smarter. To achieve this objective, it was realized a systematic literature review and a multiple case studies from smart cities projects in four European cities (Amsterdam, Barcelona, Lisbon, Vienna) where some experts were interviewed. Results show that cities to become smarter should integrate their dimensions and elements in order to offer high quality of life and a prosperous environment for innovation and creativity in the most sustainable way. If a city wants to start this process of transformation, it should develop some specific projects that that use and improve its enviro-urban configuration, its techno-economic dynamics and its socio-institutional structure in order to create wealth through a comprehensive innovation process. Therefore, the challenge to make a city smarter lies on defining how to articulate those driving elements in each dimension properly in order to build up its own urban innovation ecosystem.

Keywords: smart cities; paradigm; innovation; ecosystem; quality of life.

RESUMO

As cidades industriais ainda mantêm estruturas para uma dinâmica de produção e consumo em massa, que resultam em vários problemas, como desemprego, falta de moradia, engarrafamentos, poluição, doenças, violência e entre outros. Esta configuração industrial urbana já não está mais condizente com os princípios de criação de valor do novo paradigma do século XXI. A dinâmica do novo paradigma técnico-econômico exige que as cidades resgatem sua própria essência, que é a de aproximar pessoas para interagirem e compartilhar ideias e conhecimentos de modo que seja possível iniciar um novo ciclo de criação de riqueza. Para superar essa crise e entrar nesta nova dinâmica, as cidades do futuro devem encontrar trajetórias adequadas para se tornarem cidades inteligentes. No entanto, não há consenso sobre o que realmente torna uma cidade mais inteligente. O que é uma cidade inteligente? Quais são os elementos que podem aumentar a inteligência de uma cidade? O objetivo deste estudo é propor uma estrutura integrada para entender o processo de tornar as cidades mais inteligentes. Para atingir este objetivo, foi realizada uma revisão sistemática da literatura para definição do conceito e também um estudo de casos múltiplos de projetos de cidades inteligentes em quatro cidades europeias (Amsterdã, Barcelona, Lisboa, Viena) onde alguns especialistas foram entrevistados. Os resultados mostraram que as cidades para se tornarem mais inteligentes devem integrar suas dimensões e elementos, a fim de oferecer alta qualidade de vida e um ambiente próspero para inovação e criatividade da maneira mais sustentável. Se uma cidade deseja iniciar esse processo de transformação, deve desenvolver projetos específicos que utilizem e melhorem sua configuração ambiental urbana, sua dinâmica tecno-econômica e sua estrutura sócio institucional, a fim de criar riqueza através de um abrangente processo de inovação. Portanto, o desafio de tornar uma cidade mais inteligente está em definir como articular adequadamente esses elementos direcionadores de cada dimensão, a fim de construir seu próprio ecossistema urbano de inovação.

Palavras-Chave: cidades inteligentes; paradigma; inovação; ecossistema; qualidade de vida.

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1. INTRODUCTION

Since Ancient ages until nowadays, urban agglomerations have been true incentives for settlement. It happens because urban agglomerations (i.e. cities), bring real gains of concentration by merging population density and geographical proximity (GLAESER, 2011). Cities reduce transaction costs, raise firms' productivity, provide economies of scale, enhance quality of life and stimulate creativity and innovation by engendering ease face-to-face interactions (FLORIDA, 2002; ASHEIM and COENEN, 2005; SHAPIRO, 2006; ASHEIM et al., 2007; CUBERES, 2009; ASHEIM, BOSCHMA and COOKE, 2011).

In sum, cities are innate engines for the socioeconomic development (Rogerson, 1999). However, most of them are facing the challenge of overcoming issues such as unemployment, homeless, social inequality, traffic jams, pollution, diseases, violence and so on (DODGSON and GANN, 2011; NEIROTTI et al., 2014).

Remarkable is that the triumph of cities and the urban decay are both legacies of the Industrial Revolution (GLAESER, 2011). The astonishing urban growth transformed small towns into huge metropolises (SKOJBERG, 1955; STEARNS and BELL, 1974; FUJITA, KRUGMAN and VENABLES, 1999). On the one hand, never before in history people reached so high welfare state. On the other hand, cities were not prepared for this rapidly urbanization process, which enhanced those issues not only making cities loss their superb gains of proximity and density, but also making them hard places to live (GIL-GARCIA, PARDO and NAM, 2015).

Currently, the industrial city model is producing more negative than positive externalities, which not only hinder cities to thrive, but also accelerate their urban decline (EECKHOUT, 2004; DIRKS and KEELING, 2009). Most of urban issues are intimately connected with an industrial city model driven by mass production and consumption of declining manufacturing industries, which are supported by outdated buildings and infrastructures, stuck institutional frameworks, and a laggard knowledge base (CARTER, 2013; HAJKOVA and HAJEK, 2014; BOLÍVAR and MEIJER, 2016).

This model no longer fits with the value creation principles of the new techno-economic paradigm (BELL, 1976; PEREZ, 2004; ANGELIDOU, 2015). The new paradigm encompasses a set of assumptions, principles and values such as, sustainability, connectivity, mobility, accessibility, transparency, inclusiveness, collaboration, diversity, meritocracy and so on

(STEARNS and BELL, 1974; PEREZ, 2004; FLORIDA, 2014). These characteristics foster the emergence of new business models, new industries, new technologies, new market relations and new society (FLORIDA, 2014; SCHWAB, 2017).

The creation of wealth in the 21st century flows through the innovation primacy, mostly enabled by knowledge-intensive digital applications widespread by creative and sustainable industries (FREEMAN AND PEREZ, 1988; FLORIDA, 2014; DE JONG et al., 2015; SCHWAB, 2017). The knowledge economy demands from firms a higher level of techno-scientific knowledge to develop increasingly complex solutions in order to meet the needs of more demanding consumers.

However, just one firm is no longer able to develop a solution only with in-house knowledge, given its bounded rationality (SIMON, 1945) and the high organizational costs to produce the required knowledge (COASE, 1937; PENROSE, 1959; WILIAMSON, 1981). Thus, it is necessary to bring together knowledge from other firms to develop these complex solutions (ROTWHELL, 1994; HUIZING, 2011).

As a matter of fact, firms rely on people, because they are the very porters of knowledge and creativity, which are the main inputs for wealth creation in the 21st century. In this context, cities play an important role in the new paradigm, because they ease face-to-face interaction, which still is the best way to exchange ideas and knowledge (Florida, 2002; 2014).

The process of wealth creation demands that cities be upgraded in order to recover their innate advantages. In other words, cities should become smart in order to cope with those issues and also encompasses the dynamics of this revolution (ZYGIARIS, 2013). However, what is a smart city?

The term “Smart City” has been attracting the attention of many scholars, firms, institutions and governments around the world (CARAGLIU ET AL., 2011; NEIROTTI et al., 2014). The number of publications and projects related to smart city has been growing exponentially in the last ten years around the world (Lee, Hancock and Hu, 2014; De Jong et al., 2015).

Despite different definitions, there is no consensus about what really is a smart city (NEIROTTI ET AL., 2014; ALBINO, BERARDI and DANGELICO, 2015). The lack of a comprehensive concept is because most of literature about smart city does not consider the inherent evolutionary process of urban transformation (ANGELIDOU, 2015). It is impossible to imagine that a city will be smart from night to day.

Besides that, the smart city initiatives and experiences around the world show different strategies and ways of implementation (ANGELIDOU, 2014; LEE, HANCOCK and HU, 2014). These differences evidence that the transformation of cities is highly context dependent (WEISI & PING, 2014 apud LETAIFA, 2015), because cities are naturally different (i.e. urban morphology, natural resources, economy, culture, technology and so on).

Cities evolve over long periods in a path dependent manner by shaping the scope and possibilities of future development (MARTIN and SIMMIE, 2008). Consequently, it is possible to affirm that there is no fully-fledged smart city yet (YIGITCANLAR, 2015).

This is an undergoing process that each city should find its own trajectory to become smarter (NEIROTTI et al., 2014). Thus, it is assumed that cities have different degrees of “smartness” (ANGELIDOU, 2014; LETAIFA, 2015; GIL-GARCIA, ZHANG and PURONCID, 2016). While some cities are in more advanced stages, others are still taking the first steps towards this inevitable transformation (CARAGLIU et al., 2011; ZYGIARIS, 2013; CARTER, 2013).

Therefore, a smart city should be considered as an ideal model for urban development (ANGELIDOU, 2014), in which each city will have to find ways to enhance its “smartness”. The problem is that the literature does not present an integrated evolutionary approach about how to enhance the smartness of a city (LETAIFA, 2015; MANITIU and PEDRINI, 2016; FERNÁNDEZ-GÜELL, et al., 2016).

Several studies tried to identify which elements compose a smart city, but few of them show which features these elements should have in order to make a city smarter (CARAGLIU et al., 2011; NEIROTTI et al., 2014; GIL-GARCIA, PARDO AND NAM, 2015; ZUBIZARRETA et al., 2016). It is important to highlight that identifying the features of these elements should help practitioners to design policies and strategic initiatives in order to start the process of transformation.

However, it is not enough only identifying which elements compose a smart city and their specific features; it is necessary to understand how these elements can enhance the smartness of a city in an integrated manner (LETAIFA, 2015). The design of a new model for urban development that integrate the different elements of a city can enhance its potential for wealth creation.

Within a multidimensional approach that considers the interaction among those different elements of a smart city, it will be possible to identify how cities can enhance their smartness in order to speed up the adoption of this new urban model.

Therefore, the main objective of this work **is to propose an integrated framework to understand the process to make cities smarter.**

The secondary objectives are fundamental to achieve this main objective:

- To clarify the smart city concept in order to propose a multidimensional definition.
- To analyze different smart city experiences in order to disclose the driving elements of a smart city and their specific features.
- To integrate the different dimensions and driving elements of a smart city in order to understand how to enhance the smartness of a city.

This work used different qualitative methods in order to reach these proposed objectives. A systematic literature review was performed in order to know the state-of-art about this topic. This method allowed to build a solid definition and to suggest some assumptions. These assumptions were essential to establish the next steps of this work, because it was clear that would be only possible to identify what make a city smarter by analyzing different smart city experiences and projects around the world.

Then, it was chosen some projects of four emblematic cities in Europe and the experts that coordinate these projects were interviewed in order to disclose the most important elements of a smart city. The data analysis from those different sources enabled to build an integrated framework that present the interaction among dimensions.

This work was divided in seven sections. After this introduction, a conceptual background was revisited and the results of systematic literature review were exposed. Then, the method was presented. In the next section, the cases studies were presented. After that, it was made a discussion about the way to make cities smarter. Finally, the concluding remarks, study limitations and suggestions for future research were showed.

2. THE ROLE OF CITIES IN THE NEW TECHNO-ECONOMIC PARADIGM

Before understanding what a smart city is, the question should be; why is it necessary to make cities smarter? To answer this question, some topics need further enlightenment.

The first topic is to show that cities are not “dumb”. In fact, most of cities are just facing the paradox related to their own forces of attraction, which make them naturally lose those innate gains of concentration.

The second topic is to discuss about how the industrial city model restrains the creation of wealth in 21st century. It is crucial to show in a historical perspective that the evolution of cities is related with the current techno-economic¹ paradigm in each time. A brief characterization of this ongoing process of technologic change and its ties with the social and economic impacts are important to start a discussion about the (new) role of cities in 21st century. These topics are discussed in the further sub-sections.

2.1. THE PARADOX OF URBAN AGGLOMERATIONS: FORCES OF ATTRACTION AND CONGESTION COSTS

There is common sense that cities are no longer good places to live given their countless issues, and, consequently they would disappear in the next few decades. However, it is happening the extremely opposite. Until 2050, more than two thirds of world population will live in urban agglomerations (UN, 2014).

Considering that, one should ask why this urbanization process has been occurring at a fast pace since the first Industrial Revolution and will continue despite of those urban issues?

Briefly, it is because cities present more benefits than harms. The forces of attraction from any city rely on two correlated concepts: geographical proximity and population density (MARSHALL, 1920; DURANTON and PUGA, 2004).

Since Ancient ages until nowadays, people move from countryside into urban agglomeration, because cities concentrate buyers and sellers into a same geographical space,

¹ Freeman and Perez (1988) define a techno-economic paradigm as “a combination of interrelated product and process, technical, organization and managerial innovations embodying a quantum jump in potential productivity for all or most of economy and opening up an unusually wide range of investment and profit opportunities”. Consequently, a paradigm change implies a radical transformation on these current combinations, which has pervasive effects in the new range of products and systems, but most of all in the dynamics of the relative cost structure of all possible inputs to production.

which reduce transaction costs (WOOD and PARR, 2005). Firms and consumers can make cheaper and easier transactions given their proximity. It is a true incentive to attract even more people and firms into urban agglomerations. Then, urban density start to bring some “magical” outputs. The urban density is important, because it provides economies of scale to different stakeholders, which makes cities even more attractive (MORETTI, 2012).

Considering that, city favors the labor-intensive economic activities, because they offer not only infrastructure, but also jobs, utilities and amenities that enable people to succeed and enjoy pleasant experiences (MORETTI, 2012). They also have the power to attract firms, because they offer a thick labor market, specialized suppliers, and enable knowledge spillovers (MARSHALL, 1920).

In sum, the proximity and density are the drivers of any city, because a city *per se* can generate diverse economic externalities, which can maximize the utility curve of city’s stakeholders (HENDERSON, 1974; LUCAS, 1988; FUJITA et al., 1999; CUBERES, 2009; WINTERS, 2011).

The paradox is that this power of attraction also brings some negative outputs. On the one hand, a city has increasing returns to scale, because it accumulates capital (i.e. tangible and intangible assets) until its optimal size, and, consequently, it produces positive externalities (FUJITA et al., 1999; BLACK and HENDERSON, 1999; CUBERES, 2009). On the other hand, if a city exceeds its break-even point, it will generate additional congestion costs, which results in decreasing returns to scale, and, consequently, in negative externalities (MARSHALL, 1920; HENDERSON, 1974; LUCAS, 1988; FUJITA et al., 1999; EECKHOUT, 2004).

In other words, a city can accumulate capital until the point where the costs of this accumulation are lower than the return from the economic activities allocated in this agglomeration (FUJITA et al., 1999; EECKHOUT, 2004; CUBERES, 2009). This is happening in most of cities around the world. The rapid urbanization process without planning and management has been harming the urban development, and, consequently, the process of wealth creation in these places.

Cities are losing their innate gains from proximity and density, because they cannot provide the key assets to capital accumulation. Besides that, the “death of distance” considering the new means of transportation, digitalization and globalization reduced those transaction costs, which make cities loss their importance considering the relative gains of proximity to market manufactured goods (GLAESER, 2011).

Would the cities have lost their role as engines for sustainable socioeconomic development?

If cities are considered merely locational places to reduce transaction costs, maybe they are not more important for wealth creation. It is reasonable to think that firms and consumers will move for places that present the lowest cost to perform their activities.

However, it is the extremely opposite that is happening. People and firms are going to most expensive and fancy places to start their lives and business activities (MORETTI, 2012). What could explain something so contradictory?

Obviously that, the reduction of transaction costs are still important for any urban agglomeration succeed. However, the cities always were important because of another reason. Cities can engender ease face-to-face interactions that stimulate creativity and innovation, which enhance the knowledge production, and, consequently, the wealth creation (FLORIDA, 2002; ASHEIM and COENEN, 2005; SHAPIRO, 2006; ASHEIM et al., 2007; CUBERES, 2009; ASHEIM, BOSCHMA and COOKE, 2011).

Considering that, the urban crisis is not only because an unpredicted urbanization process, but also because they cannot accumulate capital with the current urban model anymore (EECKHOUT, 2004, CUBERES, 2009; YIGITCANLAR et al., 2010). In addition to bringing various congestion costs, the industrial city is also deterring the knowledge production, which is the most valuable asset in the new paradigm (HAJKOVA and HAJEK, 2014).

However, why did this happen? Why is knowledge so important to the new paradigm?

2.2. THE AGGLOMERATIONS OF FUTURE AND THE NEW TECHNO-ECONOMIC PARADIGM

Over time, economic activities and modes of production shape different kinds of agglomerations (HENDERSON, 1974; FUJITA, KRUGMAN and VENABLES, 1999). Villages, towns, cities, metropolises show that the evolution of urban agglomerations follow different trajectories, which rely on how they adapt their structures in order to encompass the current techno-economic paradigm (SKOJBERG, 1955; BELL, 1974; FREEMAN and PEREZ, 1988; EECKHOUT, 2004).

Actually, the cities are facing again the process of adjustments in their “regime of regulation” in order to start a new cycle of social and economic development (FREEMAN and PEREZ, 1988; PEREZ, 2004). It happened more than three centuries ago when pre-industrial city suffered several adaptations in order to support the boom of Industrial Revolution.

People migrated from countryside to search jobs and opportunities. A huge stock of human capital with different backgrounds could now exchange ideas as well as goods considering the astonishing growth of consumer market. These industrial cities should now invest in new technologies, because the huge density could cover fixed costs, which enable the deployment of those technologies on mass scale. Cities grew and established police, fire and sanitation departments, as well as road networks, schools, public transportation, hospitals, and later electricity distribution.

The mass production system enabled firms to produce goods in large scale with a standard quality in order to supply consumers' needs. This system is characterized by new sources of energy, by several workers performing fragmented processes and by the using of machineries resulted in a deep specialization process and definitively influenced all aspects of society (CHANDLER, 1990). It was the rising of the industrial society (SKOJBERG, 1955; BELL, 1976).

Within the application of basic scientific discoveries in goods, new production mode, new division of labor, organized markets, new sources of energy, and advancements in agriculture, logistics and communication characterized a major turning point in history, when the average income and population began to show a sustained growth. Social mobility could happen more often. Consequently, the bourgeoisie gauged forces with the pre-industrial elite by the political appreciation and economic power of the cities (SKOJBERG, 1955).

In comparison with the pre-industrial era, the extensive industrialization required a rational, centralized governance, in which economic, educational and social organization were based more on universalism than on particularism where the class system stressed achievement rather than ascription resulting in a small and flexible kinship system (SKOJBERG, 1955). Those gains of proximity and density showed their "magical" effects.

However, as mentioned before, this also brought several urban issues. The true is that the triumph of cities and the urban decay are both legacies of the Industrial Revolution (GLAESER, 2011). While the rapid urban growth provided unprecedented socioeconomic development, the lack of adequate planning to support this urban growth brought with it several issues. Cities cannot even provide basic services for citizens considering their high congestion costs.

Currently, the industrial cities are producing more negative than positive externalities, which results in low quality of life, declining economic growth and many other urban issues

such as unemployment, pollution, diseases, violence and so on (DIRKS and KEELING, 2009; WINTERS, 2011; MORETTI, 2012).

Besides that, the new techno-economic paradigm is shifting the productive base from handwork to brainwork, because the sustained growth of an economy results come from the knowledge application (i.e. technology) rather than other production factors, such as land, labor and capital (ROMER 1986; LUCAS 1988; AGHION and HOWITT 1992). Many manufacturing industries were once the main source of wealth creation in these cities, started to move their activities for other regions around the world where operational costs were lower (CHANDLER, 1990), apparently pre-industrial cities.

In the last centuries, the mode of mass production and the market based on mass consumption allowed a thriving growth of manufacturing industries, which was only necessary to put a good in the market that it was absorbed by consumers. The old techno-economic paradigm was utilitarian-based and machine-driven, because goods were more important than ideas, which enabled high returns to scale and high margins of profits for firms (FREEMAN and PEREZ, 1988).

The new revolution is happening at an even faster pace, because never before in the history, economic agents have elements as information, creativity and knowledge at these levels of complexity and availability (DOSI, 1988; FREEMAN and PEREZ, 1988; ANGELIDOU, 2014; HAJKOVA and HAJEK, 2014). It means that firms will mainly create value from knowledge, because it can grow exponentially and also provide unlimited increasing returns to the economy being the real source for wealth creation. One of interesting dynamics of this new paradigm is that firms require even more knowledge to produce profitable solutions in order to supply niche markets of more informed (and demanding) consumers. Consequently, it is even more difficult to achieve the innovation. In spite of knowledge can grow exponentially, the costs to produce this knowledge can make the development of a solution almost unfeasible (ROTHWELL, 1994).

In 21st century, it is almost mandatory that firms collaborate in different ways and intensities to develop complex solutions. Firms should raise up their networking for knowledge production in order to increase the efficiency and efficacy of their innovative process (ROTHWELL, 1994; CHESBROUGH, 2006; HUIZING, 2011).

In this sense, it is clear that digital applications provided easier connections among firms around the world by enabling them to exchange information and ideas even faster. However,

there are three major bottlenecks in considering that only Information and Communication Technologies (ICT's) should solve these networking issues.

First, it is because ICT's as well as many others technologies suffer from Jevons' paradox, in which more efficient means of transmitting information increase the time for transmitting information. It happens because better connections means create a more intensive relationship world, which require complementary ways to increase these connections.

Second, to produce the different types of knowledge (i.e. analytical, symbolic or tacit), there are different requirements for spatial proximity; from being relatively constant between places to being highly variable between places (ASHEIM et al., 2007).

Third, the world is still facing the digital divide, because in some countries and regions don't have an adequate infrastructure considering the lack of investments in ICT's.

Consequently, the digital communication increase the importance of face-to-face interactions to produce complex knowledge. In 21st century, human capital is the most important asset, because people are the very porters of knowledge and creativity (FLORIDA, 2002).

These aspects reinforce the crucial role that cities have in the new paradigm. Not only because the new creative industries are located in cities, but also because cities enable easier and relative low-cost interactions among people and firms, which speed up the production of knowledge and the development of complex solutions.

The question is: how is possible to deal within this dichotomous context in order to overcome the urban issues and start a new cycle of wealth creation?

It seems clear that if cities maintain this industrial configuration, it will not possible to sustain the socioeconomic development over time (MORETTI, 2012). The new technoeconomic paradigm present a very different dynamic where this industrial configuration not only hinder cities to thrive, but also accelerate their urban decline (EECKHOUT, 2004; DIRKS and KEELING, 2009).

To overcome this crisis, cities must change their trajectories with a new model for urban development, because the new paradigm demands a very different dynamic. This new city model should be able to cope with those issues and also encompasses the dynamics of the new paradigm in order to redeem the very essence of cities, which is concentrate and connect people and firms.

The cities of future should offer a set of urban assets to attract and retain creative knowledge workers and innovative firms in order to start a new cycle of wealth creation. In

other words, cities should be transformed in a more efficient and livable space that can enhance the quality of life and stimulate creativity and innovation (ZYGIARIS, 2013; ANGELIDOU, 2014; NEIROTTI et al., 2014). Cities must become “smart cities” (CARAGLIU et al., 2011; NEIROTTI et al., 2014; LEE, HANCOCK and HU, 2014; DE JONG et al., 2015; ZUBIZARRETA et al., 2016).

However, what really is a “smart city”?

To answer this question, it is necessary to deepen theoretical knowledge about smart cities. It was performed a systematic literature review in order to identify the conceptual definitions and to define the dimensions of a smart city.

3. THE SMART CITY CONCEPT: A NEW ENGINE FOR WEALTH CREATION

The discussion about how cities should cope with their key issues has become a trending topic (DE JONG et al., 2015). There is a consensus that if cities maintain an industrial configuration, they will perish in the next few decades.

Actually, most of urban issues are intimately connected with an industrial city model driven by mass production and consumption of declining manufacturing industries, which are supported by outdated buildings and infrastructures, stuck institutional frameworks, and a laggard knowledge base (CARTER, 2013; HAJKOVA and HAJEK, 2014; BOLÍVAR and MEIJER, 2016).

In this sense, the major concern lies on how is possible to redeem those natural city advantages in order to start a new cycle of wealth creation?

The fact is that in the 21st century cities should have a crucial role to play in for the economic, social and environmental development (ANGELIDOU, 2015; GIL-GARCIA, PARDO and NAM, 2015; MARSAL-LLACUNA and SEGAL, 2016).

Thus, it is necessary to find a model so that cities can fit into the new paradigm in order to overcome urban-related issues (NAM and PARDO, 2011). Academics, practitioners and private companies elected the smart city model as the most appropriated alternative for cities to overcome those issues and at same time leapfrog them into the new paradigm (BAKICI, ALMIRALL and WAREHAM, 2013; ANGELIDOU, 2014; DE JONG et al., 2015; ZUBIZARRETA et al., 2016).

However, the term “smart city” does not present a solid definition yet, which may restrain the model adoption by those industrial cities (ALBINO et al., 2015).

3.1. REVISITING THE CONCEPT: A SYSTEMATIC LITERATURE REVIEW

Aiming at clarifying the smart city concept, a protocol for systematic review was followed so that relevant papers on smart city concept could be analyzed (see Table 1). Data gathering criteria included only scientific papers in English published between 1990 and 2016 from Web of Science and Scopus Elsevier databases, which showed up “smart city/smart cities” in their title, abstract and/or keywords. Subject areas related to social sciences, business and

management, economics, planning development and urban studies were defined, considering the author's background.

Table 1 - Search Criteria for Systematic Literature Review

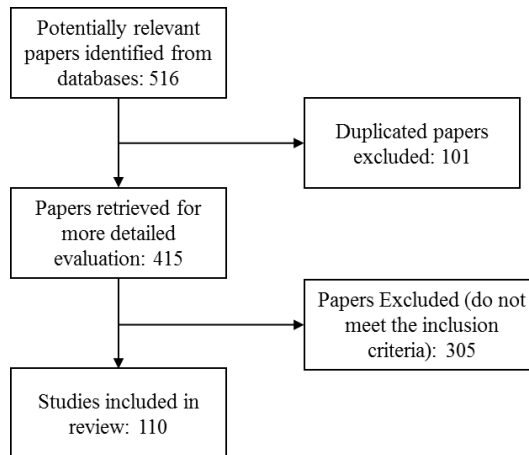
Database	Keyword(s)	Search Criteria	Results
Web of Science	“smart cit*”	Data Range: 1990 – 2016 Fields of Knowledge: Urban Studies; Economics; Management; Business; Social Interdisciplinary Studies; Planning Development Types of document: Only Articles Language: Only English	156 papers found.
Scopus	“smart cit*”	Data Range: 1990 – 2016 Fields of Knowledge: Social Sciences; Economics, Econometrics and Finance; Business, Management and Accounting; Types of document: Only Articles Types of document: Only Journal Language: Only English	360 papers found.

Results identified 360 documents in Scopus database and 156 documents in Web of Science database, which represent a total of 516 papers. Subsequently, duplicated works from the initial sample were excluded, remaining 415 papers to be further analyzed.

After that, a new selection was conducted by analyzing the abstracts and introduction according to the following inclusion criteria:

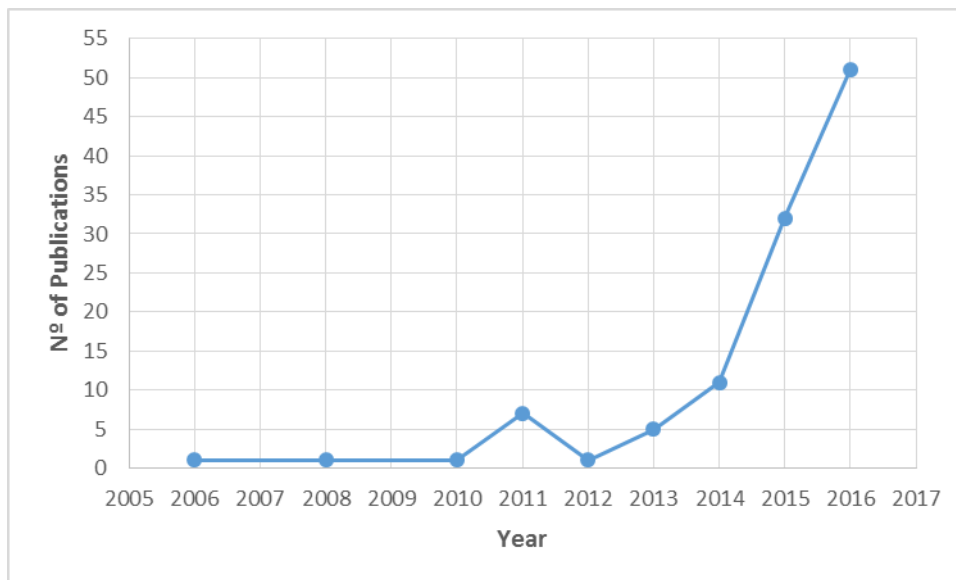
- a) papers that present a clear definition of smart city concept;
- b) papers that discuss more than a specific topic in a city (i.e. public transport, security, health, etc.) and try to make a relation with smart city concept;
- c) papers that present more than a technology application in a city (i.e. big data, smart grid, open data, etc.).

The final sample had 110 papers. This selection flow was presented in Figure 1.

Figure 1 - Systematic Review Flow Diagram

Source: Elaborated by the author

The results show that literature about smart cities has been growing in the last seven years (Figure 2) and the journals with the highest number of publications are: Journal of Urban Technology (9), Social Science Computer Review (8) and Cities (6).

Figure 2 - Publications about smart cities per year

Source: Elaborated by the author

After that, these papers were divided in two groups: 1) most cited papers – citation-based analysis is widely used as a measure of paper quality and also means that these papers have already made theoretical/empirical contributions towards knowledge accumulation and development about the theme (Saha et al., 2003); and 2) recent papers – recognizing that the

citation-based method may discriminate against recent publications, an additional group from the most recent papers (2014–16) was formed.

The main entry was retained in the first group under consideration, while duplicating entries were eliminated from the subsequent group. Thus, abstracts, introduction, theoretical background and methodological procedures from all selected papers were read in order to extract the main definitions related to the smart city concept. These several definitions were condensed and integrated in a comprehensive definition that required a content analysis in order to clarify some of these concepts.

Considering that, the content analysis was performed following the three stages proposed by Bardin (1977): pre-analysis, exploration and data treatment. All papers were read in a fluctuant mode and preliminary hypothesis and assumptions were formulated.

These definitions and assumptions were showed in the further sections.

3.2. SMART CITY DEFINITIONS

The term “Smart City” emerged in the beginning of the 1990’s, coined as the relationship between technology, innovation and urbanization growth worldwide. In these last decades, many different urban experiences have been developed, which increase the importance of this topic in both private and academic perspectives (LEE, HANCOCK and HU, 2014).

Since 90’s until nowadays, the smart city concept become more comprehensive, because the economic, social and environmental aspects were introduced within the technological perspective (DE JONG et al., 2015). Actually, the concept is an evolution of the older concepts such as “Digital City”, “Information City” and “Intelligent City” (KOMNINOS, 2002; DE JONG et al., 2015).

In that way, Harrison et al (2010) define a smart city as an instrumented, interconnected and intelligent city, which present several integrated information and communication technologies (ICT’s). These ICT’s are used to improve public services and hard infrastructures in order to enhance the quality of life (KUK and JANSSEN, 2011; LEE, PHAAL and LEE, 2013; PAROUTIS et al., 2014). These technologies provide a set of data and information that can help a city to make a better use and management of natural and financial resources, and also can solve some problems of urban living, like traffic control, energy consumption, waste management, water and sewage management (LEE, PHAAL and LEE, 2013; NEIROTTI et al., 2014).

In addition, one of the major concerns and challenges refer to environmental sustainability. Given the scarce resources and the pressures from different stakeholders, environmental sustainability is one of the big topics that every city has to discuss in their political agenda (HERRSCHEL, 2013). Smart cities need to find solutions through an optimal allocation of these scarce resources to reach some international goals, like reducing greenhouse effects, energy and water consumption, recycling and reducing pollution (GIFFINGER et al., 2007; NEIROTTI et al., 2014). More efficient processes and efficient management of natural resources, less consumption and waste awareness, are some sustainable goals that can be achieved (HERRSCHEL, 2013). There are much more indirect costs of being a filthy and polluted city.

Thus, environmental sustainability is an important output that a smart city should strive, aiming the enhancement of people's quality of life. A city has to develop policy-shaping mechanisms to facilitate collaboration, negotiation and engagement of city agents in order to mitigate these problems. It is expected that these actions will transform cities into a more sustainable place, which, consequently, will enhance the quality of life (HERRSCHEL, 2013; DE JONG et al., 2015).

In sum, smart cities have to seize the opportunities to deliver value and enhance quality of life of their inhabitants through the deployment of ICT's and new technologies (i.e. smart grids, street lightning, traffic sensors, climate meters, etc.) in their urban infrastructure and should be used to improve public facilities and utilities. These technologies can help cities to increase efficiency and environmental sustainability, reduce congestion costs and bring better returns of investments (KUK and JANSSEN, 2011; PAROUTIS et al., 2014; DE JONG et al., 2015).

In other words, these technologies can reduce, even mitigate, the transaction costs and also can provide a set of opportunities to create value considering their multiplier effects. It is no accident that big tech companies see smart cities as a huge potential market to introduce technologies in the urban environment (HARRISON et al., 2010; PAROUTIS et al., 2014).

Nevertheless, a smart city is far from being limited to the application of technologies in the urban environment (HOLLANDS, 2008; NEIROTTI et al., 2014; ALBINO et al., 2015; ZUBIZARRETA et al., 2016). Obviously that in 21st century any city should be digital in order to facilitate its development, but cities are essentially made by people. The focus of smart cities must be on people.

Actually, the human factor is at the core of economic, social, cultural and environmental processes, because the same individual can play different roles in a city, such as worker, student, consumer, inventor, citizen and so on (FLORIDA, 2002; SHAPIRO, 2006; HOLLANDS, 2008; MIGUELEZ and MORENO, 2014; ALBINO, BERARDI and DANGELICO, 2015; BETZ et al., 2016). As an example, smart cities should provide efficient mobility networks in order to ease interactions among people (CARAGLIU et al., 2011).

Smart cities must have high-skilled and creative human capital that could be trained on knowledge institutions and could work in knowledge-intensive firms to develop solutions for a global market (FLORIDA, 2002; SHAPIRO, 2006; WINTERS, 2011; ZYGIARIS, 2013; NEIROTTI et al., 2014; MARKKULA and KUNE, 2015). In other words, there is no smart city without knowledge and creativity, which increase the importance of people to achieve innovation (ZYGIARIS, 2013).

Considering the importance of human capital, Winters (2011) defines that “smart cities” are metropolitan areas with a large share of the adult population with a college degree. He claims that they may be less likely to commit crimes, more likely to vote, more likely to support local art and other cultural amenities, and more tolerant of others (FLORIDA, 2002 apud WINTERS, 2011). In addition, Shapiro (2006) proved that there is a causal effect of concentration of college graduates on local area employment growth. These college graduates can also improve quality of life in an area with a “consumer city” style (i.e. openness of amenities such as bars and restaurants), rather than from more politically mediated area attributes such as crimes, schools and pollution (SHAPIRO, 2006).

It is important to highlight that high talented people (FLORIDA, 2002) are lured by attractive and functional spaces, which means that only physical infrastructure and basic services are not enough to satisfy their needs (MIGUELEZ AND MORENO, 2014). Winters (2011) said that “an individual will move if an alternative location offers a higher utility than his current location and the utility differential is sufficiently high to compensate the individual for the costs of moving”.

Therefore, smart cities have to present unique urban design and cozy amenities to attract and retain “brains”. They have to offer options for entertainment and leisure, like museums, restaurants, stores, cinemas, theaters, and also an enjoyable environment for urban living aspects, like unique buildings architectures, aesthetic pleasing public places and vistas, walkable streets and beauty elements in the public realm.

However, it is important to highlight that merely attracting capital may not be the solution for all issues, because it will depend on how the capital is used in urban space (VANOLO, 2014). It is necessary to create a set of mechanisms to facilitate knowledge flow, to raise knowledge base and to promote innovation (LEYDESDORFF and DEAKIN, 2011; HAJKOVA and HAJEK, 2014). A smart city should increase the knowledge production and application by enabling an ease interaction and collaboration among city's stakeholders, making them integral parts of an innovation ecosystem (LEYDESDORFF and DEAKIN, 2011; HAJKOVA and HAJEK, 2014).

To facilitate knowledge production, a smart city should present a new institutional governance model (LEE et al., 2014; MEIJER and BOLÍVAR, 2016) in order to enable the community collaboration and participation, and improve public services and infrastructures aiming at offer high quality of life and a prolific innovation ecosystem (ZYGARIS, 2013; NEIROTTI et al., 2014; ALBINO et al., 2015). New partnerships (public and private) and institutions should be created to start some initiatives that can boost urban development (LEE et al., 2014). Smart legal rules and arrangements can assist all actors and make cities flourish. They offer proper conditions to seek innovative opportunities and improve urban dynamics through a smart governance (GIFFINGER et al., 2007).

Based on the systematic literature review, it is possible to affirm that the smart city concept comprehends different social, economic, urban, institutional, technological and environmental aspects in a systemic approach (HOLLANDS, 2008; NEIROTTI et al., 2014; ANGELIDOU, 2015). Besides that, the smart city concept must incorporate an evolutionary perspective, which means that smart city is a model for urban development (ANGELIDOU, 2014) and not a simple adjective.

Table 2 shows the relevant definitions according to the top ten most-cited and recent papers on smart city concept.

Table 2 - Main ideas regarding Smart City definitions

Author(s)	Definitions
Hollands (2008, p. 315)	“...progressive smart cities must seriously start with people and the human capital side of the equation, rather than blindly believing that IT itself can automatically transform and improve cities”
Caragliu et al. (2011, p. 70)	“We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.”

Leydesdorff and Deakin (2011, p. 61)	“Such cities are “smarter” at exploiting information and communication technologies and are not only creative or intelligent in generating intellectual capital and creating wealth, but also in selecting environments governing their knowledge production, making them integral parts of emerging innovation systems.”
Zygiaris (2013, p. 218)	“Smart city conceptions as “green” referring to urban infrastructure for environment protection and reduction of CO2 emission, “interconnected” related to revolution of broadband economy, “intelligent” declaring the capacity to produce added value information from the processing of city’s real-time data from sensors and activators, whereas the terms “innovating”, “knowledge” cities interchangeably refer to the city’s ability to raise innovation based on knowledgeable and creative human capital”
Angelidou (2014, S3)	“Smart cities are all urban settlements that make a conscious effort to capitalize on the new Information and Communications Technology (ICT) landscape in a strategic way, seeking to achieve prosperity, effectiveness and competitiveness on multiple socio-economic levels.”
Lee et al. (2014)	Smart Cities have to consider a global vision to develop and implement a set of policy-mechanisms through an alternative institutional governance model to change this scenario.
Neirotti et al. (2014)	Smart City concept goes beyond the focus of ICT vendors on digitalization, and also takes into consideration some of the aspects that are related to soft components that have crucial importance on the urban, social and economic development of a city, such as human capital.
Albino, Berardi and Dangelico, (2015, pg. 3;7)	“The smart city concept is no longer limited to the diffusion of ICT, but it looks at people and community needs. People are the protagonists of a smart city, who shape it through continuous interactions and the community of a smart city needs to feel the desire to participate and promote a (smart) growth.”
De Jong et al. (2015, pg. 34)	“The concept of ‘smart city’ is also relatively new in origin, although it stems from, or can at least be seen as a more advanced successor to, the older ‘information city’, ‘digital city’ and the ‘intelligent city’ categories (...) The more recent definitions are more comprehensive. Considering an apparent resemblance with the category ‘knowledge city’, ‘smart city’ is seen to be the desirable direction for urban development is similar: information and knowledge-intensive production without high environmental impact.
Zubizarreta et al. (2016, 04015005-7)	“Smart cities are not only an aggregation or a merger of some applications, they represent a new cultural idea of cities. Technology is a driver, a facilitator for the city development, but if there is not a strategy and a purpose that technology must follow, the risk is disorder.”

These several definitions and ideas regarding the literature show that the smart city concept still has not a singular definition. It seems that there is a lack of theoretical background to support a better explanation for this new phenomenon.

Obviously that, it is not an easy task to fully comprehend the dynamics behind this complex study object. It should begin this definition considering the very essence of any city, which is to bring together people into same geographical place in order to ease the flourish of ideas and knowledge exchange among them. Also has to consider how the new technologies influence the dynamics of the global economy and their effects on society in a local perspective. Besides that, it should encompass the new values, assumptions and drivers that demand a huge transformation of several city structures.

Actually, the smart city concept should provide a powerful tool to understand how the cities of future can deliver value for their different stakeholders in a more comprehensive way. In this sense, a smart city can be defined as:

An urban space that offers a high quality of life and a prosperous environment for creativity and innovation in the most sustainable way through the use of digital technologies in order to enable a collaborative knowledge network, a flexible institutional structure, an integrated governance model and a functional urban infrastructure and design.

Considering this definition, it is necessary to define analytical dimensions to ease the understanding of the possible trajectories to make a city smarter.

3.3. DIMENSIONS OF A SMART CITY

The literature indicates that it is necessary to approach the phenomenon from a holistic view to understand the dynamics of a smart city (NEIROTTI et al., 2014; ANGELIDOU, 2014; LETAIFA, 2015). In this sense, the different concepts and definitions were grouped into a multifaceted model, which allows to identify what really make a city smarter.

In order to identify which are the dimensions of a smart city, it was extracted the most frequent words from all publications with software NVIVO 11. These words were codified and grouped into similarity proximity (clustering), which enabled to identify that a smart city has four dimensions (Table 3).

Table 3 - Most Frequent words and categorized dimensions

Frequent Words	Dimensions	Main References
<ul style="list-style-type: none"> ▪ development ▪ governance ▪ planning ▪ management ▪ strategies ▪ policies ▪ initiatives ▪ collaboration ▪ participation ▪ integration ▪ flexibility ▪ data ▪ information ▪ digital ▪ public services 	City Governance	(Dodgson and Gann, 2011; Kuk and Jansen, 2011; Herrschel, 2013; Lee, Hancock and Hu, 2014; Vanolo, 2014; Dupont, Morel and Guidat, 2015; Gil-Garcia, Zhang and Puron-Cid, 2016; Castelnovo, Misuraca and Salvodelli, 2016; Bolívar and Meijer, 2016; Dameri and Benevolo, 2016)
<ul style="list-style-type: none"> ▪ design ▪ mobility ▪ infrastructure ▪ urbanization 	Environ-Urban Configuration	(Caragliu et al., 2011; Lee, Phall and Lee, 2013; Carter, 2013; Paroutis et al., 2014; Neirotti et al., 2014)

<ul style="list-style-type: none"> ▪ environment ▪ quality of life ▪ sustainability 		
<ul style="list-style-type: none"> ▪ institutional ▪ culture ▪ inclusion ▪ accessibility ▪ people ▪ social ▪ citizens 	Socio-Institutional Structure	(Hollands, 2008; Albino et al., 2015; Capdevila and Zarlenga, 2015; Betz, Partridge and Fallah, 2016; Thomas et al., 2016; Vanolo, 2016)
<ul style="list-style-type: none"> ▪ entrepreneurship ▪ business ▪ industries ▪ economy ▪ technology ▪ creativity ▪ networking ▪ competitiveness ▪ innovation ▪ knowledge ▪ research ▪ education ▪ human capital 	Techno-Economic Dynamics	(Shapiro, 2006; Leydesdorff and Deakin, 2011; Winters, 2011; Bakici, Almirall and Wareham, 2013; Zygiaris, 2013; Albino et al., 2015; Kraus et al., 2015; Markkula and Kune, 2015; Del Bo and Caragliu, 2016)

These dimensions encompass different elements that shape the dynamics of this new model for urban development (ANGELIDOU, 2014; GIL-GARCIA, NAM and PARDO, 2015). It is assumed that the combination of different elements should enhance the smartness of a city (LETAIFA, 2015; GIL-GARCIA, ZHANG and PURON-CID, 2016). However, it is important to first define how these dimensions are configured.

Considering the systematic literature review and the definition created in this work, four dimensions were categorized as **City Governance; Environ-Urban Configuration; Socio-Institutional Structure; Techno-Economic Dynamics**. These dimensions are further detailed below.

The **governance dimension** of a smart city has a central focus on collaboration between the different stakeholders that actively participate in a collective decision-making process to make or implement public policy or manage public programs or assets (GIL-GARCIA, NAM and PARDO, 2015; CASTELNOVO, MISURACA and SALVODELLI, 2016). This dimension also considers the different mechanisms, instruments, and processes (DAMERI and BENEVOLO, 2016) that are used to change the traditional functions of government (MEIJER and BOLÍVAR, 2016) in order to adapt city structures into the new paradigm (GIL-GARCIA, ZHANG and PURON-CID, 2016). The governance dimension encompass both formal (i.e. rules, laws, municipal ordinances and territorial policies, etc.) and informal institutions (i.e. partnerships, negotiations, networks) that are arranged in order to solve problems, enforce rules,

or allocate resources (SMITH et al., 2016). The governance is also important to improve the city administration in order to deliver value to citizens (GIL-GARCIA, NAM and PARDO, 2015; MEIJER and BOLÍVAR, 2016). The use of technologies in the government (e-government) should improve public services and also make it more open, transparent and democratic (BOLÍVAR and MEIJER, 2016).

The **environ-urban dimension** is composed by the built infrastructure, mobility, urban design, facilities and amenities and natural environment (CARAGLIU et al., 2011; NEIROTTI et al., 2014; GIL-GARCIA, NAM and PARDO, 2015). Focusing on wealth generation, through the attraction of new business, and quality of life of citizens, a city must provide an adequate infrastructure (CARAGLIU et al., 2011). Smart people want to live in cozy smart places; therefore, urban design is a key asset (SHAPIRO, 2006; MIGUELEZ and MORENO, 2014; BETZ et al., 2016). Urban amenities and facilities implementation must be conducted towards a sustainable environment, involving the improvement of lighting technology through solar panels and LED, as well as sidewalks, streets, bike paths and integrated urban design roads (LEE, PHAAL and LEE, 2013). Aligned to that, smart places must provide security to citizens, with monitoring cameras, lighting and more police on the streets (CHIODI, 2016). This dimension stress the importance of a good urban mobility, which means that a smart city should present multimodal accessibility to ease citizens commuting (CARAGLIU, DEL BO and NIJKAMP, 2011). It is also required to analyze the building potential of existing areas and to propose new uses to them if necessary, as well as to recover them to maintain their attractiveness in the urban landscape.

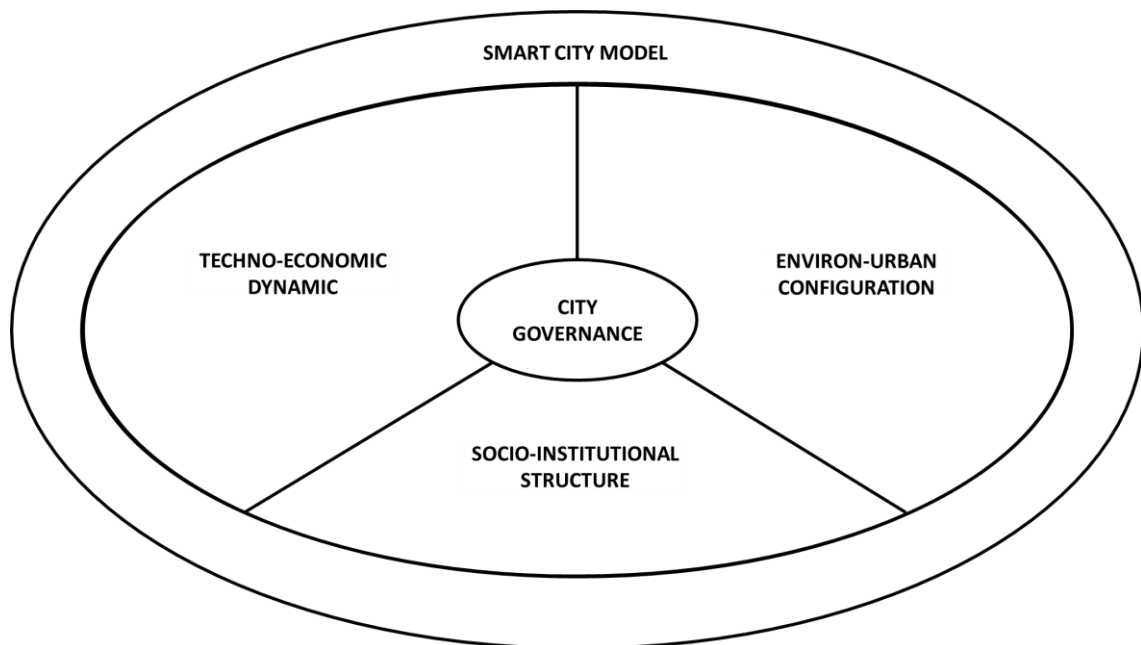
The **socio-institutional dimension** involves cultural plurality, civic engagement and social cohesion. Smart cities should provide an environment that attracts smart people, stimulating creativity through a culture of flexibility, collaboration and tolerance in order to bring together heterogeneous people (i.e. gender, age, nationality, ethnic, religion and so on) who already experience this dynamic lifestyle (NAM and PARDO, 2011). Culture is extremely related with knowledge economy, because a creative perspective relies on symbolic knowledge that enable cities to change their set of values and assumptions related to a traditional economy (FLORIDA, 2002; 2009).

The **techno-economic dimension** of a smart city considers the dynamics of the knowledge economy. This dimension comprehends all aspects that can foster innovation and entrepreneurship activities in a “glocal” perspective (NEIROTTI et al., 2014). The literature highlights the importance of human capital, science and technology institutions and knowledge

intensive firms in order to raise up the knowledge base of a city through intensive-research and education activities (HAJKOVA and HAJEK, 2014; MARKKULA and KUNE, 2015). Besides that, this dimension also encompass the collaboration networks among various stakeholders that should create competitive advantages for developing a local innovation ecosystem to produce global creative solutions (LEYDESDORFF and DEAKIN, 2011; HAJKOVA and HAJEK, 2014; MARKKULA and KUNE, 2015). Thus, the startups, accelerators, incubators, technological parks and clusters of innovation should modify the present dynamic, in order to reach a sustainable socioeconomic development (LEYDESDORFF and DEAKIN, 2011).

These dimensions shape the model of smart city, which is represented in the Figure 3.

Figure 3 - The Dimensions of Smart City Model



Source: Elaborated by the author

After this extensive literature review, it is assumed that:

- a) Every smart city has four dimensions
- b) Each dimension of smart city is comprised by different elements.
- c) The 'smartness' of a city relies on the features of these elements and how these elements are interrelated.
- d) Cities can enhance its smartness through the implementation of projects that incorporate these specific features into the different elements of each dimension.

These assumptions guided the next steps of the research. Considering that there is no fully-fledge smart city, it was necessary to conduct a qualitative research in certain cities in order to identify what elements make the city smarter.

To reduce the scope of the research and achieve the proposed objectives, it was used the method of multiple case studies. This work focused on four European cities (Amsterdam, Barcelona, Lisbon and Vienna) that have official smart cities projects in order to capture what really can make a city smarter. The comparison of these undergoing urban experiences would help to refine and validate those dimensions. These methodological procedures are detailed in the next section.

4. METHOD

An exploratory and descriptive research was performed in order to achieve the objective of this work, which is “to present an integrated framework to understand the process that make cities smarter”.

Considering the complexity of the object of this research and for being a recent theme, it was made an exploratory research using the qualitative method of multiple case study, which is the best choice to understand complex (YIN, 2010) phenomena like the process of urban transformation. Then, these stages are further detailed below.

4.1. MULTIPLE CASE STUDY

In this work, it was realized a multiple case studies of four European cities. The selection of cities and their smart city projects was done through documental analysis. Then, it was realized some interviews with experts in these projects that were guided by a semi-structured questionnaire. After that, the data was analyzed in order to disclose the driving elements of smart city and their features. These phases were detailed in the sub-sections below.

4.1.1. Case Studies Selection

The case selection was based on three main criteria:

a) continent – Europe surpassed all stages of the industrialization process and was also one of the first continents to suffer the deindustrialization process. Thus, European cities had to adapt to this process earlier than other cities in the rest of the world. Based on that, there are now several projects funded by European Union to implement smart city solutions that are already in advanced stages;

b) cities – firstly, a documental analysis aimed to identify which conceptual definition is applied on public and private projects/initiatives related to smart city around Europe. Within this technique, it was possible identify some cities that are developing smart city projects and initiatives. Then, it was chosen four European cities (Amsterdam, Barcelona, Lisbon and Vienna) that figure in the top positions of smart cities ranking of a report called, “Mapping smart cities in the EU” (Manville et al., 2014). This is a widely used report, commissioned by

the European Parliament’s Industry Research and Energy Committee, which analyzed different cities in Europe and ranked them according to their smart initiatives; and

c) projects – the projects and initiatives developed in the cities were chosen considering if their objectives were related to the analytical dimensions developed in the systematic literature review. It was searched and analyzed projects in those four chosen cities that are linked with European lighthouse projects, reports from big tech vendors (IBM, SIEMENS, CISCO and so on), reports and forecasts from major consulting firms, plans and projects related to innovation districts (e.g. 22@ Barcelona) and official websites of each City Hall. After the definition of projects, the key-members (i.e. experts or coordinators) were contacted in order to schedule an interview.

4.1.2. Data Collection

In the second phase, six experts (Table 4) that work or worked in smart city projects/initiatives in one of these cities were interviewed during the month of May in 2017 in order to disclose the driving elements of a smart city and their features. Considering that smart city projects should have several partners, there are some interviewees that participate in more than one specific project.

Table 4 – Description of Interviewed Experts

Expert	Actual Organization	Expert Background	City	Projects/Initiatives involved	Actor
Director of the Strategic Planning Department	Lisbon City Hall	Geographer and Urbanist	Lisbon, Portugal	- Program BIP/ZIP - Sharing Cities	Government
Former Director of Services and Planning and Director of Urbanism at Barcelona City Hall	Consultancy Firm	Architect and Urbanist	Barcelona, Spain	- 22@ Barcelona: Innovation District	Government
Professor at University of La Salle Barcelona and Architect in Architecture Studio	Consultancy Firm and University	Engineering and Architect	Barcelona, Spain	- 22@ Barcelona: Innovation District	Firm
Coordinator in EU projects related to sustainability	Private company	Sustainable Development	Vienna, Austria	- Smart City Wien Agency - Smart Together	Firm
Professor at Amsterdam University of Applied Sciences	University	Economics	Amsterdam, Netherlands	- Amsterdam Smart City Platform - Smart Entrepreneurial Lab	University
Project Manager and program developer at Waag Society	Innovation Lab	Arts and Computer Science	Amsterdam, Netherlands	- Smart Citizens Lab	People

These experts were chosen considering if they work/worked in smart city projects or initiatives implemented in one of those cities. They represent all important agents of a city (i.e. government, S&T institutions, firms and citizens).

Interviews were based on a semi-structured questionnaire (See Appendix A) with questions related to each dimension and were conducted in Portuguese (Lisbon) and English (Amsterdam, Barcelona and Vienna) languages. All interviews were recorded and transcribed in order to allow further analysis.

4.1.3. Data Analysis

A qualitative analysis of each interview was performed, highlighting important statements related to each question. Each statement was allocated with the related dimension, and, after that was compared with the results of documental analysis.

This final stage served to show which are the driving elements of smart city in the opinion of the experts. Besides that, these elements were crossed with the results of literature review in order to define the features of each driving element.

After that, all results were triangulated in order to make a relationship between dimensions, elements and features. This step provided a rich analysis about how they could be integrated in order to enhance the smartness of a city.

5. DISCLOSING THE DIMENSIONS OF SMART CITIES: EVIDENCES FROM EUROPE

In this section, it was presented the results based on the four analytical dimensions (i.e., city governance, enviro-urban configuration, socio-institutional structure, techno-economic dynamics) in order to show the relevant elements that can make cities smarter.

5.1. THE SMART CITY PROJECTS

Considering the results from all interviews and documental analysis, it is possible to affirm that is only possible to transform a traditional city into a smart city through projects. These projects will have different scale and scope, because each city has different needs and potentialities. It means that smart city projects will have different term, will involve different numbers of stakeholders, will need different investment amounts, and will deliver different results. Then, the projects of the four chosen cities were described following their chronological order. The main topics of each project was summarized in Appendix B.

5.1.1. Barcelona

In 1999, the Barcelona City Hall decide to start its most emblematic smart city project, which is the 22@ Barcelona – Innovation District. The 22@ Barcelona project involves the transformation of an old industrial district (Poblenou District) into an innovation district, which aims at perform a massive urban refurbishment and achieve an outstanding social and economic revitalization (Pareja-Eastaway, 2015). These three different axes encompass some strategies that shaped the implementation of several projects (22@ Barcelona Plan).

The refurbishment plan aims at upgrading urban environment in order to improve quality of life and of workplace. It comprehends the construction and improvement of social housing, facilities and green spaces, new mobility model (i.e. mix of walkable streets, exclusive bike and bus lanes, trams and metro lines and so on), advanced infrastructures (i.e. pneumatic waste selection, central heating and cooling, optical fibers and underground galleries of energy and telecommunications).

The social and economic revitalization aims at shifting traditional economic activities into knowledge intensive activities in order to boost local economy and promote better opportunities for new and old habitants. The main strategy was the formation of innovation

clusters by attracting knowledge intensive firms and universities linked with Life Science, ICT's, Biotechnology, Energy and Design sectors.

It is important to highlight that this mega project (22@ Barcelona) started with public investments in infrastructure (estimated in €310 millions), but after this, the major investments were spent by private organizations, which were benefited with tax breaks, new rules of land use and financial incentives (BARCELONA CITY HALL, 2017).

The implementation of the plan has been coordinated and carried out by the “Barcelona Activa”, since 2000, which is an urban development agency linked to City Hall. This agency offers a set of services and facilities to support local business and entrepreneurial activities, and promotes training programs for workers that are searching for employment (BARCELONA ACTIVA, 2017). Working towards a greater coordination of the public-private-community ecosystem, the Barcelona Activa develop and implement several plans in order to ensure city competitiveness and achieve a sustainable socioeconomic development. The agency also acts to strengthen the city's brand in the global scenario in order to bring investments and companies to Barcelona.

5.1.2. Amsterdam

In Europe as well as worldwide, Amsterdam is at the forefront of smart city projects. The city has a long tradition of innovation that makes Amsterdam one of the most prominent ecosystem to start new projects.

In 2009, the Amsterdam Smart City Program was initiated by some public and private organizations that created multi-stakeholder platform, called “Amsterdam Smart City - ASC”. This platform was created to address urban challenges through collaboration between diverse stakeholders in order to speed up and facilitate different projects that would benefit quality of life and sustainability in the metropolitan region (VAN WINDEN et al., 2016). The platform takes a broader perspective of smart city projects by also including projects without a strong technology approach.

The ASC platform has strategic and project partners that have different functions and responsibilities. The latter are involved on the different projects in order to develop innovative urban solutions. The formers compose the board during minimum three-year with renewable commitment to discuss latest concepts, questions and calls for urban issues and pay an annual fee to maintain the staff of ASC organization.

Actually, the ASC organization acts as an enabler and facilitator in this process through the community website “www.amsterdamsmartcity.com”, which serves as connector between urban stakeholders that want to start a smart city project with experts that can help its development (VAN WINDEN et al., 2016). Besides that, the strategic partners, such as Amsterdam University of Applied Sciences (AUAS) and Waag Society, have been developing projects and initiatives in order to make Amsterdam an even more innovative, inclusive and sustainable place.

The Smart Entrepreneurial Lab is a project created by Amsterdam University of Applied Sciences that aims at connecting university and companies to co-create solutions for different urban issues. The college students join in a research project during fourteen weeks, in which they have to solve real problems in practice for a company. In other words, this smart city project provide for students real experiences that prepare and motivate them to solve other urban issues. Besides these problem-solving activities, the university organize some workshops and academic events to discuss about relevant questions related to smart city topics.

The Waag Society perform a different role in this ecosystem. Waag Society is an institute for art, science and technology that explores how emerging technologies (digital, biotech and cognitive sciences) interact with society. It offers multifunctional spaces that are used to realize events, to promote training and to develop experiments and pilot projects that focus on open, fair and inclusive technologies. This institution created the Smart Citizens Lab, which is a project that aims to empower the people in the city by measuring their related-issues, such as water quality, air quality, noise pollution and so on. In this Lab, they can develop integrated solutions for the city by incorporating a citizen-centric approach.

5.1.3. Lisbon

In Lisbon, among the different projects related to smart city, stand out two projects: "Sharing Cities" and “BIP/ZIP Program”.

In 2011, Lisbon City Hall created the “BIP/ZIP” Program, freely translated as “Neighborhoods and Priority Areas of Intervention”. Every year the City Hall supports and funds local activities and projects in specific vulnerable areas that are proposed by residents’ associations, non-governmental organizations, companies and so on. This project aims to foster public-private partnerships, citizen engagement and minor interventions in specific areas in

order to strengthen the socio-territorial cohesion in the municipality (LISBON CITY HALL, 2017).

The “Sharing Cities” program is a consortium among three lighthouse cities (Lisbon, London and Milan) and other three fellow cities (Bordeaux, Burgas and Warsaw), which started in 2016 and received 24 million euros in European Union funding. This 5-year project seeks to develop affordable, integrated and commercial-scale smart city solutions with high market potential, such as e-mobility, energy management, smart lamp posts, urban sharing platform, user-centric services and retrofitting of buildings (SHARING CITIES, 2016).

This project has been transforming specific areas of each city’s district into a “living lab” where different technologies and ideas are co-created and tested. All practices, experiences and results are shared among cities of consortium and the validated smart city solutions are implemented across different European cities.

5.1.4. Vienna

In 2014, the Vienna City Hall launched the Smart City Wien - Framework Strategy, which is an long run term project that aims at transforming the city until 2050 into the most sustainable, livable and innovative place around the world. The framework strategy was developed though multi-stakeholder process that city administration; research institutions, private sector and civil society discussed about what city they want for the future (SMART CITY WIEN, 2017).

In order to achieve the key goal of this project that is “offer optimum quality of living, combined with highest possible resource preservation, for all citizens”, it is necessary that all stakeholders work together considering cross-cutting smart city concept (VIENNA CITY ADMINISTRATION, 2014). Then, the main question was: how to bring together stakeholders with different agendas in order to achieve those strategic goals in a multi-sectorial manner?

Considering that, in 2012, the City of Vienna commissioned as part of a service mandate the existing company TINA VIENNA as official Smart City Wien Agency (TINA VIENNA, 2017). This agency is an independent company that serves as an external support unit to the local administration in relation of smart cities.

Actually, the Smart City Wien Agency is the main link between all relevant initiatives and programs of the City of Vienna that foster new ways of collaboration in order to implement the Smart City Wien framework strategy. Therefore, the agency’s major tasks are connecting

people, coordinating groups and establishing governance structures to support the framework implementation at operational, strategic and decision-making level.

Furthermore, the Framework Strategy assumes that individual larger lighthouse projects with an innovative character will contribute to the attainment of key Smart City objectives. Similar to the Lisbon lighthouse project, the City of Vienna is involved in a project called “Smarter Together”. This is a joint project with other lighthouse cities (Munich and Lyon) and other follower cities (Santiago de Compostela, and Venice) and observer cities (Kiev and Yokohama) that focus on finding the right balance between ICT technologies, citizen engagement and institutional governance to improve citizen’s quality of life through smart and inclusive solutions (SMART TOGETHER, 2017).

To achieve these goals, it was chosen six neighborhoods in different European countries to experience new ways of adding value in urban societies that encompass urban refurbishments, co-creation process and new sustainable business models. The results will serve to deepen the knowledge in these different fields and will enable a large-scale replication of successful solutions at city level and in other cities.

* * *

After describing the projects of each city, it was necessary to make a deepen analysis about which are the relevant elements of a smart city in the view of experts.

5.2. THE DRIVING ELEMENTS OF A SMART CITY

Considering the documental analysis and the main aspects highlighted in those city projects, it was necessary to analyze the interviews of different experts in order to identify the main elements of a smart city and their features, and, consequently, understand how these projects can lead the cities to become smarter.

In further sub-sections, the statements of interviewees were presented considering the four dimensions of a smart city.

5.2.1. The Elements of Governance Dimension

Reinforcing the results of Angelidou (2014) and Neirotti et al. (2014), the expert in Lisbon said that “cities do not become smart overnight”. A smart city as a model for urban development requires a long-term plan that encompass the identification of issues, the analysis of needs and opportunities, the proposition of improvements, the implementation of these proposed improvements and the measurement of results.

She highlighted that “**strategic plans** involving a mix of top-down and bottom-up approaches are required to tackle social, economic and environmental issues”. Complementarily, an expert in Barcelona mentioned that the plan for the innovation district 22@ Barcelona could only be implemented due to big amount of financial resources provided by the government and private organizations for **investments**. To enable the operation, changes in the legislation were required, as well as the creation of new models of governance involving a **dedicated organization** – “Barcelona Activa”, in that case. The “Barcelona Activa” (which incorporated the agency 22 ARROBA BCN) promotes the implementation and development of strategic content in the new spaces created, integrates both public and private interests, and favors international visibility of new business, scientific, teaching and cultural activities.

The City of Vienna also create its own agency with the function of “breakdown already existing patterns and already existing structures”, as said by the expert. The Smart City Wien Agency has also a mandate to foster new ways of collaboration and organize the background behind it, functioning as a fundamental actor in the **decision-making** process. It was mentioned a specific organization to deal with this governance structure that is divided between leaders and supporting actors. They have a steering group with the CEO of the city of Vienna and a group of 15-20 people who are chiefs in different departments like information, economy, housing, energy and mobility. Supporting the steering group, there is a working group just one

hierarchical level lower, which meets regularly and monitors systems for implementing several plans related to the “Smart City Wien - Framework Strategy”.

Considering that, as stated by one expert, “the government can use its **power of law** to gain efficiency and create new revenues through new rules”. For example, the expert from Barcelona suggested that a smart **land use**, coping living and business activities, with mix residential and commercial activities and high-rise buildings should make the city more compact, which could influence the enviro-urban and techno-economic dimensions.

In Amsterdam, the organization “Amsterdam Smart City Platform” was created to speed up and facilitate initiatives and projects gathering different stakeholders in a **quadruple helix** approach (government, industry, university and society). It is a social platform where members can develop projects and initiatives, learn new skills and share experiences.

Among those initiatives, there is the “Smart Entrepreneurial Lab”, develop by the Hogeschool Van Amsterdam, which aims to train students in smart city projects, promoting workshops and allocating them to work with real ongoing projects.

Besides that, the city also presents the Waag Society, which is recognized by municipality as an official digital media institute and therefore receives ca. 0.5% of **funding**. Waag Society is an institution in constant and close contact with society, promoting the connection between municipality representatives and citizens. By doing so, they are able to identify and create solutions to help citizens, offering thus **public services** in a smart way. They also enable **e-governance** to take place, since they focus on a digital and participative culture in the city, trying also to secure that municipalities will make way of the legacy systems, to become a more knowledge partner instead of ICT vendor. Therefore, they work to bring the idea of service design to municipality as a way to create better, clear, open services for citizens.

In sum, different governance models show some convergent elements. The very first, and present in all projects, is the building and functioning of a governance agency. This body of city stakeholders should embrace both public and private agents, dividing the roles of leaders and supporters. The second element is the existence of a strategic plan to ease the decision-making process on whether investing, changing or recovering. Third is financing. The availability of funding from both public and private sources is crucial for the starting of a city transformation process. Finally, supporting elements, such as digital technologies and platforms for connecting stakeholders and coordinating the different actions are necessary.

5.2.2. The Elements of Environ-Urban Dimension

Regarding the enviro-urban dimension, Lisbon programs such as Sharing Cities and BIP/ZIP involve urban regeneration projects in vulnerable areas, as well as the focus to establish creative districts in central regions close to universities, retail stores, and entertainment options. Within this context, the plan for the **innovation district 22@Barcelona** also involved regeneration of a delimited area with projects related to new **mobility** alternatives, public spaces renewal, new energy and broadband networks, selective pneumatic waste collection, new heating and cooling systems and underground galleries.

In this way, an innovation district can also become a **Living Lab**. The premise of the Living Lab is that a city can be used as real-world testing ground for new ideas and technologies (Cosgrave et al., 2013). It is defined as a research methodology for sensing, validating and refining complex solutions in multiple and evolving real life contexts (Schumacher and Feurstein, 2007 apud Cosgrave et al., 2013). It is possible to test some technologies as sensors, smart grids and ICT's that can help cities to collect, process and analyze data to improve their public utilities (Harrison et al., 2010; Washburn et al., 2010; Yamamoto et al., 2012; Cosgrave et al., 2013; Neirotti et al., 2014).

One expert in Barcelona highlighted that the city must be attractive to retain talent far beyond the working hours and, to be so, **urban design** must be detailed planned. In accordance to that, he highlights that planning buildings is essential to cope both real estate agents and citizens' interests. He remarks the importance of a mixed building landscape, which preserve architectonic heritage for new uses and build new iconic sites involving both business and living spaces, so that people can walk around during 24 hours in a day. Moreover, the focus on preservation and efficient use of **natural resources** should be included on urban plans and building restrictions in order to take advantage from what is already built (e.g., brownfields regeneration).

Besides that, one expert in Barcelona highlighted that cities must be able to deal with technology, in terms of ICT, and that everything must be connected. Thus, cities must consider dealing with **infrastructure** in a long-term manner, to set the basis for the future in terms of optical fiber, waste, water, energy and climate-related issues. The expert from Lisbon also remarked that cities should offer special public **amenities and facilities** to ensure quality of life, especially in terms of elementary schools, public spaces for interaction, bike parking lots, health equipment and health hubs for hospital and emergence care. Related to that, the expert in Vienna stated that cities should provide all kind of public services that are close to the daily

life of people in an integrated way, such as housing, mobility, energy provision, but also environmental protection as the basics needs of resources. Therefore, the efficient use of resources is fundamental to a fast urban growth.

In sum, this dimension has a set of more objective but not less important elements. Urban design, amenities and facilities, the regeneration and recovery of ancient and historical buildings and areas, natural resources and sustainability are the basics to meet the expectations people have in terms of quality of life.

5.2.3. The Elements of Socio-Institutional Dimension

Linking the enviro-urban configuration to the social-institutional structure, the expert in Vienna highlighted that mobility and infrastructure must be planned together: “we current have a big Horizon 2020 project implementation project, a lighthouse project called Smart Together that is a collaboration with Munich and Lyon and there is a specific area of Vienna that we are implementing refurbishments and implementing mobility interventions”.

Besides that, the Vienna agency also plans to encompass vulnerable regions due to social and economic segregation. At the Simmering area, for example, they are working to include low-skilled people that live there in the labor pool, by promoting courses and training with civic engagement. Through their perspective, such people have their own social dynamics and must be inserted into the new economy, so that **social and cultural plurality** is not censured, but stimulated. In this context, Lisbon expert remarked that attracting some people does not need to end up in expelling others.

Besides that, the expert in Amsterdam also remarked that the city has many young people, because of the universities. “People come here to study and they leave, but have a lot of things to do here, there are lots of entertainment”. Aligning entertainment and business interest, young people find in Amsterdam the city to start a company, debating sites and visiting places to get inspiration. The expert in Barcelona stated “it is fundamental to attract young people to city districts, as a way to invigorate the area”. These findings show that a mix of demography should help cities to tackle issues related to aging population.

Another important topic highlighted by the expert from Waag Society is that “if you are a smart city, you will make sure your citizens become smart (**smart citizens**)”. It does not mean that citizens are “dumb”, but now “they are responsible for the city, which more accurately describes the role that everybody like you mean take responsibility about what is happening and become active part”.

Also regarding smart citizens, one expert from Amsterdam highlighted that there is growing effort from all institutes to do activities together in terms of arts, startups hubs and co-living spaces. “You could literally visit fifteen meetups every night around the week”, as he said. Within this context, he detailed, “The **community** is crucial. Without the community there is no smart city”. Therefore, organizations as the previously mentioned Amsterdam Smart City, the Waag Society and Parkhuis de Zwijger are fundamental, since they organize meetups and presentations to discuss about different urban issues.

The importance of community also can be seen in the Program BIP/ZIP developed by the Lisbon City Hall. This annual program provides an opportunity for local people to develop and implement projects to improve their neighborhoods. Projects like that encourage citizens to participate more actively in solving city issues.

In this sense, a smart city does not rely only on their formal mechanisms of governance or either in their urban configuration. It was highlighted that proactive citizens can together take care of city in different ways. The creation of a community mindset that bring together people from different social conditions and cultural origins should be the major concern on becoming smarter. Actually, participation, inclusiveness and spirit of community are some of the major building blocks for wealth creation in the new paradigm.

5.2.4. The Elements of Techno-Economic Dimension

Within the context of techno-economic dimension, universities are seen as important **human capital** source. The expert who works at a university in Amsterdam stated that there are university spaces being transformed into incubators, so that “students can start a company and fit in our definition of smart city projects”. Such students may work together in **partnership with big companies**. He said “we also have CISCO and IBM, they also trying to learn with startups. So every organization is in this vibe. So I think, it is like a mindset”. It shows the importance of universities to stimulate an entrepreneurship culture among their students.

In that sense, the expert from Barcelona stated that the universities and young people are the engines of transformation, because they connect research, education and technology. Aligned to that, the expert from the agency in Vienna mentioned that they function as an integrator, but they could not provide all expertise in all fields related to smart city. Therefore, they work connecting people, coordinating and finding the right people to collaborate with – enabling, thus, promising **networks**. To increase these interactions and to create new jobs, the

expert in Lisbon informed that there is great interest from companies to transform former industrial buildings into **collaborative spaces for innovation** such as incubators, accelerators, fab labs, hacker spaces and coworking.

Thus, cities must attract and retain high-qualified economic agents (firms and consumers) by offering the maximization of their utility curves. New endeavor and businesses are the ultimate goal of any emerging smart city.

As a matter of fact, this is the very special way to create wealth and, thus, to overcome all the existing socioeconomic issues, especially by increasing social inclusion through economic inclusion. Knowledge society and technological complexity need cooperation, partnership and complementarity to generate synergy and innovation. It is increasingly harder to work alone and reach excellence. Networks, accelerators, coworking, university-industry interaction are some of the different ways to bring people together in order to establish a new entrepreneurial mindset and to create novelty and new value.

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The results from the documental analysis and interviews show the main elements of a smart city. These results were crossed with the literature review in order to identify the features of these elements, which are presented in (Table 5).

Table 5 - Features of Smart City Elements

Dimensions	Elements	Features
City Governance	Funding and Investments	Proportional and regular investments in infrastructure from public and/or private institutions in order to make the city more functional, to increase the citizens' accessibility of public services and create economic incentives to make city more business-friendly. The city should develop new kinds of revenues and investments (i.e. bonds, taxes, interests, subsidies. Either only public, only private or hybrid investments)
	Partnerships	Stimulate alliances, cooperation and partnerships between public and private organizations in order to increase efficiency, improve quality and diminish bureaucracy of projects
	Dedicated Organizations	Specific and independent organizations formed by different stakeholders aiming at the implementation of the strategic plan through the coordination of smart city projects/initiatives
	E-governance	Established practices of open governance through digital tools in order to enhance transparency, inclusiveness and participation (open data, e-democracy, etc.). Democratic, transparent, inclusive, decentralized but integrated
	Public Services	Web and ICT-based services oriented in a citizen-centric approach, focusing on Health, Security, Transportation, Education, Energy, Sanitation, Waste Management
	Decision-Making	Future-oriented within a mix of bottom up and top-down strategies that stimulate the community participation on city planning process
	Rule of Law	Trust-based, Formal, Adaptive rules and laws through an efficient legal-normative framework that encompass different interests on win-win situations
	Land Use	Pro-Development of real estate stimulating mix residential and commercial areas and high-rise buildings. It makes city more vibrant, because it is possible to build compact neighborhoods with high-density strategy
	Strategic Plan	Define a long term vision setting some strategies and major transversal objectives driven by a sustainable approach (i.e. resource-efficiency, quality of life and innovation), which should be formulated in a collaborative way
	Quadruple-Helix Approach	It is easy to make interactions and partnerships between government, industry, universities and society in order to solve the city problems
Enviro-Urban Configuration	Actions/Initiatives/Projects	Smart city projects are based on the strategic plan and have different scope and scale relying on which kind of objective they must achieve within well-defined metrics and indicators to monitor the city development
	Urban Design	Preserve historical heritage and stimulate the construction of new iconic buildings. Besides that, it seeks urban densification through the balance between workers and residents in order to reduce the urban sprawling
	Innovation Districts	Delimited region of a city that concentrates high-skilled people, high-tech firms and institutions in order to achieve economic growth and social development.
	Living Lab	A delimited district area to test new ideas and technologies
	Infrastructure	Deployment of digital and green technologies in infrastructure, such as sensors, meters, smart grids that provide a huge amount of data that can be analyzed in order to make cities more efficient and connected
	Mobility	Mix of walkable streets and multimodal transportation in order to reduce commuting time and make cities more environmentally-friendly by reducing carbon emissions and transportation costs

	Amenities and Facilities	Provide a wide range of entertainment, culture, and catering venues and green public spaces for leisure, which enhance the quality of life of city inhabitants.
	Natural Resources	Balance between preservation and efficient use of natural resources in order to reduce the environmental impact
Socio-Institutional Structure	Spirit of Community	Engaged community that care about common problems and act together to solve them
	Smart Citizens	Participative citizens that not propose improvements, but also are proactive agents for urban change following their rights and duties
	Social and Cultural Plurality	Preserve the local identity while being tolerant to differences on cultural, ethnic, religious and gender orientation.
Techno-Economic Dynamics	Economic Activities	The economy is based on creative and knowledge industries that present a high ratio of startups, knowledge intensive business services and advanced manufacturing firms
	Human Capital and Entrepreneurship	Presence of young and high-skilled workers that have an entrepreneur mindset
	Research, Education and Technology	These elements relies on S&T Institutions that should produce the state-of-art knowledge, train people for those knowledge jobs and foster entrepreneurship culture
	Collaborative Spaces	Presence of spaces for entrepreneurship and innovation such as incubators, accelerators, fab labs, co-workings that should promote collaboration, improve networking and enable the prototyping of goods, enhancing a “maker culture”
	Global Business Networks/ Internationalization	Presence of multinational companies and global research centers. Besides that, the local market solutions focus on the global market enabling large export volume of goods with high added value

Considering these elements, one may conclude that former industrial cities should follow some guidelines to start their process of transformation. The connection among the dimensions and their elements may suggest such guidelines in order to enhance the smartness of city. This is discussed and detailed in the next section.

6. BUILDING THE FRAMEWORK FOR SMARTER CITIES

As mentioned before, cities have exceeded their optimum size, which resulted in the loss of economies of scale and high socioeconomic and environmental costs. Actually, the industrial city is presenting an urban decay process, because the current infrastructure limits its growth, its economic activities based on traditional industries can no longer generate wealth and its institutional framework does not provide flexibility to adapt city structures.

To transform this scenario, industrial cities must change their trajectories, aiming to maximize the utility curves of their economic agents again. In this process of change, it is necessary to consider the current techno-economic paradigm to align urban development strategies. It seems clear that to be smart is not an alternative, but the unique way to overcome those urban issues and achieve a sustainable socio-economic development.

6.1. THE SMARTNESS OF A CITY

As discussed before, it is possible to affirm that there is no fully-fledge smart city. Cities around the world are developing projects with different scale and scope in order to reach this new city model. It is an ongoing process to transform different structures in order to make cities smarter.

Actually, cities present different degrees of “smartness”, because they have different previous assets, which can be transformed and enhanced through smart city projects. The assessment of city smartness rely on two conditions:

- 1) If the city present those driving elements;
- 2) If the driving elements present those specific features;

It is important to highlight that some cities should reach both conditions. However, they will never show the same performance. Even the most advanced cities will have different degrees of “smartness”.

Therefore, the “smartness” of a city relies on how the city can provide high quality of life and economic prosperity in the most sustainable way for the different stakeholders.

The challenge is to understand how is possible to take advantages of innate potentialities and create new opportunities to enhance its “smartness”. It could be easy to define that a smart city must have metro lines or bicycle lanes. However, if the city is not dense enough to cover fixed costs of a metro or do not have a flat ground to ease the bike riding, will it be considered

a “dumb” city? The answer is no, because cities are naturally different, consequently, the smart city solutions can be different.

Actually, the smartness rely on if the city can:

- Ease the knowledge production, diffusion and application;
- Enable a business-friendly environment;
- Attract and retain high-qualified human capital;
- Enter in the global competitive scenario
- Define plans and actions to be implemented in the long-term;
- Foster an entrepreneurship mindset among society;
- Establish collaborative networks among various stakeholders;
- Stimulate citizens and community to participate actively in public affairs;
- Offer efficient public services and an advanced infrastructure;
- Attract investments and create new kinds of revenue;
- Preserve natural resources and reduce its environmental impact;
- Harmonically aggregate a socio-cultural plurality

In other words, the smartness of a city should be seen as a continuum that each smart city solution implemented in the driving elements would influence the different dimensions.

6.2. MAKING A CITY SMARTER

As mentioned before, each city has the proper way to make itself smarter. However, any city that wants to be smarter will have to develop smart city projects following a comprehensive plan.

Then, first, it is necessary to formulate, in a quadruple helix approach, a long-term strategic plan that should contain a broad vision, strategies, policies and goals for the city of the future.

After that, the city must start projects with different scale and scope in order to achieve those goals defined in the strategic plan. These projects require leadership, funding, controlling and evaluation. The projects will have to consider those different dimensions in order to create more comprehensive and integrated solutions.

In this sense, the findings of this study suggest that city governance is fundamental for the implementation of smart city model. Remarkable is that government should not be the unique transformation agent. The government should create an alternative governance model that stimulates the community engagement. This governance model is characterized by an

integrated and decentralized management structure, in which flexible organizations and public-private partnerships are some elements that can help in this transformation process.

Furthermore, it is possible to affirm that there is no smart city without knowledge. Considering the dynamics of the new economy, cities must increase their knowledge base (HAJKOVA and HAJEK, 2014) through different mechanisms related to their socio-institutional structure and enviro-urban configuration.

It means that a city should create a local innovation ecosystem, in which knowledge production, diffusion and applications flows easily (LEYDESDORFF and DEAKIN, 2011; ZYGIARIS, 2013). This innovation ecosystem allows the collaboration among actors in a quadruple helix configuration (CARAYANNIS and CAMPBELL, 2009), in which it is possible to develop smart solutions using creativity and knowledge to deal with several urban issues more efficiently. The increase of local knowledge base also fosters the creation of new knowledge intensive and high-tech ventures (HAJKOVA and HAJEK, 2014; SHUTTERS et al., 2016), which create jobs that require highly talented people (FLORIDA, 2002; 2009).

Therefore, cities should elaborate strategies to attract, retain and bring together high-skilled people, knowledge intensive firms and knowledge institutions in order to compete in the global knowledge economy.

To attract and retain people, the city has to offer high living conditions. It is important to provide good and efficient public services, such as health, education, security, but also offer good options for leisure and fun, such as bars, restaurants, museums, parks, gyms and so on.

These public services, amenities and facilities should offer alternatives for a safer, greener, happier and healthier city. They should involve green technologies in buildings and urban realm, such as smart grids, solar panels, smart meters, in order to reduce environmental impact by efficiently using natural resources and producing less waste and CO₂ gases. They should also use technologies to diminish criminality with cameras, sensors, big data.

However, it is important to highlight that the urban violence will not be solved only introducing technologies in the security systems. Other solutions that do not require huge investments can be more effective to reduce this issue. Studies show that the high urban density in specific areas can make streets safer, because crowded streets could inhibit action of criminals (GLAESER, 2011). Furthermore, areas with the presence of highly educated people show a low-level of criminality (SHAPIRO, 2006).

Mobility solutions also can be different depending on the size of the city. A minor city, considering the sprawling process, will demand solutions that could be not the construction of

a metro, but the creation of policies to stimulate the construction of compact neighborhoods. The mobility issues of a metropolis will require different solutions where technology could have a crucial role in costs savings and in decreasing commuting time, such as traffic control systems.

Actually, there are a lot of solutions and possibilities that would deliver value for the different stakeholders, depending on the evaluation of risk and return.

A business-friendly environment can attract and retain firms and investments, which are fundamental for economic development. Cities should foster the formation startups and venture capitals based on knowledge through specific policies and financial incentives in order to raise up firms' productivity, workers' salaries, and, consequently, the city's gross domestic product. However, it is important to highlight that it depends not only a flexible normative-legal framework, but also on a strong network among the different stakeholders in this ecosystem.

The knowledge institutions, such as universities, schools, research centers, are even more important for the knowledge economy. These institutions produce basic, intermediate and advanced research, which results in publications, patents, spin-offs and spin-outs. Moreover, they train high-skilled people to work in those firms or stimulate them to become entrepreneurs. A smart city must have different kinds of knowledge sources in order to produce different outputs.

Considering that, the city "smartness" should be enhanced by a well-orchestrated innovation ecosystem with a strong "smart specialization strategy" (ZYGIARIS, 2013; MARKULLA and KUNE, 2015).

In order to enhance this innovation ecosystem, cities can change and improve some elements related with the enviro-urban dimension. Cities should connect those different stakeholders through advanced digital infrastructure, mixed land use policy and efficient multimodal mobility in order to enable more interactions between them. As highlighted by Angelidou (2014), most of smart cities projects present a mix of local strategy for industrial cities (i.e. existing cities) that can focus on hard and soft infrastructure oriented strategies or on the development of economic activities for entire cities or geographically-based in districts.

Therefore, cities should start implementing their strategies, plans and initiatives in a specific district, because small-scale projects are more viable and likely to succeed (CARAGLIU and DEL BO, 2016). Emphasis should be placed on regenerating degraded urban areas (ANGELIDOU, 2014), which are characterized as abandoned industrial districts. These areas show an already existing infrastructure that does not require huge investments.

The creation of an innovation district² should be a very important stage for every city that wants to be smart. The innovation district can be the location where startups, creative and high-tech firms, universities, research and technological centers should establish their activities in order to develop solutions for global consumers' needs. This process can begin in a point that can sprawl for other city's districts gradually, transforming a city in a cozy place for living, working and entertaining. Moreover, it is also important to create some spaces that stimulate creativity and innovation, such as fab labs, coworking, incubators, accelerators and so on.

In sum, there is no "one size fits all", which means that the different elements of a city should be combined in order to solve those several key issues. Then, each city should figure out how is possible to create or transform its driving elements with those specific features in order to enhance its "smartness". This integration can enable cities around the world to change their trajectories.

6.3. THE URBAN INNOVATION ECOSYSTEM

As mentioned before, if a city want to become smarter, it should upgrade its driving elements through projects. The problem is to define which dimension should be transformed first, or even if there is a logic of transformation.

Many cities are developing projects with different scale and scope in order to transform their structures. One should focus on upgrading the techno-economic dimension by fostering new economic activities, attracting and training high-skilled people or even establishing new knowledge institutions. Other should focus on improving the environ-urban dimension by building new digital and green infrastructures, defining a new mobility configuration or even starting a great urban refurbishment in specific areas.

The fact is that there is no "right" way to start this process of urban transformation, because as highlighted before cities are different and have different needs and potentialities.

However, it seems clear that is necessary to orchestrate all driving elements in an integrated and comprehensive way in order to achieve the goals of any smart city. A city demands a model that allow integrating these dimensions and elements in order to offer "high

² Innovation districts can be defined as small pockets in a town or city (Cosgrave et al., 2013) where firms and institutions share common infrastructure and labor market pooling, to take advantages of locally-embedded technologies, production processes, and to reduce transportation and transaction costs (Fujita et al., 2000; Porter, 2000; Clark et al., 2003).

quality of life and a prosperous environment for innovation and creativity in the most sustainable way”.

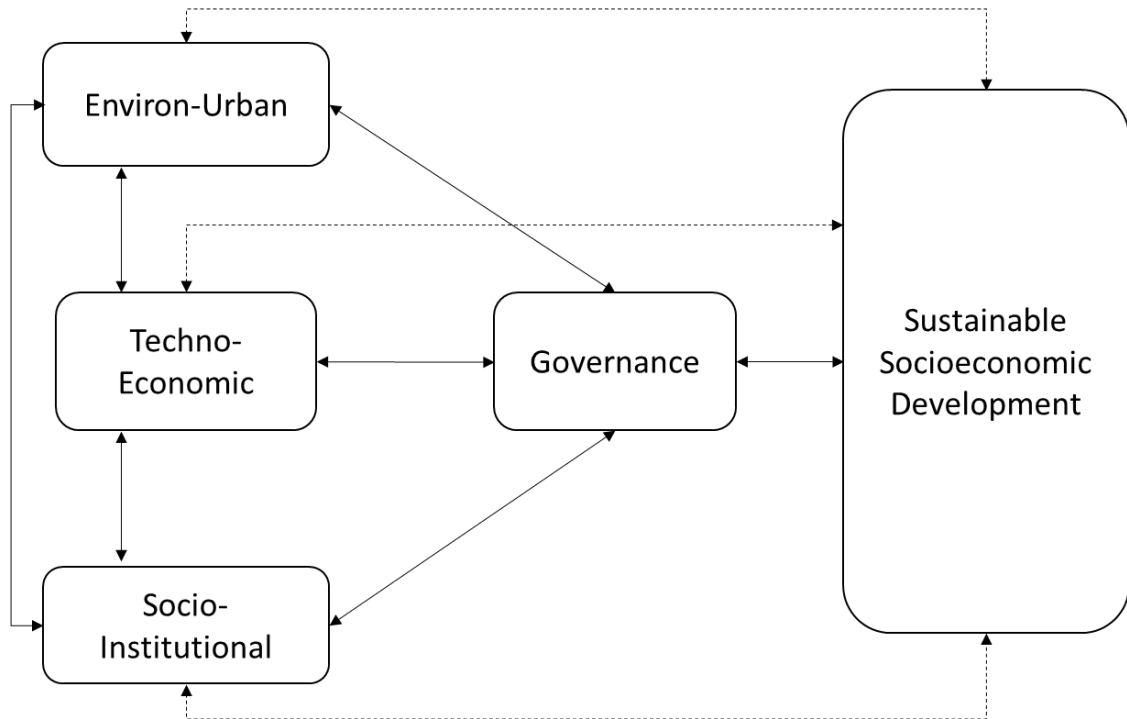
Considering the results from literature review and case studies, it is possible to affirm that a smart city is a complex ecosystem that use its enviro-urban configuration, its techno-economic dynamics and its socio-institutional structure in order to create wealth through a comprehensive innovation process. In fact, a smart city is an urban innovation ecosystem, which present a well-defined governance model to articulate the other dimensions towards a sustainable socioeconomic development. Again, there is no “magic formula” that show the best way to make a city smarter.

However, the results pointed out that the city governance dimension is a catalyst in this process of transformation. The focus on this dimension is because the industrial city model has a very different way of governance. Weak partnerships, short-term plans, unilateral decision-making processes, lack of an adaptive normative-legal framework are some of the differences between the models.

It is assumed that nothing will advance if the city does not present a strong governance. The use of different mechanisms to define which could be the best strategy to overcome those several issues and to start a new cycle of wealth creation rely on the governance dimension. As previously shown, some cities (Amsterdam, Barcelona, Vienna) started bringing together the most relevant stakeholders and creating dedicated organizations to think about the future of city and develop different projects in both top-down and bottom-up strategies.

This framework suggests that the governance dimension should lead this process of transformation, but other dimensions are also very important. Actually, a smart city should be understood as an integrated model to achieve a sustainable socioeconomic development. The relationship among dimensions was summarized in the Figure 4.

Figure 4 - The Integrated Framework of Smart City



The integrated framework suggests that the four dimensions should be integrated within different relationships in order to achieve a sustainable socioeconomic development.

Furthermore, the relationship among dimensions is not a linear function, because it should be taken in account the multiplier effects from their correlation. As an example, the improvement in the urban environment dimension will have a positive influence in the techno-economic dimension, and vice-versa.

In addition, the city development (dependent variable) will have a “rebound effect” in all dimensions. It is assumed that, there is a positive relationship when a city offers high quality of life, it will improve all dimensions of smart city. Considering that cities are highly context dependent, it is difficult to assess which dimensions have a greater impact in city development.

Within this integrated approach, it will be possible to disclose some guidelines that cities should follow in order to change their trajectories. The different driving elements of each dimension must be taken into account depending on the defined city goals. Then, the city governance should establish some priority projects to develop smart city solutions in order to overcome the current issues and to create wealth in the context of the new paradigm.

Therefore, the challenge to make a city smarter lies on defining how to articulate those driving elements in each dimension properly in order to build up its own urban innovation ecosystem.

7. CONCLUDING REMARKS

In the present study, it was highlighted the importance of cities in the twenty-first century. The dynamics of the new techno-economic paradigm demand that cities redeem their very essence in order to enable a new cycle of wealth creation. It was highlighted that the current city model based on a manufacturing industrial configuration is bringing more issues than solutions.

Actually, these issues cannot be solved with simple adjustments or improvements. It requires a radical structural change, which means a new model for urban development. The cities of future must be smart. It is much more than a lofty title, because cities must solve their issues in the most effective way and also find alternatives to achieve a sustainable socioeconomic development.

To be smart is not an option, but a single way out of this urban crisis. The smart city concept brings several solutions that can promote a massive revolution. The literature highlights some aspects linked with this concept, such as technology, knowledge, creativity, innovation, collaboration, connectivity, integration, sustainability and quality of life. Sometimes it seems a utopic model, because it requires many changes that demand a long time to be implemented and, consequently, to bring significant results.

In this sense, it is possible to affirm that there is no fully-fledge smart city yet. Not only because it requires time, but also because that cities are not “dumb”. Actually, cities have different degrees of “smartness”. Then, if a city wants to start this process of transformation, it should develop some specific projects that considers the different dimensions of a smart city.

It is important to highlight that these solutions will vary among cities, because they are naturally different. Cities differ somewhat in their history, economic activities, institutional arrangements and cultural legacy (Hollands, 2008; Martin and Simmie, 2008). Consequently, each city will present different trajectories in this shifting movement. The cities can be placed on different stages related to current degree of urban development and need to define some priorities based on their strengths and weakness (Fujita et al., 1999).

In this sense, cities will only change their trajectories through smart city projects. These projects may have different scale and scope considering the city’s smartness. They will develop solutions that must bring more efficiency and also deliver a new value for more than one stakeholder.

Now it seems easy to understand why the smart city concept is mainly related to the use of technologies to improve public services. It is because the ICT's can improve the efficiency of cities by reducing their congestion costs, and, consequently, the negative externalities. However, the use of non-technological components should also improve its "smartness". The upgrading of soft assets sometimes should be more efficient than the deployment of technologies in the urban realm or in public services.

Since the deployment of technologies in the urban infrastructure until the creation of an innovation district, the different solutions must consider the different dimensions and how is possible to solve the issue in most efficient and integrated way.

Based on the literature, existing projects related to smart cities and interviews with experts, this study offers an important theoretical contribution by identifying the dimensions and the driving elements of a smart city. Consequently, it was possible to identify what could be the first step towards this "smartification".

The results show that the governance dimension takes the lead in this process of transformation. The city that plans can take the reins of its trajectory. It is suggested that a mix of top-down and bottom-up strategies should help cities to start a new collaborative process in order to make structural changes.

This study also provides an integrated framework that may have significant practical utility to government entities, policymakers, as well as to business owners. Identifying the driving elements of a smart city allow cities around the world to evolve towards a sustainable development, by structuring feasible and realistic plans, considering their idiosyncrasies.

When defining a smart city as an "urban innovation ecosystem" should unify some different approaches, considering that the urban space can enhance the innovation ecosystem, and vice-versa. It can be discussed that innovation cannot be achieved only with strong networks, high-tech firms or high qualified human capital, but also relies on how those different elements are configured considering the smart city dimensions (i.e. techno-economic dynamics, city governance, environ-urban configuration and socio-institutional structure). Thus, it is possible to conclude that transform a traditional industrial city into a smart city requires more than willing – good practices are necessary for this revolution.

Considering that, this study reached the proposed objectives by presenting a clear definition of what is a smart city and its dimensions. Besides that, this study also disclosed the features of smart city elements, which allowed to build the integrated conceptual framework.

However, this study has some limitations considering that results are only from European experiences what could be different in other experiences around the world. Furthermore, the chosen qualitative method does not allow a broad generalization, because it is not possible to confirm and validate all proposition with only case studies. It is also important to highlight that it is necessary to realize empirical studies considering the theoretical background about innovation ecosystem and integrate with other urban theories. Besides that, it is difficult to capture the entire transformation of a city only with a few projects and to assess how these projects have an effective contribution to enhance the smartness of city.

These limitations can be solved by applying that definition and those analytical dimensions in different contexts to validate those elements and identify others.

This work also point out some future studies. A future study can assess the smartness of a city by setting indicators for those elements in order to make a quantitative comparison among cities. Besides that, it is possible to develop qualitative studies to make a deepen analysis about the identified elements and how they would enhance the smartness of a city. For example, a study would focus on how those innovation spaces can ease collaboration among people. Another study would compare the different dedicated organizations around the world in order to identify common features. It is also possible to analyze how innovation districts influence in the other city dimensions. Many studies can be developed considering the lack of longitudinal empirical studies about this topic, which will require new methodological procedures.

REFERENCES

- ALBINO, V., BERARDI, U., & DANGELICO, R. M. Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, 22(1), 3-21, 2015.
- ANGELIDOU, M. Smart city policies: A spatial approach. *Cities*, 41, S3-S11, 2014.
- ANGELIDOU, M. Smart cities: A conjuncture of four forces. *Cities*, 47, 95-106, 2015.
- ASHEIM, B. T., & COENEN, L. Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research policy*, 34(8), 1173-1190, 2005.
- ASHEIM, B. T., COENEN, L., MOODYSSON, J., & VANG, J. Constructing knowledge-based regional advantage: Implications for regional innovation policy. *International Journal of Entrepreneurship and Innovation Management*, 7(2), 140-155, 2007.
- ASHEIM, B. T., BOSCHMA, R., & COOKE, P. Constructing regional advantage: Platform policies based on related variety and differentiated knowledge bases. *Regional studies*, 45(7), 893-904, 2011.
- BAKICI, T., ALMIRALL, E., & WAREHAM, J. A smart city initiative: the case of Barcelona. *Journal of the Knowledge Economy*, 4(2), 135-148, 2013.
- BARDIN, L. Analysis of content. Lisboa: Edição, 70, 1977.
- BARCELONA ACTIVA. About us: who we are. Retrieved from: <<http://www.barcelonactiva.cat/barcelonactiva/en/all-about-barcelona-activa/who-we-are/index.jsp>> Accessed in: March 8, 2018
- BELL, D. Welcome to the post-industrial society. *Physics today*, 29(2), 46-49, 1976.
- BETZ, M. R., PARTRIDGE, M. D., & FALLAH, B. Smart cities and attracting knowledge workers: Which cities attract highly-educated workers in the 21st century? *Papers in Regional Science*, 95(4), 819-841, 2016.
- BOLÍVAR, M. P. R., & MEIJER, A. J. Smart Governance: Using a Literature Review and Empirical Analysis to Build a Research Model. *Social Science Computer Review*, 34(6), 673-692, 2016.

CAPDEVILA, I., & ZARLENGA, M. I. Smart city or smart citizens? The Barcelona case. *Journal of Strategy and Management*, 8(3), 266-282, 2015.

CARAGLIU, A., BO, C. D., NIJKAMP, P. Smart Cities in Europe. *Journal of Urban Technology*, vol. 18, ed. 2, p. 65–82, 2011.

CARAGLIU, A., & DEL BO, C. F. Do smart cities invest in smarter policies? Learning from the past, planning for the future. *Social Science Computer Review*, 34(6), 657-672, 2016.

CARAYANNIS, E. G., & CAMPBELL, D. F. 'Mode 3'and'Quadruple Helix': toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management*, 46(3-4), 201-234, 2009.

CARTER, D. Urban regeneration, digital development strategies and the knowledge economy: Manchester case study. *Journal of the Knowledge Economy*, 4(2), 169-189, 2013.

CASTELNOVO, W., MISURACA, G., & SAVOLDELLI, A. Smart cities governance: The need for a holistic approach to assessing urban participatory policy making. *Social Science Computer Review*, 34(6), 724-739, 2016.

CHESBROUGH, H. W. *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press, 2006.

CHIODI, S. I. Crime prevention through urban design and planning in the smart city era: The challenge of disseminating CP-UDP in Italy: learning from Europe. *Journal of Place Management and Development*, 9(2), 137-152, 2016.

CUBERES, D. A model of sequential city growth. *The BE Journal of Macroeconomics*, 9(1), 1-41, 2009.

DAMERI, R. P., & BENEVOLO, C. Governing Smart Cities: An Empirical Analysis. *Social Science Computer Review*, 34(6), 693-707, 2016.

DE JONG, M., JOSS, S., SCHRAVEN, D., ZHAN, C., & WEIJNEN, M. Sustainable–smart–resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner Production*, 109, 25-38, 2015.

DIRKS, S., & KEELING, M. A vision of smarter cities: How cities can lead the way into a prosperous and sustainable future. *IBM Institute for business value*, 8, 2009.

DODGSON, M., & GANN, D. Technological innovation and complex systems in cities. *Journal of Urban Technology*, 18(3), 101-113, 2011.

DOSI, G. Sources, procedures, and microeconomic effects of innovation. *Journal of Economic Literature*. Ed. 26, p. 1120-1171, 1988.

DUPONT, L., MOREL, L., & GUIDAT, C. Innovative public-private partnership to support Smart City: the case of “Chaire REVES”. *Journal of Strategy and Management*, 8(3), 245-265, 2015.

DURANTON, G., & PUGA, D. Micro-foundations of urban agglomeration economies. In.: *Handbook of regional and urban economics*. Elsevier, vol. 4, p. 2063-2117, 2004.

EECKHOUT, J. Gibrat's law for (all) cities. *The American Economic Review*, 94(5), 1429-1451, 2004.

FERNÁNDEZ-GÜELL, J. M., COLLADO-LARA, M., GUZMÁN-ARAÑA, S., & FERNÁNDEZ-AÑEZ, V. *Incorporating a systemic and foresight approach into smart city initiatives: the case of Spanish cities*. *Journal of Urban Technology*, 23(3), 43-67, 2016.

FLORIDA, R. *The rise of the creative class, and how it is transforming work, leisure, community and everyday life*. New York: Basic Books, 2002.

FLORIDA, R. *The Rise of the Creative Class--Revisited: Revised and Expanded*. New York: Basic Books (AZ), 2014.

FREEMAN, C. & PEREZ, C. “*Structural crises of adjustment: business cycles and investment behavior*”. in: DOSI, G et al. (eds.). *Technical Change and Economic Theory*. London, Pinter, 1988.

FUJITA, M., KRUGMAN, P. R., VENABLES, A. J. *The spatial economy: cities, regions and international trade*. Cambridge, MA: MIT press. Vol. 213, 1999

GIBSON, D. V., KOZMETSKY, G., SMILOR, R. W. *The Technopolis Phenomenon: Smart Cities, Fast Systems, Global Networks*. Rowman & Littlefield Publishers, 1992.

GIFFINGER, R., FERTNER, C., KRAMAR, H. et al. *European smart cities*. 2007. Retrieved from: <<http://www.smart-cities.eu/index2.html>>. Accessed in: 01 mar. 2017.

GIL-GARCIA, J. R., PARDO, T. A., & NAM, T. What makes a city smart? Identifying core components and proposing an integrative and comprehensive conceptualization. *Information Polity*, 20(1), 61-87, 2015.

GLAESER, E. L. Cities, information, and economic growth. *Cityscape*, 1(1), 9-47, 1994.

GLAESER, E. *Triumph of the city: How our greatest invention makes us richer, smarter, greener, healthier, and happier*. Penguin, 2011.

HÁJKOVÁ, V., & HÁJEK, P. Efficiency of knowledge bases in urban population and economic growth—Evidence from European cities. *Cities*, 40, 11-22, 2014.

HALL, P. The future of cities. *Computers, environment and urban systems*, 23(3), 173-185, 1999.

HENDERSON, J. V. The sizes and types of cities. *The American Economic Review*, 64(4), 640-656, 1974.

HERRSCHEL, T. Competitiveness and sustainability: can ‘smart city regionalism’ square the circle? *Urban Studies*, 50(11), 2332-2348, 2013.

HILLIER, B. Space is the machine: a configurational theory of architecture. *Space Syntax*, 2007.

HOLLANDS, R. G. Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City*, 12(3), 303-320, 2008.

HUIZINGH, E. K. Open innovation: State of the art and future perspectives. *Technovation*, 31(1), 2-9, 2011.

KNIGHT, R. Knowledge-based development: policy and planning implications for cities. *Urban Studies*, 32(2): 225-260, 1995.

KOMNINOS, N. *Intelligent cities: innovation, knowledge systems, and digital spaces*. Taylor & Francis, 2002.

KOMNINOS, N. Intelligent cities: towards interactive and global innovation environments. *International Journal of Innovation and Regional Development*, 1(4), 337-355, 2009.

KRAUS, S., RICHTER, C., PAPAGIANNIDIS, S., & DURST, S. Innovating and Exploiting Entrepreneurial Opportunities in Smart Cities: Evidence from Germany. *Creativity and Innovation Management*, 24(4), 601-616, 2015.

KUK, G., & JANSSEN, M. The business models and information architectures of smart cities. *Journal of Urban Technology*, 18(2), 39-52, 2011.

LEE, J. H., PHAAL, R., & LEE, S. H. An integrated service-device-technology roadmap for smart city development. *Technological Forecasting and Social Change*, 80(2), 286-306, 2013.

LEE, J. H., HANCOCK, M. G., & HU, M. C. Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change*, 89, 80-99, 2014.

LETAIFA, S. B. How to strategize smart cities: Revealing the SMART model. *Journal of Business Research*, 68(7), 1414-1419, 2015.

LEYDESDORFF, L., & DEAKIN, M. The triple-helix model of smart cities: A neo-evolutionary perspective. *Journal of Urban Technology*, 18(2), 53-63, 2011.

LEYDESDORFF, L. The Triple Helix, Quadruple Helix and an N-tuple of helices: Explanatory models for analyzing the knowledge-based economy? *Journal of the Knowledge Economy*, 3(1), 25-35, 2012.

LISBON CITY HALL. Program BIP-ZIP. Retrieved from: <<http://bipzip.cm-lisboa.pt/>>
Accessed in: March 7, 2017

LUCAS, R. E. On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42, 1988.

MARKKULA, M., & KUNE, H. Making smart regions smarter: Smart specialization and the role of universities in regional innovation ecosystems. *Technology Innovation Management Review*, 5(10), 2015.

MARSHALL, A. *Principles of Economics*. London: Macmillan, ed. 8, 1920.

MARTIN, R., & SIMMIE, J. Path dependence and local innovation systems in city-regions. *Innovation: Management, Policy and Practice*, 10, 193-196, 2008.

MIGUÉLEZ, E., & MORENO, R. What attracts knowledge workers? The role of space and social networks. *Journal of Regional Science*, 54(1), 33-60, 2014.

MORETTI, E. The new geography of jobs. Houghton Mifflin Harcourt, 2012.

NEIROTTI, P., DE MARCO, A., CAGLIANO, A. C., MANGANO, G., & SCORRANO, F. Current trends in Smart City initiatives: Some stylised facts. *Cities*, 38, 25-36, 2014.

NEFFKE, F., HENNING, M., & BOSCHMA, R. How do regions diversify over time? Industry relatedness and the development of new growth paths in regions. *Economic Geography*, 87(3), 237-265, 2011.

NORTH, D. C. *Instituciones, cambio institucional y desempeño económico*. Mexico, Fondo de Cultura Económica, 1993.

PARR, J. B. Spatial definitions of the city: four perspectives. *Urban Studies*, 44(2), 381-392, 2007.

PAROUTIS, S., BENNETT, M., & HERACLEOUS, L. A strategic view on smart city technology: The case of IBM Smarter Cities during a recession. *Technological Forecasting and Social Change*, 89, 262-272, 2014.

PEREZ, C. Technological revolutions, paradigm shifts and socio-institutional change. *Globalization, economic development and inequality: An alternative perspective*, 217-242, 2004.

ROMER, P. M. Increasing returns and long-run growth. *Journal of Political Economy*, 94 (5), 1002-1037, 1986.

ROTHWELL, R. Towards the fifth-generation innovation process. *International marketing review*, 11(1), 7-31, 1994.

SALVESEN, D., & RENSKI, H. *The importance of quality of life in the location decisions of new economy firms*. University of North Carolina, Center for Urban and Regional Studies, 2003.

SAHA, S., SAINT, S. AND CHRISTAKIS, D. A. 'Impact factor: a valid measure of journal quality'. *Journal of the Medical Librarian Association*, 91, 42-60, 2003.

SCHUMPETER, J. A. *Capitalism, Socialism and Democracy*. Harper and Brothers, 1942.

SCHWAB, K. *The Fourth Industrial Revolution*. New York: Crown Publishing Group, 2017. ISBN 9781524758875.

SHAPIRO, J. M. Smart cities: quality of life, productivity, and the growth effects of human capital. *The review of economics and statistics*, 88(2), 324-335, 2006.

SHARING CITIES. Sharing Cities programme. Retrieved from: <<http://www.sharingcities.eu/>>. Accessed in: November 10, 2017

SMART CITY WIEN. Smart City Framework Strategy. Retrieved from: <<https://smartcity.wien.gv.at/site/en/the-initiative/framework-strategy>> Accessed in: October 15, 2017

SMART TOGETHER. Smart Together: Objective. Retrieved from: <<http://www.smarter-together.eu/about/objectives>> Accessed in: November 10, 2017

STEARNS, P. N., & BELL, D. Is there a post-industrial society?. *Society*, 11(4), 10-22, 1974.

TINA VIENNA. Smart City Wien Agency. Retrieved from: <<http://alt.tinavienna.at/en/smartcitywienagency>> Accessed in: May 5, 2017

THOMAS, V., WANG, D., MULLAGH, L., & DUNN, N. Where's Wally? In search of citizen perspectives on the smart city. *Sustainability*, 8(3), 207, 2016.

UNITED NATIONS – UN (2014). World Urbanization Prospects. Retrieved from: <<https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf>>. Accessed in: 15 jun. 2016.

WEISI, F. U., & PING, P. E. N. G.. A discussion on smart city management based on meta-synthesis method. *Management science and engineering*, 8(1), 73, 2014.

WINTERS, J. V. Why are smart cities growing? Who moves and who stays. *Journal of regional science*, 51(2), 253-270, 2011.

WINDEN. W. VAN, OSKAM, I., BUUSE, D. VAN DEN, SCHRAMA, W., DIJCK., E. van. *Organising Smart City Projects: Lessons from Amsterdam*. Amsterdam: Hogeschool van Amsterdam, 2016.

WOOD, G. A., & PARR, J. B. Transaction costs, agglomeration economies, and industrial location. *Growth and Change*, 36(1), 1-15, 2005.

YIGITCANLAR, T., CARRILLO, F. J., METAXIOTIS, K., & ERGAZAKIS, K. Editorial: knowledge-based development of cities: a myth or reality? *International Journal of Knowledge-Based Development*, 1(3), pp. 153-157, 2010.

YIGITCANLAR, T. Smart cities: An effective urban development and management model? *Australian Planner*, 52(1), pp. 27-34, 2015.

ZYGIARIS, S. Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems. *Journal of the Knowledge Economy*, 4(2), 217-231, 2013.

ZUBIZARRETA, I., SERAVALLI, A., ARRIZABALAGA, S. Smart City Concept: What It Is and What It Should Be. *Journal of Urban Planning and Development*, vol. 142, ed. 1: 04015005, 2016.

APPENDIX A – Results of Systematic Literature Review

N°	Paper Title	Authors	Year	Journal	Database	DOI
1	A (MORE?) INTELLIGENT CITY	Santangelo, Marco	2016	NOESIS-REVISTA DE CIENCIAS SOCIALES Y HUMANIDADES	WofScience	10.20983/noesis.2016.12.5
2	A Participatory Approach for Envisioning a Smart City	van Waart, P., Mulder, I., de Bont, C.	2016	Social Science Computer Review	Both	10.1177/0894439315611099
3	A Unified Smart City Model (USCM) for smart city conceptualization and benchmarking	Anthopoulos, L., Janssen, M., Weerakkody, V.	2016	International Journal of Electronic Government Research	Scopus	10.4018/IJEGR.2016040105
4	Advancing smartness of traditional settlements-case analysis of Indian and Arab old cities	Dhingra, M., Chattopadhyay, S.	2016	International Journal of Sustainable Built Environment	Scopus	10.1016/j.ijsbe.2016.08.004
5	Anticipatory logics of the smart city's global imaginary	White, J.M.	2016	Urban Geography	Both	10.1080/02723638.2016.1139879
6	Building Smart Cities in China: Problems and Countermeasures	Cong Xiaonan; Liu Zhiyan	2016	CHINESE JOURNAL OF URBAN AND ENVIRONMENTAL STUDIES	WofScience	10.1142/S2345748116500226
7	City attachment and use of urban services: Benefits for smart cities	Belanche, D., Casaló, L.V., Orús, C.	2016	Cities	Both	10.1016/j.cities.2015.08.016
8	City Indicators on Social Sustainability as Standardization Technologies for Smarter (Citizen-Centered) Governance of Cities	Marsal-Llacuna, M.-L.	2016	Social Indicators Research	Both	10.1007/s11205-015-1075-6
9	Collaborative Innovation with External Actors: An Empirical Study on Open Innovation Platforms in Smart Cities	Ojasalo, Jukka; Kauppinen, Heini	2016	TECHNOLOGY INNOVATION MANAGEMENT REVIEW	WofScience	
10	Conceptualizing smartness in government: An integrative and multi-dimensional view	Gil-Garcia, J.R., Zhang, J., Puron-Cid, G.	2016	Government Information Quarterly	Scopus	10.1016/j.giq.2016.03.002
11	Crime prevention through urban design and planning in the smart city era: The challenge of disseminating CP-UDP in Italy: learning from Europe	Chiodi, S.I.	2016	Journal of Place Management and Development	Scopus	10.1108/JPMD-09-2015-0037

12	Decision Model for Policy Makers in the Context of Citizens Engagement: Application on Participatory Budgeting	Boukhris, I., Ayachi, R., Elouedi, Z., Mellouli, S., Amor, N.B.	2016	Social Science Computer Review	Both	10.1177/0894439315618882
13	Do Smart Cities Invest in Smarter Policies? Learning From the Past, Planning for the Future	Caragliu, A., Del Bo, C.F.	2016	Social Science Computer Review	Both	10.1177/0894439315610843
14	Geographic information science II: Less space, more places in smart cities	Roche, S.	2016	Progress in Human Geography	Scopus	10.1177/0309132515586296
15	Governing Smart Cities: An Empirical Analysis	Dameri, R.P., Benevolo, C.	2016	Social Science Computer Review	Both	10.1177/0894439315611093
16	Governing the smart city: a review of the literature on smart urban governance	Meijer, A., Bolívar, M.P.R.	2016	International Review of Administrative Sciences	Scopus	10.1177/0020852314564308
17	How smart cities transform operations models: A new research agenda for operations management in the digital economy	Li, F., Nucciarelli, A., Roden, S., Graham, G.	2016	Production Planning and Control	Scopus	10.1080/09537287.2016.1147096
18	How smart is smart? Theoretical and empirical considerations on implementing smart city objectives – a case study of Dutch railway station areas	de Wijs, L., Witte, P., Geertman, S.	2016	Innovation	Scopus	10.1080/13511610.2016.1201758
19	How will smart city production systems transform supply chain design: a product-level investigation	Kumar, M., Graham, G., Hennesly, P., Srai, J.	2016	International Journal of Production Research	Scopus	10.1080/00207543.2016.1198057
20	ICT and sustainability in smart cities management	Bifulco, F., Tregua, M., Amitrano, C.C., D'Auria, A.	2016	International Journal of Public Sector Management	Both	10.1108/IJPSM-07-2015-0132
21	Impact of the smart city industry on the Korean national economy: Input-output analysis	Kim, K., Jung, J.-K., Choi, J.Y.	2016	Sustainability (Switzerland)	Scopus	10.3390/su8070649
22	Incorporating a Systemic and Foresight Approach into Smart City Initiatives: The Case of Spanish Cities	Fernández-Güell, J.-M., Collado-Lara, M., Guzmán-Araña, S., Fernández-Añez, V.	2016	Journal of Urban Technology	Both	10.1080/10630732.2016.1164441
23	Is there anybody out there? The place and role of citizens in tomorrow's smart cities	Vanolo, A.	2016	Futures	Both	10.1016/j.futures.2016.05.010
24	Main criteria in the development of smart cities determined using analytical method	Tahir, Z., Malek, J.A.	2016	Planning Malaysia	Scopus	10.21837/pmjournal.v14.i5.179

25	New key performance indicators for a smart sustainable city	Hara, M., Nagao, T., Hanneo, S., Nakamura, J.	2016	Sustainability (Switzerland)	Scopus	
26	Opening up Smart Cities: Citizen-Centric Challenges and Opportunities from GIScience	Degbelo, A., Granell, C., Trilles, S., (...), Casteleyn, S., Kray, C.	2016	ISPRS International Journal of Geo-Information	Scopus	10.3390/ijgi5020016
27	Private video monitoring of public spaces: The construction of new invisible territories	Firmino, R., Duarte, F.	2016	Urban Studies	Both	10.1177/0042098014567064
28	Quantitative study on the dynamic mechanism of smart low-carbon city development in China	Pang, B., Fang, C., Liu, H.	2016	Sustainability (Switzerland)	Scopus	
29	Smart cities and attracting knowledge workers: Which cities attract highly-educated workers in the 21st century?	Betz, M.R., Partridge, M.D., Fallah, B.	2016	Papers in Regional Science	Both	10.1111/pirs.12163
30	SMART CITIES AS HACKER CITIES. ORGANIZED URBANISM AND RESTRUCTURING WELFARE IN CRISIS-RIDDEN ITALY	Pollio, Andrea	2016	NOESIS-REVISTA DE CIENCIAS SOCIALES Y HUMANIDADES	WofScience	10.20983/noesis.2016.12.3
31	Smart Cities Governance: The Need for a Holistic Approach to Assessing Urban Participatory Policy Making	Castelnovo, W., Misuraca, G., Savoldelli, A.	2016	Social Science Computer Review	Both	10.1177/0894439315611103
32	Smart cities in central and Eastern Europe: Viable future or unfulfilled dream?	Kola-Bezka, M., Czupich, M., Ignasiak-Szulc, A.	2016	Journal of International Studies	Scopus	
33	Smart cities within world city networks	Wall, R.S., Stavropoulos, S.	2016	Applied Economics Letters	Both	10.1080/13504851.2015.1117038
34	Smart cities: A global perspective	Hayat, P.	2016	India Quarterly	Scopus	10.1177/0974928416637930
35	Smart city as the basic construct of the socio-economic development of territories	Shichiyakh, R.A., Klyuchnikov, D.A., Balashova, S.P., Novoselov, S.N., Novosyolova, N.N.	2016	International Journal of Economics and Financial Issues	Scopus	

36	Smart city concept: What it is and what it should be	Zubizarreta, I., Seravalli, A., Arrizabalaga, S.	2016	Journal of Urban Planning and Development	Both	10.1061/(ASCE)UP.1943-5444.0000282
37	Smart City Implementation Through Shared Vision of Social Innovation for Environmental Sustainability: A Case Study of Kitakyushu, Japan	Chatfield, A.T., Reddick, C.G.	2016	Social Science Computer Review	Both	10.1177/0894439315611085
38	Smart City Research: Contextual Conditions, Governance Models, and Public Value Assessment	Meijer, A.J., Gil-Garcia, J.R., Bolívar, M.P.R.	2016	Social Science Computer Review	Both	10.1177/0894439315618890
39	Smart contradictions: The politics of making Barcelona a Self-sufficient city	March, H., Ribera-Fumaz, R.	2016	European Urban and Regional Studies	Both	10.1177/0969776414554488
40	Smart governance as key to multi-jurisdictional smart city initiatives: The case of the eCityGov Alliance	Scholl, H.J., AlAwadhi, S.	2016	Social Science Information	Both	10.1177/0539018416629230
41	Smart Governance: Using a Literature Review and Empirical Analysis to Build a Research Model	Bolívar, M.P.R., Meijer, A.J.	2016	Social Science Computer Review	Both	10.1177/0894439315611088
42	The concept, key technologies and applications of temporal-spatial information infrastructure	Li, C., Liu, P., Yin, J., Liu, X.	2016	Geo-Spatial Information Science	Scopus	10.1080/10095020.2016.1179440
43	The Intelligent Method (I) for making “smarter” city projects and plans	Marsal-Llacuna, M.-L., Segal, M.E.	2016	Cities	Both	10.1016/j.cities.2016.02.006
44	The smart city approach as a response to emerging challenges for urban development	Boykova, M., Ilina, I., Salazkin, M.	2016	Foresight and STI Governance	Scopus	10.17323/1995-459X.2016.3.65.75
45	The Smart City Ecosystem as an Innovation Model: Lessons from Montreal	Khomsí, Mohamed Reda	2016	TECHNOLOGY INNOVATION MANAGEMENT REVIEW	WofScience	
46	The variegated economics and the potential politics of the smart city	Rossi, U.	2016	Territory, Politics, Governance	Scopus	10.1080/21622671.2015.1036913
47	Thinking about smart cities: The travels of a policy idea that promises a great deal, but so far has delivered modest results	Glasmeier, A.K., Nebiolo, M.	2016	Sustainability (Switzerland)	Scopus	
48	Urban smartness and sustainability in Europe. An ex ante assessment of environmental, social and cultural domains	Manitiu, D.N., Pedrini, G.	2016	European Planning Studies	Both	10.1080/09654313.2016.1193127
49	Urban transitions: Scaling complex cities down to human size	Schiller, F.	2016	Journal of Cleaner Production	Scopus	10.1016/j.jclepro.2015.08.030

50	What is the source of smart city value? A business model analysis	Anthopoulos, L., Fitsilis, P., Ziozias, C.	2016	International Journal of Electronic Government Research	Scopus	10.4018/IJEGR.2016040104
51	Where's wally? In search of citizen perspectives on the smart city	Thomas, V., Wang, D., Mullagh, L., Dunn, N.	2016	Sustainability (Switzerland)	Scopus	
52	A Multi-indicator Approach for Smart Security Policy Making	di Bella, E., Corsi, M., Leporatti, L.	2015	Social Indicators Research	Both	10.1007/s11205-014-0714-7
53	A multilevel method to assess and design the renovation and integration of Smart Cities	Mattoni, B., Gugliermetti, F., Bisegna, F.	2015	Sustainable Cities and Society	Scopus	10.1016/j.scs.2014.12.002
54	Critical interventions into the corporate smart city	Hollands, R.G.	2015	Cambridge Journal of Regions, Economy and Society	Both	10.1093/cjres/rsu011
55	Enterprise systems: Are we ready for future sustainable cities	Ahmad, N., Mehmood, R.	2015	Supply Chain Management	Both	10.1108/SCM-11-2014-0370
56	How "smart cities" will change supply chain management	Tachizawa, E.M., Alvarez-Gil, M.J., Montes-Sancho, M.J.	2015	Supply Chain Management	Both	10.1108/SCM-03-2014-0108
57	How to strategize smart cities: Revealing the SMART model	Ben Letaifa, S.	2015	Journal of Business Research	Both	10.1016/j.jbusres.2015.01.024
58	Information reuse in smart cities ecosystems	Abella, A., Ortiz-De-Urbina-Criado, M., De-Pablos-Heredero, C.	2015	Profesional de la Informacion	Scopus	10.3145/epi.2015.nov.16
59	Innovating and Exploiting Entrepreneurial Opportunities in Smart Cities: Evidence from Germany	Kraus, S., Richter, C., Papagiannidis, S., Durst, S.	2015	Creativity and Innovation Management	Both	10.1111/caim.12154
60	Innovative public-private partnership to support Smart City: the case of "Chaire REVES"	Dupont, Laurent; Morel, Laure; Guidat, Claudine	2015	JOURNAL OF STRATEGY AND MANAGEMENT	WofScience	10.1108/JSMA-03-2015-0027
61	LESS SMART MORE CITY	Papa, Rocco; Gargiulo, Carmela; Cristiano, Mario; et al.	2015	TEMA-JOURNAL OF LAND USE MOBILITY AND ENVIRONMENT	WofScience	10.6092/1970-9870/3012

62	Lessons in urban monitoring taken from sustainable and livable cities to better address the Smart Cities initiative	Marsal-Llacuna, M.-L., Colomer-Llinàs, J., Meléndez-Frigola, J.	2015	Technological Forecasting and Social Change	Both	10.1016/j.techfore.2014.01.012
63	Making sense of smart cities: addressing present shortcomings	Kitchin, Rob	2015	Cambridge Journal of Regions, Economy and Society	WofScience	10.1093/cjres/rsu027
64	Making Smart Regions Smarter: Smart Specialization and the Role of Universities in Regional Innovation Ecosystems	Markkula, Markku; Kune, Hank	2015	TECHNOLOGY INNOVATION MANAGEMENT REVIEW	WofScience	
65	New urban utopias of postcolonial India: 'Entrepreneurial urbanization' in Dholera smart city, Gujarat	Datta, A.	2015	Dialogues in Human Geography	Scopus	10.1177/2043820614565748
66	Qualitative indicators for smart city business models: The case of mobile services and applications	Walravens, N.	2015	Telecommunications Policy	Scopus	10.1016/j.telpol.2014.12.011
67	SMART AND RESILIENT CITIES A SYSTEMIC APPROACH FOR DEVELOPING CROSS-SECTORAL STRATEGIES IN THE FACE OF CLIMATE CHANGE	Papa, Rocco; Galderisi, Adriana; Majello, Maria Cristina Vigo; et al.	2015	TEMA-JOURNAL OF LAND USE MOBILITY AND ENVIRONMENT	WofScience	10.6092/1970-9870/2883
68	Smart cities from scratch? A socio-technical perspective	Carvalho, Luis	2015	Cambridge Journal of Regions, Economy and Society	WofScience	10.1093/cjres/rsu010
69	Smart cities: A conjuncture of four forces	Angelidou, M.	2015	Cities	Both	10.1016/j.cities.2015.05.004
70	Smart cities: an effective urban development and management model?	Yigitcanlar, T.	2015	Australian Planner	Both	10.1080/07293682.2015.1019752
71	Smart cities: Definitions, dimensions, performance, and initiatives	Albino, V., Berardi, U., Dangelico, R.M.	2015	Journal of Urban Technology	Both	10.1080/10630732.2014.942092
72	Smart cities: Moving beyond urban cybernetics to tackle wicked problems	Goodspeed, R.	2015	Cambridge Journal of Regions, Economy and Society	Both	10.1093/cjres/rsu013
73	Smart city intellectual capital: an emerging view of territorial systems innovation management	Dameri, R.P., Ricciardi, F.	2015	Journal of Intellectual Capital	Both	10.1108/JIC-02-2015-0018
74	Smart city or smart citizens? The Barcelona case	Capdevila, Ignasi; Zarlenga, Matias I.	2015	JOURNAL OF STRATEGY AND MANAGEMENT	WofScience	10.1108/JSMA-03-2015-0030

75	Sustainable-smart-resilient-low carbon-eco-knowledge cities; Making sense of a multitude of concepts promoting sustainable urbanization	De Jong, M., Joss, S., Schraven, D., Zhan, C., Weijnen, M.	2015	Journal of Cleaner Production	Scopus	10.1016/j.jclepro.2015.02.004
76	The 'actually existing smart city'	Shelton, T., Zook, M., Wiig, A.	2015	Cambridge Journal of Regions, Economy and Society	Both	10.1093/cjres/rsu026
77	The image of the creative city, eight years later: Turin, urban branding and the economic crisis taboo	Vanolo, A.	2015	Cities	Both	10.1016/j.cities.2015.04.004
78	The performance of the smart cities in China-A comparative study by means of self-organizing maps and social networks analysis	Lu, D., Tian, Y., Liu, V.Y., Zhang, Y.	2015	Sustainability (Switzerland)	Scopus	10.3390/su7067604
79	The race for making up the list of emergent smart cities. An eastern European country's approach	Georgescu, M., Tugui, A., Pavaloaia, V.-D., Popescul, D.	2015	Transformations in Business and Economics	Both	
80	The Smart City as an opportunity for entrepreneurship	Richter, C., Kraus, S., Syrjä, P.	2015	International Journal of Entrepreneurial Venturing	Scopus	10.1504/IJEV.2015.071481
81	Thinking about smart cities	Glasmeier, A., Christopherson, S.	2015	Cambridge Journal of Regions, Economy and Society	Scopus	10.1093/cjres/rsu034
82	Unplugging: Deconstructing the smart city	Calzada, I., Cobo, C.	2015	Journal of Urban Technology	Both	10.1080/10630732.2014.971535
83	What makes a city smart? Identifying core components and proposing an integrative and comprehensive conceptualization	Gil-Garcia, J.R., Pardo, T.A., Nam, T.	2015	Information Polity	Scopus	10.3233/IP-150354
84	Competences and knowledge: Key-factors in the smart city of the future	Salerno, S., Nunziante, A., Santoro, G.	2014	Knowledge Management and E-Learning	Scopus	
85	Current trends in smart city initiatives: Some stylised facts	Neirotti, P., De Marco, A., Cagliano, A.C., Mangano, G., Scorrano, F.	2014	Cities	Both	10.1016/j.cities.2013.12.010
86	Developing and validating a citizen-centric typology for smart city services	Lee, J., Lee, H.	2014	Government Information Quarterly	Scopus	10.1016/j.giq.2014.01.010

87	Geographic Information Science I: Why does a smart city need to be spatially enabled?	Roche, S.	2014	Progress in Human Geography	Scopus	10.1177/0309132513517365
88	Smart cities and their roles in city competition: A classification	Anthopoulos, L.G., Fitsilis, P.	2014	International Journal of Electronic Government Research	Scopus	10.4018/ijegr.2014010105
89	Smart city policies: A spatial approach	Angelidou, M.	2014	Cities	Both	10.1016/j.cities.2014.06.007
90	Smartmentality: The Smart City as Disciplinary Strategy	Vanolo, A.	2014	Urban Studies	Both	10.1177/0042098013494427
91	The changing face of a city government: A case study of Philly311	Nam, T., Pardo, T.A.	2014	Government Information Quarterly	Scopus	10.1016/j.giq.2014.01.002
92	The real-time city? Big data and smart urbanism	Kitchin, R.	2014	GeoJournal	Scopus	10.1007/s10708-013-9516-8
93	Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco	Lee, J.H., Hancock, M.G., Hu, M.-C.	2014	Technological Forecasting and Social Change	Both	10.1016/j.techfore.2013.08.033
94	What attracts knowledge workers? The role of space and social networks	Migueluez, Ernest; Moreno, Rosina	2014	Journal of Regional Science	WofScience	10.1111/jors.12069
95	A strategic view on smart city technology: The case of IBM Smarter Cities during a recession	Paroutis, S., Bennett, M., Heracleous, L.	2014	Technological Forecasting and Social Change	Both	10.1016/j.techfore.2013.08.041
96	A Smart City Initiative: The Case of Barcelona	Bakici, T., Almirall, E., Wareham, J.	2013	Journal of the Knowledge Economy	Scopus	10.1007/s13132-012-0084-9
97	An integrated service-device-technology roadmap for smart city development	Lee, J.H., Phaal, R., Lee, S.-H.	2013	Technological Forecasting and Social Change	Both	10.1016/j.techfore.2012.09.020
98	Competitiveness AND Sustainability: Can 'Smart City Regionalism' Square the Circle?	Herrschel, T.	2013	Urban Studies	Both	10.1177/0042098013478240
99	Smart City Reference Model: Assisting Planners to Conceptualize the Building of Smart City Innovation Ecosystems	Zygiaris, S.	2013	Journal of the Knowledge Economy	Scopus	10.1007/s13132-012-0089-4
100	Urban Regeneration, Digital Development Strategies and the Knowledge Economy: Manchester Case Study	Carter, D.	2013	Journal of the Knowledge Economy	Scopus	10.1007/s13132-012-0086-7
101	Do smart cities produce smart entrepreneurs?	Sauer, S.	2012	Journal of Theoretical and Applied Electronic Commerce Research	Scopus	10.4067/S0718-18762012000300007
102	Creating smart-er cities: An overview	Allwinkle, S., Cruickshank, P.	2011	Journal of Urban Technology	Both	10.1080/10630732.2011.601103

103	Scran: The network	Cruickshank, P.	2011	Journal of Urban Technology	Both	10.1080/10630732.2011.601121
104	Smart cities in Europe	Caragliu, A., del Bo, C., Nijkamp, P.	2011	Journal of Urban Technology	Both	10.1080/10630732.2011.601117
105	Technological Innovation and Complex Systems in Cities	Dodgson, M., Gann, D.	2011	Journal of Urban Technology	Scopus	10.1080/10630732.2011.615570
106	The business models and information architectures of smart cities	Kuk, G., Janssen, M.	2011	Journal of Urban Technology	Both	10.1080/10630732.2011.601109
107	The triple-helix model of smart cities: A neo-evolutionary perspective	Leydesdorff, L., Deakin, M.	2011	Journal of Urban Technology	Both	10.1080/10630732.2011.601111
108	Why are smart cities growing? who moves and who stays	Winters, J.V.	2011	Journal of Regional Science	Both	10.1111/j.1467-9787.2010.00693.x
109	Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?	Hollands, R.G.	2008	City	Scopus	10.1080/13604810802479126
110	Smart cities: Quality of life, productivity, and the growth effects of human capital	Shapiro, J.M.	2006	Review of Economics and Statistics	Both	10.1162/rest.88.2.324

APPENDIX B - Interview Guide

About Project

1. When did this project start? Is there any deadline for conclusion?
2. Is this project linked to any strategic plan of government?
3. Why this project started to be developed?
4. What is/was the main objective of this project?
5. What are/were the solutions that this project is/intends to offer?
6. How is/was this project being funded?
7. How was the structure of this project to set up?
8. Who are/were the actors that participate (d) in this project?
9. What are/were the results obtained so far? (For stakeholders and for city)
10. What are/were the main difficulties in implementing this project?

APPENDIX C – SMART CITY PROJECTS

Table 6 – The main topics about the selected smart city projects

City	Project	Main Topics
Amsterdam	Amsterdam Smart City Platform	<ul style="list-style-type: none"> ▪ Multi-stakeholder web-platform ▪ Organize the different projects and initiatives ▪
	Smart Entrepreneurial Lab	<ul style="list-style-type: none"> ▪ Collaboration with firms ▪ Young human capital ▪ Entrepreneurship culture and mindset
	Smart Citizens Lab	<ul style="list-style-type: none"> ▪ Public and International Funds ▪ Maker culture ▪ Civic engagement ▪ Smart Citizens ▪ Maker Spaces (Fab Labs)
Barcelona	22@ Barcelona – Innovation District	<ul style="list-style-type: none"> ▪ Regeneration of degraded district through a massive urban refurbishment and socioeconomic revitalization ▪ Partnerships between public and private organizations ▪ Huge and regular amounts of public and private investments ▪ Long-term project that continued even with the change of political parties in power. ▪ City Hall is the main leader with the support of a dedicated agency ▪ Attraction of Clusters from Creative and Hi-tech industries ▪ Major Infrastructure Constructions ▪ Development of a new mobility plan ▪ Concerns about environmental sustainability and climate change
	Barcelona Activa	<ul style="list-style-type: none"> ▪ Dedicated organization with different departments of city ▪ City Branding Promotion to attract foreign investments ▪ Offer training courses for unemployed people
Lisbon	BIP/ZIP Program	<ul style="list-style-type: none"> ▪ Bottom-up strategy to solve specific issues in different neighborhoods ▪ Funded by City Hall ▪ Stimulates the civic engagement by investing in community projects ▪ Citizens Economic Activities
	Sharing Cities	<ul style="list-style-type: none"> ▪ Building retrofitting ▪ Natural Resources (Reduce energy and water consumption, low carbon emission) ▪ Living Lab (Electric Cars, solar panels, smart grids, etc.) ▪ Public-Private Partnerships ▪ New public services ▪ Public Funds
Vienna	Smart City Framework Strategy	<ul style="list-style-type: none"> ▪ Drivers are quality of life, sustainability and innovation ▪ Long-term strategic plan that embrace the actual issues and the future challenges of city ▪ The city hall developed the plan together with more than 400 different organizations, which assure legitimacy for the project. ▪ Concerns about reducing carbon emissions, save energy and water consumption
	Smart City Wien Agency	<ul style="list-style-type: none"> ▪ Dedicated organization ▪ Governance structure ▪ Partnerships ▪ Smart Citizens ▪ Social and Cultural Plurality ▪ New Laws

	Smart Together	<ul style="list-style-type: none">▪ Public funds▪ Partnerships▪ Actions/Initiatives/Projects▪ Urban Design (Building retrofitting)▪ Infrastructure▪ Mobility (Metro)▪ Education and Training▪ Economic Activities Community▪ Socio-cultural plurality Amenities and Facilities▪ Natural Resources (Reduce energy and water consumption, low carbon emission)▪ Living Lab
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