Innovation, Technology, and Knowledge Management

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Sustainable Smart Cities

Creating Spaces for Technological, Social and Business Development

Springer

Innovation, Technology, and Knowledge Management

Series Editor
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Series Foreword

The Springer book series *Innovation*, *Technology*, *and Knowledge Management* was launched in March 2008 as a forum and intellectual, scholarly "podium" for global/local, transdisciplinary, transsectoral, public–private, and leading/"bleeding" edge ideas, theories, and perspectives on these topics.

The book series is accompanied by the Springer *Journal of the Knowledge Economy*, which was launched in 2009 with the same editorial leadership. The series showcases provocative views that diverge from the current "conventional wisdom" that are properly grounded in theory and practice, and that consider the concepts of ***robust competitiveness***[1]***, sustainable entrepreneurship***[2]***,*** and ***democratic capitalism***[3]***,*** central to its philosophy and objectives. More specifically, the aim of this series is to highlight emerging research and practice at the dynamic intersection of these fields, where individuals, organizations, industries, regions, and nations are harnessing creativity and invention to achieve and sustain growth.

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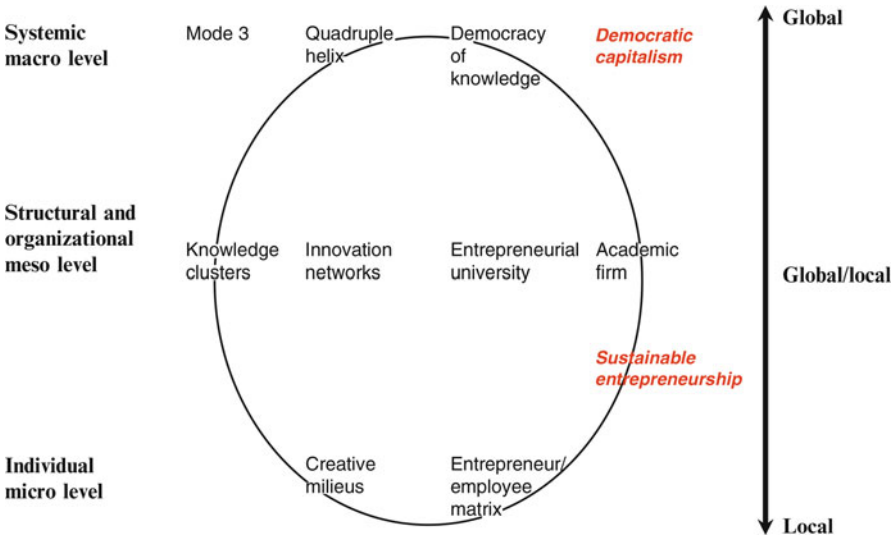
[1] We define *sustainable entrepreneurship* as the creation of viable, profitable, and scalable firms. Such firms engender the formation of self-replicating and mutually enhancing innovation networks and knowledge clusters (innovation ecosystems), leading toward robust competitiveness (E.G. Carayannis, *International Journal of Innovation and Regional Development* 1(3), 235–254, 2009).

[2] We understand *robust competitiveness* to be a state of economic being and becoming that avails systematic and defensible "unfair advantages" to the entities that are part of the economy. Such competitiveness is built on mutually complementary and reinforcing low-, medium-, and high technology and public and private sector entities (government agencies, private firms, universities, and nongovernmental organizations) (Carayannis, E. G. (2009). *International Journal of Innovation and Regional Development 1*(3), 235–254).

[3] The concepts of *robust competitiveness and sustainable entrepreneurship* are pillars of a regime that we call "*democratic capitalism*" (as opposed to "popular or casino capitalism"), in which real opportunities for education and economic prosperity are available to all, especially—but not only—younger people. These are the direct derivatives of a collection of top down policies as well as bottom-up initiatives (including strong research and development policies and funding, but going beyond these to include the development of innovation networks and knowledge clusters across regions and sectors) (Carayannis. E. G. & Kaloudis, A. (2009), *Japan Economic Currents*, pp. 6–10).

Books that are part of the series explore the impact of innovation at the "macro" (economies, markets), "meso" (industries, firms), and "micro" levels (teams, individuals), drawing from such related disciplines as finance, organizational psychology, research and development, science policy, information systems, and strategy, with the underlying theme that for innovation to be useful it must involve the sharing and application of knowledge.

Some of the key anchoring concepts of the series are outlined in the figure below and the definitions that follow (all definitions are from Carayannis, E. G. & Campbell, D. F. J. (2009). *International Journal of Technology Management*, *46*, 3–4).



Conceptual profile of the series *Innovation*, *Technology*, and *Knowledge Management:*

- The "Mode 3" Systems Approach for Knowledge Creation, Diffusion, and Use: "Mode 3" is a multilateral, multinodal, multimodal, and multilevel systems approach to the conceptualization, design, and management of real and virtual, "knowledge-stock" and "knowledge-flow," modalities that catalyze, accelerate, and support the creation, diffusion, sharing, absorption, and use of cospecialized knowledge assets. "Mode 3" is based on a system-theoretic perspective of socioeconomic, political, technological, and cultural trends and conditions that shape the coevolution of knowledge with the "knowledge-based and knowledge-driven, global/local economy and society."
- Quadruple Helix: Quadruple helix, in this context, means to add to the triple helix of government, university, and industry a "fourth helix" that we identify as the "media-based and culture-based public." This fourth helix associates with

"media," "creative industries," "culture," "values," "life styles," "art," and perhaps also the notion of the "creative class."

- Innovation Networks: Innovation networks are real and virtual infrastructures and infratechnologies that serve to nurture creativity, trigger invention, and catalyze innovation in a public and/or private domain context (for instance, government–university–industry public–private research and technology development cooperative partnerships).
- Knowledge Clusters: Knowledge clusters are agglomerations of cospecialized, mutually complementary, and reinforcing knowledge assets in the form of "knowledge stocks" and "knowledge flows" that exhibit self-organizing, learning-driven, dynamically adaptive competences, and trends in the context of an open systems perspective.
- Twenty-First Century Innovation Ecosystem: A twenty-first century innovation ecosystem is a multilevel, multimodal, multinodal, and multiagent system of systems. The constituent systems consist of innovation metanetworks (networks of innovation networks and knowledge clusters) and knowledge metaclusters (clusters of innovation networks and knowledge clusters) as building blocks and organized in a self-referential or chaotic fractal knowledge and innovation architecture[4], which in turn constitute agglomerations of human, social, intellectual, and financial capital stocks and flows as well as cultural and technological artifacts and modalities, continually coevolving, cospecializing, and cooperating. These innovation networks and knowledge clusters also form, reform, and dissolve within diverse institutional, political, technological, and socioeconomic domains, including government, university, industry, and nongovernmental organizations and involving information and communication technologies, biotechnologies, advanced materials, nanotechnologies, and next-generation energy technologies.

Who is this book series published for? The book series addresses a diversity of audiences in different settings:

1. *Academic communities*: Academic communities worldwide represent a core group of readers. This follows from the theoretical/conceptual interest of the book series to influence academic discourses in the fields of knowledge, also carried by the claim of a certain saturation of academia with the current concepts and the postulate of a window of opportunity for new or at least additional concepts. Thus, it represents a key challenge for the series to exercise a certain impact on discourses in academia. In principle, all academic communities that are interested in knowledge (knowledge and innovation) could be tackled by the book series. The interdisciplinary (transdisciplinary) nature of the book series underscores that the scope of the book series is not limited a priori to a specific basket of disciplines. From a radical viewpoint, one could create the hypothesis that there is no discipline where knowledge is of no importance.

[4] Carayannis, E. G. (2000). *Strategic management of technological learning*. CRC Press.

2. *Decision makers—private/academic entrepreneurs and public* (*governmental*, *subgovernmental*) actors: Two different groups of decision makers are being addressed simultaneously: (1) private entrepreneurs (firms, commercial firms, academic firms) and academic entrepreneurs (universities), interested in optimizing knowledge management and in developing heterogeneously composed knowledge-based research networks; and (2) public (governmental, subgovernmental) actors that are interested in optimizing and further developing their policies and policy strategies that target knowledge and innovation. One purpose of public *knowledge and innovation policy* is to enhance the performance and competitiveness of advanced economies.
3. *Decision makers in general*: Decision makers are systematically being supplied with crucial information, for how to optimize knowledge-referring and knowledge-enhancing decision-making. The nature of this "crucial information" is conceptual as well as empirical (case-study-based). Empirical information highlights practical examples and points toward practical solutions (perhaps remedies); conceptual information offers the advantage of further driving and further-carrying tools of understanding. Different groups of addressed decision makers could be decision makers in private firms and multinational corporations, responsible for the knowledge portfolio of companies; knowledge and knowledge management consultants; globalization experts, focusing on the internationalization of research and development, science and technology, and innovation; experts in university/business research networks; and political scientists, economists, and business professionals.
4. *Interested global readership*: Finally, the Springer book series addresses a whole global readership, composed of members who are generally interested in knowledge and innovation. The global readership could partially coincide with the communities as described above ("academic communities," "decision makers"), but could also refer to other constituencies and groups.

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Preface

The United Nations declared in 2007 that, 'For the first time in history the urban population will equal the rural population of the world'. Since then the march of urbanization has been relentless and across the globe there are now nearly 600 urban agglomerations of more than one million people, 70 in Europe alone. London has an urban population of nearly nine million, while megacities like Tokyo, Shanghai, Mexico City, and New Delhi have upwards of 20 million. The managerial and developmental challenges in cities of this scale are correspondingly huge.

Cities are centres of economic activity and drivers of growth. They generate wealth and prosperity. However, they are also complex challenges for governments because along with the benefits come negatives such as uncontrolled development, traffic congestion, waste management, complicated access to resources, and crime. And while the demand for services in cities is immediate, the tax revenues to fund them tend to lag behind. At the same time, globalization means that cities on opposite sides of the planet end up competing for capital, resources, and the brightest, most creative minds. In the face of these challenges, some cities experiment with new approaches to urban planning, design, finance, construction, governance, operations and services, sometimes under the broad banner of *smart cities*.

A smart city is one that develops in a manner that meets the needs of the future without compromising the ability of future generations to meet their own needs, so one of the enduring themes in this discussion is sustainability. It can, of course, be argued that city planners and managers have always tried to face issues responsibly, to square up to the future. But the vast scale and staggering complexity of the issues mean that new, innovative, integrated approaches are required. Cities must now try to become smarter, to improve their management and systems to ensure they become more sustainable, which means that a smart and sustainable city invests in human and social capital wisely, has citizens who participate in city governance, and has traditional and modern infrastructure that supports economic growth *and* high quality of life for its inhabitants.

Increasingly cities that want to become smarter seek to harness the power of ICT. As a result, much of the smart city literature puts technology at the centre of the "system of systems" for managing growth and sustaining development. ICT

innovations combined with exponential growth in networked, intelligent, and smart computers, sensor technologies, and ubiquitous personal devices like smartphones enable the creation of smarter electricity grids, smarter transport and mobility solutions, smarter city planning, smarter public service delivery, smarter buildings, and even smarter citizens.

Smarter citizens can exercise influence from the bottom-up and over the past few years a grassroots movement with particular priorities has emerged in parallel with the global technology companies that lead the way in developing tools and channeling discussions about the role of information technology in urban systems. The corporate vision is top-down, where the smart city is technology based with centralized infrastructure and governance. Smart citizens, on the other hand, have a more democratic, individualized, and decentralized world in mind, where technology is cheap or free, and rules loose—with non-proprietary technology built on open-source software in personal devices like smartphones and social networks. In the corporate view a smart city seeks to control, optimize, make efficient, and extract profit, while the bottom-up citizen version emphasizes sociability, transparency, efficiency in personal services, and entertainment.

City leaders perform a critical function in integrating these countervailing forces and the past few decades have seen novel experimentation as cities try to manage this balance productively. In practice, the big challenge to building smart sustainable cities is navigating the competing interests of diverse stakeholders. In that sense, it is a shared challenge: industry can offer valuable tools, while a diverse array of start-ups and citizens build cheap, fast, open-source alternatives.

The authors of the chapters of this book seek to illuminate the evolution of cities as policy actors, innovators, and development collaborators form the idea of the smart city.

The first article by Bennett, Perez-Bustamante, and Medrano is a progress report about smart cities in the UK. It shows that budgetary constraints faced by UK cities hamper their ability to implement smart city ideas and concludes that the main issues that cities face to becoming smarter are firstly political—only when both city and national governments agree on developmental policies and procedures will smart city initiatives begin to flourish. Mendoza Moheno, Hernández Calzada, and Salazar Hernández in Chap. 7 develop this line of thinking more generally by addressing the organizational challenges of building smart cities. They conclude that to build smart cities it is necessary to encourage flexibility in organizational structures, to energize innovative spirit and entrepreneurship, to enhance productive capacity for improved products and services, and to build an ethos of continuous organizational learning.

Vaquero-García, Álvarez-García, and Peris-Ortiz examine the fundamental role of smart cities in economic development through an extensive literature review that draws together the main themes of research. They discuss smart city initiatives in Spain and lay out guidelines and recommendations on how smart cities can positively affect economic development. Following on from this, Rodríguez-Núñez and Periáñez-Cañadillas focus on how cities must become smarter and develop strategies to make them more globally competitive. Their arguments are based on

examples from the autonomous community of the Basque Country (ACBC). To be competitive, they say cities need to engage with the knowledge society, develop ICT strategies, and protect intellectual capital, all within a sustainability umbrella. Their real-world analysis concludes with a ranking, on multiple dimensions of how well Basque cities have performed in implementing smart city principles.

Rankings are also at the heart of Chap. 4, by Arroyo-Cañada and Gil-Lafuente who tackle performance evaluation bedevilled by problems in aggregating smart city dimensions across countries and cities. Such rankings are often used in Europe to compare city performance, for example on stimulating entrepreneurial activity. The analysis uses fuzzy subsets composed of 29 factors related to the economy, people, governance, mobility, environment, and quality of life to compare European smart city performance. They propose a multidimensional system to help cities and regional institutions select better smart city strategies.

Escamilla, Plaza, and Flores address issues of sustainability from a multidisciplinary perspective beginning with the philosophical underpinnings of why sustainability is important. They talk about the need to instil corporate social responsibility amongst firms, citizens, and also political leaders to foster social awareness and participation so that smart cities can be fully engaged and effective. They analyse three Spanish smart cities, in order to establish guidelines for sustainable policy development in cities. Their main conclusion is that environmental management, governance, entrepreneurship, and citizen participation are the mainstays of any smart city. Following up on this, Álvarez-García, del Río-Rama, Vázquez-Huerta, and Rueda-Armengot focus on the development of Caceres as a smart city and compare it with the top smart cities in Spain. They conclude with an analysis which provides potential suggestions and recommendations that can help Caceres and other cities to make progress as a smart city.

Chapter 6 by Aragonez, Caetano Alves, and Blanco-González examines city branding in the context of four Portuguese cities. Their conceptual framework is based on a strategic management model. The research shows that leading politicians are critical element of city branding, but these leaders are hampered by election cycles and lack of a broad outward-focused marketing orientation. In short, city branding, to be done well and be sustainable, must also adopt smart principles. Marketing-based ideas also feature in Chap. 8 by de Esteban Curiel, Delgado Jalón, Rodríguez Herráez, and Antonovica, who describe the principles underpinning ‘smart tourism’ and the related concepts of smart hotels and airports. These ideas are shaped by the requirement of using traditional business tools to organize and execute sustainably.

Amo, Medrano, and Pérez-Bustamante focus on dimensions of the knowledge economy: internationalization, education, competitiveness, business intelligence, professional excellence, logistics, business potential, and entrepreneurship. They conclude that there is great potential to develop cities along smart dimensions through empowering citizens through the knowledge economy. However, this requires that city leaders be willing to engage in the knowledge economy and also have the political will to accept influence from the bottom up.

Chapter 10 makes a focused examination of supply chain challenges for smart cities. In this article Sánchez Martínez, Hernández Gracia, Martinez Muñoz, and Corichi García analyse supply chain issues for smart cities and show that smart cities grapple with increasing supply chain complexity, cost, and vulnerability to market forces. They show that the keys to integration between supply chain members are for top management to be fully invested and committed and for supply chains to be flexibly configured for market responsiveness.

Returning to London, Graham and Peleg envision smart cities as the outcome of a complex weave of influences, disciplines, and agencies acting to improve quality of life, sustainability, and efficiency. They demonstrate that the dynamic capability of new digital technologies plays a pivotal role in city development. But the rise of e-commerce means that traditional high-street retailers now face a global competitor with limitless product assortment, low prices, and a window display in the palm of almost every hand. While this might look like a mortal threat to high street retailers, local shopping habits are nonetheless sustainable and opportunities exist within the smart city construct for any retailer that can attract more "little and often" shoppers. They also suggest that local associations of retailers should build distinctive rather than differentiated high streets.

Durán-Sánchez, de la Cruz del Río-Rama, Sereno-Ramírez, and Bredis take a humanistic approach to examine quality of life issues in smart cities. Their study takes as a starting point the attractiveness of urban centres, which attract incomers. Their aim is to describe the current state of scientific research on sustainability and quality of life issues in smart cities. They conducted an extensive structured literature review and offer suggestions for further analysis.

In Chap. 14, Raya, García, Prado-Román, and Torres attempt to explain if residing in a smart city affects the value of our dwelling. Accordingly, they first describe if the physical characteristics and location of a dwelling affect the sales price, and then continue by analyzing if the buyer is willing to pay more for a dwelling if it is located in a smart city. This analysis is done by means of an estimated hedonic price model.

In summary, the articles here represent a small cross section of research into smart cities. Important themes have been identified as well as directions for further research. And big questions remain, for example, how can smart city solutions be adapted to cities in emerging countries where urbanization happens very quickly. Developing countries are no strangers to innovation, and sometimes embrace it at a faster pace than developed countries. For example, a great deal of banking and money transfer in East Africa is transacted using rather old-fashioned mobile phones because there are few bank branches, too little paper currency, too few offices for paying bills and so on. Mobile banking is a smart answer to real problems. There remains much to learn about smart city ideas and much to do to spread what we learn.

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Contents

Chapter 1
Challenges for Smart Cities in the UK

Dag Bennett, Diana Pérez-Bustamante, and Maria-Luisa Medrano

Abstract The rising interest in smart cities in the UK and Europe is in danger of sliding into a public–private debate. While the literature on smart cities is extensive, it is also confusing and often contradictory. Moreover, the world of technology advances far more quickly than does the tail of academic analysis. We briefly summarize the literature in order to create a brief progress report for smart cities in the UK. We begin with a short review of the smart cities concept.

Our main finding is that implementation of smart city concepts across the UK is patchy partly because in the UK, cities control only about 18 % of their budgets and their ability to act locally is constrained. As a result, smart city initiatives and investments leave much to be desired in terms of function and impact. We conclude that in the UK, the challenges to meeting the smart city ideal are many and profound, but not insuperable. The results can be summarized in four main issues that cities face in becoming smarter: (1) Critical political challenges—as opposed to technological—require involvement of highly placed political leaders. (2) Marketplace forces need to be shaped for the broader community to benefit. (3) Smart cities cannot be either bottom up or top down, they have to be both. (4) Concerns about privacy, engagement, and appropriate use of all aspects of smart city interfaces need to be better understood.

1.1 Introduction

Since the International Conference on Population and Development, held in Cairo in 1994, the world's population has grown from 5.7 to 7.2 billion, with three quarters of that growth occurring in Asia and Africa (UN, Concise Report on the World

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Population Situation, 2014). Although population growth is slowing, the United Nations project that the world's population will reach around 9.6 billion by 2050.

Much of the growth will be in cities and the world's urban population will rise to 6.3 billion by 2050. It is also useful to consider where these people are located—of the 476 cities with one million inhabitants or more in the world today 80 % are in emerging markets, 78 in China alone, 55 in India. By 2050, there will be 800 such cities. Emerging markets also have 75 cities of over three million people, and they grow between 3 and 10 % per year (United Nations, 2012). In addition, these cities tend to be very dense, e.g., Mumbai has about 20,000 people per square kilometer, compared to London at 5100 (UN, 2012).

Major urbanization requires innovative ways to manage the complexity of urban living; it demands new ways to target problems of overcrowding, congestion, energy consumption, resource management and environmental protection. It is in this context that smart cities emerge not just as an innovative modus operandi for future urban living, but as a key strategy to tackle poverty and inequality, unemployment, and energy management (Fig. 1.1).

To understand what the future for cities holds, it is useful to look back at the urbanization of the past. As a Centre for Cities analysis (Centre for Cities Report, 2014) puts it, "a city's economic past has a profound influence on its future." The analysis was based on an examination of urbanization in Britain from 1801 to the present day and reaches the conclusions that: (1) Skills are the most important factor determining long-run urban success and therefore a key area for policy intervention, (2) Targeted investment in infrastructure has significant impact on city performance, (3) Failure to invest in skills or infrastructure has long-term knock-on effects on cities and their people.

The evaluation of performance or success of cities here is primarily economic and based on indices of economic distress (joblessness, benefits claims), income,

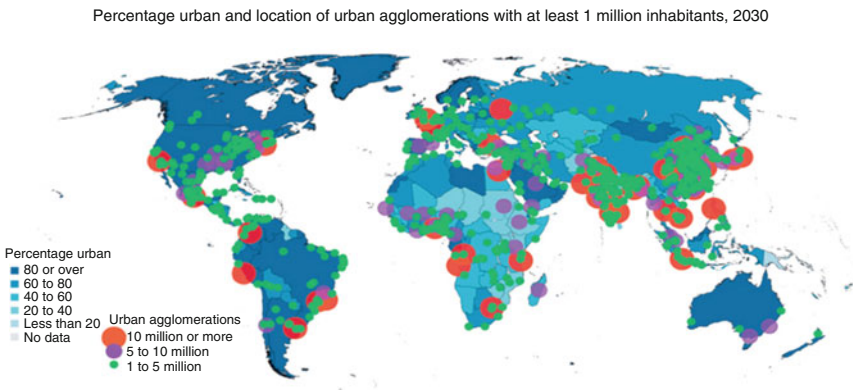

Fig. 1.1 World Urbanization Prospect 2030. Source: United Nations, World Urbanization Prospects 2014, revision

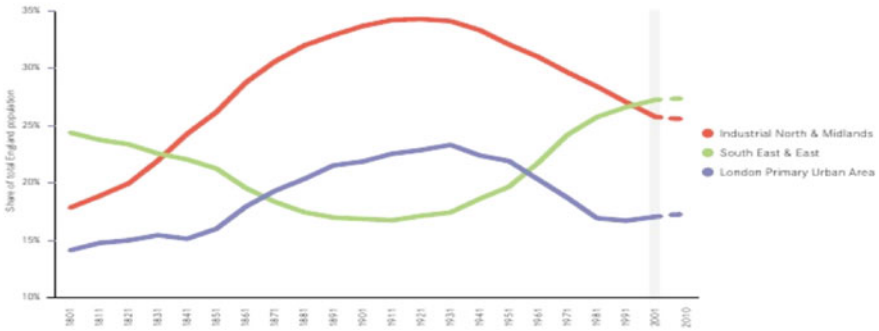

Fig. 1.2 Change in population share across England, 1801 to 2010. Sources: Southall H/University of Portsmouth, 2010. NDMIS, Mid-Year Population Estimates, 2010

income disparity, property values, the ratio of manufacturing to services, joint-stock company registrations, and professional employment. The two-century-long perspective in this research encompasses huge shifts in population, from rural to urban, huge growth of cities, transportation links, and profound evolution of manufacturing and technology. One telling graphic from the study is shown in Fig. 1.2 above. It shows how industrial cities in the North and midlands, and also London, attracted a growing proportion of the English population through about 1911—urbanization, followed by a falling off period until about 2001—suburbanization. Note also that London is again increasing its share of population.

The analogy of Britain's path over the past two centuries to cities in other parts of the world is not exact but it does help inform the debate about how to face the future. In many ways, developing world cities face the toughest challenges over the next 30 years because they will experience a great degree of change, often with low levels of resources and institutional capabilities. As the forces of globalization place cities into direct competition with one another, cities are required to deliver thriving economies, great quality of life, political stability, business friendliness, and a reduced environmental impact in order to be competitive, not only on a regional or national scale, but globally.

As the report "What are future cities? Origins, Meanings and uses" lays out, future cities will need to adapt to, or in some cases work to mitigate against:

- Climate change
- Population growth
- Globalization of economy, demographics, risks, and ecologies dependencies
- Technological developments
- Geopolitical changes
- Human mobility
- Ageing populations
- Inequality and social tensions
- Insecurity (e.g., energy, food, water)
- Changing institutional and governance frameworks

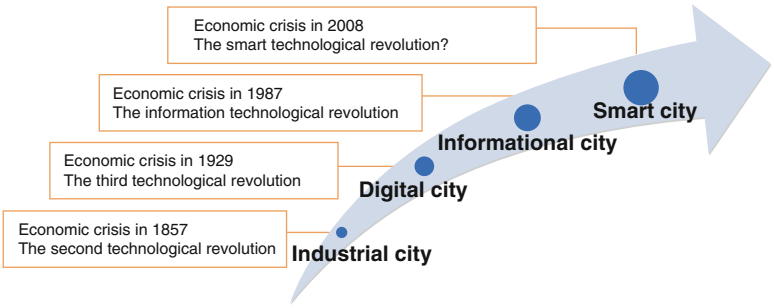

Fig. 1.3 Background of smart city. Sources: (Zhou, 2010)

These are not new issues, planners, scholars, authors and architects have been talking about the future of cities since ancient times (Fainstein, 2014). In the past century, after Ebenezer Howard's landmark Garden Cities of Tomorrow (1902), urbanism itself, as a distinct term and discourse has grown out of the concern for future city development (Pike, 2005). Nor are challenges necessarily negative—every global financial or energy crisis triggers a technological revolution, Fig. 1.3. (Zhou, 2010).

Despite the ongoing discussion of recent years, there is no agreed definition of "smart city," and it is not a term much used in strategic urban planning (Giffinger et al., 2007). There is however, a general consensus that smart cities are those that are trying to solve their long-term challenges such as population growth, transport constraints and budget pressures. Moreover, especially over the past few years, there is growing agreement that smart cities are greatly aided by the widespread adoption of Information and Communication Technologies (ICT). Below we review core concepts of smart cities.

1.1.1 Smart Cities

Cities are complex systems of interconnected people, businesses, transportation, communication networks, services, and utilities. And as cities grow and evolve they generate technical, social, economic and organizational pressures that put economic and environmental sustainability in jeopardy. In this context, there is an ongoing debate about on how technology-based solutions, combined with new approaches to urban planning can assure future viability and prosperity in metropolitan areas (Al Awadhi et al., 2012). In this discussion, the smart cities concept can be traced back to the Smart Growth Movement of the late 1990s (Harrison & Donnelly, 2011).

When applying the smart cities concept to economic activity, the term tends to embody components of "smart" industry, which usually implies ICT, and ICT-intensive sectors. Smart city also encompasses the education sector and smart

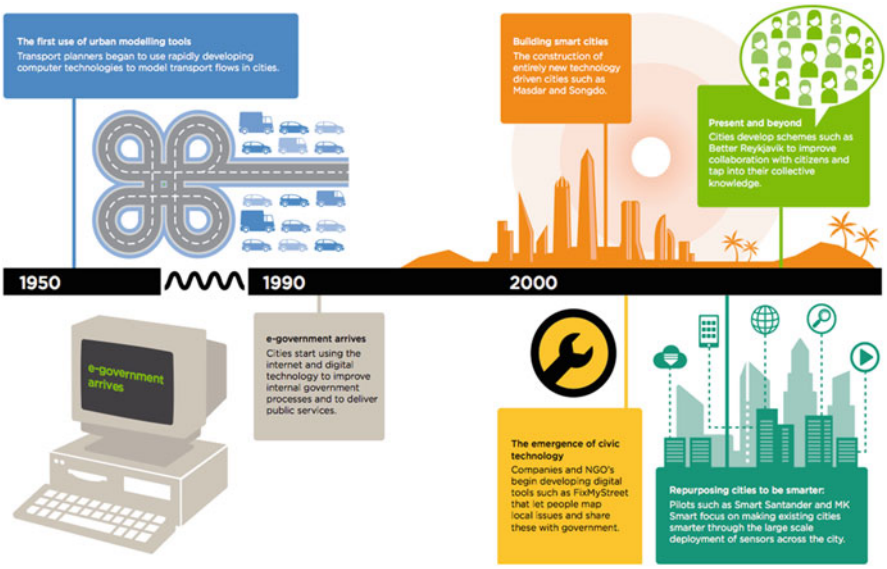

Fig. 1.4 A timeline for smart cities development. Sources: Rethinking smart cities from the ground up (Saunders & Baeck, 2015)

inhabitants in terms of education level and taught skills. In other literature the term smart city refers to the relationship and processes between the city government and administration and its citizen (Nijaki & Worrel, 2012). Good governance as an aspect of a smart administration often also refers to the use of new channels of communication with inhabitants, e.g., "e-governance" or mobile, on-the-go connectivity. Smart city also extends to the use of modern technology in everyday urban life—not only ICT, but also transport and logistics as well as transport management systems that improve traffic and reduce congestion.

Rudolf Giffinger et al. (2007) sum up these aspects and add a performance dimension to the concept, "A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens." In other words a smart city pays attention to and integrates all of its critical infrastructures, (roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings) in order to better optimize its resources, plan maintenance activities, and monitor security aspects while maximizing services to its citizens (Fig. 1.4) (Hall et al., 2000).

The need to balance social development and economic growth in a context of high urbanization is a main driver of the worldwide interest in smart cities. Because cities have diverse contexts, sizes, and resources, it is difficult to develop a comprehensive framework that conceptualizes different smart city components and the strategic steps for implementation. However, most current thinking about

conceptual frameworks emphasize the role of IT as both a source of data, and as the connective tissue between other elements in an "IT-based innovation urban ecosystem" (Zygiaris, 2012, p. 218). Although the components include technology, people, and institutions (Colldahl, Frey, & Kelemen, 2013), the literature usually focuses on technology's dominant role. Indeed, smart technologies transform cities' public and private services by integrating real-time communications and information, and enhancing livability. In a period of sluggish growth, key technology adoption offers great opportunities for cities and can spark new wealth creation (Colldahl et al., 2013; Angelidou, 2014; Giffinger et al., 2007; Washburn et al., 2010; Hollands, 2008; Caragliu, Del Bo & Nijkamp, 2009; Hall et al., 2000; Zhou, 2010).

The Landscape and Roadmap of Future Internet and Smart Cities (Hongisto & Almirall, 2012) defines a city as "smart" when investment in human and social capital, traditional (transport) and modern (ICT) infrastructure fuel sustainable economic growth and a high quality of life, with wise Management of natural resources, through participatory governance. Thus the concept of a smart city goes beyond the transactional relationships between citizen and service provider. It is essentially enabling and encourages the citizen to become a more active and participative member of the community. Furthermore, citizens need employment and "smart cities" are often attractive locations to live, work and visit.

1.1.2 Becoming Smarter

The European Commission proposes that "smart cities can be seen as systems with people, flows of energy, materials, services and financing that catalyze sustainable economic development and high quality of life through the wise use of technology and innovative transparent urban planning that is closely related to the economic and social activity of communities." Elements of the smart cities philosophy proposed by the European Commission include: (1) tackling common challenges and bottlenecks, (2) developing innovative & replicable solutions, (3) bundling demand from cities and regions, and (4) attracting and involving businesses and banks. In the European Parliament report "Mapping Smart Cities in the EU" (2014) this concept has been developed along six main axes or dimensions:

- Smart Economy
- Smart Mobility
- Smart Environment
- Smart People
- Smart Living
- Smart Governance

1.1.3 Mapping Smart Cities

Of EU cities with at least 100,000 residents, 240 (51 %) have implemented or proposed smart city initiatives, while almost 90 % of cities over 500,000 inhabitants are Smart to some degree. There are smart cities in all EU countries, but the largest numbers are in the UK, Spain, and Italy, although the highest percentages are in Italy, Austria, Denmark, Norway, Sweden, Estonia, and Slovenia. Smart city initiatives cover all six dimensions above, but most frequently focus on Smart Environment and Smart Mobility. Geographically, there is also a fairly even spread, although Smart Governance projects are mainly seen in the older EU States of France, Spain, Germany, the UK, Italy, and Sweden. It is also noteworthy that some dimensions tend to occur together, e.g., Smart People goes with Smart Living (Mapping Smart Cities in the EU, 2014).

Many cities in emerging economies also pursue smart city programs. India will spend EUR 66 billion on seven smart cities along the Delhi–Mumbai Industrial Corridor using a mixture of public–private partnerships (80 %) and publicly funded trunk infrastructure investment (20 %). China too has a smart cities strategy as part of its efforts to stimulate economic development and eradicate poverty, especially in rural areas where programs seek to attract rural workers, which can then serve as giant urban employment hubs. As of March 2012, this strategy, based in transforming existing cities, involved at least 54 smart city projects totaling EUR 113 billion.

1.2 Challenges for Cities in the UK

In its smart cities report, (2013) the Department for Business Innovation and Skills identifies major challenges for UK cities including:

- Economic restructuring, unemployment, particularly among young people;
- Urban infrastructure has grown piecemeal and rising urban population puts pressure on housing and transport;
- Climate change, and the fact that 80 % of the UK population live in cities;
- Online entertainment and online retail/consumer service changes the nature of the High Street;
- Ageing population and adult social care, absorb increasing proportions of local authority budgets;
- Pressure on public finances have reduced local authority budgets on average by 12–15 % in real terms over the past 3 years;
- Grants from Government Departments are still the main source of local authority funding, especially for cities, and this limits local authorities' ability to provide integrated responses to the challenges they face.

The scale of these challenges is forcing cities to rethink their strategies and to innovate in order to maintain service levels, in particular. Even so barriers to adoption and implementation remain (Department for Business Innovation and Skills, 2013) and include:

- Information failures
- Coordination failures
- The inability of cities to gain first mover advantage
- Finance for innovation in public services and the challenge of roll-out
- Inclusivity of public services
- Fear of lock-in
- Trust in data privacy and system integrity

Thus if smart cities are to truly work in the UK, or anywhere else, stakeholders need to learn from the successes and mistakes of those cities where the concept of getting "smarter" is more mature.

1.2.1 Local UK Policies and Country Policies

The UK government supports investment, including £95 million for research into smart cities funded by Research Councils UK, £50 million over 5 years earmarked for the new Future Cities Catapult center being established by the Technology Strategy Board in London, and £33 million invested in future city demonstrators. This investment strategy is underpinned by the idea that there is huge potential for the UK to be the world leader in smart cities. The new Smart Cities Forum will bring the best minds together on a regular basis to establish a clear plan to exploit the exciting technologies that are being developed in the UK (Department for Business Innovation and Skills, 2013).

1.2.2 Political Challenges

In comparing smart cities initiatives that get off the ground versus those that either stay in planning or languish in implementation, one of the salient characteristics of successful programs is that they have an executive who shows belief in the concept and exercises leadership to drive it forward. One example of this is Sunderland, which is one of the few UK cities that have spent significant sums of their own money on smart city projects and related technology. Sunderland's public figures show they have invested well over £10 million on various phases, one of the most recent being a "City intelligence hub." This level of investment is supported by detailed analysis leading to robust business cases that emphasize a combination of financial efficiency and social or economic value.

Milton Keynes have also succeeded in implementing smart city programs driven by the committed leadership of their city council. Their model has attracted outside and/or commercial participation, ranging from the Open University to over 40 private sector companies (Hargrave, 2015) under the umbrella of MK:Smart.

In contrast to Sunderland, the Milton Keynes model is more exploratory and many of the participating companies use UK and EU funding to test or prove new technology and business approaches to urban issues, so the long-term sustainability for Milton Keynes and widespread deployment of these approaches elsewhere remain open to question. Other cities with smart city initiatives driven from strong executive bodies include Glasgow, Bristol, and London (Hargrave, 2015).

1.2.3 Marketplace Forces

As the price of digital technologies falls, private sector companies capitalize on rapid consumer uptake to sell their own services, often via their own technical infrastructures. We see this in satellite based communications, GPS services, on-the-go wifi, and so on. However, private sector marketplace dynamics offer no guarantee that citizens will get everything they need or want in cities. To ensure that we harness the power of new technology for broadest possible benefit, a well thought-out policy environment, at both national and local level, is needed. The main aim of such policies would be grounded in the concepts of open access for ordinary people and businesses and the broader community.

As the information revolution plays out it generates tremendous economic growth and wealth. But growth and the free market will not inevitably result in greater benefits or inclusiveness for all. Historically, it has taken a tremendous amount of hard work to ensure that the benefits of growth are not overly concentrated in the hands of a few people or firms. In the UK, a prime example of this is how a tremendous public investment in education in the late nineteenth and early twentieth centuries made it possible for the benefits of growth to be shared across society. Societal improvement is not a necessary or natural outcome of economic growth or technological development, instead, it requires people, institutions and policies to guide it and ensure inclusiveness and fairness.

This is not easy because with new technologies and systems, it is rare for reliable evidence to exist on which to base cost–benefit analyses. Therefore decision-makers often struggle to justify public investment in unproven, and therefore risky systems or technologies. In order to escape from this trap, public policy needs to evolve to recognize the importance of infrastructure (especially digital infrastructure) for cities so that it becomes an integral part of any public service or infrastructure case—and not something that requires a separate justification, which almost by definition cannot be found.

1.2.4 Bottom Up or Top Down

On the one hand, the critical role that top leaders play in pushing forward smart city programs suggests that top-down approaches are most effective. On the other hand, it is people at the local or micro level whose creativity and energy are critical to creating a better life for themselves, their families and communities. The trick is to get both top and bottom to work together.

Many thinkers from a variety of backgrounds have addressed the problem of balancing top-down and bottom-up. E. F. Schumacher (1973) talked about the need to distribute investment in what he calls "appropriate technology" that emphasizes the importance of human development. Schumacher wrote at the beginning of the digital revolution, originally from a perspective of knowledge transfer to developing countries, but his work also laid the groundwork for the concept of using technology and engineering in developed nations that results in less negative environmental and social impact. In other words, technology should be both environmentally and socially appropriate.

Elinor Ostrom's work examined the role of public choice on decisions about the production of public goods and services. Her concept of common pool resource (CPR) institutions describes how humans interact with ecosystems to maintain long-term resource yields. She showed that societies develop diverse institutional arrangements to manage resources (Ostrom, 1990). A central theme in her writing about the commons is the multifaceted nature of human–ecosystem interaction that argues against any single "boilerplate" solution to social-ecological problems. Instead, self-organized governance systems with effective communication, internal trust, and reciprocity are essential to a "social-ecological-systems" (SES) framework for common-pool resource management (Poteete, Janssen, & Ostrom, 2010).

Other key thinkers include Zolli and Healy (2012) who describe ways to synthesize top-down and bottom-up approaches, Jan Gehl (2010) who started the "human cities" movement by relating the scale of city structures to the human senses, and Joseph Stiglitz (2012) and Thomas Piketty (2014) who address the problems created by increasing inequality and unfairness with social policy and taxation solutions that prioritise fairness as an objective, which is especially important in dense urban environments.

1.2.5 Privacy

Privacy is a key consideration for any smart city strategy. If ignored, citizens will fear that data tracked by innovative technology, whether from public organizations or private companies, can be used for purposes that they do not intend or may not even know about and therefore citizens must have a choice of whether to allow governments to use their data, or they will opt out of future initiatives (Datoo, 2014).

Any council or public body in Britain should keep this in mind as they consider launching projects that aim to enhance efficiency by streamlining public services, especially if they involve privatized services. For example, some councils have installed sensors around London with the aim of gathering data about available parking spaces, electricity usage and even refuse levels. This data is used to refine fares in parking garages or to reroute refuse collection trucks. However, when citizens learned that their data was being tracked, without their knowledge, there was a furious backlash against both London councils, and the private companies tracking the data.

The issue here is privacy and trust. If smart cities are to function well, it is fundamental that they develop and publicly agree policies around open data and, secondly that they include the ICT community in the discussion—partly for inside-the-tent reasons. Only then will entrepreneurs be able to build effective tools that use available data and generate new data, but also get the public to accept the technology and adapt it. As cities round the world seek to harness new technology and big data, private companies and developers scent opportunities and now promote their capabilities in technology and expertise. For example, Cisco and IBM are both in the hunt to set up managerial infrastructure around the world, often under the smart city heading. But while large companies may provide the initial tools for cities to create more data and open up data sets, it is likely to be smaller firms and developers that will create applications that will truly affect citizens on a daily basis.

There are pitfalls along the way. Boston's *Street Bump* smartphone app was hailed as a big data triumph that allowed the city to quickly identify potholes and then fix them without having workers patrol the streets. Anyone who downloaded the app onto their smartphone would automatically notify the City of potholes as they drove around. Boston proudly claimed that the data gave them real-time information to fix problems and to plan long-term investments. On the other hand, on its own, *Street Bump* actually produced a map of potholes that systematically favors young, affluent areas where more people own smartphones. This is a core problem of "found data"—as opposed to data gathered from a fair sample—it can contain systematic biases and it takes careful thought to spot and correct them.

Academics propose a number of ideas to balance the societal benefits of big data and the technology that generates it against privacy and autonomy. Deakin (2013) argues that being smart is not just about using ICT, but tailoring intelligence to the needs of citizens through community cooperation. Komninos (2013) identifies three layers of intelligence: the artificial intelligence of city infrastructure, the collective intelligence of the city's institutions, and the intelligence of citizens. Integrating these layers operationally is core to overcoming issues of public and private opacity. This is challenging because not only is the legal framework for data privacy a work in progress, but so too are the technologies that generate the data.

1.3 Conclusion

There is much academic literature on many aspects of smart cities, as well as many government and quango-based sources of information. Having reviewed the literature and other information sources, we conclude that we may never reach overall agreement on what a smart city is. Instead, regardless of the formal definition, we come to the view that for the smart city concept to be effective, it must be an organic connection among technological, human, and institutional components that involve private and public sectors and the entire population. We also endorse the current idea that "smart" captures innovative and transformative changes incorporating, or enabled by new Technologies (Nam & Pardo, 2011).

We also conclude that the support of government and policy for governance is fundamental to the design and implementation of smart city initiatives. No single person or organization can shape the smart cities ecosystem to deliver the cities of the future. Local governments have civic duty of care but lack the expertise in financing and business model innovation. Private sector corporations are mostly amoral and have irresistible incentives to maximize profits. Many social enterprises are enormously admirable attempts to fuse these two models, but often lack the resources and ability to scale up in implementation. Thus the challenge for the future lies in harnessing and reconciling radically different incentives.

Finally, it is necessary to establish an administrative environment (initiatives, structure, and engagement) that is designed to be supportive of smart city concepts (Yigitcanlar & Velibeyoglu, 2008). As Odendaal suggests, "to enable smart city initiatives, the category should also include integrated and transparent governance, strategic and promotional activities, networking, and partnerships."

1.4 Theoretical Implications/Practical Implications

The results can be summarized in four main issues that cities face in becoming smarter:

1. Critical political challenges—as opposed to technological—require involvement of highly placed political leaders,
2. Marketplace forces need to be shaped for the broader community to benefit,
3. Smart cities cannot be either bottom up or top down, they have to be both,
4. Concerns about privacy, engagement, and appropriate use of all aspects of smart city interfaces need to be better understood.

Any "smart city" initiative that successfully uses digital technology to create a financially sustainable social, economic or environmental improvement must draw together skills from a wide variety of disciplines. No initiative is purely to do with technology. But they all use technologies to achieve outcomes that are important to cities and communities. By understanding how the potential of technology is apparent

to the stakeholders in such initiatives, why it is affordable and accessible to them, and how they can acquire the skills to exploit it, we can learn how to design smart cities in a way that encourages widespread grassroots, localized innovation.

Future success depends on three main elements: an innovative and demanding customer in the form of British town halls; continuous development of capability; and staying abreast of global developments and seizing opportunities.

Recommendations to conclude on how cities can better achieve this concept are: set up a civic innovation lab to drive innovation in collaborative technologies; use open data and open platforms to mobilize collective knowledge; take human behavior as seriously as technology; invest in smart people, not just smart technology; spread the potential of collaborative technologies to all parts of society.

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Chapter 2
Urban Models of Sustainable Development from the Economic Perspective: Smart Cities

Alberto Vaquero-García, José Álvarez-García, and Marta Peris-Ortiz

Abstract In the following years smart cities are to play a fundamental role in the models of economic development. The cities that used to be just a place to live in are becoming areas that have to be adapted to the needs of their residents, and can guarantee them a better life quality, but always from a responsible position. The United Nations (UN) said repeatedly that in 2050 a 70 % of the world population would live in cities and some of them would have more than ten millions of residents. The purpose of this chapter is to make an approximation to the smart cities concept and to deepen into the application and the results of this kind of models of the urban development. The methodology is based on a theoretical–practical analysis of the smart cities. For this purpose an exhaustive analysis of the most recent economic literature on this topic has been done. Moreover, some of the most important results of this new model of the urban development have been indicated, so they can be applied to the problems that some cities have, and a case study has been done as well.

2.1 Introduction

One of the main challenges for urban development is to get cities that could take advantage of all the possibilities that Information and Communications Technologies (ICT) could offer to improve their residents' life quality, but always taking care of the environment.

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Cities influence a lot on economic and social development of countries. Nowadays cities consume about 75 % of the world resources and energy, and at the same time produce about 80 % of the greenhouse effect. A 70 % of the world population is expected to live in cities in 2050; this fact will cause problems of management of services and infrastructures that will mean some difficulties in the social organization and land management, and the environment will be damaged as well.

These cities have to tend to satisfy their residents' needs, providing them services that have more quality and that are more efficient; at the same time they have to take care of the environment, trying to guarantee the sustainable development.

Modern cities are like big enterprises that have to provide multiple services as electricity or water supply, telecommunications, gas supply, transport, education, E.R., etc., and at the same time they have to have a wide net of infrastructures. Taking into account all of this, the smart cities can contribute a lot to this way of development.

To analyze all these points, this chapter has the following structure: after this introduction in the part two a change of the urban model developed by the cities from an approach based on the smart development and at the same time respectful towards the environment is analyzed. The third part marks some of the economic aspects that have to form part of a new design of the smart cities. The fourth part describes a situation of the smart cities phenomenon in Spain, making a general analysis and a study of some of the most important cases. The fifth part establishes a group of recommendations to point out some possibilities for improvement. At the end of this chapter some conclusions drawn from the previous parts can be found.

2.2 Changes in a Model of the Urban Development: Smart Cities

Increase of the number of city residents has been a dominative pattern these years. In 1960, a 32.6 % of the world population lived in cities; in 2010, this percentage grew up to the 50.9 %; in 2030, a 60 % of the world residents will live in cities, becoming a 75 % in 2050.[1] Nowadays cities demand a 75 % of resources, generating up to 80 % of the GBP in some countries. In the following 3 decades the main part of economy, social benefits and improvement of the residents' life quality will be concentrated in cities. Moreover, due to the concentration of residents an unprecedented increase of the pollution levels in big cities that affects their residents' life quality is produced.

It has been more and more required to the cities to be more efficient, to be developed in a sustainable way, and to manage their resources; that needs an evolution of their models of management. This way, public persons, which are in charge, are

[1] See "Hoja de datos sobre las ciudades" published in the Conference of the United Nations on Sustainable Development Rio+20 (2012).

requested to nuance the economic and social effects produced by cities development, and not only to correct the deficiencies that this expansion of services and infrastructures produces, but also to be able to foresee these situations.

It implies that the cities have to progress towards a more efficient model of management with more quality that could let them, amongst other aims: (1) to assure their development, allowing to have organized and appropriate to the needs of their residents evolution; (2) to improve the provision of services with a high level of quality in the most efficient way and with less cost; (3) to get an integrated vision of the provided services to get synergies and savings.

The smart cities are born exactly under these circumstances; these cities are able to take advantage of the technological progress to foresee more and better services,[2] to reduce the environmental footprint,[3] to encourage local innovation and to improve the quality of the services that are provided to the residents.

There are a lot of approaches for a concept of a smart city (Mosannenzadeh & Vettorato, 2014). Caraglui et al. (2009) claim that a smart city as that one that gets that investments in social and human capital and infrastructures in transport and ICT could strengthen sustainable economic development and better life quality, using in an efficient way resources and having a participatory and sensible to the residents' need governance. Nam and Pardo (2011) say that a smart city is that one where infrastructure and human and social capital allow sustainable economic development and improve life quality through collaborative governance. López Pol (2012) indicate that the smart cities need an integration of the goods and services supply with suppliers and users, playing supervision a very important role in this process. For Batty et al. (2012) a smart city is a synthesis of physical capital, of a system of communication and interconnection, and of a process of constant improvement of the search for quality.

The EU, one of the institutions that support more than others this kind of initiatives,[4] indicates that the smart cities would be those ones where nets and traditional services are provided in the most efficient way, due to the use of the ICT for their residents and enterprises' profit; although a concept of a smart city has to go beyond a simple use of the ICT, involving smart networks of urban transport, water supply, collection and recycling of rubbish, lighting, improvements of public spaces, and more interactive and transparent with the residents government Unión Europea (2008, 2013) and European Commission (2013).

[2] It means to take an advantage of the ICT to interconnect and control all the services provided through centralized management and to reduce their costs due to the synergies between all the municipal departments.

[3] Environmental footprint measures an impact of any product or services on the environment throughout all its life cycle. It is possible to reduce the impact of human activities measuring the environmental footprint.

[4] This initiative follows the objectives of a document "Europa 2020: Una estrategia para el crecimiento inteligente, sostenible e integrados," better known as 20–20 objectives.

Focusing this study on the articles published in Spain, different approaches for the concept of a smart city can be found. The Institute for Diversification and Energy Savings (IDAE, 2012) indicates that a smart city is that one which is able to use sustainable development without damaging the environment using the ICT as a tool for a smart management of resources with the aim to satisfy the residents' needs. A definition of a smart city by the Telefonica Foundation (2011, 2015) is spread out as well; according to it, smart cities are those that use the ICT to allow their infrastructure and public services to be more interactive, efficient and appropriate to the residents' needs, enabling a higher interaction with the received benefits.

This way, a city will be the smart one if the investments that are made in education and academic training, in social aspects, in infrastructures, energy, ICT, transport, etc. allow a higher life quality, economic and sustainable development and prudent management of natural resources. The smart cities are the cities that are committed to their environment, where infrastructures with the most developed technological solutions are guaranteed to the residents to allow their interaction with urban elements, making their lives easier.

A structure of a smart city is based on at least four elements (Table 2.1). First of all, it is necessary to have an urban area (occasionally it can be also a metropolitan area, if it is close to an important city) where a high number of services is provided to the residents. Therefore, it is mandatory to have a city of a determinate dimension that can provide enough for the collective needs services. It allows to introduce the first criterion of selection, because not all the cities can be smart. This way, those that are small have to join another cities that are close geographically to provide a certain kind of service or if not, they will not be smart.

Secondly, it is mandatory for the cities to have infrastructures that can deal with social requests. This point needs these facilities to be respectful towards the environment. It is not enough just to have a good infrastructure if energy consumption is unreasonable or if its maintenance requires a lot of money.

Table 2.1 Elements the smart cities' structure is based on

Element to be considered	Content
Urban area	An urban or metropolitan area that allows to provide a wide range of services to the residents
System of infrastructures	Infrastructures appropriate for social requests and at the same time respectful towards the environment have to be guaranteed, in a sustainable urban development framework
System of networks and smart platforms	It is necessary to count on information systems that allow data collection, not only to provide a better service to the resident, but also to foresee new needs and to reorganize resources
Residents	The residents are to be the main element of the smart cities, due to the fact that provided services and created infrastructures have to satisfy growing needs of the urban residents, but always in a sustainable urban development framework

Source: Own elaboration from the Libro Blanco smart cities, Ernest et al. (2012)

Thirdly, it is necessary to have an information network based on smart platforms. With the implementation of the ICT in municipal services an important quantity of information can be collected, but the aim of this is to improve a service provided to the residents, not only to detect possible incidents, but also to plan potential requests. Only this way a supply of goods and public municipal services can be optimized.

Finally, it is necessary to know the residents' requests for public services and for municipal infrastructures. The smart cities' functioning is to look for a higher level of welfare of the population under sustainable circumstances. Therefore, the last duty of a smart city is to take care of the needs of its residents in a responsible and organized way.

Transformation of a traditional city into a smart one is not an automatic process; neither means it a break with traditional models. Batty et al. (2012) indicate that smart cities are heirs of ancient city models that were able to apply the ICT to the use of traditional infrastructures. However, the smart cities go beyond, because due to the implementation of the ICT a better understanding of all the problems that urban management has, and not only the present ones, but also the future ones, can be achieved. It can be explained with the fact that the ICT development enables organized planning of resources, anticipating the detected needs. Moreover, the smart cities help to improve technological initiatives, because everything is connected, improving management of urban resources and governance of the cities.

The Table 2.2 allows to name some of the actions that have to be carried out to make a city a smart one. First of all, the smart cities have to have appropriate technological infrastructure that enables interconnection between all the municipal services in real time. To do that, it is necessary to make an appropriate investment in communications networks within smart platforms that can guarantee efficiency of a service in a sustainable framework.

Table 2.2 Actions to be carried out in a smart city

Action	Steps to be done
Technological infrastructure	Creation of informational networks as a tool to improve communications, smart platforms, efficient and sustainable infrastructures
Energy strategy	To avoid energy dependence from the sources of traditional energy, especially from fossil fuels, supporting renewable energy, creation of systems of energy storage, energy exploitation, etc.
Management and protection of resources	To promote actions of area and resources development taking into account sustainability and cooperation of administrations
Provision of services	To establish new collaborative models that allow to integrate public and private vision of resources, its common use, metropolitan areas of resources, etc.
Government	Efficient use of information obtained due to an analysis of the demand of services, infrastructure, benefits, that allows to improve the offered to the residents quality

Source: Own elaboration from the Libro Blanco smart cities, Ernest et al. (2012)

Secondly, a strategy that can enable a generalized use of respectful for the environment sources of renewable energy has to be installed. At the same time it is necessary to be giving up on energy dependence on fossil fuels and to create systems of energy storage.

Thirdly, it is mandatory to manage and protect resources, so the municipal actions take place into the organized area and resources development framework taking into account sustainability and providing cooperation between different administrations.

Fourthly, it is very important to support development of collaborative models between public and private sector for provision of municipal services. This way, it is fundamental to detect and to take advantage of synergies, not only in the same city, but also in cities that are geographically close to each other to optimize available resources.

Finally, it is fundamental that municipal governments use in an efficient way information that can be collected applying the ICT for provision of services and infrastructures. This way, due to this information, its use, need to reinforce the service, possible deficiencies, etc. could be determined, so the quality that is offered to the residents can be also improved.

As it is not possible to be done in any other way, cities that want to be smart need an important investment to be done, both human and technological. The technological one needs to have technical support of specialized companies that offer an appropriate for municipal needs product. It is not strange that certain companies that work in the ICT sector foresaw the municipal interest in the smart cities and created departments that consult municipal agents about the best solutions to get subsidies.

Although there are grants to set up the smart cities, they do not cover the whole investment (80 % maximum), so economic effort of municipal funds turns out to be important. Taking into account this fact, it is convenient that public managers make a cost-benefit or cost-effectiveness analysis to estimate if an investment in the smart cities is profitable or not. To do this it is necessary to take into account a wide range of profits that can be achieved due to this decision, both in a specific and general way (Table 2.3).

Table 2.3 Benefits of being a smart city

Benefit	Main results
Specific	• Based on a kind of services that is provided or infrastructure that is optimized
Generals	• Consolidation of cities development and at the same time flexible and organized adaptation • To offer a platform for innovation and creation of new entrepreneurial initiatives followed by economic and social improvement • To save public funds in services and infrastructures that are being optimized • To improve the quality of public services provided to the residents • To enable immediate and easier identification of the residents' needs and to detect possible actions to be carried out • To improve transparency of the public administration • To get information in real time, making the residents aware of the needs of a place they live in • To share information with different departments of urban management, taking an advantage of synergies between different areas

Source: Own elaboration

First of all, it is evident that the first profits will be obtained due to improvements related to the provided services or optimized infrastructure. This way, for example, if a city has smart system of lightening that turns on/off the lights taking into account natural light, energy savings will be immediate.

Moreover, it is important to take into account other general improvements that can improve the residents' life quality more than these specific profits. Thus, the steps that can help a city to become smart strengthen cities' development under the circumstances of flexible and organized adaptation. In addition, a platform to promote new entrepreneurial initiatives is achieved; savings of public funds become possible, so they can be used for other services or the taxes can be reduced; an easier and immediate identification of the residents' needs can be also achieved, as well as to make short- and medium-term actions that allow to improve quality of the provided services. Also it helps municipal administration to have more transparency, to have information in real time and totally adjusted to the current needs that can be shared by all the departments of urban management.

Using the example we mentioned before, this system of smart lightening in public buildings will allow not only to have some savings of energy, but also to have less energy dependence, less light pollution and to reduce CO_2 emissions into the atmosphere.[5] This measurement can be also complemented by revitalization of night areas and strengthening of touristic activity in the cities, for example, with touristic routes at night. Other advantages could be increase of security levels and cities' habitability.

We should ask if the smart cities phenomenon is something new. This term has been used since more than 2 decades, but its development was more cautious in comparison with the current moment. Introduction of technologies into public services and functioning of infrastructures has been supported for several years, although nowadays, being the ICT implementation at its peak, cities start to act in another way. It is about interconnection and monitoring of all the public activity with the aim to centralize its management and to promote savings.

However, the smart cities go beyond, due to the fact that thanks to this implantation of new technological tools the cities generate a lot of information that not only has to be used by the public managers to improve infrastructures and benefits, but also to arrive to the residents and to the enterprises, so they can make better decisions in real time. For example, there would be a possibility to know if there is free parking space in a public car park, if it is necessary to improve cleaning of public roads or if a certain public area needs a better maintenance.

The Table 2.4 summarizes the main features the smart cities must have. Although there is no any standardized pattern, the main part of studies that evaluate cities' commitment to be smart uses these criteria. These features are based on six pillars: competitiveness, social and human capital, participation, transport and the ICT, natural resources and life quality, having each of them a group of actions to be carried out. It is evident that each smart city assigns a special weight to all these features, supporting specific initiatives that go for certain objectives.

[5] This kind of actions can reduce about 44 % of light consumption in a city as Madrid, see eSmarcity.es, Todo sobre ciudades inteligentes.

Table 2.4 Main pillars and actions to be carried out in a smart city

Pillars	Actions
Competitiveness (*smart economy*)	• Adaptation to the changes • Innovation skills • Encouragement of entrepreneurship • Improvement on competitiveness • International repercussion
Social and human capital (*smart people*)	• Adaptation to the changes • Creativity • Encouragement of continuous learning • Improvement on the qualification level • Participation of the residents
Participation (*smart governance*)	• Ability to be adapted to the needs • Municipal management of transparency • Participation in the decision making
Transport and the ICT (*smart mobility*)	• Infrastructures based on the ICT • Improvement on the local accessibility • System of efficient and sustainable communication
Natural resources (*smart environment*)	• Appropriate use of resources • Control of pollution • Sustainable management of resources and the environment
Life quality (*smart living*)	• Housing quality • Social cohesion • Facilities to improve education, culture and knowledge

Source: Giffinger et al. (2007) and own elaboration

Being analyzed studies carried out on this topic, we can say that the main part of all the efforts is focused on natural resources development, transport and the ICT. In addition to it, it is proved that there are patterns of different level of interest according to the number of residents. So big cities tend to support improvements related to the governance more that smaller ones do; the same tendency is noticed in relation to the life conditions. Nevertheless, improvements related to natural resources, mobility and the ICT do not depend on the number of residents (European Parliament, 2014).

2.3 Some Economic Aspects of the Smart Cities

Using efficient management of services and infrastructures of the smart cities it is possible to save a lot, speaking not only about economy but also about other important aspects.

For example, with traffic lights regulation according to the roads' occupation,[6] it is possible not only to reduce fuel expenses, but also to avoid or reduce trips towards them and to reduce pollution and noise levels as well. It would have as a result better air quality, and as a consequence it will reduce the health service expenses. At the

[6] Premios Contratos y Proyectos Smart Cities 2014: Smart city project for Castellon de la Plana. Castellon de la Plana local government.

same time it could be possible to make some improvements in smart buildings that would enable to reduce fuel costs due to the measures of energy efficiency.

Another advantage of the smart cities would be an improvement on all the system of rubbish collection that would help to introduce some changes in the collection process. This way, smart trash cans that would identify the user of the service and would inform about its level of usage could be used.[7] These cans would inform when they are full; there would also be an option to reward their users, for example, reducing local taxes (Real estate taxes) if they recycle their garbage in a correct way.

The third possibility is to make some improvements on irrigation in parks and public gardens; irrigation level could be increased or reduced optimizing water consumption according to the water needs of certain areas.[8]

Finally, due to multiple possibilities offered by smartphones, touristic routes or infrastructures used by tourists could be identified to optimize public transport service.[9] As it can be proved, there are a lot of different options.

Moreover, the smart cities are very attractive for new activities and businesses that could be brought to the cities, because if not, the tendency is to situate them in the suburbs due to the lower price of land.

In addition to this, the smart cities need strong investments in data integration and technology, because they need these tools for efficient management of resources (Pohl and Pohl, 2013). Amongst some of the activities where the main level of smart technological development is estimated we can find security, transport, education, health, automotive industry, energy, buildings and homes. This way, there is an increasing interest shown by several companies in their positioning in the smart cities business, being able to consider different options and possibilities to strengthen competitiveness of entrepreneurial networks.

A very relevant from the economic perspective point is the one derivative from collection and processing of information. In the smart cities concept local administration has an important volume of information that could be interesting not only for the public managers and the residents who receive public services, but also for those companies which are interested in providing some service.

As these data are interesting, they should be open (open data), although it is very important to be careful because of the data protection act. However, it does not mean that this information would be for free. So some ways that allow to make the use of this information profitable should be found, because if not, public money would pay not only a market research, but also the best market research due to the fact that this information would show a thorough use of a certain resource, and we cannot forget that any kind of information has its cost. If a certain price is not established, it would mean crossed subsidization from the public sector towards those companies that can take an advantage from it. This is not efficient neither fair for the residents who are those who pay with their taxes collection of this information.

[7] El Confidencial (2013): A company from Lleida makes cans that inform that they are full.

[8] Econoticias (2015): Smart city project, irrigation of gardens in Oviedo will be managed through smartphones.

[9] Cinco Días (2014): Turn your Smartphone into a touristic guide during these holidays.

2.4 Smart Cities Development in Spain

A boom of the smart cities has been noticed in Spain this decade. There were 22 local governments in 2012 that supported this kind of initiatives; in 2014 60 initiatives were registered in the Spanish Network of the Smart Cities (RECI, 2015).[10]

With these numbers Spain had an important on the European level position (on the world one as well) in the smart cities networks. The Ministerio de Industria, Energía y Turismo (2015) seems to be interested as well in the smart cities; in March 2015 it decided to finance up to 80 % of all the financial needs that the smart cities have.[11]

However, in spite of this generalized wish of any medium or big city to have a smart project, the reality shows us that development is heterogeneous. Therefore, it is necessary to be cautious with the expectations and expected results of this process.

According to the IESE index Cities in Motion (ICM) 2015 that elaborates a ranking of the smart cities on the world level, only seven Spanish cities (Barcelona smart city (2015), Madrid smart city (2015), Valencia smart city (2015), A Coruña smart city (2015), Bilbao smart city (s.f.), Sevilla Smart City Plan Director de Innovación (s.f.), and Málaga smart city 2015) are amongst the 80 best smart cities.[12] There is no doubt that Madrid and Barcelona (with the highest positions in this ranking) are two Spanish cities that more supported integral projects of smart cities development. The case of Barcelona stands especially out because this city leads some of the smart cities rankings on the world level.[13] Barcelona is also one of the headquarters of the most important international events on this topic, the Smart City EXPO World Congress.[14] The Table 2.5 summarizes some of the most important initiatives of the smart cities in Spain.

As we can prove, all these cities decided to support actions of urban development taking into account their residents' needs and being respectful towards the environment. Governance of these cities is the second of applied actions, followed by international repercussion, mobility and transport, and social cohesion. Therefore it seems to be true that there is a common pattern of behavior of the smart cities applied to the initiatives on a national level.

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[10] Smart City Red Española de Ciudades Inteligentes (2015).

[11] Red.es (2015): The first call for smart cities.

[12] This study is based on an analysis of infrastructures, innovation and energy consumption of 148 cities from 57 countries. It is a study of 66 indicators distributed in ten areas: governance, urban planning, public management, technology, environment, international repercussion, social cohesion, mobility and transport, human capital, and economic development. The difference from other analysis consists on the fact that this study does not consider any special or isolated actions, that despite the fact that they can improve provision of a certain public service, actually they cannot provide any integral improvement to the residents' life.

[13] Junniper (2015).

[14] The next World congress on the smart cities will be hold in Barcelona from the 17 until the 19 November of 2015, see http://www.smartcityexpo.com/.

Table 2.5 Main initiatives of the smart cities in Spain according to the CIM 2015 report

City	Actions that were carried out	The most important indicators	World position IESE CIM 2015
Barcelona	New network of urban buses Service of telephone support Open data Promotion of electric cars Smart traffic lights Safe routes to school Barcelona wifi Bicing Sustainable Barcelona Telemanagement of risk Smart city campus Website for formalities	Governance Environment Improvement on human capital Urban planning International repercussion Use of technologies	34
Madrid	Improvement on management of rubbish, cleaning, parks and gardens, irrigation, pavements, public lightening Payments to the suppliers according to the levels of their services and not to the quantity of used resources Continuous actualization of municipal inventory Higher level of transparence of the provided services Improvement on the ways of communication with the residents Integration of information	Governance Environment Mobility Transport International repercussion	35
Valencia	Centralization of all the municipal information Monitoring in real time of traffic, public lightening, gardening, local police, pollution, rubbish collection and tow truck service On-line search and download of taxes and fees improving administrative formalities	Social cohesion Environment Mobility and transport	73
A Coruña	Increase of the number of wifi areas Control of water supply, energy, environment Actions to improve urban mobility services Promotion of electronic administration Higher level of participation of the residents	Social cohesion Governance Environment	75
Bilbao	Free wifi in underground Mobile chargers in buses	Governance Environment Mobility and transport	76
Sevilla	Investment in energy solutions Creation of municipal technological institutes Promotion of the ICT Consultancy about grants for new technological initiatives	Governance Environment Urban planning International repercussion	79
Málaga	Installation of energy storage system with batteries Promotion of electric cars use Integration of renewable sources of energy into electrical grid	Social cohesion Technological development Environment	80

Source: Own elaboration using the IESE CIM report (2015)

2.5 Recommendations

As it was proved, cities are to play a fundamental role in social and economic development in the following years. There is no doubt that projects that form part of the smart cities development will allow to achieve this goal.

However, we have got still long row to hoe. Many Spanish cities form part of this project, but a smart city is more that just make changes or isolated improvements in certain services and infrastructures. It does not mean to make applications that could make the residents' life easier in some aspects, but to make actions that have to go beyond it.

It is not enough just to have a good idea, it is necessary to be able to implement it and to guarantee improvements on integral management of all the activities that are developed by the cities. The cities are not recommended to be up for it all of them just because they do not want to be out of the list of smart cities.

Some kind of regulation of the smart cities needs to be carried out, because up to the current moment there is nothing that could allow to set any objective that must be achieved. Currently each city has its own objectives that they set themselves just not to be out of the smart cities list.

Obviously, this kind of behavior is not recommended if a city wants to learn from other experiences and to take an advantage from possible synergies between the cities. It is convenient to remember that one of the goals that the smart cities want to achieve is to have interconnection of the public services and municipal infrastructures, but there is nothing that could promote interconnection and information transmission between different cities, especially when it is proved that there are challenges and similar problems that could be dealt with the other cities' experience.

This lack of regulation does not allow to know with certainty when a city is implementing a smart program, because as there is no standard of what it must do, any initiative could be seen as an innovative one.

In addition, this lack of information in the beginning does not allow to know the results of evolution of each city. So it is urgent to define what the smart city is and what it is not, collaborating with private organizations that have experience with certification programs. Only this way it will be possible to establish behavior protocols and those that can design initiatives that will really improve the residents' life quality into the sustainable development framework. It could help to avoid this urgency that there were when some Spanish cities decided to become the smart ones. These protocols should include some indicators that have to be satisfied by the smart cities, their deadline, persons in charge of each action and expected results.

Another very important point would be evaluation of profitability of these investments. It is very normal for Spain to stand up for applying of policies and actions that have to improve the offered services' quality, but the final results are analyzed only few times. This way, as the EU and Central Government economically support this kind of initiatives, there is a tendency to ask for "whatever" just not to lose these grants. Acting this way means an inefficient management of public resources, because these funds have to be used to achieve a goal and not to be a goal of the cities.

It is also necessary to provide more information about the smart cities. There is a lot of information about these initiatives provided by public managers, but a huge quantity of residents does not have any background, including those who live in the cities where these initiatives were implanted many years ago. They do not know how a city becomes a smart one, and an important role that the residents have to play in all this process is completely unknown. It is evident that it is rather important to organize awareness campaigns of the importance of the residents' collaboration and participation. Moreover, if the residents are aware, they will be more responsible with their acts, improving the quantity and quality of information provided by their own behavior. All of it will have more effect on the level of intelligence of the actions made by the public managers.

Another point, related to the previous one, consists in going in depth of new technologies development. Young residents form part of the so-called "digital generation," but the cities are inhabited by elderly people who do not know almost at all how to use the new technologies. Many of them do not know to use the Internet, they do not have an e-mail and they are totally lost with social networks. It shows that immersion to the new technologies is an urgent need, but very few times public administrations take it into account.

Digitalization of the processes will be viable if the residents are able to use in an appropriate way new tools. That is why it is necessary that smart cities programs support actions that could improve computer knowledge of the residents.

Finally, we cannot forget what a smart city means. According to Batty et al. (2012), smart cities, despite all their potential, present a challenge for public managers that few times is taken into account. This way, it is necessary to link these smart cities' infrastructure to achieve a better present and future functioning. We cannot forget that the smart cities turn into real laboratories for new ideas and applications development (Veeckman & Van der Graaf, 2015). So the smart cities are more than just an isolated improvement of a certain service.

2.6 Conclusions

In this chapter an important role that the smart cities have to play in the new framework of knowledge-based economy is described. This kind of cities, that are founded to allow sustainable development of big urban areas and that have a sense of social responsibility with the environment, follow a model that was born 2 decades ago and that was to make cities more human.

An appropriate approach of the smart cities goes beyond it, because besides guarantees of a better life quality using the ICT it is also about being responsible towards the environment minimizing damage that they could cause to it. As the population is more and more concentrated in cities and as they are becoming bigger, it is necessary to improve the resources use through an intensive use of new technologies.

In spite of all the positive points of this approach, it is necessary to be aware of the fact that the smart cities require a comprehensive project that could benefit all the residents, that would be viable and long-lasting. In addition, the success of the smart cities depends not only on public efforts but also on their level of usefulness for the residents.

Public managers have to put resources aside not only for these new projects but also to promote spreading of its positive points. Information that could be gotten from a study of the residents' behavior would allow to improve goods and public services providing and available infrastructures. Only this way the smart cities will be viable and useful.

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Chapter 3
Intellectual Capital as the Fostering Factor for Sustainable Smart Urban Development in the Basque Autonomous Community

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Abstract The study seeks to confirm that the design of third-generation cities must include a strategy which makes the city more competitive to face today's global challenges from the perspective of the municipalities of the autonomous community of the Basque Country (ACBC).

Firstly, this study examines the literature on smart cities, sustainable and innovative knowledge-based development, new public management and urban IC. Secondly, it presents a multivariate analysis based on secondary data to establish the relations between the 6 axes of the studied model and at what level are they introduced in each of the Basque municipalities under study. The total population studied includes the 251 municipalities of the ACBC. Of these, the study analysed a representative sample comprising the 200 members of "Udalsarea 21" (the Basque Network for Sustainability), a forum for coordination and cooperation in launching Local Agenda 21 in this region.

The main conclusion was that the ranking of the three Basque capitals as smart cities has improved: Bilbao as a transition case, from a post-industrial to an innovative city model, with modern interurban infrastructures; Vitoria-Gasteiz as an environmentally responsible city, with recovered green spaces and established pollution reduction plans; and Donostia-San Sebastian as a cultural city, innovating and fostering a culture industry. In particular, Bilbao performs best in the "smart mobility" factor, while Donostia-San Sebastian scores better in "smart economy" and "smart living", with the highest quality of life in the ACBC, and Vitoria-Gasteiz performs well for the "smart environment" factor.

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3.1 Introduction

The topic of economic development is frequently addressed in research because the wealth and prosperity of a nation is of mutual concern to both society and policy-makers. In the past two decades, the concept of the competitiveness of nations has emerged as a new paradigm of economic development (Oprescu, 2012). In the knowledge economy, the value of organisations and individuals is directly linked to their knowledge and intellectual capital. Global trends show a clear transition towards an economy based on intellectual capital assets, particularly in developed countries which have the most chance of benefitting from using and incorporating such assets into their economic activities. Not only are developing countries striving to improve local factors; they are also searching for ways to widen their competitive edge over international competition (Oprescu, 2012). Lately, there has been a strong emphasis on the role of local development as a key driver for national wealth.

New political agendas and scientists have focused on finding methods to quantify the knowledge capital of nations; boost it and capitalise on it in terms of collective wealth. Development and competitiveness arise out of a fine mixture of individuals' skills, institutions that sustain a healthy innovative environment and suitable legislation to support entrepreneurship (Oprescu, 2012). The most internationally successful and productive industries are those in which human and structural capital interact in a synergic fashion. In the global economy, IC research has the potential to make an important contribution to understanding new facets of competitiveness. For this reason, we consider that the development of reliable methodologies for identifying, assessing and measuring local IC may be of help in coping in the knowledge economy.

Bontis (2004) defines IC as "hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources of value creation", while Andriessen and Stam (2005) see it as consisting of intangible resources available to a country or a region—a city or municipality in our case—that provide a relative advantage and which together are able to produce future benefits. Intangible resources refer mostly to knowledge, whether explicit or tacit, cognitive or emotional (Brătianu & Orzea, 2009, 2010). Knowledge has been regarded as being a key influence on production functions. The main difficulty of understanding and operating with knowledge and intellectual capital arises from the intangible nature of these assets and their strongly nonlinear nature (Brătianu & Orzea, 2011).

A nation's future is dependent on its national competitiveness, which is influenced by the national intellectual capital and the ability to extract value from it. This research therefore seeks to provide an analysis of the 6-axis smart city model in the Autonomous Community of the Basque Country (ACBC) and explain the degree to which it has been introduced in Basque cities and towns, with a view to improving future actions of local government and describe the relationship between innovation and sustainable and intelligent development in the 200 Basque municipalities under study (all members of the Udalsarea 21 network).

3.2 Conceptual Framework

3.2.1 Smart Development and the City

The concept of a smart city marks an advance on the previous term, "sustainable city", in that it combines the definitions attributed to the terms "city of knowledge", "digital city", and "sustainable city" and brings the additional criteria of technology and sustainability, which make life easier, more comfortable, and happier for its citizens. The ICT sector is of crucial importance in this city model, which has been created to meet the needs of inhabitants. It involves investment in R&D in order to identify, for example, new forms of environmentally friendly resource management, remote healthcare, and remote administration solutions (De Pablo, 2012). In any event, the smart city includes three essential elements: respect for the environment, use of ICT as a management tool and the ultimate goal of sustainable development.

It is important to note that the idea of a smart city is an intelligently conceived city and not merely a city with smart (or intelligent) devices. This means that the technology must be placed at the service of citizens to make their daily lives easier (González Fernández-Villavicencio, 2012).

3.2.2 Smart City Model

The smart city model currently enjoying the highest degree of acceptance is based on six key features developed by the Centre of Regional Science at the Vienna University of Technology (Giffinger et al., 2007) as part of a European project. Defined as a model of urban management that emphasises the importance of intellectual capital and sustainable development for local growth, it is built on six pillars:

1. "Smart Economy": the entrepreneurial and innovative spirit of a productive city, with a flexible labour market, international scope, capacity for transformation, and a solid economic reputation—a city, in short, in which companies want to do business.
2. "Smart Living": investment in cultural and educational facilities, optimal health and hygiene conditions, measures to ensure public safety, quality of housing, tourist attractions, and social cohesion.
3. "Smart Environment": protection of the environment, attractive natural settings, low levels of pollution, and consistently sustainable management of resources and waste.
4. "Smart People": improving the skills of citizens, placing a high value on learning, sensitivity to social and ethnic differences, and encouragement of flexibility, creativity, cultural diversity, and participation in public life.
5. "Smart Governance": citizen participation in the decision-making process, in ensuring the quality of public and social services, and in promoting governmental transparency.

6. "Smart Mobility": a city that is physically accessible—locally, nationally, and internationally, that places ICT infrastructures at the disposal of all of its citizens, and that utilises sustainable, innovative, and secure data-transport systems.

3.2.3 Sustainable Urban Development and the Smart City Model in the ACBC

The Basque government first used the notion of the "information society", as applied to Basque society, in its Information Society Development Plan for the period 2000–2003 (Basque Government, 2000). That document defined it as being a community that extensively and optimally utilises opportunities offered by information and communication technologies as a means for personal and professional development of its citizens.

EcoEuskadi 2020 (Basque Government, 2009, 2011), the flagship initiative in the Calendar of Prominent Plans and Activities for the Ninth Legislature, is a sustainable development strategy for the Basque autonomous community to the year 2020. It sets out strategic objectives defining sectorial plans in terms of sustainability. EcoEuskadi 2020 will serve to further refine the concept of sustainable development, integrating its implications for the design of departmental and sectorial policies within the ACBC.

At the First Forum of Sustainable Urban Planning, held in Vitoria-Gasteiz in 2011, the first minister of the Basque Country said that "The projects already underway as part of the 2020 EcoEuskadi Strategy for Sustainable Development include a commitment to more compact cities, a more rational use of territory, and recovery of spaces for the use of citizens" (Basque Government, 2011).

The forum also heard of the need for a commitment to cities that were "more sustainable, through the rehabilitation and recovery of lost spaces". The Basque Country faces the challenge of developing more sustainable cities. It is necessary "to reduce the excessive use of material and energy resources; to commit to recycling, as well as to the rehabilitation and renewal of land and housing; to avoid dispersed urban development; and also to minimise distances between home, work, and public facilities". Another need identified was for measures to promote urban renewal and rehabilitation of buildings, as well as "the recovery of the city's lost spaces for the benefit of its citizens" (Basque Government, 2011). All of these goals are to be facilitated by more sustainable structures.

Basque cities have already made important headway in this direction. A total of 200 municipalities have joined the Basque Network of Sustainably Oriented Municipalities (Barrutia, Aguado, & Echebarria, 2007), also known as Udalsarea 21 Network. This organisation was created to be a forum of coordination and cooperation, intended to spur on the development of the Local Agenda 21 agendas among Basque municipalities, and expedite their action plans. In addition to the municipalities, which are the principal agents in the organisation, the network also includes the Basque government's departments of environment and territorial planning; agriculture

and fisheries; and health and consumption; as well as Ihobe (the public environmental management body) and the Basque water agency (URA).

In order to determine the degree to which the "smart city" model has been implemented in the ACBC, secondary-source data from the Basque statistical agency, Eustat, will now be analysed for each of the municipalities in Udalsarea 21.

3.3 Methodology

3.3.1 Sample Definition

The statistical universe for this study comprises the 251 Basque municipalities that make up the ACBC, which are distributed throughout three territories (regions) (Table 3.1).

From the total universe a sample of 200 municipalities were selected, based on their membership of Udalsarea 21, the Basque network of municipalities for sustainability, given that one of the stated objectives of these municipalities—as set out in the network's Strategic Plan for 2010–2015—is to become "smart towns".

Udalsarea 21's mission is "to foster the introduction of Local Agenda 21 and the consolidation of local action plans as a tool for local sustainability policies that might contribute to improving the environment and quality of life; fostering the role of Basque municipalities in Basque Government policies and increasing the co-responsibility of Basque society".

This mission is consolidated in the six operating objectives of the 2010–2015 strategy. The second of these objectives is the one most closely linked to the concept of implementing the "Smart City Model" in the ACBC: "To advance in urban knowledge management and technical upskilling and provide shared high added-value public services and resources, tailored to different needs in Basque regions".

3.3.2 Data Gathering: Secondary Data Source

For the purposes of the research, secondary data was used from EUSTAT, the Basque Statistics Agency, particularly the section on urban indicators, which contains information on sustainable economic development in the 251 municipalities in the ACBC. Of these, this study will analyse the 200 municipalities that make up

Table 3.1 Area and number of municipalities in the ACBC and by territory (last updated February 2014)

	Total ACBC	Araba/Álava	Bizkaia	Gipuzkoa
Area (sq. km)	7234.8	3037.3	2217.2	1980.3
Number of municipalities	251	51	112	88

Source: EUSTAT

Udalsarea 21. One of the difficulties involved in searching for information is a lack of up-to-date data. The study therefore uses the most recent figures available for all factors, 2010–2011.

3.3.3 Components and Data Analysis

Table 3.2 below shows the variables analysed for each of the six axes in the "smart city" model. In order to facilitate an understanding of the results the variables have been coded as follows:

3.3.4 Multivariate Analysis: Principal Components Analysis

For comparative purposes, a multivariate analysis was performed in this phase in order to summarise the information (in this case the number of municipal variables gathered) in a smaller set of dimensions (factors) with a minimum loss of reliability (Hair, Black, Babin, Anderson, & Tatham, 1999). For this purpose, an exploratory factor analysis (EFA) was used. This technique has been defined by Kim and Mueller (1994:1) as a "variety of statistical techniques whose objective is to represent a group of variables in terms of a smaller number of underlying variables or factors". It was conducted with SPSS (statistical software for social science). More specifically, the principal-components analysis (PCA) method was used with Varimax rotation, as recommended by Hair et al. (1995:380) since it helps to simplify the factorial structure and usually defines more significant factors.

Correspondingly, Hair et al. (1999) consider that the minimum sample required to perform this analysis is 50 cases, always taking into consideration at least twice the variables asked, and preferably more than 100. In this study, 200 municipalities were analysed for each variable, thus fulfilling this requirement.

In order to ensure the suitability of the technique, Bartlett's significance test of sphericity was performed for all data groups. This showed that the study was appropriate, giving a result of zero in every case, less than the maximum required level of 0.05. Kaiser-Meyer-Olkin's measure of sampling adequacy was also applied and the results were in all cases higher than 0.7. This indicates an acceptable level for this measure (Cronbach, 1970) (Table 3.3).

The percentage of variance explained by the rotated components matrix is in all cases higher than 60 %, and the solutions may therefore be considered to be satisfactory (Hair et al., 1995). It may therefore be concluded that the factor analysis is satisfactory for these data (Table 3.4).

The factors obtained or principal components will therefore be termed the "Specific municipalities group" as they highlight some of the variables in each axis of the "smart city" model under study.

Table 3.2 Variables

Axis 1. Smart economy	2.2.3 Foreign population (%) 2011
1.1.1 Gross Value Added—farming and fishing sector(%) 2010	2.2.4 Non EU-15 foreign population (% foreign population) 2011
1.1.2 Gross Value Added—industrial sector (%) 2010	2.2.5 Non-EU foreign population (% foreign population) 2011
1.1.3 Gross Value Added—building sector (%) 2010	2.2.6 Natural population growth (‰) 2011
1.1.4 Gross Value Added—service sector (%) 2010	2.3.1 Empty family homes (%) 2011
1.2.1 Workers over 16 in farming and fishing sector (%) 2011	2.3.2 Family homes older than 50 years (%) 2011
1.2.2 Workers over 16 in industrial sector (%) 2011	2.3.4 Comfort rate of principal family homes 2011
1.2.3 Workers over 16 in building sector (%) 2011	2.3.5 Subsidised housing provided by Etxebide (‰ pop.) 2011
1.2.4 Workers over 16 in service sector (%) 2011	2.3.6 New housing licenses (‰ pop.) 2011
1.3 Activity rate (%) 2011	2.3.7 Subsidised housing built in last 5 years (‰ pop.) 2011
1.4.1 Working population over 16 (%) 2011	2.3.8 Urban area (%) 2011
1.4.2 Working population aged 55–64 (%) 2011	2.3.9 Residential area (%) 2011
1.4.3 2 Working population aged 16–24 (%) 2011	2.3.10 Housing density in urban area (houses/inht.) 2011
1.5.1 Unemployed population registered with Lanbide (%) 2011	2.3.11 Residential buildings with gas installation (%) 2011
1.5.2 Contract turnover index (contract/people) 2011	2.3.12 Housing requests registered in Etxebide (‰ pop.) 2011
1.6.1 Employment generated by micro-companies (%) 2011	2.3.13 Population density (inhab./sq. km) 2011
1.6.2 Average size of indust. establishments (employees) 2011	2.4.1 Registered accidents -pedestrians (per 10,000 inhabitants) 2011
1.6.3 Industrial establishments (%) 2011	2.4.2 Registered traffic accidents (‰ inhabitants) 2011
1.6.4 Building sector establishments (%) 2011	2.4.3 Number of local police (‰ inhabitants) 2012
1.6.5 Service sector establishments (%) 2011	2.4.4 Crime rate (‰ inhabitants) 2011
1.6.6 Total establishments (‰ pop.) 2011	2.5.1 Bank offices (per 10,000 inhabitants) 2011
1.6.7 Tourist accommodation (‰ pop.) 2010	2.5.2 Post offices (per 10,000 inhabitants) 2010
1.6.8 Hotel and restaurant establishments (‰ pop.) 2011	2.5.3 Petrol stations (per 10,000 inhabitants) 2011
1.7.1 Registered contracts during the year (‰ pop.) 2011	2.5.4 Pharmacies (per 10,000 inhabitants) 2010
1.7.2 Inter annual employment variation rate (%) 2011	2.5.5 Public libraries per inhabitant 2011

(continued)

Table 3.2 (continued)

1.7.3 Municipal GDP per capita (€) 2010	2.5.6 Public telephones (per 1500 inhabitants) 2011
1.7.4 Annual accumulative GDP growth rate (%) 2010	*Axis 3. Smart environment*
1.8.1 Total personal income (€) 2011	3.1.1 Local special protection area (% total area) 2011
1.8.2 Available personal income (€) 2011	3.2.1 Parks, gardens and other green urban areas (%) 2011
1.8.3 Accumulative annual growth (total pers.income, €) 2011	3.3.1 Water demand per person per day (l/inhab./day) 2011
1.8.4 Personal salary (% total personal income) 2011	3.3.2 Water sanitary rating 2011
1.8.5 Persons on welfare (‰ pop.) 2011	3.4.1 Houses with energetic efficiency label (CADEM) (‰) 2011
1.8.6 Families on emergency welfare (‰ pop.) 2011	3.4.6 Annual electricity consumption (Kwh./inhabitant) 2011
1.9.1 Council's tax revenue per capita (€) 2011	3.4.8 Annual electricity consumption of industrial sector (Kwh./inhab.) 2011
1.9.2 Council's debt per capita (€) 2011	3.5.1 Number of days with good quality air (%) 2011
1.9.3 Council's investment per capita (€) 2011	*Axis 4. Smart people*
Axis 2. Smart living	4.1.1 Population rate with secondary education (%) 2011
2.1.1 Total population (inhab.) 2011	4.1.2 Population rate with vocational education (%) 2011
2.1.2 Population variation in last decade (%) 2011	4.1.3 Population rate with university education (%) 2011
2.1.3 Young-age ratio: Population aged 0–14 (%) 2011	*Axis 5. Smart governance*
2.1.4 Older ratio: Population aged over 65 (%) 2011	5.1.1 Participation in local elections (% electoral register) 2011
2.1.5 Elderly: Population aged over 75 (%) 2011	*Axis 6. Smart mobility*
2.1.6 Demographic dependency ratio (%) 2011	6.1.1 Transport and communications infrastructure surface (%) 2011
2.2.1 Birth rate (‰) 2011	6.1.2 Roads as percentage of land area (%) 2011
2.2.2 External migration rate (‰) 2011	6.1.3 Vehicle rate (vehicle/inhabitant) 2011

Source: Authors with information from EUSTAT

Table 3.3 KMO and Bartlett's significance test of sphericity

Kaiser–Meyer–Olkin measure of sampling adequacy		0.661
Bartlett's significance test of sphericity	Chi-square approx.	16,916.419
	Gl	3403
	Sig.	0.000

The Table 3.5 and the representing Fig. 3.1 show the results of the analyses performed in each phase of this study with the municipality group detected, with a detailed definition of each one.

The first group is characterised by including almost all the variables on "housing and urbanization" and also population size in Axis 1 "Smart Economy". It also includes the variable concerning number of post offices from Axis 2 "Smart Living"; the variable on electoral participation from Axis 5 "Smart Governance" and the variable on infrastructure surface from Axis 6 "Smart Mobility". Considering all the variables included in this group, it may be titled "Housing and mobility infrastructures".

It is worth noting that although it was only possible to include the 'electoral participation' variable in this study, Udalsarea 21 is also making major efforts in terms of citizen participation (forums and participative groups, dissemination of local topics, etc.) and in raising awareness on the importance of public opinion for local management.

The second group includes nearly all the demographic variables in Axis 2 "Smart Living", those concerned with the labour market in Axis 1 "Smart Economy" and the number of bank offices from Axis 2 "Smart Living". This group might therefore be termed "Demography and labour market".

The third group is made up of variables related to Education (secondary and university studies) from Axis 4 "Smart People" and the variables on workers in the farming/fishing and service sectors from Axis 1 "Smart Economy". There might be considered to be a direct relationship between them; however further investigation has shown that this was not the case and one must therefore consider the influence of other factors such as culture or others for further investigation. This third group could therefore be termed "Education and labour market".

The fourth group includes variables related to GDP of industry and tourism and the variable related to company type from Axis 1 "Smart Economy". This group is therefore termed "GDP and business network".

The fifth group contains practically all variables concerning the population's economic resources from Axis 1 "Smart Economy", and is therefore (logically) referred to as "Population's economic resources".

The sixth group is made up of two variables on citizen security and the variable "number of petrol stations" in Axis 2 "Smart Living" and the variable "number of vehicles" from Axis 6 "Smart Mobility". In this case, the group is called "Citizen security and vehicles".

The seventh group includes a range of variables from Axis 1 "Smart Economy": those on natural migration of the population plus contracts registered during the

Table 3.4 Total explained variance

	First auto values			Saturation square sums of the extraction			Saturation square sums of the rotation		
Component	Total	Variance %	Accumulated %	Total	Variance %	Accumulated %	Total	Variance %	Accumulated %
1	10.610	12.784	12.784	10.610	12.784	12.784	7.773	9.364	9.364
2	8.149	9.818	22.602	8.149	9.818	22.602	7.160	8.627	17.991
3	6.693	8.064	30.665	6.693	8.064	30.665	4.801	5.785	23.776
4	4.516	5.441	36.106	4.516	5.441	36.106	4.424	5.330	29.106
5	3.424	4.125	40.231	3.424	4.125	40.231	4.324	5.210	34.316
6	3.138	3.781	44.012	3.138	3.781	44.012	3.277	3.948	38.263
7	2.778	3.347	47.359	2.778	3.347	47.359	2.972	3.581	41.844
8	2.348	2.829	50.187	2.348	2.829	50.187	2.949	3.552	45.397
9	2.172	2.617	52.804	2.172	2.617	52.804	2.803	3.377	48.773
10	1.923	2.316	55.120	1.923	2.316	55.120	2.766	3.332	52.105
11	1.781	2.146	57.266	1.781	2.146	57.266	2.617	3.153	55.259
12	1.719	2.071	59.338	1.719	2.071	59.338	2.546	3.068	58.327
13	*1.688*	*2.034*	*61.372*	*1.688*	*2.034*	*61.372*	*2.528*	*3.045*	*61.372*
14	1.570	1.892	63.264						
15	1.538	1.853	65.116						

Table 3.5 Rotated components matrix[a]

	Components												
	1	2	3	4	5	6	7	8	9	10	11	12	13
2.3.8	0.809												
2.3.13	0.761												
2.3.12	0.758												
2.4.3	0.744												
6.1.2	0.716												
6.1.1	0.697												
2.3.10	0.647												
5.1.1	–0.646												
2.3.11	0.643												
2.1.1	0.546												
2.3.1	–0.495												
2.5.2	0.356												
2.2.4	0.337												
3.1.1	–0.319												
2.1.4		–0.895											
1.4.1		0.845											
2.1.5		–0.835											
1.3		0.757											
2.1.3		0.753											
2.1.2		0.746											
1.8.4		0.696											
2.2.6		0.638											
2.1.6		–0.583											
2.2.1		0.515											
2.3.2		–0.385											
2.5.1		–0.382											

(continued)

Table 3.5 (continued)

	Components												
	1	2	3	4	5	6	7	8	9	10	11	12	13
2.3.4		0.368											
4.1.3			0.846										
4.1.1			0.797										
1.2.4			0.628										
1.8.1			0.581										
1.4.3			–0.577										
1.2.1			–0.419										
1.1.2				–0.810									
1.6.1				0.733									
1.1.4				0.726									
1.6.2				–0.680									
1.7.3				–0.613									
1.6.5				0.451									
1.1.1				0.413									
1.8.5					0.742								
1.5.1					0.631								
1.4.2					–0.626								
1.8.6					0.615								
1.8.2					–0.535								
1.8.3					–0.387								
2.5.4					0.304								
2.4.2						0.672							
6.1.3						0.569							
1.9.1						0.560							
2.5.3						0.429							
4.1.2						0.394							
2.4.4						0.394							

2.2.2							0.655						
2.2.3							0.609						
1.6.3							0.536						
1.7.1							0.532						
2.4.1							0.388						
1.7.4							–0.373						
3.5.1								0.572					
1.2.2								–0.485					
1.6.6								0.395					
1.5.2								0.263					
1.7.2								0.257					
3.4.8									0.914				
3.4.6									0.913				
3.3.1									0.526				
2.3.7										0.692			
2.3.5										0.645			
2.3.9										0.439			
3.4.1										0.428			
2.2.5										0.336			
1.6.8											0.709		
1.6.7											0.557		
1.9.3												0.703	
2.5.5												0.595	
2.3.6												0.446	
3.3.2												–0.422	
1.9.2												0.337	
1.2.3													–0.752
1.6.4													–0.698
1.1.3													–0.399
2.5.6													0.371

Extraction method: principal components analysis
Rotation method: Varimax with Kaiser
[a]The rotation converged in 23 iterations

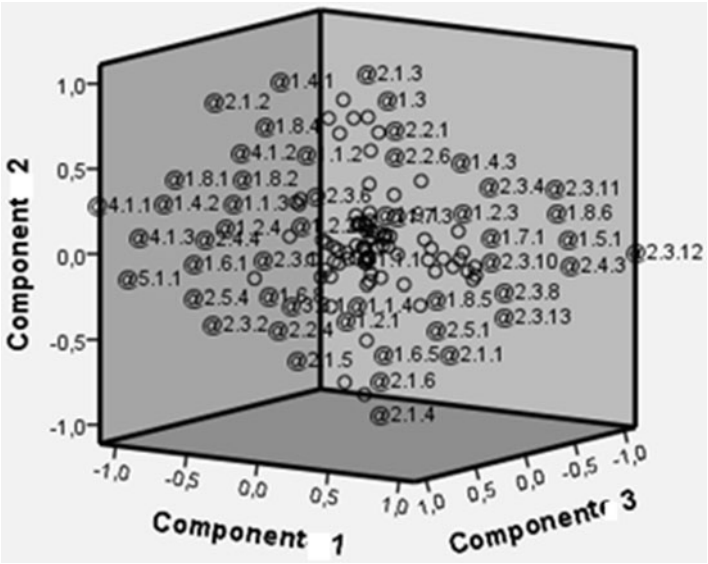

Fig. 3.1 Rotated components graphic

year and tax revenue of the local council. In addition, it also includes the variable on the number of pedestrians knocked down from Axis 2 "Smart Living". The most appropriate name for this group might be "Natural migration in the ACBC".

The eighth group contains the variables related to employment rates from Axis 1 "Smart Economy" and air quality from Axis 3 "Smart Environment". It could therefore be titled "Employment".

The ninth group contains the variables on water and energy consumption from Axis 3 "Smart Environment", and may therefore reasonably be named "Water and energy consumption".

The tenth group contains the variables on subsidised housing and land area for housing, amongst others from Axis 2 "Smart Living". It also includes the variable on housing with the efficiency label from Axis 3 "Smart Environment". This group is therefore termed "Smart housing".

The 11th group is made up of the variables Tourist Accommodation and Hotel and Restaurant industry establishments, and will therefore be named "Smart tourism".

The 12th group includes three unconnected variables: "water quality" from Axis 3; "Smart Environment", "new housing licenses" and "number of public libraries" from Axis 2 "Smart Living". In this case it is quite difficult to name the component and the three variables have all been included in the title, "Water quality, new housing licenses and number of public libraries".

Finally, the 13th group contains variables related to productivity of the building industry; GDP of the building industry; number of workers in the industry and percentage of establishments in this industry from Axis 1 "Smart Economy". This group is therefore titled "Building capacity".

3.4 Conclusions

Basque municipalities are developing new strategies to obtain higher rates of sustainable and smart development in keeping with new trends in economic development. The Basque Udalsarea 21 Network promotes sustainable economic development and implementation of the "smart city" model amongst its member municipalities (which comprise 200 out of a total of 251 municipalities in the autonomous community of the Basque Country). This aim is stated in the Network's Strategic Plan for 2010–2015, particularly in the second operating objective: "To advance in urban knowledge management and technical upskilling and provide shared high added-value public services and resources, tailored to different needs in Basque regions".

Following a multivariate analysis with SPSS consisting of a Principal-Components Analysis, factors or principal components have been obtained such as "Specific municipalities groups" containing some of the variables in each axis of the "smart city" model under study. In particular, 13 Principal-Components or "Specific municipalities groups" were obtained as follows:

Group 1: "Housing and mobility infrastructures".
Group 2: "Demography and labour market"
Group 3: "Education and labour market"
Group 4: "GDP and business network"
Group 5: "Population's economic resources"
Group 6: "Citizen security and vehicles"
Group 7: "Natural migration in the ACBC"
Group 8: "Employment"
Group 9: "Water and energy consumption"
Group 10: "Smart housing"
Group 11: "Smart tourism"
Group 12: "Water quality, new housing licenses and number of public libraries"
Group 13: "Building capacity"

These groups or Principal Components offer a snapshot of the Smart City Model in the Basque Country. They therefore include variables from the different axes, showing the relation between axes and how the model has been implemented in Basque municipalities. Each of the municipalities studied could be included in one of these groups. Each would be included in the group in which it obtained the

highest score for the variables in that group related to the "smart city" axes. In subsequent research, the authors have studied how the 200 Basque municipalities are distributed around these 13 groups of variables.

The most significant variables are related to smart housing and building capacity. This may be due to the various European programmes implemented in the ACBC for sustainable building and also due to the housing crisis following the economic downturn. Relations between education level and the labour market in the region should also be studied, since a direct positive relation would appear logical. Tourism is not yet the largest industry in the Basque economy, lying behind industry and the services sector. This explains how the Basque economy is moving towards a smart and knowledge-based economy as is happening in other European countries. Nonetheless, as in the rest of Spain, the Basque Country continues to suffer the effects of the economic crisis and unemployment rates are high. Environmental concerns are also important. The strategies cited here (Basque Government, 2011: EcoEuskadi 2020) establish the objectives for a sustainable future for the region.

As mentioned in the analysis, Udalsarea 21 has taken significant steps in the area of increased citizen participation. Indeed, this is one of the main areas of interest of the network. Their activities in this domain are targeted at all population groups (forums, dissemination of Local Agenda 21, best practice, events, etc.). Their aim is to provide information on the progress of local action plans, involve and share responsibility with citizens in implementing the plans and raising awareness and educating citizens on sustainability, among others.

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Chapter 4
Multidimensional Positioning of a Set of European Smart Cities

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Abstract This chapter aims to resolve the problem of the aggregation of smart city dimensions when ranking a set of European cities. Rankings are often used to analyze a certain characteristic of cities, such as entrepreneurship; however, the use of a multidimensional concept, such as the smart city, requires a different approach in order to consider the several dimensions. The analysis initially used fuzzy subsets to describe the cities. Theses fuzzy subsets are composed of 29 factors related to the economy, people, governance, mobility, environment, and quality of life. The findings suggest that there are significant differences between western and eastern European cities. Several studies have analyzed the aggregation problem, but this study uses the goals of the city to build a multidimensional ranking of European cities. The strengths and weaknesses analysis in relation to the proposed factors presented in this chapter will help cities and regional institutions to select better strategies.

4.1 Introduction

The United Nations (2014) notes that the urban population of the world has grown from 746 million in 1950 to 3.9 billion in 2014. The world's urban population is expected to surpass six billion by 2045. Today, 54 % of the world's population lives in urban areas, a proportion that is expected to increase to 66 % by 2050. Today, there are 28 mega-cities worldwide, home to 453 million people or some 12 % of the world's urban dwellers. By 2030, the world is projected to have 41 mega-cities with ten million inhabitants or more. Nearly half the world's urban population resides in cities with fewer than 500,000 inhabitants. These cities are numerous and many are growing rapidly, mainly in Asia but also in Europe, the region with the second most urban concentrations.

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Notwithstanding the enormous challenges and disadvantages associated with urban agglomerations, the world population has been steadily concentrated in cities (Caragliu, del Bo, & Nijkamp, 2009). This will result in numerous challenges in meeting the needs of their growing urban populations, including for basic services such as health care, education, mobility, public safety, or housing.

John Wilmoth, Director of the Population Division of the Department of Economic and Social Affairs of the United Nations said that "Managing urban areas has become one of the most important development challenges of the 21st century". The key to successful development is a sustainable urbanization that offers important opportunities for economic development and access to basic services. This increased urbanization raises a variety of technical, social, economic, and organizational problems that may jeopardize the economic and environmental sustainability of cities (Neirotti, de Marco, Cagliano, Mangano, & Scorrano, 2014).

In discussion of the new paradigm of intelligent urban development and sustainable socioeconomic growth, new technology-based solutions for urban planning and living are welcome, so as to assure the future viability of, and prosperity in, metropolitan areas (Alawadhi et al., 2012; Dirks, Keeling, & Dencik, 2009; Nam & Pardo, 2011; Nijaki & Worrel, 2012). In this context, the concept of smart cities is welcome as an efficient and sustainable means of urban development.

Current cities are complex systems characterized by massive numbers of interconnected citizens, businesses, different modes of transport, communication networks, services, and utilities (Neirotti et al., 2014). Cities are also empowered technologically, as the core systems on which they are based become instrumented and interconnected, enabling new levels of intelligence. In parallel, cities face a range of challenges and threats to their sustainability across all their core systems, and these need to be addressed holistically. To seize opportunities and build sustainable prosperity, cities need to become *smarter* (IBM, 2010).

Cities can lead the way towards economically, socially, and environmentally sustainable societies, but a holistic approach to urban planning and management is needed to improve the living standards of urban dwellers and achieve their goals. It is thus necessary to offer a multidimensional vision of cities, for analysis of their weaknesses and strengths.

Our research is structured as follows: after this introductory section; we carry out a review of the literature relevant to the dimensions of the smart city and approaches to aggregating the information. We then set out the methodology adopted, as described in the sample above, and the statistical methods and variables utilized. The chapter closes with an analysis and discussion of the insights that were provided and recommendations for future research areas.

4.2 Theoretical Background

4.2.1 Smart City Concept

The concept of the smart city was first used in 1994 (Dameri & Cocchia, 2013) and since 2010 the number of publications on this topic has increased considerably. Important technology companies, such as Cisco and Siemens, have adopted the concept for the application of complex information systems used to integrate the operation of urban infrastructure and basic services.

Hall (2000) defines a smart city as "a city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens". Similarly, (Caragliu et al., 2009) introduced the use of sensors, electronic devices and networks to stimulate sustainable economic growth and a high quality of life.

Washburn et al. (2010) proposes the use of computing technologies to make the critical infrastructure components and services of a city more intelligent, interconnected, and efficient. In the same way, the International Telecommunication Union (2014) uses the concept of smart city as "the use of information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects".

Giffinger et al. (2007), one of the most detailed studies, consider the smart city as a multidimensional concept. Six dimensions comprise the smart city: smart economy, smart people, smart governance, smart mobility, smart environment, and smart living. A smart economy includes factors related to entrepreneurship, productivity, labor market, and positioning of the trademarks. Smart people are the result of ethnic and social diversity, tolerance, creativity, and engagement. Smart governance is related to the participation of citizens in public life and the development of public services through social media or e-government. Smart mobility involves efficient and sustainable transport using information and communication technologies to facilitate routes for citizens. A smart environment is related to sustainable resource management and ecological awareness of improving the air quality and ecosystem protection. Smart living is the quality of life related to cultural facilities, health conditions, individual safety, housing quality, education facilities, and the touristic attractiveness.

4.2.2 The Aggregation Problem

There are many alternatives for adding heterogeneous opinions, from the simple mean to the easy and effective, although less known, method of expertons (Kaufmann & Gil-Aluja, 1993). This is an instrument that allows retention of all

information transmitted by every expert or interviewee. Similarly, the probabilistic set is a hybrid element of calculation that incorporates, at the same time, probability and uncertainty (Gil-Lafuente, 1997) for adding heterogeneous factors to the ranking of a set of objects. If we do this then we avoid the entropy fall until the total calculations has been completed. This process limits and reduces uncertainty and unnecessary error. When working with nonlineal operators the error increases in each operation.

Numerous studies use a ranking to study the cities, such as Cohen (2013) or Giffinger et al. (2007). Other authors use a fuzzy method (Anthopoulos, Gerogiannis, & Fitsilis, 2011) or a simulation (Patasius, Patasiene, & Patasius, 2013). To resolve the aggregation problem, bearing in mind that the data obtained in the field research does not reflect high levels of uncertainty, it is sufficient to work with probabilistic sets (Gil-Lafuente, 1997). Others approaches can be used, such as multicriteria analysis or OWA aggregation.

4.2.2.1 Rankings

Lazaroiu and Roscia (2012) note that city-rankings are usually used by cities to improve their profile and their competitive position: a top position in a highly reputed city ranking helps to improve the international image of a city and can therefore play a central role in its marketing strategy. The main problem is that these rankings are frequently based on a certain characteristic of the cities, such as entrepreneurship, but the city goals are multidimensional. A problem thus arises when factors are added for a multidimensional ranking.

Giffinger et al. (2007) configure a ranking of medium-sized cities in Europe based on a catalogue of factors to illustrate differences between cities, elaborate specific perspectives for development and position or identify strengths and weaknesses. Giffinger' ranking only includes one dimension or aggregates all dimensions across the average. This chapter proposes a multidimensional ranking that considers the adequacy of the city for a specific goal. For this, it is necessary to obtain the valuations of the cities in each factor, the optimum level of the factor for the best positioning and the importance of each factor to achieve the specific goal. The results can be used to rank cities. Values near 1 mean a higher position in the ranking and values near to 0 mean a lower position in the ranking.

Along with the assignment, the grouping and the relation, the ranking is one of the four pillars to support any decision (Gil-Aluja, 1998) in the different fields of knowledge. A ranking based on one or more preferences will allow selection of the element closest to the desire or need. Different types of coefficients, indexes, or distances have been used for comparison. All types of distance have four formalities:

1. $d(X,Y) \geq 0$;
2. $(X = Y) \Rightarrow (d(X,Y) = 0)$;

3. $d(X,Y) = d(Y,X)$
4. $d(X,Z) \leq d(X,Y) * d(Y,Z)$, where "*" is the operator associated with the corresponding notion of distance.

With the data obtained in the interviews and the instruments of addition and ranking, we will proceed to:

1. Keeping the totals of the obtained information with the probabilistic sets. Each variable will have a representative probabilistic set of each city.
2. With the objective of making a coherent ranking, we establish an ideal probabilistic set of the city goal (optimum) with an operator of maximization on the probabilistic set previously found.
3. Comparing the distances between the optimum and every one of the probabilistic sets that describe each variable.
4. Ranking the cities, bearing in mind that the greatest adequacy reflects the best positioning.

The value of this alternative is very important because it retains all information, without any type of discrimination.

4.2.2.2 Clustering

Cluster analysis groups the objects (cities) from a set of heterogeneous factors, using the proximity between the objects in an iterative process. Two clustering methods are very useful:

- Hierarchical clustering is the most common method used to work with factors or variables rather than cases; it can cluster variables together in a manner somewhat similar to factor analysis. It can aggregate small and similar clusters into a larger one, or divide a large cluster of dissimilar objects into smaller ones: it generates a series of models with cluster solutions from 1 (all cases in one cluster) to *n* (all cases are an individual cluster)
- The partitioning method finds the best way to partition objects into a preset number of clusters, e.g., k-means cluster. This is a method used to quickly cluster large data sets, which typically take a while to compute with the preferred hierarchical cluster analysis. The researcher must to define the number of clusters in advance. This is useful to test different models with a different assumed number of clusters (e.g., customer segmentation).

For scale data, the most common method is Square Euclidian Distance. This is based on the Euclidian Distance between two observations, which uses Pythagoras' formula for the right triangle: the distance is the square root of squared distance on dimension *x* and *y*. The Squared Euclidian Distance is this distance squared, which thus increases the importance of large distances, while weakening the importance of small distances.

4.3 Methodology

4.3.1 Sample

The focus of this research is cities with a population between 100,000 and 500,000 inhabitants. This approach involves a large number of cities and citizens in Europe, and thus, we use the sample of 76 cities included in the work of Giffinger et al. (2007). In order to work with comparable cities, we identified seven outliers with the highest or the lowest valuation average (Cork, Craiova, Jyväskylä, Kielce, Ljubljana, and Luxembourg), which were eliminated. We finally used a sample of only 71 cities for the ranking.

4.3.2 Ranking of Cities from the Adequacy Ratio with Convex Weighting

The object of this research is study the multidimensional positioning of a set of European cities on a specific goal, through the ranking construction. In order to validate this methodology we introduce a specific goal: "attract creative Information and Telecommunication (IT) designers." We thus propose the following research question: *which cities are better positioned to attract creative IT designers*? To resolve this question, we propose the following hypotheses:

H1: Western European cities, particularly those in the Nordic countries, are the best positioned to attract creative IT designers.
H2: Western European cities have significant differences to eastern European cities.

With the aim to contrast these hypotheses, we analyze the effectiveness of the city, bearing in mind the weight of the factor and desirable level of the factors required to attract IT creative designers and the degree of the factor present in the city. The analysis is based on two basic assumptions: that overcoming the desirable level of the factor does not penalize the city, and that there is no minimum level required for the factor.

The analysis starts using a fuzzy subset to describe the cities (Kaufmann & Gil, 1986). The chosen factors must be related to the aim and the target audience of the ranking (Lazaroiu & Roscia, 2012). In this sense, the fuzzy subset is composed of 29 features, six related to economy (innovative spirit, entrepreneurship, economic image and trademarks, productivity, flexibility of labor market, international embeddedness); five related to people (level of qualification, lifelong learning, social and ethnic plurality, open-mindedness); three related to the governance of the city (participation public life, public and social services, transparent governance); four related to mobility (local accessibility, international accessibility, availability of

ICT-infrastructure, sustainable, innovative, and safe transport systems); four related to the environment (environmental conditions, air quality, ecological awareness, sustainable resource management); and seven related to the quality of life (cultural facilities, health conditions, individual safety, housing quality, education facilities, touristic attractiveness, economic welfare). These factors were used by Giffinger et al. (2007).

Referential set C is composed of 70 cities:

$$C = \{c_1, c_2, c_3, \ldots c_{68}, c_{69}, c_{70}\} \tag{1}$$

Experts valued all elements of the referential set to complete the characteristic membership functions (Kaufmann & Gil, 1986) of each fuzzy subset.

For cities:

$$C_n = \begin{matrix} f_1 & f_2 & & f_{i-1} & F_i \\ \boxed{\mu f_1^{(n)}} & \boxed{\mu f_2^{(n)}} & \boxed{\ldots} & \boxed{\mu f_{i-1}^{(n)}} & \boxed{\mu f_i^{(n)}} \end{matrix} \tag{2}$$

Being $\mu f_i^{(n)}$ valuations between [0, 1], i number of factors and n number of cities.

For the proposed goal:

$$G_n = \begin{matrix} f_1 & f_2 & & f_{m-1} & f_m \\ \boxed{\mu f_1^{(p)}} & \boxed{\mu f_2^{(p)}} & \boxed{\ldots} & \boxed{\mu f_{i-1}^{(p)}} & \boxed{\mu f_i^{(p)}} \end{matrix} \tag{3}$$

Being $\mu f_i^{(m)}$ valuations between [0, 1], i number of factors. This example only uses a goal because it is a simplification, but we preferred to use a general description where m represents the number of goals. Usually, the city managers have several goals or targets, and then the proposed description is valid for working with several goals in a holistic manner (Arroyo-Cañada & Gil-Lafuente, 2012). The referential set of goals is then represented by $G_n = \{g_1, g_2, \ldots, g_n\}$.

After the description via fuzzy subsets of all formats and the goal, as shown in Table 4.1, the experts weighted each factor with convex weighting:

$$\omega_i = \frac{\upsilon_i}{\sum_{i=1}^{n} \upsilon_i}$$

Obtaining:

$$\omega_1 = \frac{\upsilon_1}{\sum_{i=1}^{n} \upsilon_i}, \ldots, \omega_2 = \frac{\upsilon_2}{\sum_{i=1}^{n} \upsilon_i}, \ldots, \omega_m = \frac{\upsilon_m}{\sum_{i=1}^{n} \upsilon_i}$$

Table 4.1 Expert valuations: factors, goal and weights

Dimensions	SMART ECONOMY (competitiveness)						SMART PEOPLE (Social and Human Capital)					SMART GOVERNANCE (Participation)			SMART MOBILITY (Transport and ICT)				SMART ENVIRONMENT (Natural resources)				SMART LIVING (Quality of life)						
Factors	Innovative spirit	Entrepreneurship	Economic image & trademarks	Productivity	Flexibility of labour market	International embeddedness	Level of qualification	Life long learning	Social and ethnic plurality	Ethnic plurality	Open-mindedness	Participation public life	Public and social services	Transparent governance	Local accessibility	(Inter-)national accessibility	Availability of ICT-infrastructure	Sustainable, innovative and safe transport systems	Enviromental conditions	Air quality (no pollution)	Ecological awarness	Sustainable resource management	Cultural facilities	Health conditions	Individual safety	Housing quality	Education facilities	Touristic attractiveness	Economic welfare
Cities																													
AALBORG (DK)	0,52	0,70	0,32	0,28	0,70	0,35	0,48	0,64	0,39	0,35	0,51	0,50	0,54	0,56	0,45	0,40	0,50	0,46	0,31	0,47	0,55	0,39	0,35	0,47	0,32	0,58	0,54	0,38	0,53
AARHUS (DK)	0,46	0,70	0,66	0,30	0,68	0,34	0,65	0,65	0,39	0,41	0,51	0,45	0,57	0,56	0,72	0,38	0,55	0,35	0,25	0,51	0,55	0,39	0,44	0,49	0,13	0,54	0,47	0,38	0,54
ABERDEEN (UK)	0,43	0,38	0,55	0,55	0,61	0,39	0,63	0,42	0,39	0,39	0,32	0,28	0,42	0,39	0,38	0,42	0,37	0,36	0,21	0,52	0,45	0,39	0,43	0,45	0,33	0,35	0,41	0,47	0,48
ANCONA (IT)	0,33	0,38	0,38	0,50	0,24	0,34	0,24	0,26	0,39	0,41	0,29	0,29	0,16	0,38	0,22	0,41	0,34	0,32	0,50	0,40	0,30	0,47	0,35	0,41	0,42	0,44	0,23	0,27	0,33
BANSKA BYSTRICA (SK)	0,29	0,29	0,32	0,31	0,22	0,39	0,27	0,31	0,39	0,37	0,40	0,42	0,40	0,29	0,23	0,23	0,36	0,56	0,50	0,43	0,26	0,47	0,47	0,39	0,46	0,32	0,35	0,34	0,35
BIALYSTOK (PL)	0,27	0,32	0,32	0,31	0,34	0,39	0,24	0,28	0,39	0,24	0,43	0,36	0,39	0,38	0,38	0,18	0,29	0,52	0,39	0,46	0,29	0,13	0,28	0,32	0,54	0,32	0,43	0,27	0,34
BRUGGE (BE)	0,40	0,41	0,32	0,41	0,43	0,36	0,30	0,31	0,39	0,29	0,45	0,38	0,49	0,46	0,40	0,56	0,40	0,34	0,29	0,33	0,42	0,47	0,66	0,52	0,39	0,39	0,39	0,68	0,45
BYDGOSZCZ (PL)	0,28	0,35	0,32	0,33	0,34	0,32	0,23	0,28	0,39	0,24	0,43	0,38	0,31	0,38	0,39	0,38	0,34	0,37	0,47	0,49	0,29	0,17	0,29	0,30	0,52	0,27	0,35	0,31	0,35
CARDIFF (UK)	0,47	0,41	0,55	0,51	0,53	0,35	0,51	0,43	0,39	0,39	0,32	0,30	0,45	0,39	0,38	0,50	0,43	0,47	0,26	0,39	0,45	0,39	0,39	0,49	0,33	0,34	0,46	0,59	0,44
CLERMONT-FERRAND (FR)	0,47	0,36	0,38	0,39	0,42	0,34	0,45	0,33	0,39	0,41	0,41	0,62	0,33	0,41	0,41	0,49	0,37	0,36	0,36	0,51	0,49	0,46	0,41	0,42	0,46	0,42	0,42	0,57	0,39
COIMBRA (PT)	0,32	0,11	0,38	0,35	0,27	0,39	0,37	0,31	0,39	0,32	0,35	0,35	0,50	0,51	0,44	0,18	0,25	0,38	0,65	0,38	0,32	0,41	0,33	0,64	0,41	0,30	0,41	0,54	0,24
CORK (IE)	0,52	0,37	0,55	0,48	0,40	0,81	0,39	0,33	0,39	0,38	0,48	0,30	0,34	0,39	0,36	0,34	0,60	0,39	0,28	0,50	0,43	0,39	0,39	0,37	0,32	0,41	0,49	0,59	0,39
DIJON (FR)	0,39	0,38	0,32	0,40	0,40	0,31	0,41	0,34	0,39	0,42	0,38	0,62	0,33	0,41	0,41	0,38	0,38	0,40	0,39	0,49	0,49	0,49	0,44	0,41	0,40	0,41	0,39	0,57	0,40
EINDHOVEN (NL)	0,82	0,41	0,49	0,41	0,48	0,38	0,53	0,50	0,39	0,51	0,44	0,45	0,29	0,55	0,44	0,63	0,63	0,35	0,29	0,36	0,37	0,50	0,41	0,40	0,13	0,58	0,38	0,27	0,52
ENSCHEDE (NL)	0,45	0,40	0,32	0,34	0,48	0,39	0,43	0,52	0,39	0,48	0,44	0,42	0,36	0,55	0,35	0,50	0,58	0,38	0,28	0,30	0,37	0,49	0,38	0,38	0,39	0,55	0,42	0,24	0,51
ERFURT (DE)	0,43	0,59	0,38	0,53	0,27	0,33	0,57	0,37	0,39	0,38	0,43	0,41	0,44	0,27	0,48	0,64	0,37	0,41	0,30	0,42	0,39	0,41	0,36	0,38	0,40	0,50	0,34	0,47	0,41
ESKILSTUNA (SE)	0,61	0,31	0,32	0,33	0,60	0,38	0,30	0,64	0,39	0,90	0,50	0,41	0,58	0,56	0,42	0,30	0,67	0,34	0,49	0,46	0,67	0,49	0,31	0,42	0,27	0,59	0,45	0,24	0,54
GENT (BE)	0,51	0,41	0,43	0,45	0,46	0,39	0,54	0,32	0,39	0,43	0,45	0,37	0,42	0,46	0,40	0,67	0,42	0,42	0,33	0,37	0,42	0,47	0,51	0,48	0,20	0,39	0,50	0,64	0,46
GOETTINGEN (DE)	0,69	0,51	0,32	0,48	0,27	0,31	0,56	0,42	0,39	0,54	0,43	0,42	0,48	0,38	0,44	0,51	0,35	0,27	0,35	0,38	0,39	0,47	0,37	0,51	0,39	0,58	0,44	0,38	0,41
GRAZ (AT)	0,52	0,36	0,38	0,44	0,40	0,35	0,49	0,40	0,39	0,60	0,35	0,44	0,29	0,50	0,55	0,56	0,42	0,35	0,40	0,38	0,41	0,47	0,39	0,55	0,41	0,51	0,71	0,68	0,50
GRONINGEN (NL)	0,48	0,44	0,32	0,48	0,46	0,39	0,59	0,52	0,41	0,44	0,39	0,46	0,43	0,55	0,39	0,34	0,56	0,39	0,25	0,37	0,37	0,50	0,54	0,49	0,22	0,57	0,47	0,24	0,59
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VALLADOLID (ES)	0,35	0,44	0,32	0,38	0,38	0,33	0,40	0,35	0,39	0,31	0,36	0,37	0,49	0,36	0,37	0,37	0,30	0,42	0,58	0,33	0,36	0,39	0,34	0,42	0,59	0,40	0,34	0,38	0,40
VENEZIA (IT)	0,31	0,37	0,38	0,47	0,27	0,58	0,30	0,26	0,39	0,40	0,29	0,25	0,26	0,38	0,16	0,61	0,42	0,47	0,37	0,31	0,30	0,47	0,60	0,44	0,41	0,44	0,30	0,87	0,33
VERONA (IT)	0,31	0,38	0,43	0,51	0,27	0,58	0,28	0,27	0,39	0,48	0,29	0,33	0,28	0,38	0,16	0,62	0,42	0,32	0,41	0,21	0,30	0,47	0,38	0,47	0,46	0,46	0,22	0,64	0,33
Goal 1: Attract IT entrepreneurs	0,82	0,70	1,00	0,63	0,70	0,81	0,68	0,71	0,60	0,90	0,79	0,64	0,71	0,56	0,72	0,67	0,71	0,65	0,65	0,53	0,67	0,50	0,74	0,67	0,60	0,59	0,71	0,87	0,59
Weighting for Goal 1	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,02	0,02	0,02	0,05	0,05	0,05	0,05	0,01	0,01	0,01	0,01	0,04	0,04	0,04	0,04	0,04	0,04	0,04

In this case, "sub-weightings" and "sub-sub-weightings" were required to maintain the importance of factors analyzed.

With valuations of the city factors, the weights and the achieved goal level, the relative weighted adequacy ratio between the analyzed cities and the established goal was calculated. The experts believe that the excess of the factor values isn't bad. Then the degree of "proximity to the ideal" must be 0.

To calculate the adequacy ratio with convex weighting:

$$\prod_i (n \to p) = \omega_i \left[1 \rangle \ \left(1 - \mu f_i^{(p)} + \mu f_i^{(n)} \right) \right]$$

Thus, the adequacy ratio with convex weighting between the goal and, for example, Aalborg is:

$$\prod_i (n \to p) = 0.758$$

In the same way, process all others (all ratios are in Table 4.2).

4.3.3 Cluster Analysis

We used the hierarchical cluster analysis in order to group the cities, because the number of clusters was not previously identified. In practice, we used the average-linkage-between-groups method to maximize the differences between groups. This method defines the distance between two clusters as the average of the distances between all pairs of cases in which one member of the pair is from each of the clusters. This differs from the linkage methods in that it uses information about all pairs of distances, not just the nearest or the furthest. For this reason, it is usually preferred to the single and complete linkage methods for cluster analysis (Norušis, 2011). The proximities between objects were then used to configure the first group. This group will be considered another object in the next step. Subsequently, all objects must be grouped, step by step, with the new proximities between the objects. Finally, each cluster contains the most similar cities considering the total values in the 29 factors for smart cities.

Following the recommendation of Hair et al. (1992), we used standardized data to eliminate the potential effects of scale differences between factors. We used the partial coefficients of the adequacy ratio with convex weighting as input in SPSS for the hierarchical cluster analysis. In this way, we introduced weighting factors based on the city goal. The dendrogram related to the clustering process is shown in Fig. 4.1.

Table 4.2 Ranking based on the adequacy ratio with convex weighting

	City	Ratio		City	Ratio		City	Ratio
1	Aarhus (Dk)	0.781	25	Enschede (Nl)	0.713	48	Padova (It)	0.659
2	Salzburg (At)	0.764	26	Leicester (UK)	0.713	49	Trieste (It)	0.655
3	Regensburg (De)	0.761	27	Montpellier (Fr)	0.711	50	Coimbra (Pt)	0.647
4	Aalborg (Dk)	0.758	28	Kiel (De)	0.711	51	Perugia (It)	0.644
5	Linz (At)	0.756	29	Brugge (Be)	0.708	52	Kaunas (Lt)	0.643
6	Graz (At)	0.752	30	Nancy (Fr)	0.706	53	Banska Bystrica (Sk)	0.640
7	Eindhoven (Nl)	0.749	31	Clermont-Ferrand (Fr)	0.705	54	Rzeszow (Pl)	0.638
8	Innsbruck (At)	0.746	32	Poitiers (Fr)	0.698	55	Liepaja (Lv)	0.637
9	Tampere (Fi)	0.746	33	Rostock (De)	0.695	56	Ancona (It)	0.631
10	Eskilstuna (Se)	0.746	34	Venezia (It)	0.692	57	Szczecin (Pl)	0.631
11	Umeaa (Se)	0.745	35	Dijon (Fr)	0.692	58	Bydgoszcz (Pl)	0.630
12	Odense (Dk)	0.742	36	Magdeburg (De)	0.689	59	Nitra (Sk)	0.630
13	Turku (Fi)	0.741	37	Pamplona (Es)	0.687	60	Bialystok (Pl)	0.628
14	Gent (Be)	0.737	38	Maribor (Si)	0.685	61	Gyor (Hu)	0.627
15	Joenkoeping (Se)	0.735	39	Santiago de Compostela (Es)	0.682	62	Pecs (Hu)	0.625
16	Oulu (Fi)	0.735				63	Kosice (Sk)	0.624
17	Groningen (Nl)	0.729	40	Stoke-on-Trent (UK)	0.679	64	Suwalki (Pl)	0.619
18	Cardiff (UK)	0.725	41	Verona (It)	0.679	65	Miskolc (Hu)	0.613
19	Goettingen (De)	0.722	42	Tartu (Ee)	0.678	66	Ruse (Bg)	0.600
20	Nijmegen (Nl)	0.718	43	Plzen (Cz)	0.678	67	Larisa (El)	0.599
21	Aberdeen (UK)	0.717	44	Valladolid (Es)	0.672	68	Sibiu (Ro)	0.589
22	Erfurt (De)	0.716	45	Usti Nad Labem (Cz)	0.664	69	Timisoara (Ro)	0.584
23	Portsmouth (UK)	0.716	46	Oviedo (Es)	0.663	70	Pleven (Bg)	0.583
24	Trier (De)	0.714	47	Trento (It)	0.662	71	Patrai (El)	0.582

To calculate the partial coefficients of the adequacy ratio with convex weighting, between the factor and the goal, we use a partial function:

$$\gamma_{\mathrm{i}}\left(n \to p\right) = \omega_i \left[1\Lambda\left(1 - \mu \mathrm{f}_i^{(p)} + \mu \mathrm{f}_i^{(n)}\right)\right]$$

Thus, for example Factor 1 (Innovative spirit) and City 1 (Aalborg) is: $\gamma_1\left(n \to p\right) = 0.034$. All others should be processed in the same way. We then conducted a one-way ANOVA to determine which classifying factors were significantly different between the clusters. Ideally, we would obtain significantly different means for most, if not all factors, used in the analysis. The grouping variable is the variable obtained in the cluster analysis.

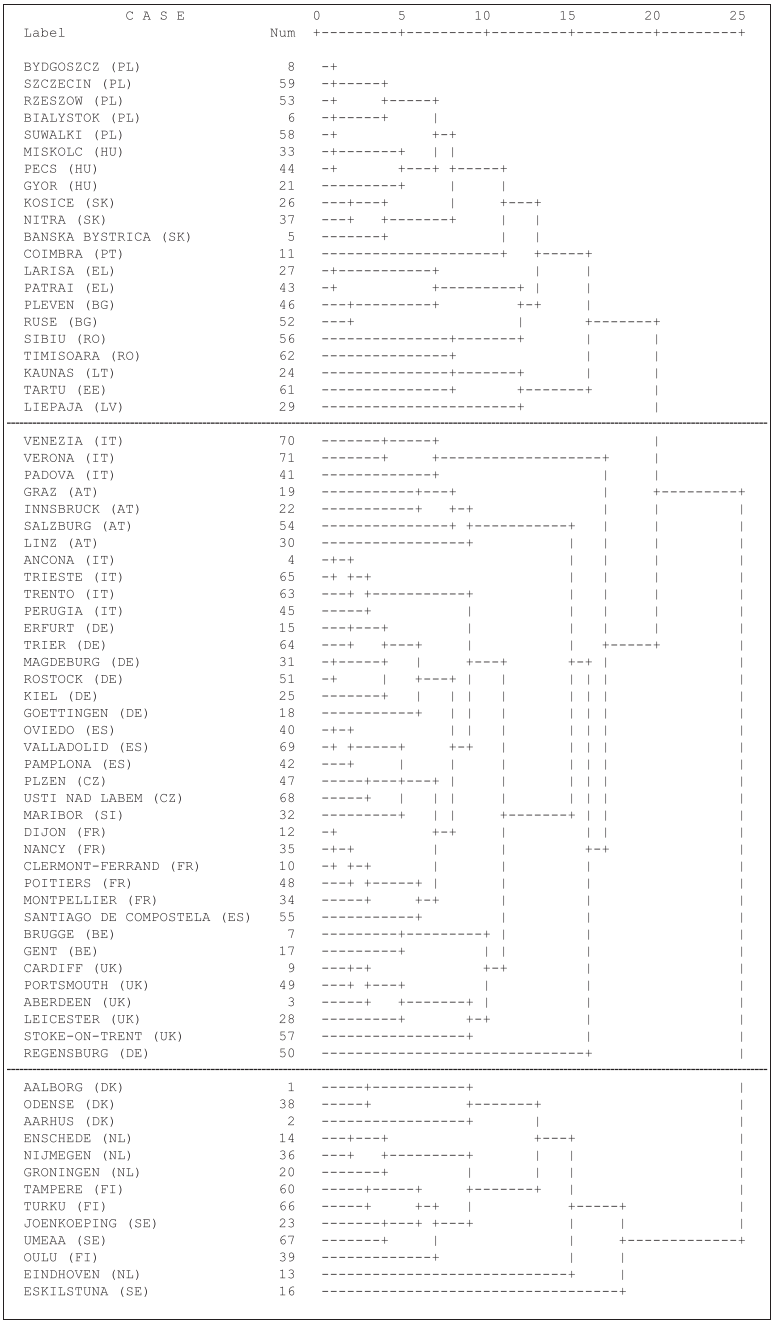

Fig. 4.1 Dendrogram of hierarchical cluster analysis

4.4 Findings

The first objective was to rank a set of European cities based on the adequacy ratio with convex weighting to achieve a proposed goal (e.g., to attract IT creative designers). Cities such as Aarhus (Dk), Salzburg (At), and Regensburg (De) are thus at the top of the ranking and cities such as Timisoara (Ro), Pleven (Bg), and Patrai (El) were the lowest in the ranking (Table 4.2). A general analysis of the positioning of European cities, in the multidimensional ranking related to the proposed goal, shows how the western European cities fill the top positions, and the opposite is true for the eastern cities. This confirms hypothesis *H1: Western European cities, particularly those in the Nordic countries, are best positioned to attract IT creative designers.*

In depth analysis of the positioning of the European cities shows that none is absolutely ideal for achieving the proposed goal in a holistic manner, because the highest adequacy ratio is 0.781 instead of 1. Aarhus, the best positioned city in the ranking, is only highest in 3 of the 29 factors. There is much competition to reach the top of the ranking, the best position to achieve the goal (in this research, attract IT application designers). On the other side is Patrai, with an adequacy ratio of 0.582 due to the following weaknesses: economic image and trademarks; international embeddedness; open-mindedness; local accessibility; availability of ICT-infrastructure. Thus, the distance between the partial coefficients of the adequacy ratio with convex weighting and the ideal of the factor is used to identify the strengths and weaknesses of each city. For example, the strengths of Aarhus are entrepreneurship, transparent governance and local accessibility, and their weaknesses are ethnic plurality, individual safety, touristic attractiveness.

The second objective was clustering the set of European cities to identify the kind of cities that comprises each cluster, and to find significant differences.

The cluster analysis offers more than one possible solution, but a solution with three clusters seems logical based on the dendrogram (Fig. 4.1). The first cluster is comprised of eastern European cities with the exception of Coimbra, the second cluster is comprised of western European cities, and the third cluster groups Nordic European cities.

An ANOVA analysis shows how it helps to determine the basis of each cluster. In this research only 5 of 29 factors have no significant differences. Thus, it confirms the goodness of the grouping in three clusters. In order to contrast hypothesis H2 (Western European cities have significant differences than eastern European cities), we used two groups: western and eastern European cities. The ANOVA analyses shows significant differences ($p < 0.05$) across clusters of European cities in 20 factors unlike these 9 factors: international embeddedness; social and ethnic plurality; open-mindedness; participation in public life; public and social services; local accessibility; sustainable, innovative, and safe transport systems; environmental conditions; air quality (Table 4.3). Thus, it confirms hypothesis *H2: Western European cities have significant differences than eastern European cities*.

Table 4.3 ANOVA

	F	Sig.		*F*	Sig.
Smart economy (competitiveness)			*Smart mobility (Transport and ICT)*		
Innovative spirit	37.056	0.000	Local accessibility	1.698	0.198[a]
Entrepreneurship	8.206	0.006	(Inter-)national accessibility	68.711	0.000
Economic image & trademarks	7.632	0.008	Availability of ICT-infrastructure	15.625	0.000
Productivity	79.353	0.000	Sustainable, innovative, and safe transport systems	1.461	0.232[a]
Flexibility of labor market	10.705	0.002	*Smart environment (Natural resources)*		
International embeddedness	0.001	0.977[a]	Environmental conditions	1.112	0.296
Smart people (Social and Human Capital)			Air quality (no pollution)	0.215	0.645[a]
Level of qualification	21.501	0.000	Ecological awareness	12.937	0.001
Lifelong learning	19.682	0.000	Sustainable resource management	32.421	0.000
Social and ethnic plurality	3.496	0.067[a]	*Smart living (Quality of life)*		
Ethnic plurality	34.114	0.000	Cultural facilities	7.988	0.007
Open-mindedness	0.008	0.931[a]	Health conditions	26.406	0.000
Smart governance (Participation)			Individual safety	9.938	0.003
Participation in public life	1.070	0.305[a]	Housing quality	37.904	0.000
Public and social services	0.194	0.661[a]	Education facilities	7.528	0.008
Transparent governance	19.599	0.000	Touristic attractiveness	24.488	0.000
			Economic welfare	54.718	0.000

[a]Not significant ($p < 0.05$)

Usually the cluster analysis allows weighting of the objects in the grouping process, but not the factors. This research uses weighted measures to introduce the importance of the dimensions and factors to achieve the goal. In this sense, factors related to smart mobility and economy have a greater weight than factors related to governance or environment.

4.5 Conclusions

In the context of a steady concentration in urban areas, cities should not only improve their economies and profit the natural resources efficiently, but also invest in the quality of life of their citizens and an effective mobility, strengthen social and human capital, and propose a participative governance. A smart city must use a holistic approach based on information and communication technologies (ICT) to face challenges and improve their positioning in order to achieve their goals. Thus, the use of a multidimensional ranking is relevant to develop a competitive analysis.

Despite the recent growing interest in smart cities, few researches have considered the problem of the aggregation of the dimensions and factors when configuring a multidimensional ranking or using the average (e.g., Giffinger et al., 2007). City managers need tools to analyze the positioning and identify international benchmarks so as to improve their cities. The cities must focus on the most weighted factors in the ranking process, as they are the most effective improvements for achieving the goals. Similarly, city managers must improve the dimensions and factors with a partial coefficient of the adequacy ratio far away to the ideal. On the other hand, regional administrations may be involved in improving cities, as this study notes that the levels of development of cities is linked to countries or regions.

This research proposes a methodology to support cities in analyzing their strengths and weaknesses, identify the necessary efforts that must be made to increase the smartness level of a city, to set strategic objectives, and to select effective actions in order to achieve targets. For use as a multidimensional ranking, the adequacy ratio is a preferable measure of proximity to the ideal without penalizations. Using distance measures between the cities and the ideals probably penalizes higher values than the ideal, although in this empirical research, we use the optimum as ideal, so that none of the factors exceeds the ideal. We chose this approach in order to generalize this methodology.

In this chapter, a practical approach has been proposed to confirm both hypotheses of the research: that Western European cities, particularly those in the Nordic countries, are the best positioned to attract IT creative designers; and that Western European cities have significant differences to eastern European cities. This work provides a starting point for the design of smart city strategies and extends the smart city conversation by instigating further research.

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Chapter 5
Smart Cities and Sustainable Development. A Case Study

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Abstract Cities are the economic engines of the future due to the great migration that occurs in rural environments, and more than 60 % of the world's population will live in cities by 2030. These circumstances may lead to an unsustainable growth. Sustainability must be understood from a multidisciplinary perspective taking into account all the players involved. Under this premise new urban developments arise, called smart cities, where it works to develop sustainable management. This article has two goals: first, to contribute to the state of the art in the theory of smart cities and second, to complete the limited academic research in this field of study. In order achieve those goals, three Spanish smart cities were analyzed because of their strategy for sustainable management. The methodology used is the study of multiple holistic cases. Pillars and variables must be considered in the smart cities, based on the Spanish Network of Smart Cities, the White Book of Smart Cities, MIT and sets Sustainable Cities Index. This study tries to see if the smart cities of the sample disclose information about the variables defined. The main conclusion shows that environmental management, governance and entrepreneurship and citizen participation are mainstays of any smart city. The limitations found are that the analyzed information is only displayed on their websites and access to information is limited. A future line of research will highlight the potential advantages of the cities that are considered sustainable compared to those which are not.

5.1 Introduction

The evolution of the concept of Corporate Social Responsibility (CSR) throughout the twentieth century and the first decade of the twenty-first century has meant that it has longer been considered a fad to become a form of management that must be

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included in strategies not only in companies but also in cities. The concept of sustainability, the thrust of social responsibility, in the lives of people, leads them to think about future generations, which will result in the need to acquire capabilities and skills to increase the value of companies, cities and the society. To obtain them, a great effort must be made to educate citizens on sustainability. Sustainable cities turn our society into a responsible and global society, where technology improvements and innovation in the daily lives of the population are integrated.

The report of Change Global Spain 2020 (CGE2020's)[1] shows that the solution to the global crisis in which we are is only possible through the achievement of more sustainable development, including a new culture in the use of natural resources.[2] The summit in Rio de Janeiro in 1992 laid the foundation for sustainability, on the UN Conference held 20 years later on sustainable development in Rio de Janeiro (2012) made this line clear that this is an opportunity if you want to leave a world habitable for future generations.

The crisis that drives this need for Global Change comes not only from an environmental dimension but also from an economic and social perspective, also considering issues such as governance and transparency. We live in a time when reflection on the reformulation of global development models has been opened. The need to learn to live within the limits, for example, reducing the impact on the biosphere and consideration of new ethical, cultural, political, financial, and economic approaches, etc. which address change and make it an opportunity, considering that cities are the engine for growth and creating jobs.

The strategic response to this crisis, from all points of view, falls within the framework of sustainability and CSR in the public sphere. It should be instilling and implemented increasingly widespread at all levels of the structure of world population (regional, national and global municipal levels).

At the municipal level, the search for sustainable alternatives is vital because of the concentration of the population living in cities, and its accelerated lifestyle and mobility is one of the greatest challenges facing a sustainable future. According to the latest report from UN-HABITAT's State of the World's Cities and Global Change Spain 2020, today there are more than 7000 million people in the world, and more than half of humanity lives in cities. If we translate this data to Europe 80 % of the population are "urbanites" and in Spain this number approaches 70 %. Therefore, if our cities are not sustainable, neither is the planet nor the global ecosystem. It is essential to open a new phase with a commitment to fund sustainability in cities.

The aim of this study was to identify the variables, initiatives or fundamental indicators which a city should have in order to be considered a smart city. To do this, a methodological structure study (Escamilla et al., 2013; Villarreal & Landeta, 2010; Yin, 1989; Zabalza & Matey, 2010) is followed, thoroughly analyzing the

[1] The report "Global Change Spain 2020's. The challenge is to act" was jointly conducted by the University Complutense de Madrid (FGUCM) General Foundation and the Foundation CONAM and is available at www.cambioglobal.es.

[2] In Finland, Denmark and, more recently, in France tax systems are considered linked to reasonable limits of climate impact.

object of study in its real context. To this end, a series of indicators for a smart city have been developed, based on the Spanish Network of Smart Cities, MIT Sustainable Cities, White Study on Smart Cities, MIT and Sustainable Cities Index: the sample corresponds to three major smart cities in Spain; Rivas, Alcobendas and Santander. The main conclusion is that environmental management, governance and entrepreneurship and citizen participation are mainstays of any smart city.

5.2 Theoretical Framework

5.2.1 Sustainability and Smart City

Antiquity cities have played a key role in development and economic growth, supporting the exchange of ideas and opportunities for collaboration (Fernández, Collado, & Guzmán, 2015), but they also negatively generate conflicts because the urban areas produce inconvenience such as congestion and pollution that impact economically, socially, and environmentally (Fernández et al., 2015: 18). Therefore, future cities must face major environmental challenges but also economic and social. Jiménez (2009: 209) states that "it is the challenge of global sustainability with local sustainability model, which is known as global sustainability" and the most important thing is to conceive sustainability as an open process in permanent change, adaptation and learning and to start implementing new management systems in urban areas (cities and towns) with this perspective.

The concept of a smart city is still a new concept that supports a multidisciplinary approach according to the area addressed (Chourabi et al., 2012). It is a growth market considering the sustainability and ICTs in cities that can offer innovative products and services as well as an opportunity to improve the welfare of citizens and the industrial development of the city (Caragliu et al., 2009). In cities today, the current urban services are significant to satisfy a high quality of life of its inhabitants and most of them are provided by public administration (collection of urban solid waste, street lighting, transport, irrigation of parks and parking public areas, etc.) (Table 5.1).

A smart city allows citizens to interact with it and adapt their needs efficiently in relation to cost- and quality-oriented solutions to the citizens as individual services, to resolve the effects of the growth of cities, in public and private fields, and through the innovative integration of intelligent infrastructure management systems (PNR, 2015).

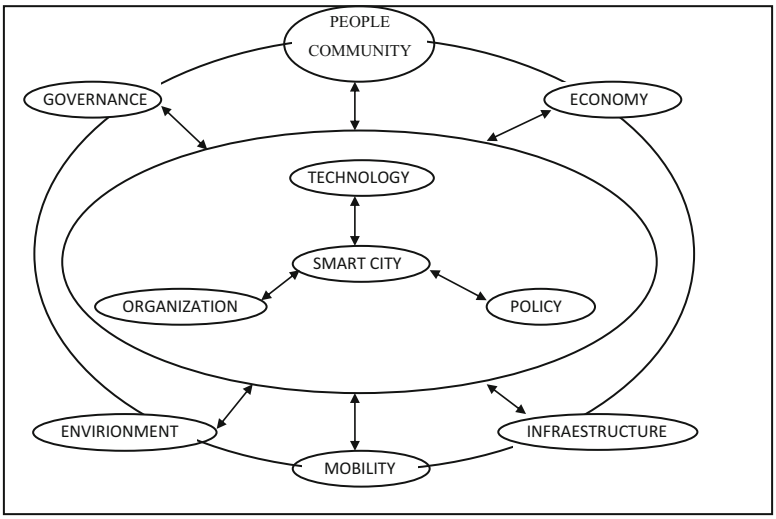
In this context, the main goal of a smart city is to provide a supposed "intelligence" to the city in order to obtain a more efficient management of infrastructure and services. Therefore, the local authorities have the right environments to develop plans for promoting innovation and entrepreneurship (PNR, 2015). The elements necessarily present in the current conception of a smart city are:

- The use of network structures to improve economic and political efficiency that allow urban social development, culture and (Caragliu et al., 2009) public administration which should provide new and better services

Table 5.1 Smart city definitions

Author	Definition
Chourabi et al. (2012)	Effective combination of telecommunications networks on a set of key factors together in a framework of smart sustainability and liveability
Harrison et al. (2010)	Interconnected and intelligent city
Toppeta (2010)	City that emphasizes sustainability and liveability
Washburn et al. (2010)	Considered a smart computer collection applied to infrastructure and services
Dirks, Keeling, and Dencik (2009)	Organic integration of systems
Giffinger et al. (2008)	A smart city is the projection of future that considers issues such as awareness, flexibility, processability, synergy, individuality and strategic behavior
Aenor	Holistic view of a city that applies ICT to improve the quality of life and accessibility of its inhabitants and ensures sustainable economic, social and environmental development in continuous improvement

Source: Own elaboration



Source: own elaboration from Chourabi et al 2012

Fig. 5.1 Pillars of a smart city. Source: Own elaboration from Chourabi et al. (2012)

- Citizens become the mainstay
- Social and environmental sustainability as a strategic element of the smart city creating a balance between the environment and natural resources
- Information Technology and Communication, as support and tool that facilitates the provision in a smarter way (Fig. 5.1)

In the smart city model developed by Chourabi et al. (2012) and followed in this work, major initiatives can be identified which should be included in any smart city. There it can be seen that technology, organization and policy are key parts, with direct impact on the smart city, and initiatives such as the community and people, governance, the economy, the environment and infrastructure have a significant impact overall on the smart city. Following that model, and as a contribution to improve at the same, allowing to shed more light on the theory of the smart city and given the importance of transport in the life of cities, it is considered essential that any smart city should include initiatives on mobility.

Going into depth on the three most significant variables in a smart city—technology, organization, and policy—we can say that the development of new technologies over the past decades have allowed ICT to become the engine of any initiative in a smart city, especially if we want to look after the governance from a technological point of view through the e-government as a competitive advantage (Ebrahim & Irani, 2005). In relation to the organization and management of smart cities there are not advances in the literature, but the work of Gil-García and Pardo (2005) is remarkable, which shows that this initiative is directly related to the e-government as well as behavior, diversity, and aligning organizational goals. Finally the policy variable becomes crucial to understand the concept of a smart city and it helps to understand issues such as how to govern the relationship with the community and institutions (Alawadhi et al., 2012; Nam & Pardo, 2011).

The Chourabi model considers issues as governance in the smart city from different perspectives considering the implementation of processes under the laws and transparency (Johnston & Hansen, 2011), integration of services and communication (Odendaal, 2003) as well as participation of citizens (Giffinger, Kramar, & Haindl, 2008). As stated in the White Book on Smart Cities (2012), sustainable cities are the best places to live and are less expensive to manage. Cities compete to attract direct resident investments that contribute to GDP growth and the promotion of a tourism sector that promotes consumption. Therefore, it is necessary that cities to include the development of more sustainable economic initiatives among their priorities. This vision will enable them to identify opportunities, strengths, weaknesses and threats in the long term, and will make them more competitive. Regarding environmental initiatives, since the late twentieth century the concerns raised by the society and governments to protect the environment have become a fact of vital importance not only from an economic perspective but also from a social aspect. The inclusion of environmental programs in companies and public institutions has led to the emergence of a competitive force that today cannot be ignored (Aragón, 1998; Arangón & Rubio, 2007; González & González, 2005) and society demands. The migration of population from rural areas to the cities has increased the population of the cities and, therefore, CO_2 emissions; it is necessary for an efficient and effective mobility to ensure mobility of citizens and contribute to the sustainable development of cities (Arroyo, 2008; Flores, Toledano, & Anguita, 2013).

This new concept is about the need to provide solutions to develop a macro model for cities. This is a new model of urban management that goes beyond the installation of sensors and technology in the city; it involves the development of joint initiatives between municipalities and other public and private institutions.

5.3 Empirical Framework

5.3.1 Methodology

The dynamic environment of the business world due to globalization, internationalization and development of new technologies has led to traditional theories of the study question (Eisenhardt, 1989; Villarreal & Landeta, 2010; Yin, 1989; Zabalza & Matey, 2010) and progressive search for new models to suit the Business Economics (Applegate, 1994).

In this exploratory study, the choice of a qualitative approach as a method of analysis, which involves using interpretive techniques from a series of observations of reality are built or generate theories (Martínez, 2006). Furthermore, although its application does not allow a priori to contrast hypotheses, it does not necessarily involve not using a posteriori other techniques that would complement the statistical verification of the emerging model (Sarabia, 1999: 228). It is necessary to point out that the case study is not only synonymous of exclusive qualitative research but can also be a combination of both using techniques such as observation, interviews, questionnaires, analysis of documents, files, etc. (Eisenhardt, 1989).

In this sense, the case study is a methodology of empirical research (Eisenhardt, 1989; Yin, 1989) to analyze the object of study in its real context using multiple sources of information either qualitative or quantitative (Villarreal & Landeta, 2010). For this, the technical data sheet on the methodological design is presented about the case study (see Table 5.2).

In this sense the study of smart city under the current context would be appropriate to make a first approach through case studies, with a dual purpose, each side contributing to the state of the art in the theory of smart city and other academic side by limited research in this area of study.

Table 5.2 Technical data sheet of the case study

Purpose of research	To analy ze cities called smart city that allow to use as model for the rest of Spanish cities
Methodology	Multiple, descriptive and exploratory Study of cases
Analysis Unit	Cities called smart city and associated with Smart Cities's Spanish Network
Field of research	National
Sample type	Logical and theoretical, not random sample
Information sources	Internal: documentation (reports, studies and reports), files (Web pages) actual physical context
	External: specialized publications, reports of official bodies
Sample	Alcobendas, Rivas y Santander
Method of analysis of the evidence	Analysis of contents of the web pages of the smart city of the sample, and document review
Period of realization	January-May 2015

Source: Own elaboration

Like all research techniques the case study has its detractors (Gummesson, 1991; Hamel et al., 1993) of how it proceeds to the validity and reliability of research. In this sense and after using multiple sources of information allows triangulation meet the same used in compliance with the empirical evidence following previous works such as Villareal (2006), Yin (1989) and Zabalza and Matey (2010) and Martínez, Pérez, and Rodríguez (2012). We use external information (reports and studies, website municipalities) given the characteristics of the sample. Internal and external validity was made with all steps; internal defines at what level the study reflects the situation studied (Bonache, 1999; Yin, 1989) and external validity involves establishing the generalization of results and logic replication (Eisenhardt, 1989). As the case study does not represent a significant sample, a perspective analytical generalization if two or more cases support the same theory can be considered so that the empirical basis of this is correct and therefore can replicate the experience (Zabalza, 2008: 346). To establish the reliability of the case study it is necessary to follow the same criteria of data collection and the establishment of a database following recommendations (Bonache, 1999; Chiva, 2001; Yin, 1989). For that purpose a table was made with the most important indicators in a smart city, taking as a basis the Spanish Network of Smart Cities,[3] the White Book of Smart Cities, and MIT.

5.3.2 Sample and Variables

The sample consists of three Smart Cities of the Spanish Network of smart cities which have the characteristics shown in Table 5.3.[4]

These cities were chosen for their different population sizes, the area and the budget, in order to show that the will of a population to be considered a smart city does not depend on those characteristics.

The indicators of a smart city are made from the provisions of the Spanish Network of Smart Cities, the White Study of the Smart Cities, and MIT so that there were a total of 23 items (Table 5.4).

Table 5.3 Sample

Characteristic	Smart city 1 Rivas	Smart city 2 Alcobendas	Smart city 4 Santander
Population	80.483	112.188	175.736
Area	67.38 km^2	44.98 km^2	34.76 km^2
Annual budget	n.d.	134.438′08€[a]	187.097€[a]

[a]Expressed in thousands of euros

[3] http://www.redciudadesinteligentes.es/.

[4] The population and area data are taken from page INE.

Table 5.4 Items of smart cities

Pillars	Items
Services	1. Medical conditions 2. Accessibility 3. Security 4. Educational facilities 5. Cultural offers
Economy	6. Productivity 7. Public–private agreement 8. Business ventures 9. Tourism
Government	10. E-government 11. Transparency
People	12. Employment and formation 13. Citizen participation 14. Citizen integration 15. Channel of suggestion
Movility	16. Sustainable transportation 17. Smart traffic control 18. Pedestrian streets 19. Smart parking
Environment	20. Environmental protection 21. Air quality 22. Paperwork of sustainable resources 23. Pollution reduction

Source: Own elaboration

5.4 Results

	Smart city 1 *Rivas*	*Smart city 2* *Alcobendas*	*Smart city 3* *Santander*
1	YES	YES	YES
2	NO	NO	NO
3	YES	YES	NO
4	YES	YES	YES
5	YES	YES	YES
6	NO	NO	NO
7	NO	NO	YES
8	NO	YES	YES
9	NO	NO	YES
10	YES	YES	YES
11	YES	YES	YES
12	NO	YES	YES
13	YES	YES	YES
14	NO	YES	YES
15	YES	YES	YES

	Smart city 1 Rivas	*Smart city 2 Alcobendas*	*Smart city 3 Santander*
16	YES	NO	YES
17	NO	YES	YES
18	NO	NO	YES
19	YES	YES	YES
20	YES	YES	YES
21	YES	YES	YES
22	YES	YES	YES
23	YES	YES	YES

5.4.1 Smart City 1

The smart city of Rivas-Vaciamadrid includes an integrated project through the Rivas Ecopolis plan aimed at changing the consciousness of citizens in order to face the problems of global change. Indicator 1 is an animal adoption program and volunteerism. Indicator 3 emphasizes prevention tips. Indicator 4 has multiple actions: child care, adult education activities and special support to psychosocial counselling, etc. Block government presents both items although the amount of information disclosed is not very big. The block of mobility is characterized by public and private transport bicinrivas, civitas-net, and 'share your car'.

The environmental dimension is revealed as the most relevant within the information disclosed on the website. Present actions ranging from agro-ecology, renewable energy and efficiency, environmental protection and assessment indicators are also marked in the table.

5.4.2 Smart City 2

Smart city 2 is Alcobendas, Indicator 1 considers very important actions for the population, not just those who must work for their public nature but especially those who voluntarily provide necessities such as supporting health promotion and health education, speech therapy at home, health inspection, CAID, young query, municipal laboratory, memory and language, pediatrics Online, adopt a pet, the Thao program, school health, and heart-Alcobendas city. Indicator 3 offers programs covering the local police, not only via mobility and road safety programs, but also coexistence between districts, tutor agents, etc.

Indicator 8 is remarkable due to its extensive venture plan from advisory services, local prices with bonus, training, entrepreneurship portal, grants and financing as well as a star line up. Indicator 11 refers to transparency; this smart city is characterized by a protocol of transparency and good governance as well as a set of good practices of municipal communication also rated as # 1 in transparency by the index transparency municipalities (ITA). Indicator 12 can be found in the section of

companies, employment and trade, with the training and employment section being one of the most important especially given the current economic circumstances; there we can find measures such as employment exchange, employment counselling services and a training center and job placement, and insertion of disabled. Indicators 13 and 14 are transverse axes of the strategy's council, with a range of programs. The environmental dimension is central to this smart city because of its actions for environmental sustainability from parks and gardens., For this reason the city has ISO 1400 certification, waste management plans as well as the measurement of air quality and strategic map noise.

5.4.3 Smart City 3

The Smart City Santander is a benchmark in terms of a smart city because it has the 2020 strategic plan mainly supporting a technological deployment throughout the city. In Indicator 1 there are very important actions for the population, not just those who must work for their public nature but by those who volunteer, especially distinct health programs (aimed at all groups), working for the health and solidarity (dependence and foundations), and acting on smoking and strategy.

The block of government shows a smart city committed to what society demands today. The indicator 8 shows a guidance service for entrepreneurs with information and support in the process of entrepreneurship and entrepreneurial school, business plans, support and funding.

The environmental dimension concerns many actions, protecting the environment not only in terms of city but also in coastal terms. This plan is important for the conservation of biodiversity, and it has the environmental certificate EMAS for the quality of the beaches, the "Q" for quality and ISO 14001.

5.5 Conclusions

Review of literature has shown that the concept of a smart city is constantly evolving, and today more scientific contributions are needed that can build solid theories to this state of the art. Linking a smart city to CSR and sustainable development, which has consequences in the management of cities, is not only to reduce costs but also to involve different stakeholders in the management of cities to be sustainable and viable.

With these initiatives a dynamization of the economy of cities offering great opportunities for people who wish to undertake and also for the consolidated companies in order to contemplate new forms of business or niche markets that have not yet been satisfied is possible. With regard to the involvement of different stakeholders in the cities, local authorities become promoters of sustainable initiatives that reversed on the city, not only through individual projects but also with a line strategy integrated with other projects. From this perspective should be considered

aspects such as the TIC and innovation should be considered as a way to establish improved processes where local corporations will serve them to build relationships with citizens, not only to inform but also as a way to communicate with them and let them participate in initiatives of cities.

It becomes clear that in the cities of the sample none has all indicators analyzed through the information they disclose on its website. The indicator 2 and 6 are not included in any of the cities. However, the government is considered as a pillar in all of the important aspects, especially if you want to link with the Transparency Act enacted by the government. It is also important to note that the environmental pillar is present in all cities analyzed in the sample, with a large number of initiatives. Research has shown that the smart city 1 does not disclose any information on the economic pillar, while the smart city 2 only discloses information about entrepreneurship in the city. The research shows that the smart city 3, even without having all the proposed indicators, has the highest number of initiatives carried out and revealed through their website.

The main limitation found in this study is that the only information analyzed is the one available on the website, therefore perhaps holding more initiatives than that actually reported. Therefore, future research will entail investigations using a larger sample of smart cities and complement this analysis with a survey where we can set different models depending on the budget and number of inhabitants.

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Chapter 6
Strategic Management of City Brands and Its Influence in Smart Cities

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Abstract This current research aims to build and validate a city strategic management model which allows the development of medium-long-term city strategies. The empirical research design is based on mixed methods. Four exploratory interviews of mayors responsible of city marketing preceded the collection and analysis of 400 informants' sample obtained from face-to-face questionnaire-based surveys. The research took place in four Portuguese cities located in the Region Center of Portugal. The qualitative research shows that politicians of cities don't take into consideration neither the city brand nor the objectives of smart cities. For them the strategic management of cities is only 4 years last. The quantitative research shows that citizens are involved with their city although half of them are unknown to public marketing efforts. The city attributes which are positively valued by citizens are activity and innovation, whereas stiffness, "to be outdated," and no dynamism are considered negatively. Finally, the results indicate that city brands are perceived differently by visitors and residents.

6.1 Introduction

It is estimated that by the end of the twenty-first century the world population will be peaked and stabilized; it is known that the vast majority live in cities and this fact is a unique opportunity to shape the future of global society through innovation in urban systems (Harrison & Donnelly, 2011). In a world where resources are scarce and the cities consume the vast majority of resources, it proves to be vital that cities think more sustainably creating advanced systems to improve and automate processes in order to play a leading role in smart cities (Hancke, Silva, & Hancke, 2012). The fact that cities around the world face new challenges as a result of the growing urban

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population raises the level of importance of information and communication technologies (ICT) to make this growth sustainable (Doran & Daniel, 2014).

Sustainable and competitive cities require medium-long-term planning and, while ensuring quality of life, should think the city as a product. Just like it occurs in industrial context, the city is a product to be desired and "bought." Most cities (in Portugal) that were part of our study did not focus on the city as a brand and the respective city managers only associate the city brand to a mere logotype. The current instruments of strategic planning are insufficient to meet the new challenges of cities. The cities' representatives should adapt their strategies to new trends (citizens' participation, technology, quality of life, or sustainable development). Definitely, there is a problem in the relationship between politicians and citizens.

This research's main purpose was to verify if cities under study had strategic planning in which there were applied territorial marketing concepts as well as if the brand of cities was used as a positioning tool of cities. It was used a mixed methodology—interviews and questionnaires—in the city of Aveiro, Coimbra, Leiria, and Viseu (Portugal). This chapter consists of the literature review, following the methodology and the presentation of results. Finally we present the main conclusions and left future lines of research.

6.2 Theoretical Background

The concept of smart cities has stood out in the urban development policy context (Kroes, 2010), reaching also increasingly leading role at the policy-level management (Caragliu, Del Bo, & Nijkamp, 2011). It has emerged during the last decade, as a fusion of ideas about how ICT could improve the functioning of the cities, improving efficiency, competitiveness, and the creation of new ways of solving social problems (Harrison et al., 2010).

According to Batty et al. (2012) cities are becoming intelligent, not only in terms of how we can automate everyday functions that serve the citizens but also in terms of buildings, traffic systems in a way to track, understand, analyze, and plan the city to improve the efficiency, equity, and quality of life for its citizens, leading to change in the cities' management paradigm. These transformations of smarter cities will require innovation in planning, and the number of cities around the world looking for smarter transformation is growing at an accelerated rate. However, these efforts face numerous obstacles to be overcome that must include a joint effort of different stakeholders (Naphade, Banavar, Harrison, Paraszczak, & Morris, 2011). This work must be done in partnership—between public and private management—because according to Batty et al. (2012) companies have experience in providing hardware, software, and also data solutions that enable cities that knowledge while the government's role is to involve the agents of the territory which are the users of services, community, and citizens whose interests traditionally are focused on quality of life in communities.

Monferrer, Arda, and Fernández (2013) argue that cities today need to design and implement marketing strategies that give value and lead cities to differentiate themselves from the competition in terms of customer satisfaction. Indeed, territorial

marketing strategies have been gaining ground fruit of the huge competition between cities, but also as a way to address current challenges and those that in the future, cities are likely to struggle, due to the steady increase in consumer demand, as well as any changes in paradigm, from the point of view of factors such as the need to address sustainability factors and a more balanced idea of how people want to live in cities that are forcing to redesign strategies (Aragonez & Alves, 2012).

Thite (2011) argues that the best way to attract people to the smart cities happens through word of mouth and how it acts as influential in decision making, although stressing that knowledge workers work in network, not only with family and friends, but also with colleagues around the world with the result that they may also consider in relocating. Rogers, Lombardi, Leach, and Cooper (2012) argue that making the most sustainable smart cities is a priority. Braun (2012) believes that the brand of the cities gained popularity among politicians and managers in recent years, having checked this trend mainly in European cities.

Rainisto (2012) states that countries, cities, and regions are facing increasing competition at a global level, in an attempt to attract and win over visitors, residents, businesses, labor, skilled labor, and investment for their city. In fact, adds the author, a city with a positive reputation can become a valuable asset. According to Thite (2011) the intelligent city requires an intelligent workforce, and the quality of life of a place depends on the overall life experience of its citizens, which may increase the "membership" of a place on the slippery slope of globalization.

The new modern city management models understand cities as products and stakeholders as customers, investing in active citizenship as a competitive advantage and with the economic base diversification of services. Precedo, Orosa, and Míguez (2010) understand that in the management and planning of modern cities, where the smart cities are naturally included, we are faced with the existence of a new paradigm in which citizens are identified as strategic elements. Also Pînzaru (2012) argues that this is the main challenge and ambition of the managers of cities, to successfully create and manage brands of cities. However, the author warns of what he considers the "main trap" which is short-term thinking, which finally results only in specific actions and communication campaigns, with Kavaratzis (2009) to draw attention to the importance of implementing marketing strategies instead of the usual sporadic activities.

Zenker and Beckmann (2013a) highlight the fact that the mark is increasingly popular in urban management, a process which according to Cozmiuc (2011) requires time, commitment, leadership, and energy. Also it requires close coordination between the government (public sector), the business community (private sector), and civil society, representing the three one co-authored and co-management of the reputation of their city. Thite (2011) adds that only when all the stakeholders come together towards the same goal smart cities can truly develop. Lucarelli (2012) argues for the importance of public managers, who guide the destinies of cities and understand that the brand of a city is not just a matter of image and perception, which can have an impact (positive and negative) on the city. As Zenker (2011) exposes, it is important to have a combination of different approaches in order to "capture a city."

Ashworth and Kavaratzis (2009) argue that the brand of cities is an increasingly important asset for development and an effective tool for the cities to stand out from

other competitors and strengthen their position. However, these authors report that in practice there is confusion between a brand strategy and the design of a new logo or slogan which is only one of its components. For Trueman, Cornelius, and Wallace (2012) the economic fabric also has influence over the management of the brand of the city. The attractiveness of cities is another point and highlighted by Kourtit, Nijkamp, Franklin, and Rodríguez-Pose (2014) who claim that more people live in urban areas. For the authors, the big cities are not only job providers but also provide powers of creative ideas, innovative technologies, sustainable development, and socioeconomic wealth in an open economy and globalization, and most likely this trend will continue, also leading to more hulking smart cities.

Zenker and Beckmann (2013b) highlight the fact that the marketers focus only on establishment of the city as a trademark, without considering that the perception and knowledge of a city differ among target audiences. Also Kazançcoglu and Dirsehan (2014) argue that to ensure success, the brand of the city and marketers should focus on the experience of residents and visitors, and develop marketing messages based on those experiences. Monferrer et al. (2013) argue that, today, cities need to design and implement marketing strategies that place value and differentiate themselves from the competition, in terms of their customer satisfaction (Fig. 6.1).

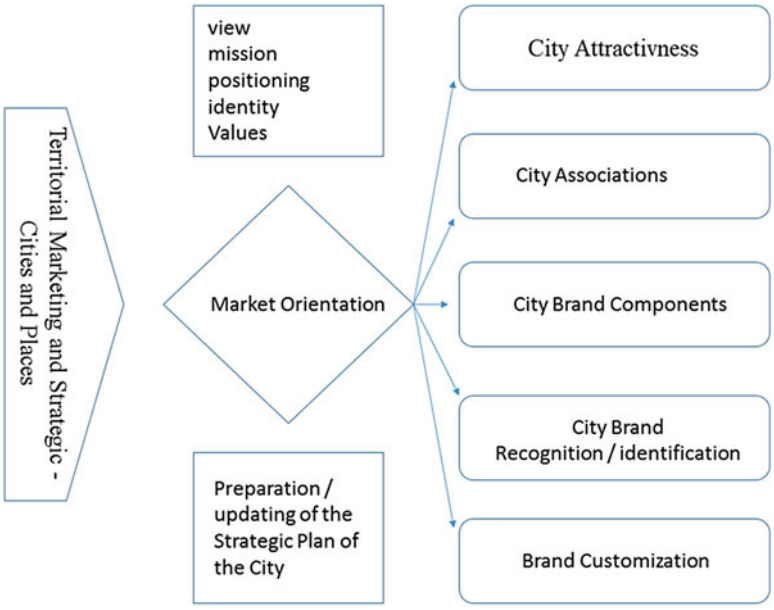
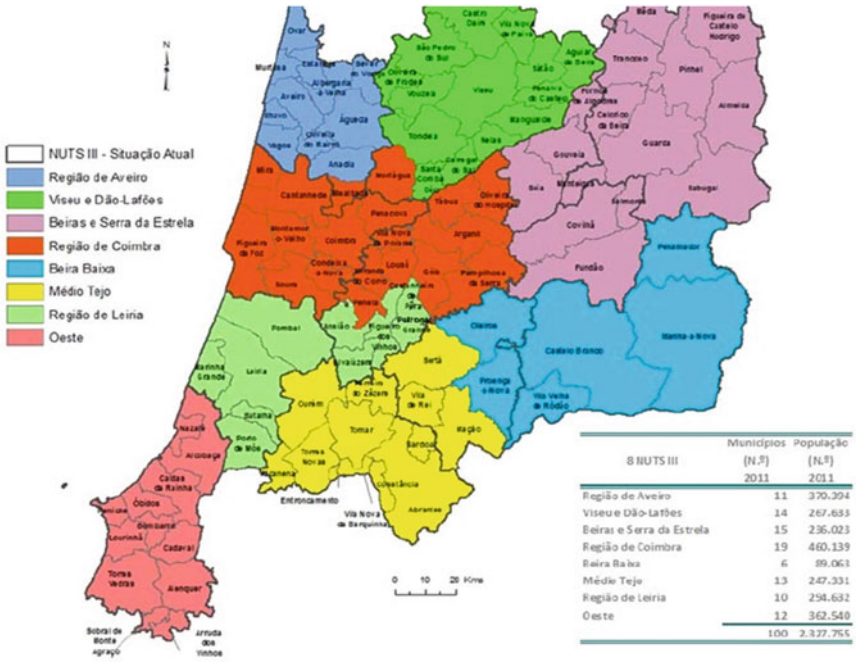


Fig. 6.1 Proposal for a conceptual model. *Source*: Own elaboration

6.3 Methodology

With regard to approach this study used a mixed approach (quantitative and qualitative), defined by Tashakkori and Teddlie (2010) as a paradigm based on the rejection of the simple dichotomy between quantitative and qualitative approaches. The two instruments used in research—script of interviews and questionnaire—were drawn up based on scientific articles from different authors. Regarding the questionnaire, this was made up of three sections—(a) sociodemographic data, (b) characterization of the city, and (c) brand of the city—taking as its starting point the articles of Kotler, Haider, and Rein (1993) and Merrilees, Miller, and Herington (2012).

The research took place in four Portuguese cities located in the Region Center of Portugal. The Region Center of Portugal is composed of 100 municipalities that correspond to a total of 32.5 % of Portuguese municipalities; it has 28,200 km^2, representing 30.6 % of the Portuguese territory. Both city visitors and residents were part of the sample (Fig. 6.2).



S NUTS III	Municípios (Nº) 2011	População (Nº) 2011
Região de Aveiro	11	370.394
Viseu e Dão-Lafões	14	267.653
Beiras e Serra da Estrela	15	236.023
Região de Coimbra	19	460.139
Beira Baixa	6	89.063
Médio Tejo	13	247.331
Região de Leiria	10	294.632
Oeste	12	362.540
	100	2.327.755

Fig. 6.2 NUTS III map of the central region of Portugal. *Source*: CCDRC, 2014

6.4 Results

In the qualitative aspect of our study and in a very summary way, we can say that there is no planning of territorial marketing policies, although finding some cities, especially Viseu and Coimbra, with developed work but specifically based on actions of knowledge of the city of shares, however Viseu showed a huge concern with residents. Overall, the city's brand idea is based on the existence of a logo, as well as on sale of shares of the city but always in a tourist perspective.

Also with regard to the existence of generic perception of a "brand" it settles on the one hand, by the lack of knowledge of what is truly a brand covering the whole of its components, and on the other hand by way how the four cities in study are worked, without the existence of theories and territorial marketing strategies in their planning. Regarding the interviews, only Viseu and Coimbra claim to have brand. Aveiro and Leiria report the existence of isolated actions of promotion of the city but without the consistent creation of a brand. We found that cities with planning don't incorporate the territorial marketing as a city management tool; therefore a paradigm shift is needed in the perspective of marketing approaches.

The quantitative aspect, which includes the 400 questionnaires face to face, made in the four cities and study has the following data regarding the five dimensions evaluated (Table 6.1):

In terms of dimension "attractiveness of the city" the factors most prominently are "study" with an average of 4.13 and "living" with 3.95. For the less bright side we have the factor "holiday" with 3.27 and "business investment" with 3.32 (Table 6.2).

Table 6.1 Items that make up the attractiveness of the city

	Average	Standard deviation
Living	3.95	0.77
Working	3.52	0.91
Studying	4.13	0.78
Holiday	3.27	0.98
Leisure	3.68	0.82
Cultural activities	3.53	0.84
Sports activities	3.63	0.8
Business investment	3.32	0.97

Table 6.2 Items that make up the associations to town

	Average	Standard deviation
Economic development of the city	3.32	0.83
Tourist attractiveness	3.65	0.81
Quality of living	3.91	0.77
Historical-cultural heritage	4.13	0.72
Education/knowledge	4.01	0.74
Health	3.76	0.96
Urban development	3.65	0.83

The dimension "association to the city" had the most valued items "historical-cultural heritage," with 4.13 average and "education/knowledge" with 4.01. Less valued in this dimension comes the "economic development of the city" with 3.32 (Table 6.3).

In terms of "characterization of the city" arises most notably the item "welcoming" averaging 3.95 and less the factor "bold" with an average of 2.98 (Table 6.4).

Regarding the dimension "identification with the brand of the city" the most valued item was "the brand of the city conveys the culture/history" with 4.07 average and less "I identify with the brand of the city" with 3.77 average (Table 6.5).

Table 6.3 Items that make up the associations to town

	Average	Standard deviation
Economic development of the city	3.42	0.86
Imaginative	2.98	0.86
Bold	3.53	0.77
Dynamic	3.47	0.8
Focused	3.26	0.84
Sophisticated	3.54	0.85
Original	3.39	0.85
Energetic	3.95	0.71
Welcoming	3.44	0.86

Table 6.4 Items that make up the identification with the brand of the city

	Average	Standard deviation
I identify with the brand of the city	3.77	0.85
The brand of the city is rooted in pop culture	3.98	0.79
The brand of the city is known all over the *world*?	3.91	0.92
The brand of the city identifies the region	4.04	0.75
The brand of the city conveys the culture/history	4.07	0.74

Table 6.5 Items that make up the customization of the city brand

	Average	Standard deviation
Young	3.37	1.01
Active	3.79	0.76
With personality	3.95	0.63
Modern	3.42	0.91
Innovating	3.47	0.87
Rigid	2.78	0.93
Old fashioned	2.43	0.9
Static	2.49	0.94
Sloppy	2.01	0.72

In the last dimension "customizing brand" clearly the highlight goes to the factors identified as positive as "with personality" (3.95) and "active" with 3.79 average and less positive "sloppy" with 2.01.

6.5 Discussion, Conclusion, and Implications

The results presented in the previous section indicate a reduced use by the cities in study of planning with marketing strategies of cities. Specifically as regards the management of cities and starting from a prepositional highlight of the most relevant points of view of qualitative research, only one city—Viseu—found a clear concern on the need to appeal to residents before an identification of a notion quality of life, also felt by residents (when asked), based on the idea of planning for the medium and long terms, in a clear link to the fact that if there is quality of life there will also be a strong factor of attractiveness. Rogers et al. (2012) argue that making cities more sustainable is a priority—either to regional or national governments, as well as for people who live, work, or visit the cities.

We conclude that there are only isolated actions of promotion of the city but without the consistent creation of a brand, meeting the defended by Pînzaru (2012) that most "falls on the main trap" which is short-term thinking, which ultimately translates only in specific actions and communication campaigns.

Generally true brands of city don't exist in our region under study; in that the municipalities do not work all of the brand but only some of its components; we found that the managers of cities studied don't have in their work teams any element with training in marketing, or have a real and consistent territorial marketing strategy. Our conclusion is consistent with that advocated by Kotler et al. (1993) and Kavaratzis (2009) who claim that the starting point for a successful marketing strategy is the creation of a multidisciplinary working group and involving the different actors (public to private) to carry out the diagnoses (internal and external) as well as a long-term vision and strategy.

It is obvious the clear need for municipal managers leave only to affirm the importance of territorial marketing through his theory to its practical application in day-to-day management of spaces, whether designed for residents or visitors, meeting the defended by Zenker and Beckmann (2013a) noted up more evidence of stereotypical perceptions in visitors and, for us, it is reasonable to override our findings as we have already mentioned, the lack of territorial marketing strategy which induced such a determination in all cities. A brand of a city, like a product or service, is not built with loose ideas but with a work team to address, effectively, the whole range of professionally branded and respect all culture and history of the place and its people.

With regard to the quantitative component, the study reveals generally satisfactory results, except for the topics less valued by the target audience and which are

the holiday item (size attractiveness of the city), economic development of the city (dimension associations to the city), bold (dimension characterizing the city), identification with the brand of the city (dimension identification with the brand), and sloppy (dimension customized brand).

These preliminary results may enable managers of cities to identify which are the brand attributes most valued by the target audience and use this "intelligence" for better and more focused planning of smart cities.

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Chapter 7
Organizational Challenges for Building Smart Cities

Jessica Mendoza Moheno, Martín Aubert Hernández Calzada, and Blanca Cecilia Salazar Hernández

Abstract The aim of this research is to identify the organizational and managerial challenges faced by smart cities and hence determine research opportunities. The current research is exploratory and a documentary method was used, presenting a review of the smart cities literature found in the Internet, Thomson Reuters web of knowledge, Ebsco, Proquest, and Emerald. Findings show that to build smart cities, it is necessary to determine mechanisms to overcome the following organizational and managerial challenges: flexibility in organizational structures, development of innovative spirit, generation of business opportunities, improvement of productive capacity to provide better products and services, continuous organizational learning, change resistance, and ability to transform and innovate.

7.1 Introduction

As a result of the changes that occur in a population's lifestyle derived from its own growth, and due to migration to urban cities, it is necessary to find smarter ways to manage these cities (Chourabi et al., 2014) in order to render them more inhabitable, safer, and cleaner through sustainability. Thus the concept of smart cities (SC) emerges.

The aim of SCs is to improve the quality of life for both individuals and communities. The main actors are the government, organizations and citizens. This scenario implies changes in several aspects, from behavior to mentality, in order to adapt to the new demands on SC. Organizations must adapt to the new changes through culture and the way they organize their work. New and innovative ways to unlock growth are required (Department for Business, Innovation & Skills, 2013), making it necessary to change the way of operating and doing things in order to cope with an organizational culture oriented to innovation that enables the adaptation to the new demands of SC.

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Research on SC is incipient (Chourabi et al., 2014) and it has been focused on constructing liveable and sustainable cities. SC as a subject has been tackled by other disciplines, especially by the information and communications technology (ICT) field. A review made on the literature about SC has revealed that the concept focused on government initiative proposals regarding ICT and e-government. It also includes frameworks, ranking of the top SCs, and index proposals for evaluation as well as the identification of new challenges for SCs. However, the SC subject has been poorly addressed from the managerial and organizational points of view (Ricciardi & Za, 2011). Taking into account this research gap, our interest is focused on the identification of organizational and managerial challenges faced by SCs in order to assess research opportunities.

The research focus in this study is prospective. A documentary method was used presenting a review of the literature on SC as found in databases, including Thomson Reuters web of Knowledge, Ebsco, Proquest, and Emerald. Due to the lack of SC papers focused on organizational issues, a Google search was also performed. The obtained documents were analyzed in an attempt to classify the different challenges as identified by several authors. We noticed that the challenges were primarily distinguished through interviews with government officials in case studies.

The contribution of this research regarding the former studies is the identification of organizational and managerial challenges faced by SCs, thus posing several questions for future research. Additionally, this chapter discusses the factors involved in organizational changes and the role of organizational culture in reducing the resistance to change while promoting their acceptance.

After this introduction, the chapter is organized as follows: a review of the literature on SCs and the main challenges they face are presented. Afterwards, the need for organizational changes in SCs is defined while highlighting organizational culture as a means to achieve it. Some important points that must be taken into account in order to bring about change are mentioned. Finally, the conclusions drawn from the research are presented.

7.2 Smart Cities and Their Challenges

The concept of SC is vague and is not always used in a consistent way (Chourabi et al., 2014), as it is specifically related to the infrastructure capacity possessed by the city. SC attempts to alleviate urban problems in order to attain a sustainable urban development (Alawadi et al., 2012). Harrison et al. (2010) point out that an SC is a city that tries to link all physical, ICT, social, and business infrastructures in order to promote its collective intelligence. Consequently, SC is supposed to respond quicker to new challenges (Department for Business, Innovation & Skills, 2013).

The SC concept describes how investments in human, social, and modern ICT infrastructures as well as e-services fuel both sustainable growth and quality of life (Schaffers, Ratti & Komninos, 2012). SCs look for investments in human and social capital with the ultimate goal of attaining a sustainable growth and raising the citizen's quality of life. In order to achieve this, the government's participation is crucial. The interconnection of the government's data with a corporate computing platform resulting in its transmission

among various city services is considered an indicator of SC (Chourabi et al., 2014). The SC concept is underpinned by the enabling power of ICT, which interconnects systems and stimulates innovation in order to pave the way for a series of policy goals (European Parliament Policy Department, 2014). SC is not only about the government, it also includes other features related to people, economy, mobility, business, the environment, and living (Giffinger et al., 2007). It is important to consider all of the involved factors.

Research on factors that hamper the initiatives for SCs is not sufficient (Lagzian & Wood-Harper, 2006). In the literature, several authors have identified barriers and other aspects that hinder the processes for the construction of SCs and they have also proposed their classification. Chourabi et al. (2014) identified eight critical factors for SC initiatives through the Smart Cities Initiatives Framework: (a) management and organization, (b) technology, (c) governance, (d) policy context, (e) people and communities, (f) economy, (g) built infrastructure, and (h) natural environment.

Conversely, Lagzian and Wood-Harper (2006) have classified these barriers as six different types: organizational, political, cultural, legislative and regulatory, resource and technological. Furthermore, Bajracharya, Cattel, and Khanjanasthiti (2014) identified five essential factors for SC creation. They are interrelated and not mutually exclusive:

(a) Cultural and natural amenities: local amenities that enhance quality of life.
(b) Technology: ICT implementation to improve the city's systems and functions.
(c) People and skills: attraction, retention, and support of knowledge and business workforce
(d) Knowledge and innovation precincts: facilities for attracting and generating knowledge workforce
(e) Governance: Arrangements and plans for creating an SC.

Specifically, regarding management and organizational challenges, Gil-Garcia and Pardo (2005) suggest a list of factors and challenges related to e-government (Table 7.1). Among the noteworthy factors are: managers' attitudes and behavior, lack of alignment on organizational goals, conflicting goals and resistance to change.

Table 7.1 Challenges and strategies for smart cities

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

Reference: Gil-Garcia and Pardo (2005)

Gil-Garcia and Pardo (2005) state that one of the main problems for e-government is the lack of alignment between organizational goals and ICT projects. Similarly, in government projects there are multiple objectives that sometimes conflict each other, in addition to a great resistance to change and internal conflicts. In response, the authors propose a series of strategies in order to overcome such challenges. In this regard, the first step is the identification of stakeholders, including all the involved affected parts, either directly or indirectly. The skills and expertise of the project team members are essential once the objectives have been established in a realistic way. The strategic planning process must be developed before initiating the project and the required training must be provided to all participants. Occasionally, financial resources are not the most important factor, however it is fundamental to develop innovative financial schemes so the process cannot be disrupted by the lack of resources.

Lagzian and Wood-Harper (2006) classify organizational barriers in two groups. On one hand, there are the challenges related to the traditional model of bureaucratic government, and on the other, the barriers implied in the transformation process and related to the implementation phases (Table 7.2).

Regarding cultural barriers, Lagzian and Wood-Harper (2006) declare that it is important to take into account the dominant mindset of bureaucrats, as it can slow down the process of transformation due to the beliefs and assumptions of the people who work for the government. According to these authors, the most important barriers are: resistance to change, inappropriate cultural infrastructure, wrong attitude towards technology, as well as the fear of sharing business data and processes with other departments, which could weaken their authority (Ebrahim & Irani, 2005).

Lagzian and Wood-Harper (2006) argue that the second types of barriers are those related to the e-government transformation process, dealing with the hastiness

Table 7.2 Organizational barriers

Barriers posed by the bureaucratic model	Barriers in the transformation process
Dominant mindsets: It refers to the problems originated from the bureaucrat's ideas and thoughts. Beliefs about the relationship between government and citizens are in contradiction.	Premature and precipitant actions from senior officials have been the consequence of unclear strategy and ambitious targets based on temporary efforts and non-systematic thinking and planning.
Structural barriers: The size of the government and the nature of the monopoly. It refers to extremely complex organizations.	
Operational barriers: Inefficient and long procedures in traditional management. The major operational barriers are: inefficient management procedures as well as non-standard business processes, lack of a seniority system and managerial proficiency, instability of managerial positions, lack of culture documentation, avoidance of making high risk decisions, weakness of policy implementation.	

Reference: Lagzian and Wood-Harper (2006)

of putting initiatives in practice without being planned beforehand and thoroughly analyzed. Alawadi et al. (2012) concur that one of the challenges for e-government projects is implementation, knowing beforehand that each one differs depending on the objectives as well as on goal alignment, resistance to change, and organizational behavior. In order to develop an SC it is important that e-governments also develop in such way that they allow citizens, among other things, to carry out paperwork without the need to be physically present at government offices, as well as the simplification of processes within the government itself. Ebrahim and Irani (2005) contemplate a series of organizational barriers for the adoption of an e-government. They are related to different aspects, such as management strategy, individual attitudes, structural issues, organizational culture, as well as the belief of government officials being a threat to power.

Another organizational barrier is the government's own structure. As it is a complex organization with several departments, agencies, and commissions (Ebrahim & Irani, 2005), a government has coordination and integration problems that lead it towards bureaucracy. E-governments need to adjust and look for organic structures that enable flexibility. Maarse and Janssen (2012) state that culture and change are essential in the process of creating lean organizations.

SCs imply changes in several ways. Since SCs are something new, governments as well as the rest of the agents are not ready to overcome the challenges. For this purpose, an organizational change is needed.

7.3 Organizational Change for Smart Cities

It is important to understand that SCs by themselves are change agents and they provide the conditions and resources required for change (Schaffers, Ratti & Komninos, 2012). It is also important to bear in mind that problems in SC construction are not due to technology itself, but rather cultural and organizational aspects (Alawadi et al., 2012). One of the SC objectives is to ensure that organizations improve their efficiency, transparency, and their access to technology. Therefore, besides changes in digital systems, organizational changes are needed in order to bring the organization to an enhanced status (Ragsdell, 2000).

Researchers in SCs talk about a change, but they do not mention how such a change should be effected. The literature has been mainly centered on changes related to e-governments and ICT projects. Nevertheless, this change must be comprehensive. Changes are required in operation processes, technology, mindsets, structures, and organization. In spite of this, changes cannot successfully occur without modifying organizational culture (Odagiu & Piturlea, 2012). Organizational culture is a set of basic values, beliefs, and assumptions shared by the members of one particular organization, adopted either consciously or unconsciously, that regulate their behavior, and they are understood as the organization's personality. Organizational culture is defined as "the pattern of basic assumptions that a given group has invented, discovered, or

developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to these problems" Schein (1985:9). Organizational culture is built from different factors, including the social culture in which the organization resides, technologies, markets, competitors, and the personality of the dominant leaders. It is a stabilizing basis for organizational interaction (Dörhörfer, Minnig, Pekruhl, & Van Reine, 2011), as well as a strategic resource (Barney, 1986).

Organizational culture is as important as the effective design of concrete economic and political changes in SCs and it needs to be modified in order to improve performance within the public sector (Odagiu & Piturlea, 2012).

It is important to take into account that changes are continuous processes, and the aspects described below may be useful when dealing with organizational changes:

7.3.1 Define the Identity of the Stakeholders

Perhaps government is the organization that possesses the highest number of stakeholders. Under this premise, it is necessary to identify them so the change can be performed. Stakeholders are those persons involved in and affected by the process. Regarding SCs, they are mainly the public and private sectors as well as the citizens (Bajracharya et al., 2014). Hollands (2015) states that the initiatives for SCs must not only come from the government, but other perspectives should also be considered, such as those emanating from citizen-based types of smart initiatives. Thus, the collaboration of the private sector with citizens is crucial.

Research conducted by Lee, Hancock, and Hu (2014) demonstrates that effective and sustainable SCs emerge as a result of dynamic processes in which public and private sector actors who coordinate their activities and resources are involved, within the framework of an open innovation platform. This objective cannot be attained without the existence of embedded cultural and social capabilities. SCs must be a good place to live. This implies giving responsibility to inhabitants to co-create a viable environment (Van den Bergh & Viaene, 2015), as well as promoting government's leadership.

7.3.2 Mindset and Attitudes

The biggest challenge for change can be mindsets and attitudes. The government members will make a transition from a bureaucratic model to an innovative model that will enable coordination. It is important to analyze the current organizational culture beforehand as there will be values and beliefs that should be not only kept, but emphasized. It is a serious mistake to think that none of the values and beliefs of the traditional bureaucratic model are useful. Regarding this aspect, it is necessary to

equally analyze both national and regional assumptions in order to outline the context and to lead the way towards an open mindset that confers significance to the work.

7.3.3 *Laying Out Changes*

Changes are complex and uncertain (Pettigrew & Whipp, 1991), thus it is necessary to assess both which type of change is required and the time it will take. Bennis, Benne, and Chin (1969) point out that changes are non-intervening, radical or planned. The effectiveness of the planned change is related to the members' participation in all organization levels.

Resistance to change which departs from the current economic and political models is an aspect that cannot be ignored, also taking into account skepticism of change (Maarse & Janssen, 2012). Culture shapes resistance to change (Danisman, 2010), and when organizational changes are planned the resistance toward change can better be overcome (Lozano, 2012).

Society-based cultural understandings and values within an organization serve as a source of resistance to change among employees. For this reason, it is important to analyze the society-based patterns of understanding and meaning systems gathered around status, hierarchy, and emotion-based relationships (Danisman, 2010). It must be borne in mind that organizational changes contemplate people as well.

7.3.4 *Develop an Innovative Spirit and Share Knowledge*

Organizational culture plays a central role in innovation within organizations. There are some cultures more resistant than others. Innovation capacity and its effects on performance have been studied. The evidence shows that those organizations possessing an innovation-oriented culture obtain better outcomes (Chih, Huang, & Yang, 2011). It is important to measure the impact of learning and sharing knowledge on innovation (Cerne et al., 2012). The data from research has showed that those cultures promoting organizational learning allow the development of innovations (Liao, Chang, Hu, & Yueh, 2012). Thus, innovation-centered values, through organizational culture, become the central elements for this type of organizations, thereby creating a more open culture that simplifies communication and promotes trust. Organizational culture decreases resistance to change when introducing new technologies and also facilitates innovation. The research conducted by Van den Bergh and Viaene (2015), discovered that the culture required for the adoption of new technology must be a "want to" attitude, rather than a "have to" one.

Carvalho (2015) comments that the contemporary vision of SCs based on information technologies and telecommunications imply social and technical

challenges that could be benefited by technological learning. This means that the people's values and beliefs must be taken into account as elements of organizational culture.

7.3.5 Social Capital Development

Caragliu, Del Bo and Nijkamp (2009) paid special attention to the role of society and relationships as capital, as people must learn, adapt, and innovate.

The combination of shared values associated with contacts and relationships results in mutual benefits for the members within a network (Dörhörfer et al., 2011), in which both rules and values are shared and provide meaning, promoting the achievement of objectives.

Social capital is based on the relationship's structure among actors, individuals and collectives (Lemieux, 2001). Kwon and Adler (2010) define the social capital as the individual's or group's goodwill to help each other while maintaining a friendly attitude. Organizational culture ensures a social capital by involving beliefs, shared values, and assumptions (Odagiu & Piturlea, 2012) centered on trust and learning (Dörhörfer et al., 2011).

7.3.6 Structure

SCs imply a structure change, passing from a bureaucratic model to a rather lean and organic model, improving efficiency. As it has been laid out, the most important limiting factor is the mindset change; transitioning from values and beliefs infiltrated by bureaucratic work to another way of work that modifies beliefs and assumptions in order to improve the services provided to citizens. However, change cannot be carried out if the current government's organizational structures are kept, as they hinder communication and make difficult the necessary coordination.

7.4 Conclusions

The findings of this documentary research provide evidence on organizational and managerial challenges for SC building.

SCs are not only about technological issues. The building of SCs requires several changes. Technological, structural, and operational changes must be implemented along with cultural changes. These are defined as changes in values, beliefs, and assumptions, not only from the government leaders and employees, but also from the private sector and citizens.

One of the goals of SCs is the investment of human and social capital. How can this be achieved? First is the matter of training. SCs need talented people who are attracted by the work infrastructure within an SC. A city cannot be considered smart if it does not have industries offering good products and services. Thus, new methods of service and product offering need to be implemented. Second is the sharing of knowledge. We consider ourselves as living in the era of knowledge, but this knowledge is not shared due to the fear of sharing business data, as it is either considered a threat to hierarchy and power, or simply because it is not known how to. Research on this issue is needed in order to identify the factors that obstruct the sharing of knowledge, as well as to propose models of promoting knowledge.

SCs imply a different behavior from all stakeholders, the citizens, the private sector, and of course, the public sector. New ways of doing things are required, however resistance to change delays changes in behavior. Research is required in order to identify the current culture, delving into values, beliefs, and basic assumptions that determine, in order to adjust ourselves to the new necessities of the SC so that they allow us to assign significance to the new ways of doing things.

As the SC is a new research subject regarding organization and management, it offers the opportunity to conduct prospective studies in order to build up the theory. A higher number of SC cases is required in order to assess the main problems they face, as well as the identification of new research opportunities. It is likely that developing countries face greater challenges, thus a comparative analysis could contribute to answering this question and providing a context for initiatives.

Objective alignment and conflict of interests is another barrier that opposes SC development. The government's own structure represents a great research challenge. The creation of new organizational designs are needed in order to decrease its complexity and to guide it towards more lean and organic structures, simplifying communication, coordination, and integration.

Strategic planning and management are needed. As noted before, one of the main problems is that project launching has not considered all of the consequences and problems that may appear, sometimes they have even been ignored. Research is needed in order to identify all factors that hamper the successful achievement of SC plans and initiatives.

Similarly, an SC requires new competences from the stakeholders, so that they are able to respond to its current needs, thereby progressing towards the achievement of being Smart People. SCs need extensive links between government, citizens and superior education institutions in order to promote talent.

A crucial aspect of organizational culture is to also take into account national and regional culture so that long-established values, typical of the national culture, might prevail. These must be respected and noted when implementing SC changes. SC changes may be jeopardized if these aspects are not contemplated.

An important part of SC is ICT, which sometimes is not completely exploited by users due to their lack of skills or training, or because of their resistance to change. Through organizational culture the use of new technologies acquires more meaning and their optimal use is promoted.

Social capital is one of the SC constituents, with trust and goodwill being the core elements. Social capital could be strengthened by the networks created by stakeholders. Research on social capital is needed in order to provide the knowledge required to support its development. Multidisciplinary research is necessary in order to analyze SCs from different focuses and perspectives, thus improving the results.

This research provides a starting point to promoting a debate involving policy-makers, developers and academics. It has implications for stakeholders, especially policy-makers and developers of SC projects. Similarly, it has implications for academics as it identifies research lines that may contribute new knowledge in order to solve problems.

The limitations of this study are mainly two. On the one hand, the foremost limitation is the documentary nature of this research and, on the other hand, the absence of research on the subject, from the managerial point of view, restricts us to only being able to make a series of proposals.

Finally, even when publications regarding SC organizational and managerial issues are not enough, this research provides insights into the understanding of challenges for building SCs. Organizational culture is essential for SCs and the development of Smart Governments, Smart Industries, and Smart People, through changes in values, beliefs, and attitudes in order to attain the general SC objectives, i.e., to improve the quality of life and the sustainability of cities.

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Chapter 8
Smart Tourism Destination in Madrid

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Abstract The main objective of this research is to find out what are the principal concepts that characterize the Smart Tourism Destination (within smart city) at this moment and in particular "Smart Hotel" and "Smart Airport." For the last couple of decades managers of many hotels and airports around the world have used traditional tools for organizing and implementing requirements for sustainable development. Sustainability and the use of smart tools have become the key element to ensure the survival of a hotel/airport in the present global, dynamic, smart, and flat world.

8.1 Introduction

Research topic and hypotheses: At present times, one of the main goals of the Spanish Ministry of Tourism is to support the development of Smart Tourism Destinations (STD) which aims to improve the benchmarking and competitiveness of Spain as the world tourism destination. To this end, it is necessary to find new mechanisms to promote innovation, deployment, and development of "Information and Communication Technologies (ICT)" that involve the establishment of a strategy for upgrading the destination through state-of-the-art technologies, a better use of the natural and cultural resources, and creating innovative processes which eventually boost sustainable development and eco-efficiency. Indeed many business companies and state institutions as a principal strategy in their activities include eco-efficiency (as basis for survival and sustainability. Hence, for obtaining these goals they implement several kinds of smart technologies.

"Smart Tourism Destination" is a made-up word composed of "Smart," "Tourism," and "Destination." Probably "Smart" is the term that highlights better

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the substance of this chapter, as more discriminating distinction for tourism "smartness" is proposed in this research, based on the management of technology and smart solutions to achieve eco-efficiency at a destination level. In this sense, the destination of Madrid and its interation of ICT is studied from the visitors' perspective, both nationals and internationals. In other words, the aim of the researchers is to figure out if the eco-efficiency in Madrid as a STD is strongly influenced by the applications of Smart Technologies (direct effect) and some moderators taken place (induced effect), such as technological education of the tourism staff, the economic budget of tourism companies, the mentality of these companies toward Smart Technologies and the tourist's accceptability of its implementation.

Thus, the scope of our research wraps up in the following Fig. 8.1:

In view of the above discussion, the following hypotheses are therefore proposed and are contrasted by statistical procedures over the chapter (see Table 8.1):

Academic reasons: The main reasons for accomplishing this study about STD in Madrid can be classified into academic factors. It was peculiar that there is still a gap in terms of research while looking for information about this matter. Up to date there is only barely research performed; at this juncture, it should be taken into account that most of research conducted comes from the US, the UK, and the Asian universities. Indeed, Spanish Tourism Authorities are currently boosting the implementation of STDs, but there is still not so much research published in Spain on this matter. Hence, this research could modestly contribute to a better understanding on tourism destination policies and give a new fresh air for marketing practitioners.

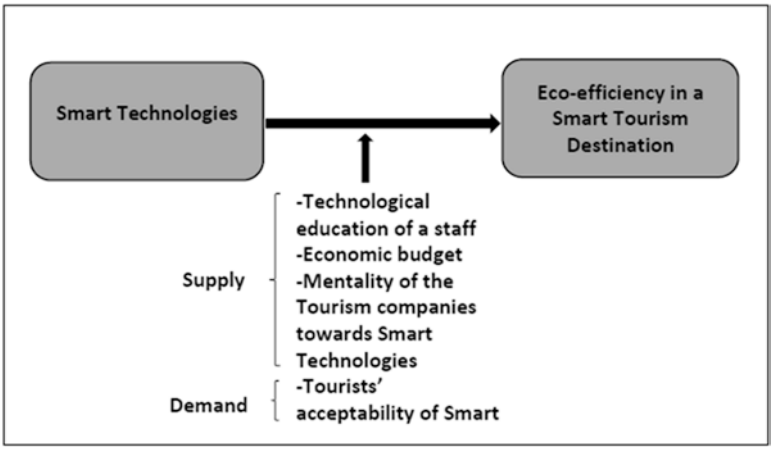

Fig. 8.1 Scope of this research. *Source*: Authors (2015)

Table 8.1 Hypotheses

H1	More technology means more eco-efficiency
H2	More smart technologies are accepted by visitors

Source: Authors (2015)

8.1.1 Smart Tourism Destinations and Smart Hotels as New Solutions for Sustainability

Smart tourism destination: The Smart Tourism Destination (STD) concept emerges from the development of smart cities. With technology being embedded on all organizations and entities, destinations will exploit synergies between ubiquitous sensing technology and their social components to support the enrichment of tourist experiences. By applying smartness concept to address travellers' needs before, during, and after their trip, destinations could increase their competitiveness level (Buhalis & Amaranggana, 2013).

It has been suggested that a STD consists of three main components: Cloud Services, the Internet of Things (IoT), and End-User Internet Service System (Zhang, Li, & Liu, 2012) First, cloud services are designed to provide convenient and scalable access (e.g., measurable for payment per use) to applications, software, and data through web browsers. For example, a sophisticated tour guide system can serve a large number of tourists without being installed on any personal device. A centralized distribution system can serve any travel agents on a pay-per-use basis. The cloud services are the fundamentals of a smart destination. Second, the Internet of Things (IoT) refers to the pervasive presence around us of a variety of things or objects—such as Radio-Frequency Identification (RFID) tags, sensors, actuators, and mobile phones—which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals. The IoT system supports smart destinations in terms of (1) information and analysis; and (2) automation and control. The third component of a smart destination is the End-User Internet Service System, which refers to the applications and equipment support of the cloud service and the Internet of Things at various levels of end-users. For example, the design of individual payment systems is based on personal telecommunication devices such as smartphones and tablets. Wireless connections and touch screens are set up in scenic spots to serve tourists. Tourism service providers and government organizations are equipped with portals and connections to the cloud service (Wang, Li, & Li, 2013).

Technology in the tourism industry (supply): The tourism industry can be seen as one of the first business sector where business functions are almost exclusively

using information and communications technologies (ICT). ICT have played an important role in the development of tourism. Computerized Reservation System (CRS) were among the first applications of ICT worldwide (Gupta, 2012).

Tourism as an international industry and as the biggest provider of jobs on the planet boasts a greater array of heterogeneous stakeholders than many other industries. The energetic growth and development of the industry are perhaps only mirrored by the growth of ICT. The accelerating and synergistic interaction between technology and tourism in recent times has brought fundamental changes in the industry and on our perceptions of its nature. The significance of crossing the new information threshold of universal, ubiquitous communications access has brought the entire tourism industry to the new levels of interactivity, propelling management by wire. Increasingly, ICT play a critical role for the competitiveness of tourism organizations and destinations as well as for the entire industry as a whole (Buhalis & Law, 2008).

Technology and tourists (demand): Information Technologies support tourists throughout various activities, such as preliminary information search, comparison, decision making, travel planning, communication, retrieval of information, and post-sharing of experiences. Depending on their respective needs, tourists employ a wide range of tools, such as websites, travel blogs, recommendation systems, virtual communities, or mobile technologies to facilitate and enhance these actions. With technology being present in all stages, the traditional experience co-creation space undergoes a significant change. Beyond the co-creation space on-site, Information Technologies unclose a new space in the pre- and post-travel stages, where the destination, tourism suppliers, tourists and networks of consumer communities interact, not only in a physical but also in a virtual experience co-creation space (Neuhofer, Buhalis, & Ladkin, 2012).

Tourists become sophisticated and more demanding, requesting high quality products and value for their money. Thus, destinations and principals need new methods to serve the new types of demand. The usage of ICT in the industry is driven by both the development of the size and complexity of tourism demand, as well as by the rapid expansion and sophistication of new tourism products, which address mini-market segments. Increasingly, new, experienced, sophisticated, demanding travellers seek information about more exotic destinations and authentic experiences, as well as the requirement to interact with suppliers in order to satisfy their specific needs and wishes. The contemporary/connected consumer is far less willing to wait or put up with delays, to the point where patience is a disappearing virtue (Rach, 1997).

Information Technologies facilitated factors enhance consumer satisfaction, namely: consumers have more information and enjoy a greater choice; a reduction of bureaucracy and paperwork effectively frees time for customer service; customizing the product and establishing “one-to-one” marketing by using intclligcnce collected by loyalty schemes (Buhalis, 1998).

8.2 Methodology

Applied techniques for this research: face-to-face survey: A face-to-face survey has been implemented for gathering and analyzing the data collected. According to Creswell (2012: 376) a face-to-face survey design is a procedure in quantitative research in which the investigator administer a survey to a sample of people to describe attitudes, behaviors, opinions or characteristics of the population. Thus, a face-to-face survey involves the systematic collection of data and lay down the importance of standardization. Precise samples are selected for this kind of surveying and attempts are made to standardize and eliminate errors from data gathering tools (Gray, 2011: 219).

In particular, one questionnaire has been applied for this research process and conducted with respondents at Prado Museum (150 subjects) and Adolfo Suarez Barajas Airport (150 subjects) on the random basis. Prior to that, the questionnaire used for this survey was filtered by a pilot test. This questionnaire is a formalized set of questions (see Table 8.2) for obtaining information from respondents and the overriding objective is to translate the researcher's information needs into a set of specific questions that respondents are willing and able to answer.

The questionnaire (both in Spanish and English languages) has been pre-tested and swept away accordingly before final field work with Cronbach's Alpha of 0.810 (the reliability of the questionnaire is highly acceptable, see Table 8.3).

The questionnaire took over 7 min to be completed with a refusal rate of 12.54 % (we have approached 343 subjects and 43 have rejected to participate in the survey). For measuring the variables of the questions, some five-point Likert-type scales are applied to determine the sensibilities of these variables. All the details about the ground work are summarized in the Technical Datasheet (Table 8.4 above).

The advantages of a five-point or a four-point Likert-type scale continue to be discussed, with some researchers believing that the answer from a four-point scale does not really follow a normal distribution (is skewed too much on one side).

Finally, the information obtained has been analyzed through the quantitative software SPSS in order to describe the main patterns and identify main causal relationships between tourists and services businesses in a Smart Tourism Destination

Technical data-sheet. In a nutshell, all the steps taken regarding the methodology for this research are wrapped up in the following table:

Table 8.2 Design of the questionnaire applied for this research

Block 1	Sociodemographic profile of respondents
Block 2	Use of technologies by tourists
Block 3	Smart Tourism Destination
Block 4	Technologies used by tourists in a Smart Tourism Destination

Source: Authors (2015)

Table 8.3 Cronbach's Alpha of the questionnaire for this research

Reliability statistics						
Cronbach's alpha	*N* of items					
0.810	11					
ANOVA						
		Sum of squares	df	Mean square	*F*	Sig.
Between people		619.173	254	2438		
Within people	Between items	9.959.218	10	995.922	408.830	0.000
	Residual	6.187.509	2540	2436		
	Total	16.146.727	2550	6332		
Total		16.765.900	2804	5979		
Grand mean = 3.54						

Source: Authors (2015)

Table 8.4 Technical data sheet for the methodology of this research

Features	Face-to-face survey
Participants	300 participants in Prado Museum (150) and Adolfo Suarez Barajas Airport (150)
Sampling	Stratified and simple random sampling
Sampling error	±5.6 %
Confidence level	95 % (with $p = q = 0.5$)
Duration	7 min
Dates of implementation	From Monday 9th February 2015 to Sunday 15th February 2015 (both dates included)
Analysis technique	Statistical procedure:
	Univariate analysis (frequency, mean, standard deviation)
	Bivariate (Cross-tabs)
	Multivariate (Multiple linear regression)
Software used for the analysis technique	SPSS V.20

Source: Authors (2015)

8.3 Findings

In the following lines we cover the main results of the research related to univariate, bivariate, and multivariate analysis.

Univariate analysis. Table 8.5 shows that 26.9 % persons of the applied research project cannot decide whether they are ready to lose their privacy for ceding some

Table 8.5 Are you willing to lose privacy in exchange for ceding some personal information for more amenities?

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1—Strongly disagree	72	23.9	24.3	24.3
	2	51	16.9	17.2	41.6
	3	81	26.9	27.4	68.9
	4	57	18.9	19.3	88.2
	5—Strongly agree	35	11.6	11.8	100.0
	Total	296	98.3	100.0	
Missing	System	5	1.7		
Total		301	100.0		

Source: Authors (2015)

Table 8.6 As a business strategy, more technology means more eco-efficiency? Do you agree with this approach?

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1—Strongly disagree	25	8.3	8.6	8.6
	2	33	11.0	11.4	20.0
	3	86	28.6	29.7	49.7
	4	100	33.2	34.5	84.1
	5—Strongly agree	46	15.3	15.9	100.0
	Total	290	96.3	100.0	
Missing	System	11	3.7		
Total		301	100.0		

Source: Authors (2015)

personal information for more amenities or not. With the very slight difference (23.9 %) interviewed subjects "strongly disagree" on this affirmation.

According to Table 8.6, 33.3 % of studied people "agree" or "strongly agree" (15.3 %) that by implementing technology business companies, including hospitality industry companies, can be more eco-efficiency, but almost the third part of the respondent (28.6 %) could not decide whether technology is important or not.

During the last decade travellers all around the world use more technologies for their trip organization and also during the trip. The use of technologies are important during all the process of the journey, and the Table 8.7 affirms that for the big part of travellers the use of the in-room technologies is very important and they are ready to pay for it a bit more as well. Results of this table show that 34.6 % of people

Table 8.7 How relevant do you consider to pay a little more for better in-room technologies at your hotel?

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1—Strongly disagree	22	7.3	7.6	7.6
	2	26	8.6	9.0	16.6
	3	79	26.2	27.2	43.8
	4	104	34.6	35.9	79.7
	5—Strongly agree	59	19.6	20.3	100.0
	Total	290	96.3	100.0	
Missing	System	11	3.7		
Total		301	100.0		

Source: Authors (2015)

Table 8.8 Would you be willing to use more smartphone as a portal of multitude capabilities during your travel experience?

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1—Strongly disagree	58	19.3	19.5	19.5
	2	51	16.9	17.1	36.6
	3	81	26.9	27.2	63.8
	4	64	21.3	21.5	85.2
	5—Strongly agree	44	14.6	14.8	100.0
	Total	298	99.0	100.0	
Missing	System	3	1.0		
Total		301	100.0		

Source: Authors (2015)

"agree" to pay a bit more to the total bill of the hotel, 19.6 % "strongly agree" and 26.2 % "neither agree nor disagree."

During the last 10 years our smartphones are not only important tool for communication but also for organizing our everyday life activities and different business processes. Therefore, Table 8.8 reveals that 26.9 % tourists "neither agree nor disagree" of willingness to use their smartphones as a portal for their tourism activities or for their travel experiences, but 21.3 % "agree" that smartphones are important for multiple uses during their trip.

Bivariate analysis: By using bivariate analysis we can see how vary the use of smartphones for multiple capabilities during the trip among different nations across the world. Table 8.9 shows that 60 % of the travellers from the East Europe "strongly agree" that smartphone is important when they travel. 42.9 % of the Mexican, 31.3 % of the Australian, 28.4 % of the Spanish, and all Italian (100 %) tourists do agree on the importance of smartphones; 64.3 % British, 60 % Canadians, 58.3 % Germans, and 40 % Americans cannot decide is it or not important for them. For the big majority of travellers from Denmark, China, Costa Rica, New Zealand, and Middle East region smartphone while travelling is not very important or not important at all.

Table 8.9 Nationality * Would you be willing to use more smartphone as a portal of multitude capabilities during your travel experience (Cross-tabulation)

		Would you be willing to use more smartphone as a portal of multitude capabilities during your travel experience?						Total
			1—Strongly disagree	2	3	4	5—Strongly agree	1—Strongly disagree
Nationality	Spain	Count	37	20	34	46	25	162
		% within Nationality	22.8 %	12.3 %	21.0 %	28.4 %	15.4 %	100.0 %
	Germany	Count	2	0	7	2	1	12
		% within Nationality	16.7 %	0.0 %	58.3 %	16.7 %	8.3 %	100.0 %
	UK	Count	0	5	9	0	0	14
		% within Nationality	0.0 %	35.7 %	64.3 %	0.0 %	0.0 %	100.0 %
	Italy	Count	0	0	0	4	0	4
		% within Nationality	0.0 %	0.0 %	0.0 %	100.0 %	0.0 %	100.0 %
	Denmark	Count	0	4	0	0	0	4
		% within Nationality	0.0 %	100.0 %	0.0 %	0.0 %	0.0 %	100.0 %
	USA	Count	4	4	12	2	8	30
		% within Nationality	13.3 %	13.3 %	40.0 %	6.7 %	26.7 %	100.0 %
	China	Count	4	0	0	0	0	4
		% within Nationality	100.0 %	0.0 %	0.0 %	0.0 %	0.0 %	100.0 %
	Australia	Count	3	3	4	5	1	16
		% within Nationality	18.8 %	18.8 %	25.0 %	31.3 %	6.3 %	100.0 %
	Mexico	Count	2	1	1	3	0	7
		% within Nationality	28.6 %	14.3 %	14.3 %	42.9 %	0.0 %	100.0 %
	Middle east	Count	3	4	4	0	1	12
		% within Nationality	25.0 %	33.3 %	33.3 %	0.0 %	8.3 %	100.0 %
	Costa Rica	Count	1	4	3	0	0	8
		% within Nationality	12.5 %	50.0 %	37.5 %	0.0 %	0.0 %	100.0 %

(continued)

Table 8.9 (continued)

		Would you be willing to use more smartphone as a portal of multitude capabilities during your travel experience?						Total
			1—Strongly disagree	2	3	4	5—Strongly agree	1—Strongly disagree
	New Zealand	Count	2	1	0	1	0	4
		% within Nationality	50.0 %	25.0 %	0.0 %	25.0 %	0.0 %	100.0 %
	East Europe	Count	0	2	0	0	3	5
		% within Nationality	0.0 %	40.0 %	0.0 %	0.0 %	60.0 %	100.0 %
	Canada	Count	0	0	3	1	1	5
		% within Nationality	0.0 %	0.0 %	60.0 %	20.0 %	20.0 %	100.0 %
Total		Count	58	48	77	64	40	287
		% within Nationality	20.2 %	16.7 %	26.8 %	22.3 %	13.9 %	100.0 %

Source: Authors (2015)
*versus

8.3.1 Multivariate

In a multiple linear regression model, a single response measurement (y) is related to at least two predictors (covariate, regressor) (x) for each observation. The critical assumption of the model is that the conditional mean function is linear:

$$P\left(y_{\mathrm{i}}\right)=\beta_0+\beta_1 x_1+\beta_2 x_2+\ldots\beta_{\mathrm{p}} x_{\mathrm{ip}}+\varepsilon_{\mathrm{i}} \quad \text{for } i=1,2,\ldots n.$$

Or

$$P\left(\text{More smartphone capabilities}\right)=\beta_0+\beta_1\left(\text{More technology more ecoeffiecny}\right)+\beta_2\left(\text{Pay a little more}\right)+\beta_3\left(\text{Lose privacy}\right)+\varepsilon_{\mathrm{i}}$$

where β_0 is called the intercept and the β_i are called slopes or coefficients.

Based on this mean function, we can determine if visitors "the willingness of tourists to use more smartphone as a portal of multitude capabilities during the travel experience" as long as we know their (1) willingness to lose privacy in exchange for ceding some personal information for more amenities, (2) their degree of importance to pay a little more for better in-room technologies at your hotel, and (3) their degree of agreement that more technology means more eco-efficiency. Thus, some assumptions have been made for designing this model: linearity, independence, normality, and equal variation of the selected variables.

According to Table 8.10, to predict "the willingness of tourists to use more smartphone as a portal of multitude capabilities during the travel experience" will be influenced just by (1) their willingness to lose privacy in exchange for ceding some personal information for more amenities (with a statistical significance lower than 0.05).

8.4 Conclusions and Recommendations

Conclusions of the face-to-face survey and some recommendations. In a nutshell, this research reveals that the implementation of technology is a driver for boosting more eco-efficiency in the tourism and hospitality industry. However, tourists are somehow a bit reluctant to lose privacy in exchange for ceding some personal information for more amenities. According to the multiple linear regression model proposed for this study, the willingness to use more smartphones when visiting a destination is clearly influenced by this loss of privacy. So, more technological awareness should be developed by local authorities and tourism companies to scope the goals of a Smart Tourism Destination. Certainly, technology has more pros than cons in terms of tourism management and companies that prioritize technology for their guests provide a return on innovation. In fact, ICT are drivers to enhance the tourism experience if used appropriate, changing the dynamics of social interactions between residents and visitors for more convenience, and reducing dramatically the operating and environmental costs for tourism companies (eco-efficiency).

Table 8.10 Prediction of the "the willingness to use more smartphone as a portal of multitude capabilities during the travel experience"

Model summary						
Model	*R*	*R* square	Adjusted *R* square	Std. Error of the estimate		
1	0.805[a]	0.648	0.644	0.789		
ANOVA[b]						
Model		Sum of squares	df	Mean square	*F*	Sig.
1	Regression	317.232	3	105.744	169.764	0.000[c]
	Residual	172.540	277	0.623		
	Total	489.772	280			
Coefficients[d]						
Model		Unstandardized coefficients		Standardized coefficients	*t*	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.396	0.209		1.889	0.060
	As a business strategy, more technology means more eco-efficiency? Do you agree with this approach?	0.054	0.040	0.048	1.334	0.183
	How relevant do you consider to pay a little more for better in-room technologies at your hotel?	0.061	0.041	0.054	1.491	0.137
	Are you willing to lose privacy in exchange for ceding some personal information for more amenities?	0.780	0.036	0.789	21.821	0.000

Source: Authors (2015)

[a]Predictors: (Constant), Are you willing to lose privacy in exchange for ceding some personal information for more amenities?, How relevant do you consider to pay a little more for better in-room technologies at your hotel?, As a business strategy, more technology means more eco-efficiency? Do you agree with this approach?

[b]Dependent variable: Would you be willing to use more smartphone as a portal of multitude capabilities during your travel experience?

[c]Predictors: (Constant), Are you willing to lose privacy in exchange for ceding some personal information for more amenities?, How relevant do you consider to pay a little more for better in-room technologies at your hotel?, As a business strategy, more technology means more eco-efficiency? Do you agree with this approach?

[d]Dependent variable: Would you be willing to use more smartphone as a portal of multitude capabilities during your travel experience?

Table 8.11 Contrast of hypotheses of the chapter

	Hypotheses	Contrasts (accepted or rejected)
H1	More technology means more eco-efficiency	We refuse this hypothesis as in Table 8.6, 146 out 301 respondents do really agree (score 4 or 5) that more technology implies more eco-efficiency
H2	More smart technologies are accepted by visitors	This hypothesis *is refused* based on the fact that only 35.9 % (21.3 % and 14.6 %) declare they would will to use more smartphone as a portal of multitude capabilities during your travel experience (shown in Table 8.8). So, less than the majority (50 %)

Source: Authors (2015)

As stated by Buhalis (1998: 410) "ignoring and under-utilizing ICT in a destination could be disastrous as it would create strategic vulnerability and competitive disadvantage. No action is not an option." Hence, in the case of Madrid struggles might be increased on infusing the use of technology by the tourists for achieving more eco-efficiency as a Smart Tourism Destination.

Confirmation of the hypotheses. To test the hypotheses established at the beginning (Sect. 8.1), we convert the analysis of statistical procedures worked out earlier in the chapter. The results are shown in the below table (Table 8.11).

Contribution to the Science. This research chapter achieves understanding about Smart Tourism Destination (especially Smart Hotels and Smart Airports) not only from the perspective of managers but also from the view of customers/visitors as final users of smart products and services. Therefore, from the obtained survey results there can be given some practical suggestions not only for hotels and airports, as a part of myriad of a concept the Smart Tourism Destination, but also for other tourism infrastructure resources like "Smart Restaurants," "Smart Museums," and "Smart Transportation."

Limitations and further research. Certainly, this research project has some limitations that should be mentioned for the interpretations of final findings. First of all, this investigation concentrates (obtained primary data) only on the Madrid City and does not analyze other cities/towns which could be considered as the Smart Tourism Destinations in Spain. Secondly, the representativeness of sampling units is limited (only 300 subjects have participated in a survey technique). Therefore, the future investigations could be developed by enlarging amount of sampling units and analysis of other tourism destinations in Spain.

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Chapter 9
The Knowledge Economy as a Key Determining Factor to Improve Smart Cities

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Abstract This chapter analyses the components of the Knowledge Economy as key determining factors to improve smart cities. By analysing the citizens' perception, we find eight factors that determine the Knowledge Economy: Internationalisation Skills, Education, Global Competitiveness, Business Intelligence, Professional Excellence, Logistics, Potential of the city, Entrepreneurship, and their effect on the Dimensions of the smart city. The methodology of this chapter is based on the citizens' perception, estimating the importance of these factors by sampling 500 randomly selected citizens for the empirical study of the hierarchical model. We conclude that if the consensus of the citizens is to empower the aforementioned factors of the Knowledge Economy, this provides local leaders and managers with valuable information to develop strategies that will improve smart cities.

9.1 Introduction

Cities that want to advance today must take into consideration that their process will be linked to different factors encompassed within the Knowledge Economy concept, such as Internationalisation Skills, Education, Global Competitiveness, Business Intelligence, Professional Excellence, Logistics, Potential of the City and Entrepreneurship. Fostering these factors will allow local leaders and managers to generate the capacity to attract production capital to the city, not only in the form of monetary flows but also in terms of highly qualified employment and the development of infrastructures.

The approach based on the "*knowledge-based city*" concept has become especially important based on the works by Knight (1989), Dosi and Malerba (1996),

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Malmberg and Maskell (2002), Eisenhardt and Santos (2002). The Knowledge Economy has been a target for study since the decade of the 1990s, the case studies by Lever (2002) being examples of this.

From the economic perspective, Arthur (1996), indicates that cities with high development and important growth rates, show decreasing marginal performances, in terms of their productivity, and generating higher growth rates can only be obtained based on intangible assets, that is based on knowledge.

The objective of this work is to prepare a synthetic index that will permit obtaining a score in terms of the Knowledge Economy, in agreement with the actual citizens perception of each of its components. Thus, the research aims to quantify or assess the Knowledge Economy based on factors that define it, based on the perspective and experience of its participants in its physical space.

9.2 Theoretical Background

9.2.1 Dimensions of the Smart City

Komminos (2002), Giffinger et al. (2007), Shapiro (2008), Van Soom (2009), Lombardi (2011) as well as Nam and Pardo (2011) point out that the main dimensions that comprise the smart city are:

- Smart Economy: defined as a system that is able to generate a sustainable economic environment.
- Smart human capital: the capacity to develop citizens' talent and skills in the actual city,
- Smart Environment: sustainable environment strategies and attractive conditions of the physical medium.
- Smart Living: strategies aimed at facilitating access to the citizens' education and development, as well as social cohesion and the attraction of tourism.
- Smart Governance: policies and strategies developed by the government in order to develop the city and the transparency of the public sector.

There is considerable literature about the development of technologies, the development of technological infrastructures and logistics to explain the smart city. Lombardi (2011) maintains that the smart city must take into account another type of factor, such as citizen participation, safety, cultural heritage, retaining of international talents and availability of international education or places for professional and social interaction. On the other hand, Nijkamp and Kourtik (2011) states that the variables that define the Knowledge Economy can be encompassed within four groups.

- *The Connected City: (logistics and sustainable mobility)*: the image and one of the characteristics of the city acts as interconnection between the interior and the exterior. Thus, the city becomes a territory without barriers, and progress is due to the interaction between the local and foreign framework.

- *The Entrepreneurial City: (economic feasibility)*: this vision assumes that the present and the future are continuously competing both in a local and global perspective; cities would only be able to survive if they could maximise innovation, creativity and knowledge to externalise the city and be able to capture the attention of other cities as reference.
- *The Pioneer City (social participation and social capital)*: this vision refers to the great diversity of lifestyles of citizens in the cities. This diversity promotes opportunities and considerable changes to the cities, giving rise to creative initiatives in the future of the cities, generating great scientific and cultural knowledge.
- *The Liveable City: (Sustainable ecology)*: Smart cities do not forget their responsibility with respect to the environment, they must be efficient consumers of clean and renewable energies. This responsibility with respect to the environment will lead to different types of citizens considering the city to be an attractive place to live and work, and therefore to retain human capital.

9.2.2 Knowledge Economy

The OECD (1999, 2003) defines the Knowledge Economy as "that space that is directly based on the production, distribution and use of knowledge and information".

The generation and dissemination of knowledge is mainly linked to the characteristics of the city and its physical medium, as it is due to the creativity and cross-fertilisation of ideas between sectors, activities and the agents that comprise it, namely, the interactions of the city's citizens within it, Jacobs (1996). The city acts as a centre for the centralised accumulation of information, because within it, the different agents interact and generate new knowledge.

Regarding knowledge, Montuschi (2001) highlights *codified knowledge* as that type of knowledge that is found within some type of support, either digital such as a website or social networks, or traditional, because it is found in a textbook or a newspaper. This type of knowledge is characterised because it is easy to transmit, easy to interpret and, in general, because it has a low acquisition cost.

On the other hand, *non-codified knowledge* is a tacit knowledge, in the sense that there is no standardised way of codifying this knowledge. Its transmission is complicated and in the majority of the cases it is due to the personal interaction of agents in the same physical medium. This second type of knowledge is dealt with in this chapter, because the interaction of the citizens per se is a key factor for generating knowledge, which although not codified, must be considered (Montuschi, 2001).

Measuring the size of the Knowledge Economy, as well as the possibility of being able to estimate the undertaking of an economy with an important component of Knowledge Economy cannot be based on indicators generated from primary information or on the results of National Accounting (Stewart and Tansley, 2002). This means that calculating descriptive measurements will manage to capture codi-

fied knowledge but it would not be able to extract qualitative information from the tacit or relational knowledge of the city's agents (OECD, 1999).

With respect to the components of the Knowledge Economy, there is no unanimous agreement about which and how many there are. Thus, the OECD (1997) proposes 30 components to be taken into account in the phenomenon of Knowledge Economy, whilst Vegara (2004), from the Metropoli Foundation reduces the factors to 27.

In this chapter, we try to identify which components of the Knowledge Economy are perceived by citizens as relevant, as well as their impact on the smart city.

The main problem that we encounter when assessing the Knowledge Economy, is the lack of existence of an indicator to sum up all this information, although there is extensive literature that attempts to quantify this variable.

Thus, Lugones, Bianco, Peirano and Salazar (2003) develop an indicator based on international competitiveness, the development of production sectors, and the specialisation and size of companies. They reached the conclusion that a change in production strategy is a measurable factor to determine the generation of knowledge for the city. The cities' strategy should be to concentrate companies and knowledge-intensive production factors in industrial areas to foster the city as a "knowledge-based city". Thus, the authors conduct a dynamic study over time to measure the aforementioned factors and, therefore, the changes in the production structures of knowledge-intensive activities is a factor to be taken into account.

On the other hand, Vilaseca, Torrent and Díaz (2002) assess the Knowledge Economy from an ICT-based perspective. The authors sustain that information-based industry forms part of the Knowledge Economy and places emphasis on the following effects: (I) Social effects, (II) Political effects, (III) Cultural effects, and (IV) Economic effects. These authors explain the contribution of the Knowledge Economy to economic growth measured in agreement with the contributions to the added value of the national product, using annual time series from 1980 to 1999 to do so.

This chapter purports to continue the application of the determination model of the main attributes of the Knowledge Economy from the citizens' perception.

9.2.3 Knowledge Economy and Its Impact on the Smart City

The smart city represents a qualitative leap in the city from the citizens' viewpoint. A city is smart insofar as its citizens have more opportunities. The smart city must commit to human and intangible assets: education, culture, social cohesion, creation of new job opportunities, fostering entrepreneurship, business excellence, internationalisation, etc., factors that are encompassed within the Knowledge Economy.

Literature identifies that the number of business headquarters or large companies, as well as business premises are positively related to the productivity of the city (Strauss-Kahn & Vives, 2009). The degree of expansion of the city is also explained by the consolidation of international centres with global management

capacity in different areas such as Accounting, Finances, Legal Services or Advertising (Beaverstock et al., 1999; Sassen, 2002). Likewise, we see that the Knowledge Economy is a determining factor for the development of the smart city.

9.3 Methodology

9.3.1 Sample

To carry out the research, a questionnaire was sent out to discover the citizens' perception of the Knowledge Economy. Properly completed questionnaires provide us with a random sample of 500 observations which would give us an estimation error of 3.21 %. The proportion of completed questionnaires with respect to the total was 75.82 %. With respect to the remaining proportion, 12.17 % were not answered and the rest of the sample contained errors or sections that had not been completed.

9.3.2 Factor Analysis

The factor method attempts to find a series of non-directly observable factors that adequately explain the variables observed, losing the least amount of information possible, so that they are easily interpretable and represent a small number of factors. The factors extracted must be independent from each other, that is, orthogonal. Consequently, "*the factor analysis is a data reduction technique that examines the interdependence of the variables and provides knowledge of the underlying structure of the data"* (Peña, 2002).

9.3.2.1 Appropriateness of the Factor Analysis

The basic hypothesis compared is that the correlation coefficients between the variables are non-existent for each pair of variables selected.

The statisticians Kaiser, Meyer and Olkin (Kaiser, 1974) propose an adequate measure of sampling adequacy for the factor analysis, which is known as the KMO measure. Table 9.1 shows a summary of the results of the KMO test as well as of the sphericity test.

Table 9.1 Adaptation measurements of the factorial analysis

Kaiser-Meyer-Olkin measure of sampling adequacy		0.797
Bartlett sphericity test	Approx. Chi-squared	887.409
	Sig.	0.0000

Source: Compiled by authors

It can be confirmed that the independence hypothesis is rejected in each group of answers for a significance level of 5 % or more. This provides evidence in favour of there being statistically significant theoretical correlations. On the one hand, the KMO measures are above 0.7, indicating that the sampling adequacy regarding the factor analysis is satisfactory.

9.3.3 Modal Analysis

The modal criterion is applied in the next section in order to establish a classification based on the degree of consensus generated in the replies. The nature of this criterion is completely different to that of normal methods, which evolve around the correction or moderation of the data dispersion.

In this case, an analysis will be performed of the number of times that citizens have shown consensus when they have evaluated a characteristic of the territory, included in the question asked, as being above/below the mean. The modal criterion is going to permit classifying the variables in such a way that two groups of the most "*popular*" answers appear, according to the existing positive or negative connotation in the perception of the people surveyed, and regarding their importance.

9.3.4 Normalisation of the Perception Based on Consensus

In this section, we explain how to correct the citizens' evaluations on the different concepts of the Knowledge Economy based on neutral normalisation or transformation. Although the measurement scale is the same for each one of the study variables, the scores contained a biased measurement, as we consider that the citizens' answers depend on their involvement in the city and in the component aimed to be quantified, namely the Knowledge Economy. Based on this, the results before normalisation provide higher results in the 18–25 age groups and with academic or scientific professions. This confirms that these groups of individuals tend to overrate the variables of the phenomenon in question, inducing a bias in the study. An indicator of perception and subsequent normalisation is carried out.

$$\alpha_{ij} = \frac{z_{ij} - M_j^m}{M_j^m - M_i^m}; \qquad \alpha_{ij} \in \left[-K;+K\right]$$

where: α_{ij}: The estimated perception for the individual "*i*", z_{ij}: Score obtained by the individual "*i*" in attribute or variable "*j*", Mj^M: Ideal value of the distribution, considering this as the Mode value, Mj^m: Anti-ideal value of the distribution, considering this as the Median value.

As the perception indicates, positive and negative values can be afforded of between $\pm K$, this being due to the fact that the interval will depend on the initial measurement scale of the variable. Thus, it would not be possible to initially compare the perceptions of each attribute. Accordingly, the normalisation, as described below, was carried out:

$$\beta_{ij} = \left[\frac{\alpha_{ij}}{\sigma_*}\right] \rightarrow \beta_{i^*} = \frac{\beta_i}{\sum \beta_i};\ \ \beta_{i^*} \in [0;1]$$

where: β_i: Normalised perception, σ_*: Relative dispersion measure.

We can easily verify that the proposed measure provides values of the estimated perception within the interval 0–1, hence managing to assess the opinions more accurately on a homogeneous measure scale. Thus, we have a way of comparing the users' opinions or expectations regardless of how the questionnaire was configured and of the type of measure scale proposed.

9.3.5 Analytical Hierarchical Process (AHP)

By constructing an AHP hierarchical model, it is possible to efficiently and graphically organise the information of an analytical and decision-based problem, breaking it down and analysing it by parts, viewing the changes in the levels of the problem and synthesising the information throughout the entire decision process.

One of the advantages of the AHP is the flexibility of the model, which permits evaluating consistency when including the individuals' preferences.

To achieve precision in the process used, the compared elements must belong to homogeneous groups or at least to relatively similar groups (Miller, 1956).

The last stage of the methodology (*prioritisation and synthesis*), provides the different priorities considered in solving the problem: *local priorities, global priorities and total priorities*.

In general, priority is understood as a valid abstract unit for any scale that integrates the individual's preferences when comparing tangible and intangible aspects. In this model, it is achieved through the comparison between factor matrixes. That is, it measures the citizens' preference between each pair of factors ((F1). Internationalisation skills, (F2). Education, (F3). Global competitiveness, (F4). Business intelligence, (F5). Professional excellence (F6). Logistics, (F7). Potential of the City, (F8). Entrepreneurship) for each one of the five dimensions of the smart city.

Thus, Fig. 9.1 represents the five dimensions of the smart city and the interaction of the different factors identified in the analysis. Based on this, it would be possible to describe a hierarchical classification of the priority factors that determine each dimension of the smart city as well as the importance of each one of these dimensions.

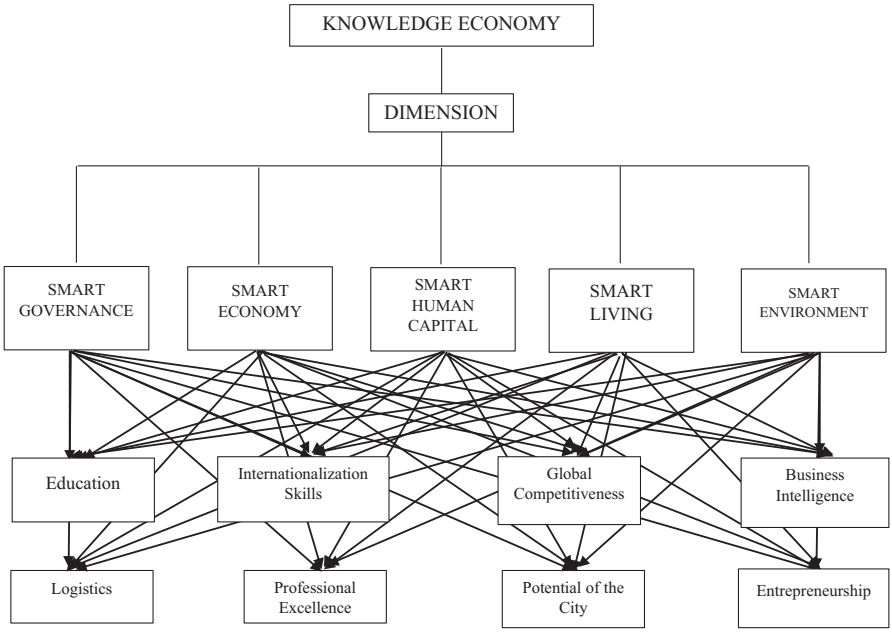

Fig. 9.1 Hierarchical model of the factors of the knowledge economy and of the dimensions of the smart city. *Source*: Compiled by authors

9.4 Results

9.4.1 Factor Analysis

By means of a factor analysis with VARIMAX we conclude that Vegara's 27 variables of the Knowledge Economy (Vegara, 2004) can be grouped into eight factors that explain 87.74 % of the variation in the information, as shown in Table 9.2.

On the other hand, Table 9.3 describes the variables that comprise each factor as well as their names based on the results obtained.

The eight factors described by this methodology can also be grouped into three groups of main players of the smart city: Universities, enterprises and businesses, Institutions and Public Administrations, the results coinciding with those described by Lombardi (2011).

- *Actor 1. Universities.* (F2) Education, (F5) professional excellence.
- *Actor 2. Enterprises and businesses.* (F4) Business intelligence, (F6) Logistics, (F8) Entrepreneurship.
- *Actor 3. Institutions and Public Administrations.* (F1) Internationalisation skills, (F3) Global competitiveness, (F7) Potential of the city.

Table 9.2 Breakdown of factors

Factor	Variance	Accumulated	Proportion	Accumulated
F1. Internationalisation skills	0.600008	0.600008	0.157903	0.157903
F2. Education	0.512767	1.112775	0.134944	0.292848
F3. Global competitiveness	0.475064	1.587839	0.125022	0.417870
F4. Business intelligence	0.433124	2.020962	0.113985	0.531854
F5. Professional excellence	0.430015	2.450978	0.113167	0.645021
F6. Logistics	0.301559	2.752536	0.079361	0.724382
F7. Potential of the City	0.289646	3.042182	0.076226	0.800607
F8. Entrepreneurship	0.280909	3.323092	0.073927	0.874534

Source: Compiled by authors

9.4.2 Results of the AHP Model

9.4.2.1 Results of the Priorities of the Dimensions of the Smart City

Given the intangible nature of the smart city and of the Knowledge Economy, they cannot be measured. Thus, the AHP model permits estimating both the priorities of the dimensions of the smart city (Table 9.4), and, at a second tier, the priorities of the Knowledge Economy (Table 9.5).

Table 9.5 shows the priorities of the dimensions of the smart city, resulting from the hierarchical analysis, concluding that the citizens' preferences follow the order given below: Smart Economy, Smart Governance, Smart Human Capital, Smart Living and Smart Environment. Thus, from the citizens' viewpoint, the "*SMART ECONOMY*" dimension accounts for 40 % of the smart city, followed by the "*SMART GOVERNANCE*" dimension that accounts for 20 %, "*SMART HUMAN CAPITAL*" (17 %), "*SMART LIVING*" (15 %). The lowest priority dimension for the citizens is "*SMART ENVIRONMENT*" accounting for 8 % of the smart city. Thus, citizens consider that the "SMART ECONOMY" dimension has twice as much priority as the "*SMART HUMAN CAPITAL*", "*SMART LIVING*" and "*SMART GOVERNANCE*" dimensions, and five times more priority than "*SMART ENVIRONMENT*". On the other hand, the "*SMART HUMAN CAPITAL*" dimension as well as the "*SMART LIVING*" dimension show similar preferences, indicating that citizens grant them a very similar priority level.

Finally, it must be pointed out that the citizens' opinions with respect to the dimensions of the smart city are consistent with obtaining consistency rates of under 10 % (Saaty & Vargas, 1998).

9.4.2.2 Results of the Priorities of the Factors of the Knowledge Economy and the Impact on the Smart City

The following AHP Hierarchical analysis—Table 9.5, shows the priorities of the factors of the Knowledge Economy, and their impact on each one of the dimensions of the smart city. We conclude that the citizens' main preference is Factor F1, Internationalisation skills, for all dimensions except for the Smart Living dimension.

Table 9.3 Resulting factors and name

Factor	Knowledge Economy variables	Name of the factor
F1	Availability of financial institutions	Internationalisation Skills
	Political, cultural and social type international connections	
	Strength of the Diaspora abroad	
	Language-speaking skills	
F2	Lifelong education Culture of innovation and capacity to mobilise new ideas and projects	Education
	Capacity to attract international students	
	Capacity to organise international meetings	
	Ease of access to housing of international talent	
	Availability of international schools	
	Design and artistic creation	
F3	Telecommunications infrastructure (IT, Wi-Fi)	Global Competitiveness
	University programmes in foreign languages	
	Capacity of the city to attract foreign talent	
	Business environment	
F4	Research and Development activities. (R&D)	Business Intelligence
	Capacity to attract international tourism	
F5	Capacity of the cities to retain highly qualified personnel	Professional Excellence
	Cooperation between enterprises and universities	
	Professional interaction spaces	
	International prestige of the city (awards and recognitions)	
F6	Advanced logistics activities	Logistics
F7	Availability of seed funding	Potential of the City
	Quality and specialisation of professional services	
	Social cohesion of the population	
F8	Entrepreneurial spirit	Entrepreneurship
	Availability of business schools	

Source: Compiled by authors

Table 9.4 Priorities of the die mention is of the smart city

Order	Dimension	Estimated priority	Consistency
2	Smart Governance	20.343 %	0.41 %
1	Smart Economy	39.562 %	
3	Smart Human Capital	17.501 %	
4	Smart Living	14.931 %	
5	Smart Environment	7.662 %	

Source: Compiled by authors

Table 9.5 Priorities of the dimensions of the Knowledge Economy

	Smart Governance	Smart Economy	Smart Human Capital	Smart Living	Smart Environment
Internationalisation skills	31.462 %	32.971 %	30.674 %	2.463 %	29.831 %
Education	14.232 %	14.276 %	15.474 %	2.848 %	15.670 %
Global competitiveness	15.084 %	22.467 %	20.071 %	10.284 %	22.617 %
Business intelligence	15.098 %	11.298 %	11.059 %	19.877 %	11.252 %
Professional excellence	4.847 %	6.061 %	5.729 %	23.318 %	5.940 %
Logistics	12.423 %	7.438 %	8.341 %	4.260 %	8.756 %
Potential of the city	3.689 %	3.588 %	6.461 %	13.590 %	3.674 %
Entrepreneurship	3.166 %	1.901 %	2.190 %	23.360 %	2.260 %
Consistency rates	*4.79 %*	*0.51 %*	*7.80 %*	*0.95 %*	*1.00 %*

Source: Compiled by authors

The citizens' priorities with respect to the 8 factors of the Knowledge Economy are very similar in the Smart Governance, Smart Economy, Smart Human Capital and Smart Environment dimensions, and once again the Smart Living dimension is an exception.

The greatest priority for the citizens is factor F1 Internationalisation Skills, followed by F3 Global Competitiveness and F2 Education, in all dimensions except for Smart Living. On the other hand, for the citizens, the lowest priority factors of the Knowledge Economy are: F5. Professional excellence, F7 Potential of the city, and F8 Entrepreneurship.

Figure 9.2 clearly shows how in the "Smart Living" dimension of the smart city, the citizens' priorities are contrary to the priorities of the other dimensions. Thus, the most outstanding priority factors of the Knowledge Economy of the Smart Living dimension of the smart city are: F5 Professional excellence, F8 Entrepreneurship, F4 Business Intelligence, and F7 Potential of the city. Noteworthy is the fact that these of the most highly valued factors in the remaining four dimensions. For Smart Living, the lowest priority factors are: F1 Internationalisation skills, F2 Education, and F6 Logistics, which are the major priority for citizens based on the other four dimensions of the smart city.

The values of the consistency rates of the AHP analysis confirm that the citizens' opinions with respect to the dimensions of the Knowledge Economy are consistent (Saaty, 2005).

By analysing the results of Fig. 9.2, we group the citizens' priorities over the factors of the Knowledge Economy and their dimension in the smart city into three groups: fundamental factors (highest priority), mid-term strategic factors (medium priority) and long-term strategic factors (lowest priority). Thus, the summary of the results of the priorities as well as the consistency rates obtained are shown in Fig. 9.2.

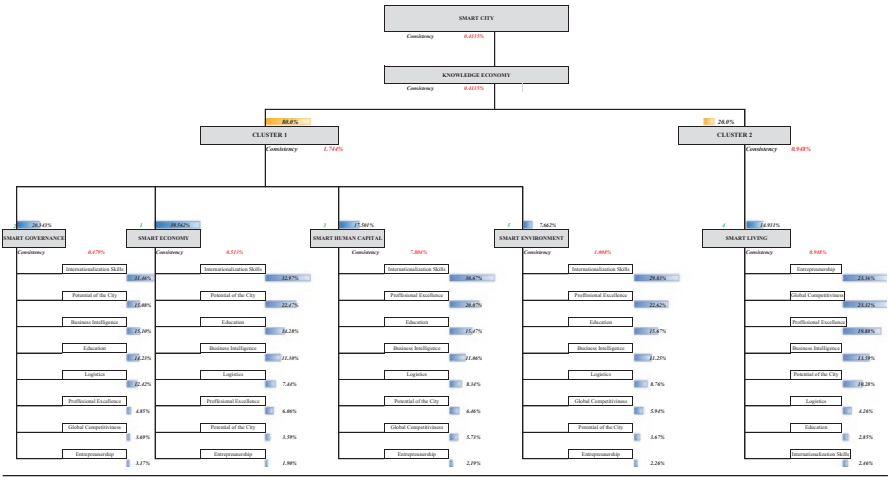

Fig. 9.2 AHP Model estimated for the dimensions of the smart city and the fundamental factors of the Knowledge Economy. *Source*: Compiled by authors

9.5 Conclusions

The smart city represents a qualitative leap in the city from these citizens' viewpoint. Smart cities must generate more opportunities for the people who live in them, so commitment must be made to fostering the human and intangible factors that are encompassed in the Knowledge Economy.

The actions of the governing parties must be aimed at developing the smart city. Thus, local policy-makers encounter the problem of deciding which dimensions of the smart city and/or which factors of the Knowledge Economy they should foster.

This chapter shows that through the fundamental factors that construct the Knowledge Economy it is possible to define short, medium and long-term action strategies in the different development dimensions of the smart city.

The hierarchical model designed for this purpose establishes that there are two differentiated clusters depending on the priorities of the citizens analysed.

On the one hand, we find cluster 1, made up of the SMART ECONOMY", "SMART GOVERNANCE", "SMART HUMAN CAPITAL" and "SMART ENVIRONMENT" dimensions, and, on the other hand, we find cluster 2, made up of the "SMART LIVING" dimension, whose priority factors for the citizens are contrary to those of Cluster 1. Thus, the highest priority factors for the city's inhabitants, bearing in mind the four dimensions of Cluster 1 are the lowest priority factors in the Smart Living dimension.

For the "SMART ECONOMY", "SMART GOVERNANCE", "SMART HUMAN CAPITAL" and "SMART ENVIRONMENT" dimensions of the smart city, the priority factors to be taken into account are: International Skills, Global Competitiveness and Education. For the citizens, these would be the areas that policy-makers should

foster in the short term. In the mid-term, the priority factors to be started up would be: Business Intelligence and Logistics, and in the long-term, Professional Excellence, potential of the City and Entrepreneurship should be fostered.

From a qualitative viewpoint, priority actions can be proposed to be started up by local policy-makers, depending on the time horizon when these strategies are planned. Thus, in the short term, policy-makers should place greater emphasis on fostering the following strategies: Availability of financial institutions, political, cultural and social type international connections, strength of the Diaspora abroad, language-speaking skills. Secondly, the strategies to be focused on would be: Telecommunications infrastructure (IT, Wi-Fi), University programmes in foreign languages, Capacity of the city to attract foreign talent, Business environment. Thirdly, Foster lifelong education, the Culture of innovation and capacity to mobilise new ideas and projects, Capacity to attract international students, Capacity to organise international meetings, Ease of access to housing for international talent, Availability of international schools, and design and artistic creation.

On the other hand, in the medium term, the strategies to be fostered would be: Research and Development Activities, Capacity to attract international tourism, and Advanced logistics activities.

Finally, in the long term, the strategies to be fostered would be: Capacity of the city to retain highly qualified personnel, Cooperation between enterprises and universities, Spaces for professional interaction, fostering international Prestige of the city (awards and recognitions): Availability of seed funding, quality and specialisation of professional services, Social cohesion of the people; Entrepreneurial spirit and Availability of business schools.

However, for the "SMART LIVING" dimension, the citizens' preferences in the short, medium and long-term are the opposite to those indicated in cluster 1. Thus, to maximise the development of the smart city given the existing conflict of the different objectives, policy-makers should focus their efforts on establishing strategies that would foster the factors of Cluster 1, as this accounts for 85 % of the development of the smart city.

Consequently, if the consensus of the citizens is to empower the aforementioned factors of the Knowledge Economy, it will provide valuable information to local leaders and managers to develop strategies to promote smart cities.

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Chapter 10
Smart Cities' Challenge: How to Improve Coordination in the Supply Chain

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Abstract The purpose of this chapter is to analyze the impact of coordination in the supply chain and its connection in the formation of smart cities. More specifically, it aims to investigate the index of coordination, its connection to smart cities, and the characteristics of the supply chain in analyzed companies. The results show that smart cities have different implications for the supply chain and its management is concerned, because these chains have become more complex, costly, and vulnerable to companies. Integration is key for this process; since all decisions must be aligned in order to achieve global objectives, every member depends on each other and must be able to effectively manage multiple resources. In evaluated companies, the categories of the model used were found: (1) Top management commitment and (2) mutual understanding in a supply chain have a low score which suggests that it may be related to problems in delivery times, inventory levels, and forecast management based on demand.

10.1 Introduction

Today, with the increasing globalization, small and medium enterprises (SMEs) are considered the major source of dynamism, innovation, and flexibility in both emerging and developing countries (Chin, Hamid, Rasli, & Baharun, 2012).

In Mexico, six out of every ten SMEs close their doors in less than 2 years because of administrative and organizational problems, the most affected being those related to manufacturing (Zambrano, 2014). The survival and growth of SMEs can be difficult in the current environment of business competitiveness and the global market; clients now demand more economical products which must be varied, with improved service levels, and faster and faster deliveries. To these, we can add the changes in business models such as lower production costs and the delivery

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of a better value to the customer, flexibility, and the generalized impact of information technologies (Chin et al., 2012). Under these conditions companies are required to excel simultaneously in several areas such as innovation capacity and response to their customers (Singh, 2011).

To meet all these challenges is crucial to carry out the supply chain management. It must conform to the needs and objectives of the firm, with a good response capability to unexpected changes in the purchase conditions, production, and client demands (Miglierini & Treviño, 2012). Furthermore, it has been identified that competition today occurs between supply chains rather than individual enterprises (Arshinder, Kanda, & Deshmukh, 2007; Chin et al., 2012; Lim, Baines, Tjahjono, & Chandraprakaikul, 2006). Therefore supply chain (SC) and its management within SMEs is an effective tool to gain competitive advantage in the marketplace. In addition to facing their competition, the members of the SC should be together as part of a unified system to improve its performance and it is right here that the coordination of it becomes an effective way to address all process and operations among the dependent members in SC (Arshinder et al., 2007).

The adoption of the concept of smart cities presents opportunities and constraints for the management of the supply chain as these cities are based on collaboration between companies, end users, and local stakeholders.

10.2 Theoretical Background

The SC is formed by all the parts involved directly or indirectly in the satisfaction of a request by a customer; it does not only include the manufacturer and his providers, but also transporters, warehouses, retailers, and even the same customers (Chopra & Meindl, 2008). SC usually consists of different functions such as logistics, inventory, purchasing and procurement, production planning, interorganizational relationships, and their performance measures (Arshinder et al., 2007). Furthermore supply chain management (SCM) is a global strategy to comanage all the functions, processes, activities, and participants that make up an SC (Maldonado, 2009).

On the other hand, a smart city uses information technology to optimize the efficiency and effectiveness of the processes and activities of a city and its services, which are united by various elements and actors in an interactive intelligent system more or less perfect. In addition, smart cities include environmental issues as well as social and human capital (Elcio, Tachizawa, Alvarez-Gil, & Montes-Sancho, 2015).

Following the model of Giffinger et al. (2007), a smart city covers at least one of the following six characteristics: smart economy (e.g., innovation, entrepreneurship, productivity); intelligent mobility (e.g., accessibility, sustainable transport systems); intelligent environment (e.g., pollution, sustainable resource management); smart people (e.g., skill level, creativity, flexibility); live intelligent (e.g., quality of life); and intelligent and governance (e.g., public and social services, transparent government).

Among the applications that smart cities have in the SCM, the use of databases that a city with such features can provide can be mentioned; for example they can help define strategies based on today's mobile consumer distribution patterns; in the case of retailers, they can use these data to plan their inventories based on real time both in stores and online sales (Elcio et al., 2015).

The SC is usually complex given that there are numerous and compound activities which are distributed among multiple organizations and functions and, sometimes, for long periods of time (Kanda & Deshmukh, 2008). All the members of an SC depend on each other since they must effectively manage different resources, such as inventories, money, and information; however, to improve the performance of the SC, members must behave as a unified and coordinated system between them; that is when coordination becomes the center of attention.

Coordination may be defined as the organization of the activities of two or more groups in order to work efficiently and identify what the others are doing. Coordination covers all the efforts for information exchange and the integration for the processes of development, production, and delivery of a product or service to the final customer (Cao, Zhang, Man To, & Po Ng, 2008). That is how the coordination of supply chain (CSC) concept can lead its members to work consistently and identify the dependencies among each other, so that, at the end, goals can be defined mutually and the risks and rewards can be shared. The CSC requires effort at the individual, organizational, and inter-organizational levels; plus it is an effective way to improve the performance of the SC (Arshinder et al., 2007; Kanda & Deshmukh, 2009). The CSC is an effective way to improve and determine the performance of a supply chain (Cao et al., 2008; Kanda & Deshmukh, 2008).

Coordination can be seen from the different components of the SC, such as logistics, inventory, management, forecasts, and transport (Kanda & Deshmukh, 2008). The integration of SC activities results in a better coordination. The pillars of integration in an SC are cooperation, collaboration, information sharing, trust, and exchange of technology. Integrating all these activities helps companies reach their potential and have a competitive advantage; furthermore, it will lead to reduction in operating costs and customer service improvements (Arshinder et al., 2007).

An effective coordination among units of SC plays a key role by focusing on innovation, flexibility, and speed which are competitive advantage sources necessary for survival in the global competition (Simatupang, Sandroto, & Lubis, 2004). An SC is fully coordinated when all the decisions are aligned to achieve the global objectives. Lack of coordination occurs when those in charge of making the decisions have incomplete information which is not compatible with the global objectives, even if all the information is available (Cao et al., 2008); the performance of the SC is partially optimal because each decision maker uses it to his individual goals, so a lack of coordination will lead to a change in demand, better known as "bullwhip effect" resulting in an increase in manufacturing costs, inventory, transportation, labor, among other things (Singh, 2011).

The conflict between the objectives and the lack of communication among these members may cause uncertainty in the SC; therefore appropriate coordination can help manage these relationships and reduce uncertainty (Singh, 2011). Coordination

between production, marketing, purchasing, and all other activities of the SC cannot be overemphasized because if only individual activity is optimized, this could harm one or another area and negatively affect the performance of the SC (Ballou, 2004). Lack of coordination may cause a low performance in the SC; some of the consequences are wrong forecasts, overloaded inventories, bad quality, and not enough customer attention and satisfaction (Kanda & Deshmukh, 2008).

To achieve coordination there are several factors to be considered apart from quality, innovation, and customer satisfaction; some of them are the human factor, technology, strategies, relationships, rewards, benefits, and risks. Besides that, it is necessary to implement initiatives such as the exchange of information, schedule regular meetings with stakeholders to resolve conflicts, and learn the basic concepts of the supply chain (Arshinder et al., 2007).

There are different benefits from CSC for instance the elimination of excess inventory, reducing the delivery times, increased sales, improved customer service, lower manufacturing costs, increased customer retention, and increased flexibility to address the uncertainty of high demand. Also there are different CSC mechanisms such as SC contracts, exchange of information, technology, collaborative decision making, holding meetings with members of the SC, and technical support (Kanda & Deshmukh, 2008).

Among the benefits these mechanisms bring, we can mention the following: the contracts increase profits, and allow the risks to be shared among SC partners; the information exchange reduces costs and variability in demand, and improves both the level of service and responsibility. Information technology permits quick exchange of products and information; it gives visibility and accessibility to all the members of the SC, reduces the variability on demand, and increases the flexibility on the customers' requests. Likewise, the collective decision making reduces the asymmetry of information and the costs. It also improves customer service. Frequent meetings generate long-term relations with the members of the SC, and it lets them to take conscience about their role. Finally, technical support diminishes the cost of the products and improves the quality of the service and the product (Arshinder et al., 2007).

Although coordination improves the performance of the SC, it may not be always beneficial to coordinate its members, since the high cost of implementing the information systems among the organizations and the different conditions in which the companies work may hurt some of its members (Kanda & Deshmukh, 2008). Therefore, it is essential to research the conditions in which a CSC is beneficial so that it does not end up being too costly for the SC and the right information is obtained (Arshinder et al., 2007).

10.2.1 Previous Studies

In the study of the CSC there are different perspectives reported in the literature without an appropriate definition and/or measure to quantify the coordination concept (Table 10.1).

Table 10.1 Perspectives of CSC

Author (year)	Perspective
Narus and Anderson (1996)	Cooperation between independent but related companies to share resources and capabilities to meet the most extraordinary customer needs
Lambert et al. (1999)	Particular degree of relationship between the members of the SC as a means to share risks and rewards that result in higher performance than an individual company reaches
Ballou et al. (2000)	The ability of the logistics functions to integrate the activities of the SC through different levels of authority and responsibility
Lee (2000)	The CSC as a means to redesign the right decisions, the workflow and the resources among the members of the SC and achieve better performance
Larsen (2003)	The CSC achieved via collaboration and planning activities through forecasts
Hill and Omar (2006)	Coordination is achieved when members of the SC minimize operating costs and share profits

Source: Adapted from Arshinder et al. (2007)

Moreover, Sahin and Robinson (2002) have categorized different coordination structures according to the levels at which information and the physical flow of integration are shared from the point of view of operations management. At the first level, information is not shared and there is no integration; the bullwhip effect occurs. On the second level information is shared but there is no integration, so the bullwhip effect continues; finally, at the third level, all the information is shared and there is integration; the vendor management inventory (VMI) becomes a typical practice at this level of coordination.

10.2.2 Supply Chain Coordination in Mexican Textile Industry

These days, the textile industry represents a significant contribution to the economy, whether in developed or developing countries. The long SC in the textile industry makes delivery times to be extended and uncertain, together with what is a very volatile market; CSC, therefore, becomes very important in this industry.

In Mexico, with the North American Free Trade Agreement (NAFTA) in 1994, the industry became an important source of supply to the USA; however since 2001, growth has been negative as well as sales and foreign investment showed a downward trend. Currently the Mexican textile industry is facing a process of change by trying to join a global network run especially by US buyers that have global sourcing strategies, high-quality products, low production costs, and customer satisfaction, aspects that a supply chain, with proper coordination, can achieve (Patlán & Navarrete, 2009).

In the case of the state of Hidalgo, according to the study by Patlán and Navarrete (2009), in the textile companies evaluated, there is a low degree of vertical integration which means that companies must rethink their strategy for competitiveness and therefore the CSC can present an opportunity area.

10.3 Methodology

10.3.1 Sample and Data Collection

The methodology is descriptive and is based on the collection of quantitative data and using Likert scale and so averages and indexes were obtained. It is transversal since a definite and specific time period in the studied population.

A survey that used the convenience sampling works by selecting only the cases available. It is a valid data collection, not probabilistic strategy, especially for small and very specific samplings. Although the results of this type of test are limited to generalizations from the sample, the power of sampling is to select information-rich cases for in-depth studies.

To establish the size of the sampling, we carried out an analysis of textile companies in the State of Hidalgo, using as a reference the Mexican Business Information System (SIEM in Spanish) which shows a registry of 9453 businesses in the state, of which 98 belong to the textile industry, taking this as the manufacture, preparation, outsourcing, and spinning of clothing and derivatives. Twenty-one of these are SMEs because they have more than 11 employees but less than 250; from them we obtained a sampling of seven companies.

10.3.2 Components and Data Analysis

The instrument used for the study is the index supply chain coordination, developed by Singh (2011) and adapted by Jurburg and Tanco (2012) which consists of 25 items divided into six categories (commitment to high management, organizational aspects, mutual understanding, information flow, relationships, and decision making and responsiveness of the supply chain). With this modification the assessment tool is used to compare the degree of coordination of businesses among each other.

Within the categories evaluated with the assessment tool, the top-level commitment is essential to develop an effective CSC; furthermore, they are the ones who create the SC strategies and its success depends on them (Singh, 2011).

The organizational aspects such as the behavior, organization culture, and its members' integration among the different departments and their relationship with other members are the key to develop activities within the SC (Jurburg & Tanco, 2012).

Mutual understanding and trust are the base to develop proper information flow and increase the SC performance because if they do not exist, the members may be looking for individual benefit instead of trying to maximize the benefit of the whole SC and thus minimize the risks (Jurburg & Tanco, 2012).

In relation with the flow of information, we must understand the advantages of having data from the points of sales as well as the inventories, and information about the demand and quality of the products since this way of sharing

among the members of an SC allows them to be more active (Jurburg & Tanco, 2012; Singh, 2011).

As for the relations and decision-making process, authors suggest that long-term relationships have three outcomes, such as increased satisfaction among members of the SC, reduction of conflicts, and even a better demand forecast since they increase the trust between their members and improve information flows.

Finally responsiveness: In a globalized world, consumers are better informed each time, which makes them more demanding in their requirements. Therefore, companies have a growing need to work with agile and flexible chains, enabling them to adapt quickly to changes in consumer tastes and preferences; thus, the SC with fast response will make the company meet its deliveries on time, reduce costs, and improve its forecasts (Jurburg & Tanco, 2012; Singh, 2011).

To get the index coordination first of all the questionnaire of Singh (2011) and adapted by Jurburg and Tanco (2012), must be answered which has 25 attributes. Everyone should be scored from 1 (very low) to 5 (very high).

Afterward it is proceeded to make an average of the scores by category, getting six scores (one per category). Singh (2011) proposes an index for which you must first sort categories from highest to lowest based on their scores and then must use the following formula:

$$C = \sum_{1}^{6} \left(w_i * \log \log k_i \right)$$

where:

C = Coordination index

k_i = Inverse rank (If $R = 1$, $k = 6$; if $R = 2$, $k = 5$

w_i = Weight assigned to particular coordination factor

If:

$w_i = 1$, if percentage score is >3

$w_i = 0$, if percentage score is between 2 and 3

$w_i = -1$, if percentage score is <2

Using this formula, a number ranging between −2.86 and +2.86 is obtained, which according to Jurburg and Tanco (2012) makes the score obtained by the company difficult to understand, as the average value obtained in each of the six components is not taken into account for the score, but all that matters is the relative order of each component, together with the fact that the maximum score is obtained by having more than 3 points in each of the components; therefore, a firm that gets 3, 4, or 5 in all its components will get the same score, diminishing the possibility of detecting improvement opportunities and establishing an improvement plan.

From the perspective view of Jurburg and Tanco (2012) they propose to calculate the coordination index and simplified in a different and simplified way which allows us to obtain a number that is easy to interpret and that in turn is closer to reality, allowing companies to compare with each other.

The formula used is as follows:

$$C = \frac{1}{f}\sum_{i=1}^{f}\left(\frac{m_i}{e}\right)$$

where:

C = Coordination index
f = Quantity of components (6)
e = Maximum value of Likert scale 0–4
m = Average of each component

Thus an index value between 0 and 1 is obtained; this allows the possibility to identify opportunities for improvement and propose an improvement plan for the companies.

10.4 Results

Figures 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, and 10.7 show how, starting from the data obtained by the CSC analysis with the modified Jurburg and Tanco method, textile businesses from Hidalgo present in general, at the attributes of management commitment and mutual understanding, a low level, averaging 5.2 in both. This indicates that the main players of the SC, the managers, are not playing their essential role within the chain and, furthermore, they are not creating effective strategies for each company. This lack of commitment, for example, is one of the main obstacles

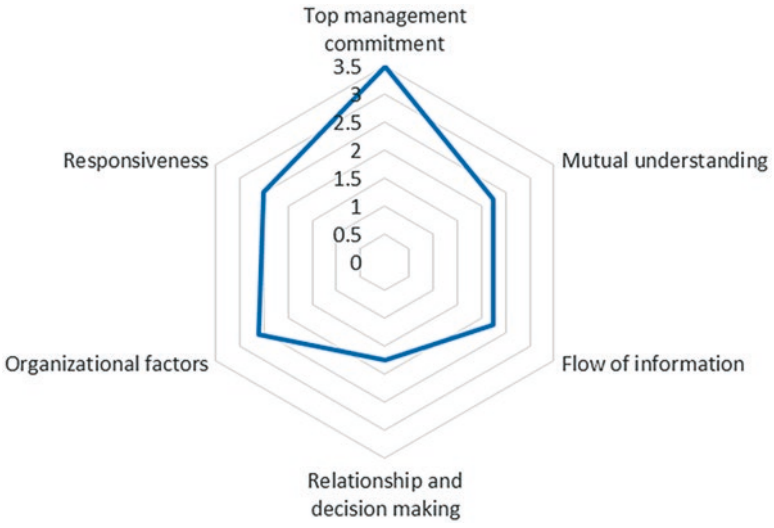

Fig. 10.1 Coordination index enterprise A

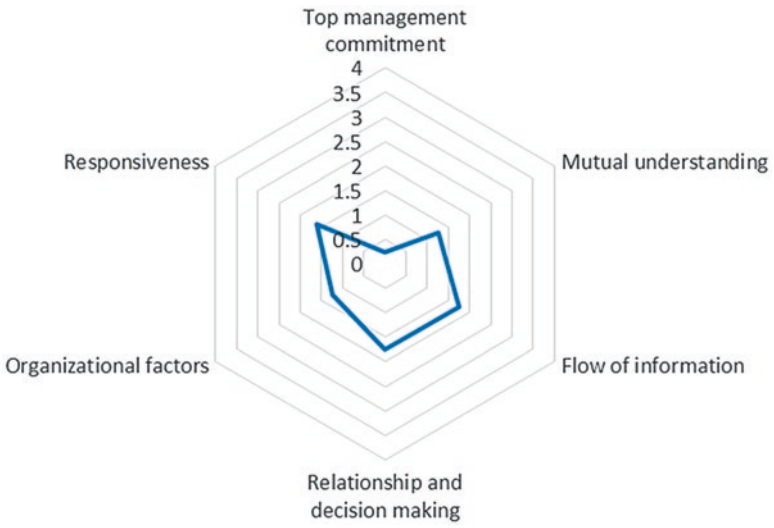

Fig. 10.2 Coordination index enterprise B

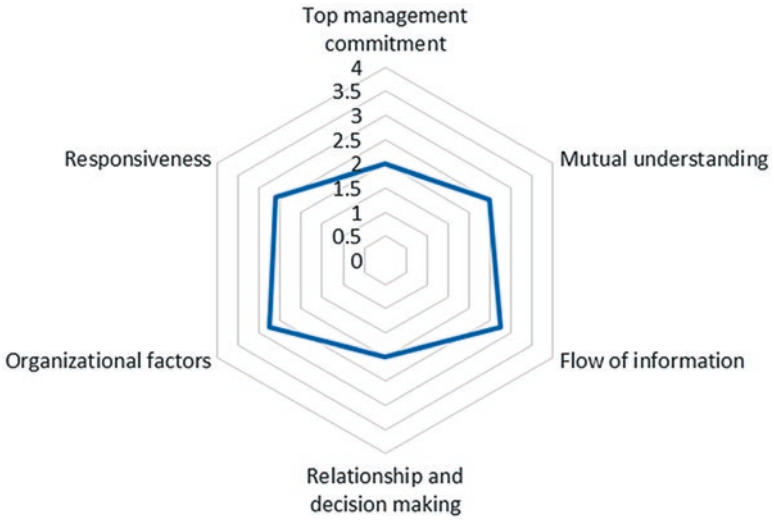

Fig. 10.3 Coordination index enterprise C

when creating a net of suppliers, given that the creation of a commercial relation between both parts is based on the perception of commitment by the other part (Miglierini & Treviño, 2012).

On the other hand, low mutual understanding indicates that the trust among the members of the chain is not enough, which in turn affects the flow of information. Trust is a phenomenon that contributes to strengthen interpersonal and

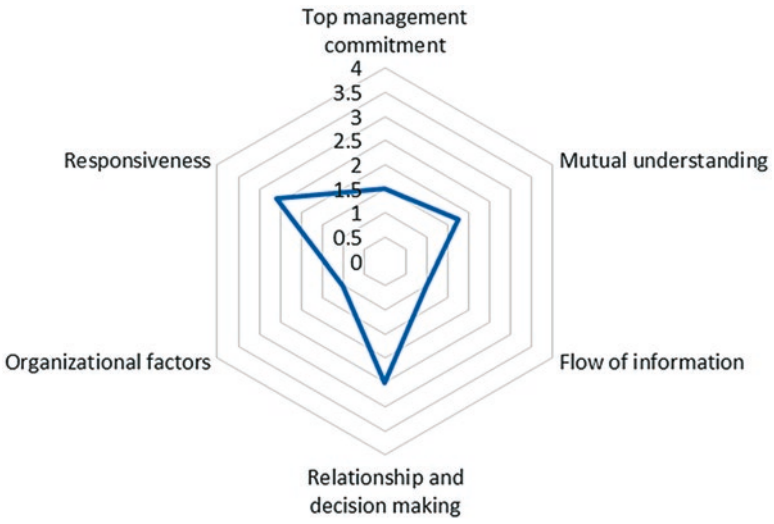

Fig. 10.4 Coordination index enterprise D

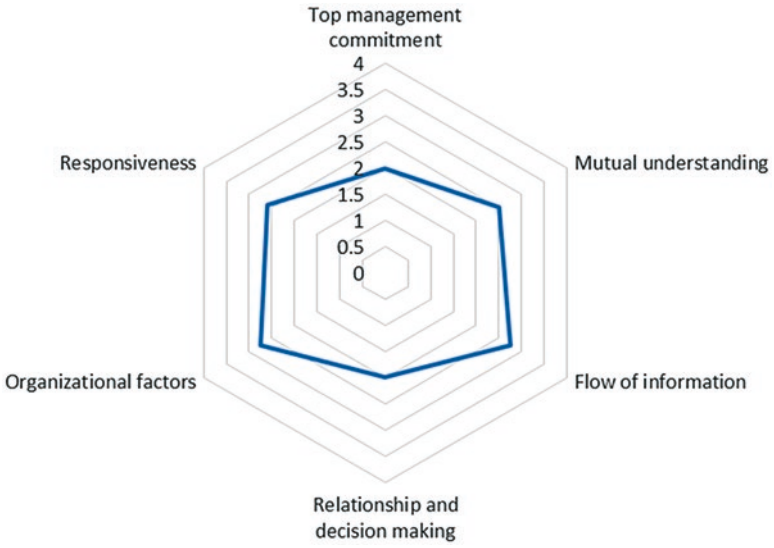

Fig. 10.5 Coordination index enterprise E

inter-organizational relationships in an SC. For a firm, it means that it is willing to take risks or expose itself in a relationship with another company (Sahay, 2003). Both attributes are essential to improve the performance of the SC.

Within the best evaluated categories in the coordination index for textile companies in Hidalgo, two that stand out are speed of response and the relationship and decision process. The speed of response indicates that they comply with one of the characteristics as SMEs, that is, flexibility. This could show that they are capable of

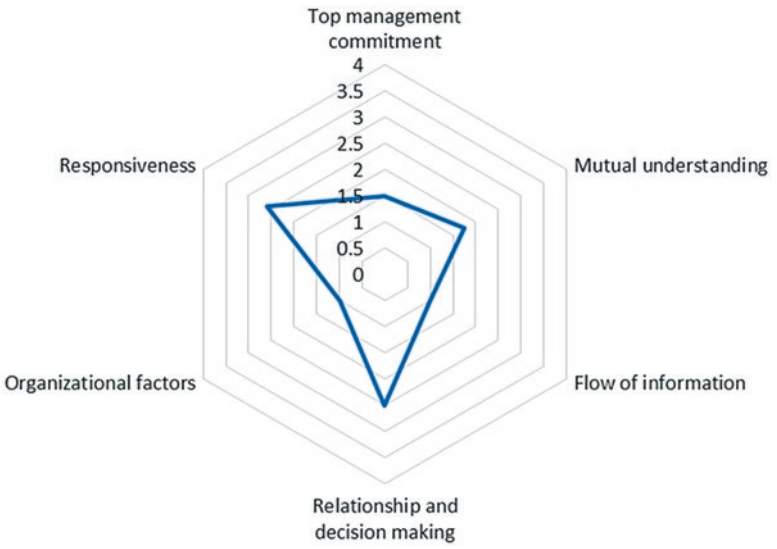

Fig. 10.6 Coordination index enterprise F

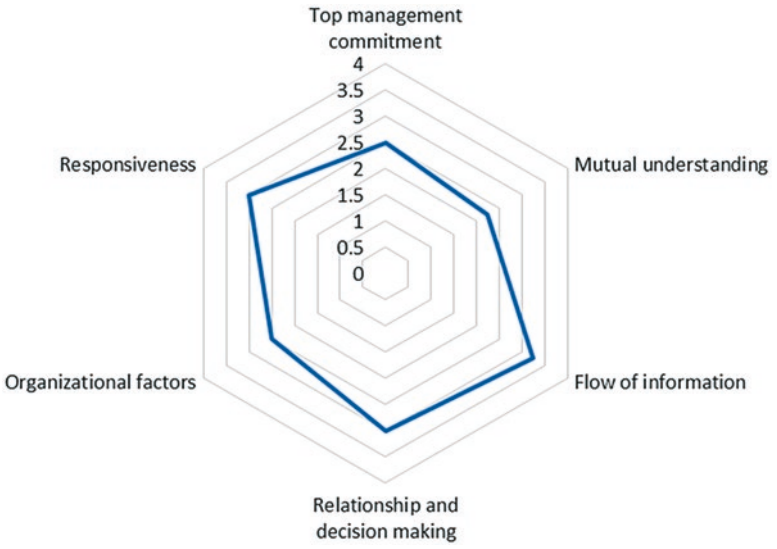

Fig. 10.7 Coordination index enterprise G

adjusting delivery times when they have short requests or that they can deliver urgent orders without being affected by negative costs; it can even prove that there is enough information at the points of sales when needed. In the case of relationships and decision making, this implies that companies may have long-term relationships which reduce conflicts; in addition, making decisions collectively can allow for better forecasts of the demand of a product.

10.5 Discussion

With the results of companies assessed, the low management commitment found undoubtedly affects the entire chain because as mentioned by Sandberg and Abrahamsson (2010), managers are identified as the main facilitators in the implementation of the CSC and its coordination becomes their main challenge. However, it also indicates that, in the studies carried out, most of these executives do not recognize the importance of logistics and its impact in the whole company; besides that, they have very little time to tend CSC-related business, which could be what is happening in the textile industry in Hidalgo.

In turn, Sandberg and Abrahamsson (2010) indicate that to increase coordination, senior management has to carry out specific activities in order to participate and take responsibility for the CSC, such as improving the flow of information across the company's borders and developing stronger relationships in the SC, leaning on information technology.

In the case of mutual understanding or some other evidence of trust, this is one of the pillars of the CSC and the results from the analyzed companies were low. Sahay (2003) stresses its importance and he also mentions a study that talks about the different factors that lead to inefficient integration between suppliers and buyers in a CS; the first evaluated it in position 4 and the other, in position 3. This indicates that without a strong commitment and broad understanding of the CSC and its potential, there will be no improvement in the conditions of the textile enterprises evaluated.

10.6 Conclusion

The main objective of this study was to identify the main problems facing the supply chains in SMEs in the textile area in the state of Hidalgo, because in these days and the growing competitiveness that we live in, it is vital that these companies grow more concerned about their development as part of a supply chain as competition happens no longer between companies but between chains.

Strategies and procedures that are performed on an SC in order to be effective must be translated into benefits that reach all levels, from the operational to the end customer because this way we can speak of coordination in the SC.

In the case of textile enterprises in the State of Hidalgo, the average results vary greatly in some companies against their individual assessment. It is necessary that the latter put more attention to the opportunities for improvement identified and also to the fact that they can be supplemented with a SWOT analysis which enables organizations to develop strategies in the SC to improve coordination between the different members of the chain and improve competitiveness.

In turn, the study may help textile SMEs assess their performance by making the coordination index comparable with other companies and thus focus on their

strengths and weaknesses and develop strategies according to the result obtained. However, these results should not be generalized because, unlike big textile companies—which were not evaluated, SMEs have certain limitations, primarily on the use of information technology, which as one of the assessed attributes is a determining factor in the coordination of an SC.

On the contrary, if such a study should be conducted in a smart city, it could have an influence on companies since they could use the large databases and improve their coordination. Finally, a supply chain is fully coordinated where all decisions are aligned to achieve global objectives.

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Chapter 11
Will a Smart City Have a High Street?

Charles Graham and Anita Peleg

Abstract A smart city is the outcome of a complex weave of influences, disciplines and agencies acting to improve quality of life, sustainability and efficiency. A common factor, whether smart cities are built from scratch or evolve from existing infrastructure, is that the dynamic capability of new digital technologies will play a pivotal role in their development. For example, the rise of e-commerce means that traditional retailers now face a global competitor with a limitless product assortment, low prices, and a window display in the palm of almost every hand. The question is therefore whether the local high street has an economically sustainable future in a smart city. We suggest that it does. The aim of this cross-sectional study was to describe the relative vitality of eight inner London high streets. Findings from 100,000 observations and nearly 700 survey responses revealed substantial differences in footfall densities between high streets, but behaviour followed familiar split-loyal stochastic norms. Local shopping habits are sustainable and efficient, but they account for just one part of multi-functional high street visits and are therefore hard to change completely or fast. The one crucial measure of vitality is however high street footfall and digital marketing communications alone are unlikely to influence this substantially partly because reach and adoption were found to be low. Instead opportunities exist within the smart city construct for any retailer that can attract more "little and often" shoppers, and for associations of retailers that can build distinctive rather than differentiated high streets. Results offer direction for local government planning strategies.

11.1 Introduction

Britain's high streets, according to the British Retail Consortium (2012), have been under pressure for decades. The trend has been attributed to many factors including retailer concentration, the planned regenerative shift of retail space,

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recession and omni-channel retail, all prompting the BRC to call on local and national government:

> "… to act now to create the conditions for high streets to once again take a central role in our economic and social life." (p. 7)

Current thinking in urban planning is influenced by the smart city concept (for example DBIS, 2013), which proposes routes to global competitive advantage through ICT-driven advances in quality of life, sustainability and efficiency. In defining the concept Mosannenzadeh and Vettorato (2014, p. 687) quoted the IBM expectation that innovation in ICT will create and anticipate behavioural patterns, and change may be dramatic in the UK high street retail. Internet purchasing as a proportion of retail sales has been rising at 10 % a year (BRC, 2012) while Deloitte (2015) predicts that two-thirds of all in-store purchase choices will soon be influenced by digital media. Online may be influencing offline behaviour and the two are merging. The UK smartphone penetration, which allows social-media-driven influences, browsing and buying on the move from any retailer in the world, is at 66 % (ofcom, 2015 p.63). Many might even consider that a smart city will not need a high street—its functions will move dramatically online.

Top-line statistics are however frequently simplified. Studies of consumer behaviour from a marketing and economics viewpoint (for example in observed patterns of category buying, store or brand choice) have suggested that decision sequences often remain quite stable over time (or when they move they trend slowly) because they are largely habitual (Ehrenberg, Uncles, & Goodhardt, 2004).

Ehrenberg and his colleagues described the way in which behaviours differ greatly between individuals, but when viewed in aggregate they reveal surprisingly generalisable patterns and norms which therefore become predictable. In the context of competition for UK high street sales these behavioural norms suggest three important ideas. The first is that consumer choices about which high street to visit, which shop to enter and which brand to buy are likely to be split loyal; for any competitive set most buyers select from a small individual portfolio of tried and tested alternatives established through habit and experience. The second point is related, that contrary to widely held beliefs, such "polygamous" loyalty is resilient to permanent change through differentiation, advertising, price promotion or social media influence. Competitive forces mean that these interventions act mostly to maintain market share over time through switching between alternatives (Graham, 2009), and so the rare cases of permanent growth or decline observed can only come about through increasing or decreasing buyer numbers, rather than changes in loyalty (Sharp, 2012). The third point is that change to oligopolistic structure is observed occasionally but it must disrupt behaviour at the market level, diffusing across the entire buying population. ICT advances in marketing communications, promotions and new sales channels may be, as Deloitte predicts, such a disruptive technology, ultimately segmenting consumer behaviour dramatically into online and offline retail users.

These predictable and widespread patterns of buying behaviour are well known at least at brand and store levels (Sharp et al., 2012), but the overarching patterns and norms at the high street level (for example, the frequency of visits and switching rates

between high streets) are less well researched. They are likely both to define store performance and to be dependent on consumer penetration more than any special high street characteristic. With one or two notable exceptions (e.g. Denison, 2005; Underhill, 2009), footfall density has more widely concerned the urban planning than the marketing literature. The aim of this chapter is therefore to describe the comparative vitality of eight high streets in the London Borough of Southwark by the large-scale benchmarking of footfall density patterns. A specific purpose was to identify empirical generalisations in consumer behaviour on the high street, and a second was to understand underlying motivations, including the influence of ICT on current behaviour.

11.2 Theoretical Background

11.2.1 Smart Cities and ICT

In the future, city-level competitive advantage will likely be achieved and maintained through faster adoption rates of ICT and its more innovative uses in increasing knowledge and wealth, so that changes to consumer behaviour will be permanent and disruptive. In outlining a complex multi-disciplinary smart city research agenda, Batty et al. (2012, p. 512) foresee a "once-for-all transition from a world based in energy and materials to one based on information". Smart citizens will benefit from improved quality of life. Existence will become more sustainable and efficient, and greater social and civic interaction will be possible. The retail function of the smart city may thus be subsumed into a new paradigm of e-commerce and the social and civic functions of the high street will also move online.

How quickly? The nature of the disruptive impact to retail behaviour was examined by Wrigley and Lambiri (2014). They found that online is now ***a part*** of a multi-channel retail system rather than an all or nothing switch, so that while it is having a transformative effect on the face of the high street, retailers and consumers are proving adaptive. Buyers still enjoy the immediacy of shopping, but augment it with the benefits of click and collect, or show rooming. They suggest too that a rise in the number of convenience stores and the rate at which trade is moving back from out of town retail indicates a proactive shift in behaviour towards local "little-and-often" shopping. Third, like Dobson (2012), they also emphasise that retail is not the only reason to visit a town centre, but once there, people often buy something.

11.2.2 Consumer Behaviour, Motivation, Habit and Predictability

The NBD-Dirichlet model developed by Goodhart, Ehrenberg and Chatfield (1984) has long been demonstrated to describe the well-established regularities and patterns of brand buying in competitive FMCG categories. This is because the model's

assumptions rest upon the habitual nature of choice—that since individuals have a propensity to repeat certain past behaviours, those behaviours can be modelled probabilistically across a population. For marketers paid to influence shopping behaviour, the two assumptions of the model, stationarity and non-partitioning, might seem hard to accept, but growing behavioural evidence over 50 years supports its continued use to predict and explain market structure (Sharp et al., 2012).

In the grocery store then, individual shopper behaviour appears to be quick, habitual and almost unthinking. Anesbury, Nenycz-Thiel, Kennedy and Dawes (2014) have reported findings from a large sample of consumers in the USA, Singapore and Australia which show that most brand choices take less than 10 s. Sorensen (2003) suggested that the average shopping trip covers only 25 % of the store in the interests of speed, while the most commonly seen basket at the checkout contains just one item.

The NBD-Dirichlet captures such brand buying patterns but also extends to store choice. Brewis-Levie and Harris (2000) showed that the competitive structure of women's high street fashion retail is dependent more on the number of customers attracted to a store than on the number of visits those buyers made, while Kennedy and Ehrenberg (2001) demonstrated that grocery store buyers were similarly unsegmented when choosing between multiple grocery brands. These findings are important because they confirm that store health depends largely on penetration, footfall, rather more than any special USP to attract loyalty. They show that consumer behaviour is as habitual (and likely slow changing) at store level as it is when choosing between FMCG brands.

Apart from choice of brand and choice of store, consumers may also choose to visit a range of available high streets . East, Wright and Vanhuele (2008) draw attention to the factors underlying the regularity of consumer choice here too. They make the point that many shopping trips occur when they do for good reason, and that those reasons while different between individuals are likely to be relatively long-term stable. For example, the choice of day on which to visit a town centre might reflect its proximity to a weekend, a day off or a day when a store is less busy. It would then be reasonable to expect that the number of shoppers present on a high street at a given time would remain relatively stationary, but might fluctuate predictably around a long-run mean with seasonal variations, or in response to one-off events.

These papers were largely written before the rapid advance of *e*-commerce, but two rather more recent contributions also suggest that subsequent behaviour is slow to change. Dobson (2012) makes the point that the town centre is better viewed as a multipurpose retail, social, civic and communal space, or *agora.* Indeed the planning literature suggests many factors that may influence footfall. The commercial and civic experience can be enhanced by retail diversity (Shaw, 2012), retail clustering and choice (Bagwell, 2008; Porter, 1995); image and distinctiveness (Hart, Stachow, & Cadogan, 2013) and the safety and cleanliness of the environment (Dobson, 2012). Many of these factors are now managed through BIDs or similar stakeholder associations (Berry, Godfrey, McGreal, & Adair, 2010; Instone & Roberts, 2006) designed to enhance the environment and drive footfall beyond retail marketing interventions. Wrigley and Lambiri (2014) have also confirmed that high street vis-

its are often more than functional shopping trips, stressing the influence of routine . If high street choices over time are as stochastic as expected, it is unlikely that ICT-driven marketing interventions will permanently influence established patterns of competition.

In summary, evidence-based research in the literature suggests that three main measures of retail performance are very likely to be constrained by habit and consumer knowledge. These are the number of shoppers on the high street at any one time (the potentially available buyers), the proportion of those shoppers who choose a particular store (attraction) and the choices made within that store (conversion). If these measures are predictably related, the one number that matters most is high street footfall; yet this has been little studied (some exceptions are Denison, 2005; Kirkup, 1999; Yiu & Ng, 2010). Our research concentrates on describing this number first and then examines the potential influence of ICT since urban planning policies, local association efforts and independent retail marketing all need to combine to drive this number up.

11.2.3 Research Aim and Objectives

From the review of current literature, three objectives were defined:

- To describe relative characteristics of daytime footfall densities in eight retail locations
- To describe the population's usage of and attitude and satisfaction towards those locations
- To assess the likely influence of smart technologies on high street usage and store choice

11.3 Methodology

Research was conducted in the London Borough of Southwark, which runs from the south bank of the River Thames to the prosperous Dulwich Village through some of the most deprived inner city areas in the country. Southwark is densely populated, its citizens younger than the UK average and with about two-thirds from an ethnic minority (Southwark Council, 2014). Eight locations were selected to represent diversity in population characteristics and retail offer and research was conducted on a Tuesday and Saturday in early spring in each one to minimise any mediating effects such as weather conditions, national holidays or other large-scale events. The study began at 10.00 am and finished at 5.30 pm which is by no means the extent of the retail day or trading week, but captured enough data to establish initial patterns. In order to maintain consistency between locations, data was collected by trained student teams according to an earlier pilot study methodology.

Footfall observations were collected manually in each location. Valid subjects were counted individually rather than as groups, and only adults were included. Since the count is time bounded the measure of interest is the number of potential shoppers present on a high street at a particular moment. It is immaterial if they have been counted once before at a different time, or on a different day; thus the data describes the number of shoppers available to buy in an identified time period.

Usage and attitude survey students were trained to collect survey data via street intercept interviews conducted throughout the days that the teams were on high streets. According to Bush and Hair (1985) the street or mall intercept benefits from being relatively inexpensive, and has a relatively low non-response rate, but more importantly it gives access to respondents that are knowledgeable about the retail location where the survey is being conducted. Following a sampling method outlined in Miller, Wilder, Stillman and Becker (1997, p. 655) interviewers were trained to intercept the "first eligible respondent they saw who was anywhere on the block as the interview period began" repeating that process at the end of the first interview. Refusals were recorded by gender and approximate age in order to establish the reliability of the final sample. Over 2 days of data collection a total of 684 usable interviews were completed, plus over 100,000 footfall counts.

11.4 Results

11.4.1 Observed Behaviour: Footfall Densities

Footfall densities on the eight Southwark high streets were tabulated to reveal peaks and troughs in continuous pedestrian flow. The analysis revealed a tenfold disparity in footfalls between high streets and some important local variances in density distributions over each day. The first column of Table 11.1 presents the observed footfall totals. In order to put these counts into perspective the data were compared with previously collected footfall samples taken across West End shopping centres. Total counts at Peckham Rye were *higher* than those observed at the Westfield retail malls, while Borough High Street was busier than the prestige shopping streets of Kensington and Covent Garden. The ratio between weekday and weekend was however observed to be largely similar on high streets in Southwark and the West End suggesting that while shopper demographics and densities might be different, underlying patterns of behaviour and high street usage may be largely similar.

11.4.2 Observed Behaviour: Footfall Distributions

Footfall density distributions were then derived at half-hourly intervals, and similarities and variances in behaviour at each location were revealed. In Fig. 11.1 six examples of these distributions are shown. In all three locations Saturday

Table 11.1 The characteristics of shopping behaviour in Southwark ($n = 684$)

High street	Number of shoppers (thousands) Tue + Sat	% spending less than 30 min (%)	More than three visits a week (%)	% spending less than £20 (%)
Peckham Rye Lane	31	32	73	52
Borough High Street	24	34	44	59
Camberwell	17	48	71	68
Lordship Lane	13	40	58	51
Herne Hill	8	63	42	73
The Blue	7	53	74	85
Nunhead Lane	3	78	66	66
Average	*15*	*50*	*61*	*65*

distributions build across the morning and then remain flatter than the weekday curves, tailing off gradually in the late afternoon. This pattern was largely consistent across all high streets (outlying spikes in the Herne Hill distribution are likely due to the smaller sample observed and timing error).

The weekday patterns highlight local variances. Borough High Street is exceptional in being slightly less busy on Tuesday than Saturday and is an important lunchtime destination with a very pronounced spike in traffic after 12.00. There is also an upward curve towards the end of the day. All three features reflect the nature of the area. There is no pronounced weekday lunchtime spike at either Peckham Rye (where Tuesday footfall resembles its weekend distribution), or at Herne Hill. At this quieter location a third distribution is noticeable with a mid-afternoon peak around 4.00. The peak is a function of the school-run as parents and children pass through on their way home, but the rest of the day looks rather flat, but slightly busier during the afternoon.

The variations are locally important in managing retail operations and they result from habitual individual behaviours that would tend to bring the same people onto the same high streets at the same times of day and days of the week. Footfall densities at any location therefore become largely predictable in aggregate, but reasons for any single visit are likely to be different by individual and perhaps complex rather than motivated entirely by a purchase. The nature of the pool of potential buyers on a high street in a given period means that stochastic models should describe aggregate competitive choice behaviour *between* high streets—measures that are critically interesting for local businesses and for local government which may be competing for high street footfall across borough boundaries. The findings confirm that the competition for footfall density is likely to be constrained by normal choice patterns.

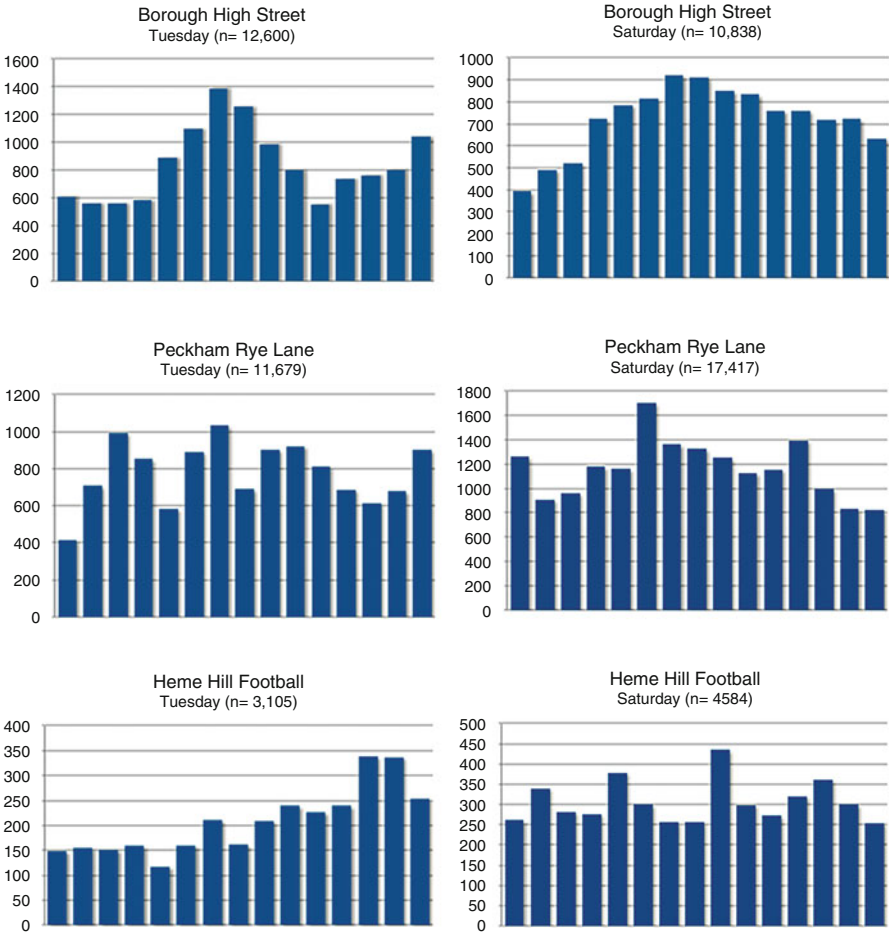

Fig. 11.1 A comparison of half-hourly footfall distributions on three high streets. Observations taken from 10.00 on Tuesday and Saturday

11.4.3 Shopper characteristics, High Street Usage and Attitudes

Footfall density patterns were next interpreted in the light of the survey data collected. In Table 11.1 densities are compared with dwell time, visit frequency and average spend, highlighting several points. First, despite the wide variation in footfalls already noted, there is far less variance around the means of the three other variables. Since shoppers largely behave the same way wherever they are, the key to successful sustainable retail marketing in Southwark must be to recognise and play to this fact.

Second, the table identifies that Southwark shopping is characterised by convenience. The average visitor is on the high street for under 30 min, spends under £20, and returns two or more times each week. A third pattern is visible: the busier the high street the longer the dwell time and the higher the spend. This is hardly surprising. With more on offer in Peckham, Borough and Camberwell there is more opportunity to spend time and money, yet it is surprising that the distinction between busier and quieter streets is still so slight.

The "little and often" type of shopping represented in Table 11.1 has been reported elsewhere (Anesbury et al., 2014; Sorensen, 2003), but "smart city" being highly sustainable in its localism. Almost all respondents lived or worked locally, and had come on foot (49 %) or by public transport (35 %). Just 10 % had used a car. Under half (46 %) claimed that their primary purpose was to make a purchase in a shop or market, but even though most were there for another purpose, many of this group said that they *would also* be buying.

Retailers often think about a target market in terms of behavioural segments in order to create and position more attractive offers. For example findings showed a systematic female bias in dwell time; but the largest part of the sample (nearly half of all respondents) claimed that they would be spending just half an hour less and in this group genders were evenly divided. For retailers the message is therefore very clear. The most meaningful target market is the large number of available convenience shoppers.

Finally, "little and often" behaviour does not indicate dissatisfaction with any particular high street. The survey found surprisingly positive sentiments. Over half claimed to like the experience because it was convenient, and a further third liked the choice of shops, restaurants and bars. When asked what should be improved the most common response was that the environment should be "tidier" or "cleaner" and while the shoppers in Peckham Rye wanted more "big brand" retailers, those on the smaller high streets were vehemently against chain stores. But shoppers have a large choice of retail locations, and over time can be expected to switch between a range of high streets. Patterns revealed from this competitive structure are described next.

11.4.4 Competitive Structure Between Retail Centres

Table 11.2 shows the top 15 stated "first alternatives" to the Southwark high streets where intercepts were conducted, ordered by popularity, and accounting for 61 % of all choices collected. It is clear that shoppers are drawn to a wide selection of other shopping centres since the remaining choices had very few takers each. The competitive set of high streets is therefore large and consumers split their "loyalties" between many options. Under the stochastic conditions found, the expected pattern is a familiar one, known to marketers as the Law of Duplication of Purchase (Ehrenberg & Goodhardt, 1970; Sharp, 2012). The law states that the biggest competitive threat to any named rival is simply from the most popular overall choice,

Table 11.2 Stated duplication of shopping destination

High street	% naming as first alternative
West End	13.0
Peckham	13.0
Brixton	8.8
Lewisham	6.4
Westfield	3.8
Surrey Quays	3.2
Elephant and Castle	2.8
Dulwich	1.9
Bromley	1.8
Borough	1.8
Croydon	1.6
Walworth Road/East Street	1.5
Camberwell	1.0
Lordship Lane	0.3
Herne Hill	0.3
Total	*61*

Responses to the Q: where else do you go shopping? ($n = 684$)

because each competitor tends to share its buyers with all other choices simply in line with its overall popularity. In this context the law suggests that we should not expect any single alternative to appear higher or lower than its own footfall indicates, and this appears largely to apply. Southwark shoppers on all eight high streets are drawn to other high streets, some in other boroughs—but in the greatest numbers to the West End, and in very much smaller numbers to Herne Hill and to Lordship Lane. This largely follows comparative footfall densities identified earlier.

The law is also useful as a benchmark to highlight entities that ***are not*** behaving as expected, usually because they compete more or less intensely together around some functional difference (for example in other contexts budget and national airlines). Here, as distance begins to make alternatives less attractive for some, competitive pull becomes weaker. Croydon might be a less attractive offer than its footfall suggests because it is not equally accessible to all in Southwark. Camberwell and Borough were also not mentioned as often as expected, prompting questions about their role in shoppers' portfolios.

11.4.5 Current Digital Influences on Shopping Behaviour

Table 11.3 lists response levels to questions about traditional and digital media exposure and usage. The purpose of these questions was to understand how Southwark shoppers receive marketing communications and how various media

Table 11.3 The reach and relative possible influence of digital and traditional media and promotional channels

Media	Proportion using today (%)
Marcom tools	
Loyalty card	15
Coupons	6
Social media promotion	5
E-mail promotions	4
Store locator	3
Voucher apps	2
QR codes	2
Service locator apps	0
(e.g. Around me, TripAdvisor)	
Main source of local news	
Local papers	20
Online[a]	13
WoM	14

[a]13 % = 87 various digital responses, $n = 684$

might currently influence their choice of retail location, retail store and brand purchases. Internet-enabled smartphones carry advertising, location software and other apps which marketers use to promote goods, services and destinations to consumers on the move. Much of this can be targeted and some is location sensitive.

The table indicates that Southwark respondents are surprisingly "un-smart" (but not in the sense suggested by Glaeser & Berry, 2006)—the survey found a higher than expected level of graduates). There was a far lower level of reach and uptake of mobile marketing incentives and communications than anticipated. The most popular promotional device was the store loyalty card, but this had been used on the current trip by just 15 % of respondents. The use of mobile apps and social media recommendation was even less widespread. The most surprising finding was however the continuing reach of local newspapers and freesheets. A fifth of the sample claimed these to be a first source of local news, followed by 14 % who stated word of mouth.

These findings do not appear to support the current claims made for e- and m-marketing; because reach is so low they suggest that in the near future such techniques will achieve little in driving high street footfall densities, especially read in conjunction with the established behavioural shopping patterns presented earlier.

11.5 Discussion and Managerial Implications

Dramatic claims are often heard about the decline of the British high street. Deloitte (2015) and Batty et al. (2012) expect imminent disruptive structural change in the way goods are retailed in line with a smart city concept that predicts and

promulgates the adoption of new forms of online social interactivity and far greater e-commerce (DBIS, 2013; Mosannenzadeh & Vettorato, 2014). Will the smart city of the near future have a high street? This chapter described current consumer behaviour on eight high streets in one inner London borough. Results confirm other recent work and acknowledge gradual change, but they do not support the view that shoppers will soon abandon the high street forever. A total shift online would require a dramatic change in complex habitual behaviour, and this seems unlikely given that most high street use is multi-purpose.

We found of course that not all high streets are equal: the footfall densities at the three busiest centres were comparable to some West End destinations but varied by a factor of ten between the busiest and slowest in Southwark. Nevertheless, individual behaviour was remarkably constant. On any high street people treat the visit largely in the same way, that is, coming regularly, spending little time and money on average and travelling by foot or by public transport. These are smart city attributes because they are sustainable.

Patterns of footfall between locations, days and times suggested that visit occurrence is shaped by everyday and habitual events far more than by a particular functional desire to go shopping. Marketing incentives are therefore unlikely to be persuasive. Just half of our respondents claimed to be primarily shopping, although most said that they would be buying on that trip. In marketing this is a familiar although seemingly random consumer canvas, from which aggregate choices and switching behaviours in fashion, leisure and grocery have all been shown as astonishingly predictable (Scriven, Perez-Bustamente Yabar, Clemente, & Bennett, 2015; Uncles & Hammond, 1995). Such split loyalty as seen here between retail centres is a well-known marketing phenomenon which does not imply dissatisfaction or an imminent or permanent defection. Buyers just switch.

These stochastic patterns confirm that footfall is critical to centre and retailer sustainability but the breadth of stated choice means that competition to attract footfall is wide and intense. In light of the smart city vision, we examined the reach of digital and traditional media and marketing tools. Despite widespread diffusion of smartphones, current behaviour suggests that e- and m-marketing techniques are unlikely to permanently increase high street footfall levels or to switch buyers between competing retailers.

11.5.1 Implications

Findings have implications for competitive response at two levels: store and high street. Success at the latter level will result from an understanding of the multiple purposes of the high street as Jan Gehl discovered in Copenhagen (1996), and the ability to draw footfall from other centres to more complex alluring propositions. Footfall is the measure upon which everything else depends, and our findings suggest compelling reasons for local-level investment to maintain and increase

pedestrian flows. High streets should seek to be distinctive rather than differentiated: a rich mix of different offers will draw more consumers, and most, according to our evidence, are likely to become shoppers. High street image management (e.g. Hart et al., 2013) should aim to build associations across many retail and *agora* categories and attempt to create more reasons to visit.

Competition for available footfall at the store level is also strong. The "convenience" nature of high street shopping described in our results means that retailers should make it easy to shop. For example Sorensen (2003) suggests that stores should make it simple to find the 80 most frequently purchased items in the "Big Head" not the 50,000 in the typical long tail of products stocked. "Little and often" shopping creates an advantage for independents over multiple retailers because it becomes easy to establish a meaningful face-to-face relationship, which may outperform digital engagement for the time being. But regular behaviours are often conducted without much thought and so like advertising "wear out" where certain communications become invisible through repetition (Stewart & Kamins, 2006), some retail premises might also become hidden in plain sight for many pedestrians simply because they have become so familiar. Successful retailers continuously make efforts to attract ***all available*** shoppers, as well as converting those that come through the door.

Finally, Dobson (2012) suggests that local loyalty schemes could be established. Given the popularity of this technique it might seem like a good idea, but our evidence suggests that it will not be strong enough in itself to persuade the average shopper to confine all of their purchasing to one local high street, and will serve only to distribute profits among shoppers who would be there anyhow. On the high street Batty et al. (2012) have suggested that the crowd-sourcing and geo-locating functions of twitter would be useful marketing tools for local retailers. There is little to suggest that the shoppers of Southwark are ready for this.

11.5.2 Limitations and Avenues for Further Research

The chapter has a number of limitations. First, it is cross sectional. Measures such as footfall are best considered in time series. Temporary or local perturbations in footfall density can only be understood in comparison with sequences of prior results, and these were not available to us here. Second, the research was conducted in only eight centres within one borough. London is a large city and many town centres compete for footfall within it. According to retail gravitation models competition between centres is influenced by distance, travel time and retail space. The duplication of purchase model provided a simple measure of competition but further studies might extend the number of centres and boroughs observed and consider these mediating effects on competition. Finally, multi-channel retail was not explicitly considered in detail here. Further work could consider the interplay of physical and virtual on the retail customer journey.

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Chapter 12
Sustainability and Quality of Life in Smart Cities: Analysis of Scientific Production

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Abstract Economic, social, and environmental sustainability of cities stands out from other important challenges that come from constant urban development at the global level. This fact attracts many researchers from different areas of knowledge that pretend to carry out the way cities will be managed in future. A study on the smart cities analyzes a tendency to settle urban centers and their adaptation for increasing the population growth following six central concepts that influence on a city's behavior: Economy, mobility, governance, people, living, and environment. This way, the aim of the authors is to describe an actual stage of scientific researches on the smart cities focused on sustainability and life quality. Following this purpose, a comparative bibliometric study on publications indexed in WoS and Scopus databases has been done, analyzing correlations between growths, coverage, overlapping, dispersion, and concentration of articles. This way, a search strategy has been established with the aim to get a representative subset of documents to gather them in an ad doc database used afterwards to extract the results. Taking into account these final results, we can conclude that although WoS and Scopus databases differ in terms of range, data volume, and coverage policies, the documents and their analysis are similar in several aspects, Scopus database being the one that covers better our area of study, having a higher number of journals, articles, and authors.

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12.1 Introduction

Analyzing an emerging phenomenon of the smart cities, it is convenient to remember the first words of a book Cities by John Reader: "Cities are the defining artifacts of a civilization" (Reader, 2014:1).

In 2014, 54 % of the world population lived in urban areas to the detriment of rural ones. Taking into account that in 1950 this percentage was only 30 %, a clear tendency for depopulation of rural areas to the benefit of cities can be observed, an increase of up to a 66 % of the world population being expected for 2050 (United Nations, 2014:1) (Fig. 12.1).

Due to their abundant population, cities are important consumers of goods and services that do not always take into account a limit that is caused by a shortage of resources. However, urban society of the twenty-first century does not want to refuse to enjoy nicer and nicer environment, so a concept of sustainability that has not only an environmental but also an economic and a social facet is a rising value. This way, more and more cities want to have a smart model of management of their resources.

As an answer to important challenges, the smart cities appear as cities that integrate through smart planning economy, population, mobility, environment, and administration with the aim to turn the cities into sustainable, innovative, and efficient places, where improvement of the residents' life quality is the main axis around which all the changes turn.

As a smart cities' concept is getting an increasing relevance, it is necessary to find and analyze works published recently. This way, the main goal of this chapter is to carry out an in-depth analysis on the actual stage of researches on the smart cities and sustainability using a bibliometric study; it means, to analyze and determine the main features of existent scientific literature applying mathematical and statistical methods (Spinak, 1996:34).

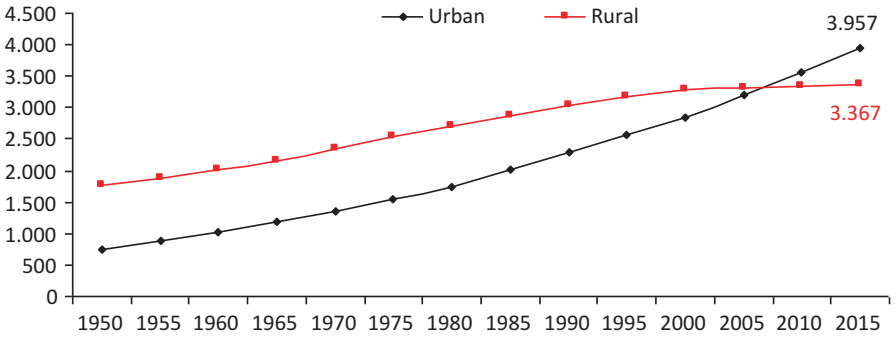

Fig. 12.1 Evolution of urban and rural world population (millions of persons). *Source*: Own elaboration from the data from http://esa.un.org/unpd/wup/

To be able to carry out the bibliometric analysis, the first step is to evaluate available databases, their suitability, and consequences of using one or another one. Defined by Luque (1995:44) as "a combination of data organized according to a logical sequence that allows a simple access, the way that the information it has can be updated, used in any moment by any computer program and according to different criteria," they allow, among other things, to carry out studies of quotations; classify scientific production by authors, universities, regions, or countries; and identify the main tendencies of a research. Validity of a study depends on appropriate selection of the base to a large extent, because it has to cover sufficiently the area that is the object of the study (Granda-Orive et al., 2013:2; Granda Orive, 2003; Odendaal, 2003).

During more than 40 years the Web of Science database of Thomson Reuters (WoS from this position on) was the only one base for this kind of bibliometric studies. However, when the Elsevier Science launched the Scopus database in 2004, a rivalry to control international market of scientific multidisciplinary databases began.

Recently, comparative studies between Wos and SCOPUS showed that due to this rivalry both databases had a lot of improvements (Bakkalbasi, Bauer, Glover, & Wang, 2006:7), but there is no definite winner. This is the reason why some authors suggest, trying to determine which one is the most appropriate one and to be able to calculate a level of similarity between both of them, to carry out an analysis of overlapping specified by area and time period (Neuhaus & Daniel, 2008:208). This way, and as the second aim, it is expected to determine source and document distribution (dispersion) and coverage (overlapping) of WoS and Scopus in the area of the smart cities and sustainability.

With the aim to find out the documents indexed both in WoS and in Scopus, and that which constituted a base used for this bibliometric study, a search of terms smart cities, sustainability, and life quality has been done in both databases. As a result, 90 references until 2014 were found in WoS and 181 in Scopus; they were analyzed using a bibliographic program Refworks.

This chapter has four main parts. In the first place, after this introduction, the theoretical framework that will be used as a documental base for the bibliometric analysis and the one of overlapping of literature on the smart cities and sustainability is established. The second part describes used databases, indexes, and strategy of search applied for choosing the references. Afterwards, in the third part, the main results of the calculation of basic bibliometric indicators, as well as of the analysis of overlapping and singularity, are described. Finally, the fourth part establishes the final conclusions and limitations of the research.

12.2 Theoretical Framework

Recent increases of scientific production, as well as its collection in bibliographic databases, have produced a use of bibliometry as a tool for measuring of researchers' activity basing on quantitative statistical analysis of the data provided by

scientific literature (Sancho, 1990:842–843). One of the first definitions of the bibliometry concept was drawn up in 1969 by Alan Pritchard: "application of statistical and mathematical methods ready to define processes of written communication and nature and development of scientific disciplines through techniques of re-counting and analysis of this communication" (Pritchard, 1969:348).

Bibliometry uses databases as a source of documentation that is used afterwards for carrying out some analysis. It has become usual to compare these databases using a relative singularity index, or Meyer's index (Meyer et al., 1983:34), that allows to compare the coverage that different databases have of a determinate topic, as traditional and relative overlapping, measures originally used by Bearman and Kumberger (1977) and defined by Gluck (1990:45) that provide a calculation of overlapping of one base to another one taking into account the volume of shared documents in relation to the unique ones (Pulgarín & Escalona, 2007:339).

This kind of researches started to be carried out in the 1960s (Martyn, 1967; Martyn & Slater, 1964), although a lot of their conclusions were invalidated (Bost, 1968). Subsequent studies started to distinguish overlapping of primary sources (Bourne, Kasson, & North, 1969), secondary sources (Bearman & Kunberger, 1977), and multiple overlapping (Poyer, 1984). In 1990 the first revision on overlapping was published (Gluck, 1990).

Before the Scopus database appeared in November of 2004, the WoS had been the main source of bibliometric data (Archambault, Campbell, Gingras, & Larivière, 2009:1320). With the Scopus appearance the first studies that found out which database responded better to the needs of their users appeared. In the one made by Goodman and Deis (2005), and its subsequent revision (Goodman & Deis, 2007), where those aspects as prices, coverage in relation to the content and time, updating, kind of documents, searching facilities, and access are compared, the conclusion says that Scopus has more journals, and WoS offers a better coverage in relation to the time, both of them being complementary products (Escalona, Lagar, & Pulgarín, 2010:160). On his behalf, Fingerman (2006) thought that an advantage of Scopus over WoS was that it had not only articles, but also other kinds of documents, as books or congress minutes. As a result, subsequent versions of WoS included two new databases having congress minutes as well.

According to Bakkalbasi et al. (2006:7) and Neuhaus and Daniel (2008:208), it is recommended to apply this kind of analysis in specific areas of studies with the aim to determine which one of the databases works better in each case, because it depends on the analyzed discipline and period of time. This way, studies as those made by Mingers and Lipitakis (2010:624) come to the conclusion that the WoS coverage is worse in administration and companies' management areas. On the same way, Santa and Herrero-Solana (2010:25) analyzing scientific production of the main countries of the Latin America and the Caribbean found out that Scopus had a wider coverage of journals.

Going beyond the differences of the area, data volume, and coverage policies, the studies show a good correlation between WoS and Scopus due to a high number of journals indexed by both databases (Gavel & Iselid, 2008:15).

Torraco (2005:359) suggests that a revision should begin with a conceptualization of everything known on the studied topic or the area to study. Speaking about a case of the smart cities, and despite the fact that the first study was published in 1992 (Gibson, Kometsky, & Smilor, 1992), it is not yet possible to find a definition that could be accepted by all the authors, neither to determine which are their main elements and limits (Pardo & Nam, 2011:283).

The difficulty to define it consists on the use of the concept "smart" in a diffused way. In literature, several typologies of cities refer to the smart city concept (Cocchia, 2014:18): wired city (Hollands, 2008), virtual city (Schuler, 2002), ubiquitous city (Anthopoulos & Fitsilis, 2010), intelligent city (Komninos, 2006), information city (Piro, Cianci, Grieco, Boggia, & Camarda, 2014), digital city (Couclelis, 2004), smart community (California Institute, 2001), knowledge city (Ergazakis, Metaxiotis, & Psarras, 2004), learning city (Andone, Holotescu, & Grosseck, 2015), sustainable city (Batagan, 2011), and green city (Antrobus, 2011).

Pardo and Nam (2011:285-286) organize these definitions in three groups according to some features that they have in common:

1. Technology: The emphasis is made in the possibilities that new technologies offer to transform, strengthen, and improve an urban system. This dimension includes the concepts of digital city, virtual city, information city, wired city, ubiquitous city, and intelligent city (Lee, Phaal, & Lee, 2013; Odendaal, 2003).
2. Human resources: They are focused on persons, education, learning, and knowledge, concepts of learning city and knowledge city (Lombardi, Giordano, Farouh, & Yousef, 2012; Shapiro, 2006).
3. Institutions (government): Their aim is government and politics, so cooperation and interaction between different involved agents are crucial for implementation of initiatives of the smart cities. Concepts: smart community, sustainable city, and green city (Walravens & Ballon, 2013; Walters, 2011).

Other authors (Giffinger et al., 2007) analyze the smart cities following six main axes or dimensions that define their behavior (Fig. 12.2).

- *Smart Economy*: Concept used in different contexts: smart design and urban development, economic development, strategic planning, cities' promotion and brand promotion, innovation, entrepreneurship … (Bruneckiene, 2014).
- *Smart Mobility*: Accessibility, systems of transport compatibles with the needs of mobility of future generations, security … (Crivello, 2015).
- *Smart Governance*: Transparency, participation of the residents, social policies, commitment with the democratic values (Walravens & Ballon, 2013).
- *Smart People*: Cities need to base their evolution and sustainable development on valid and qualified human capital (Zheng, 2014).
- *Smart Living*: It comprehends different attributes that different researchers consider to be fundamental for identification of what the life quality level that can be offered by a city is based on: health, security, and education (Rogerson, 1999).

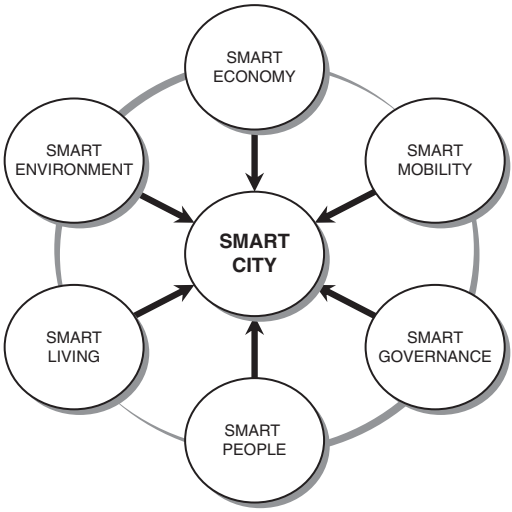

Fig. 12.2 Dimensions of the smart cities. *Source*: Adapted from Madakan and Ramaswamy (Madakam & Ramaswamy, 2013:116)

– *Smart Environment*: To assure the cities' sustainability it is necessary to combine in an appropriate way protection of the environment with prosperous urban lifestyles (Yoshikawa, Tada, Furuya, Koda, & Geerli, 2011).

That is why, it is considered that one of the most complete and accepted definitions that involves all the aspects mentioned before was done by Caragliu et al. (2009:50) who speak about a smart city as a city where "correct investments of human capital, infrastructures of transport and information technologies are done through sustainable economic growth and high level of life quality, with a rational management of natural resources and participative and close government."

Nowadays sustainability is a transverse question that affects all the life aspects and that requires our urgent attention as a consequence of the intensification of human activities that use arbitrarily natural resources and harm the environment. As approved, there are a lot of publications regarding this aspect (Ausaverri, 2014; Höjer & Wangel, 2014; Jepson & Edwards, 2010; Kramers, Höjer, Lövehagen, & Wangel, 2014).

For its part, the idea of sustainable development and a city is a multidimensional concept that includes economic, social, and political aspects highly related to the life quality (Levent & Nukamp, 2006). Sustainable development is the one that satisfies current needs without putting at risk the needs of future generations with a limit that consists in appropriate respect towards the environment and with the ail to improve life quality through technological development, the aims that the smart cities have as well (Batagan, 2011:81). So, life in an eco-city revolves around reduction, recycling of resources, changes of the patterns of production and consumption, use of sources of renewable energy, mobility, and transport, among others (Yigitcanlar & Lee, 2014:102).

12.3 Methodology

In this part a process of elaboration of bibliometric study and overlapping of the scientific documentation on the smart cities and sustainability found in the WoS and Scopus databases is described. It is not just an evaluation of quality of content of the publications included in these databases, but also their descriptive-quantitative analysis from the first publications until the last ones.

12.3.1 Databases

WoS and Scopus were chosen from all the available databases because of their multidisciplinary and international character and because of the importance these tools have for the researchers as sources of documentation for their studies.

Web of Science, created in 1960, is owned by a company Thomson Reuters. It has a wide selection of bibliographic databases, quotations, and references of any discipline as scientific, technological, humanistic, or sociological one since 1945. It has more than 12,000 alive journals, 23 millions of patents, 148,000 min of congresses, more than 40 millions of sources, and 760 millions of quoted references (Fig. 12.3).

Scopus was created by the Elsevier publishing house in 2004, and it analyzes quotations since 1996. It has more than 53 millions of references (21 millions of records previous to 1996, the oldest one published in 1823) published in more than 21,000 scientific journals (2600 titles of direct access). It also includes 390 commercial publications, 370 book series, 5.5 millions of papers, 25.5 millions of patents, and 376 millions of web pages (Fig. 12.4).

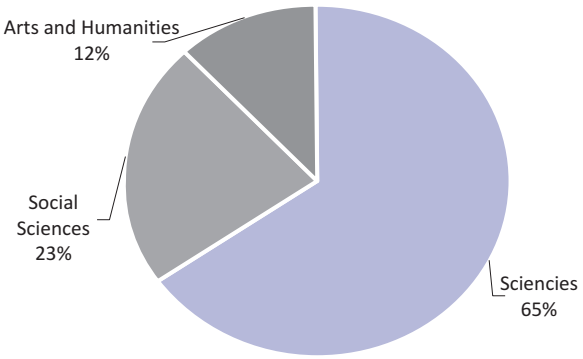

Fig. 12.3 Coverage of journals of WoS according to their areas. *Source*: www.accesowok.fecyt.es/?page_id=21

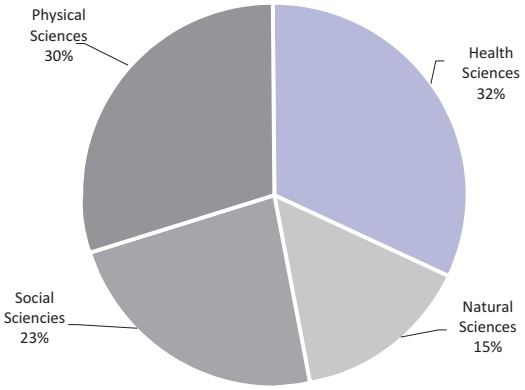

Fig. 12.4 Coverage of journals of Scopus according to their areas. *Source*: www.elsevier.com/online-tools/scopus/content-overview

12.3.2 Methodology of Calculations

To calculate an overlapping degree between WoS and Scopus in a certain area we can choose to do it basing on primary sources (journals) or focusing on the documents than these databases have (articles and papers in our case).

The first proceeding is quite difficult because of the differences presented by policy of indexation that all the databases have; while some of them use all the sources, others do it in a selective way (Pao, 1993:99). The second proceeding requires a bigger effort for the database comparison.

12.3.2.1 Meyer's Index

It is used to evaluate a monitoring that a database can do on a certain topic; its result means a degree of coverage that a database has on this area (Pulgarín & Escalona, 2007:338).

The sources, or unique documents, means those that are included in one database, and have a higher weight or value that will be reducing progressively for duplicates (weight = 0.5), triplicates (weight = 0.3), etc. according to the number of bases to be compared. The higher the index, the higher the level of singularity of the database, so the number of unique documents will be higher as well (Costas, Moreno, & Bordons, 2008:332):

$$\text{Meyer's index} = \frac{\sum \text{Sources} \times \text{Weight}}{\text{Total sources}}$$

12.3.2.2 Traditional Overlapping (TO)

The % of overlapping between two databases was commonly measured using traditional overlapping (TO) defined by Gluck (1990) as

$$\%\,\mathrm{TO} = 100 \times \left(\frac{|A \cap B|}{|A \cup B|} \right)$$

Being a level of similarity between both databases, a high TO means a high level of similarity. As an example, a coefficient of 0.25 indicates a 25 % of singularity or a 75 % of difference between both databases, or, in other words, if we did a search in one of them, we would find a 755 of unique sources or documents.

12.3.2.3 Relative Overlapping

Originally used by Bearman and Kunberger (1977), it measures a percentage of coverage of a database *A* in relation to the other one, *B*. Its calculation is done using this expression:

$$\%\,\text{Overlapping in } A = 100 \times \left(\frac{|A \cap B|}{|A|} \right), \%\ \text{Overlapping in } B = 100 \times \left(\frac{|A \cap B|}{|B|} \right)$$

and the result means a percentage of covering of the database *A* on the database *B*.

12.3.3 Methodology of Search

The search strategy consisted in a search of documents in the databases using keywords. An advantage of this methodology is to allow to find studies independent of the area they belong to and beyond a concrete selection of journals, so it is more exhaustive (Corral & Cànoves, 2013:59). "Smart cit*" was used as a keyword in the field "title" (Moser, Wendel, & Carabias-Hütter, 2014:509), and the terms "sustainab* or "quality of life" were used in Title, Abstract, and Keywords (Scopus) and Tema (WoS) to equate the searches between the databases and to delimit all the results to those studies that have any relation with sustainability and life quality (Brocke et al., 2009:11).

As in any research of this kind, it has been necessary to work with the originally selected documents to delete the weaknesses that both databases have. This way, the final results were 42 articles published in 28 journals and 45 papers in WoS database, and 74 articles, 54 journals, and 97 papers in Scopus.

Although the overlapping analysis has been carried out on articles, sources, and conferences, the bibliometric study is focused just on the articles published in scientific journals as a representative sample of international scientific activity (Benavides-Velasco, Guzmán-Parra, & Quintana-García, 2011:79) and as a basic pillar of any bibliometric study (Martín-Vega, 1995:50). So, comments, conferences' reports, press articles, editorials, notes, letters, or errata that the databases have are not included in it.

12.4 Results and Discussions

12.4.1 Methodology of Search

As it has been already mentioned in the Methodology part, the selection of documents that form the empirical basis and that connect a smart city with sustainability and life quality has been done through a search of terms. Fig. 12.5 shows a summary of the found documents.

Due to a high number of papers from conferences found among the chosen documents, it is better to make some analysis differentiating them from articles. Other documents as books, book chapters, editorials, notes, reviews, and short surveys were excluded because they were considered not relevant for our study. 74 articles and 97 conferences of Scopus and 42 and 45, respectively, of WoS will be analyzed in this work.

As it can be seen in Figs. 12.6 and 12.7, the first works appeared in the beginning of the twenty-first century, and in 2011 a number of both articles and papers started

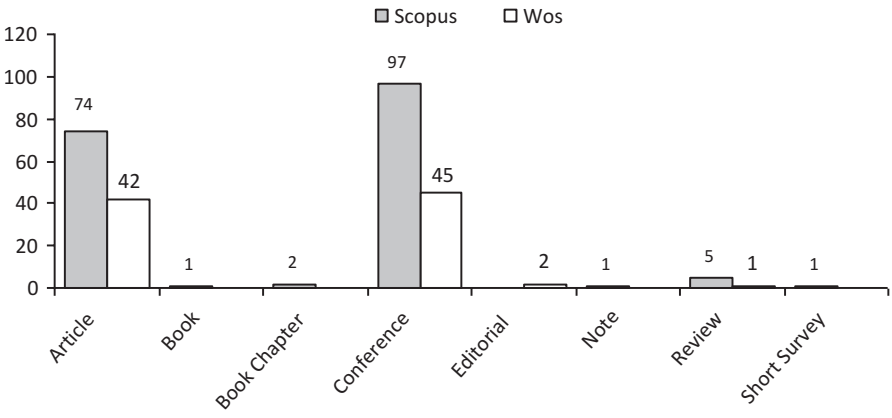

Fig. 12.5 Classification of documents. *Source*: Own elaboration

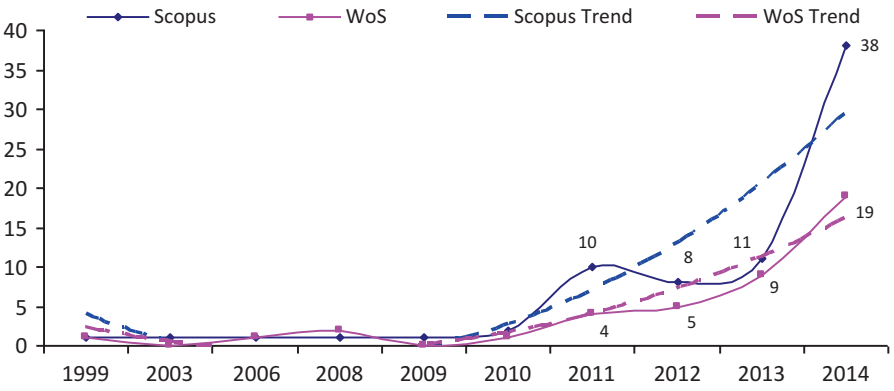

Fig. 12.6 Evolution of the number of articles. *Source*: Own elaboration

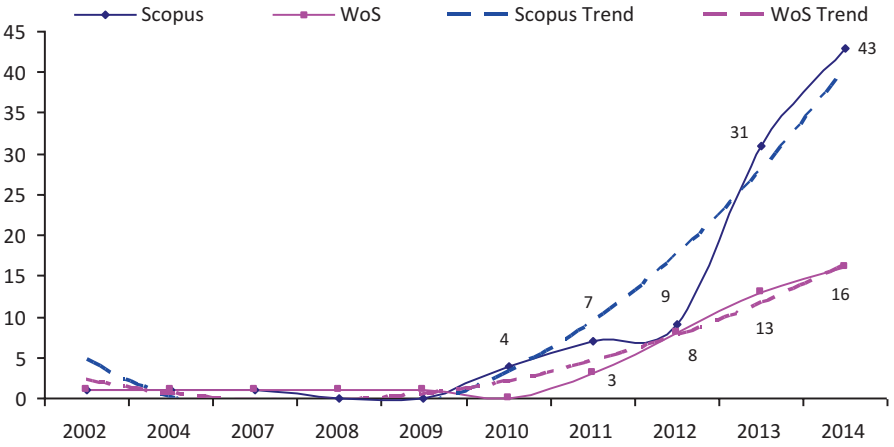

Fig. 12.7 Evolution of the number of papers. *Source*: Own elaboration

to increase in both databases in a significant way. More than 66 % of the articles and papers were published between 2013 and 2014.

12.4.2 Correlation Between WoS and Scopus

As we have annual distribution of the number of articles and papers in WoS and Scopus, we checked if there was a strong correlation between both databases or not. Fig. 12.8 represents these data and their adjustment to a straight line with the coefficient of $R = 0.9522$ for articles and $R = 0.9228$ for papers.

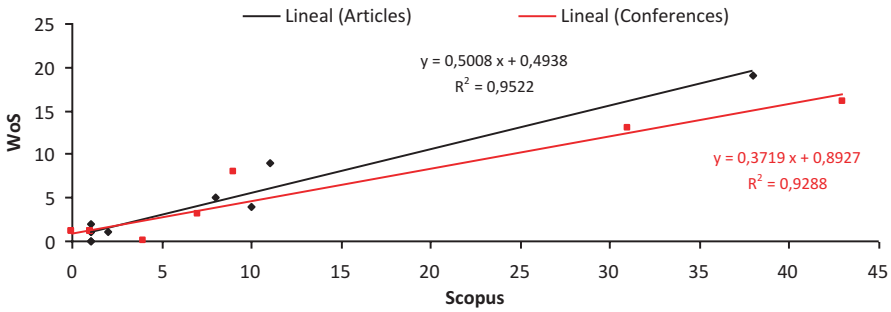

Fig. 12.8 Correlation between articles and conferences of WoS and Scopus. *Source*: Own elaboration

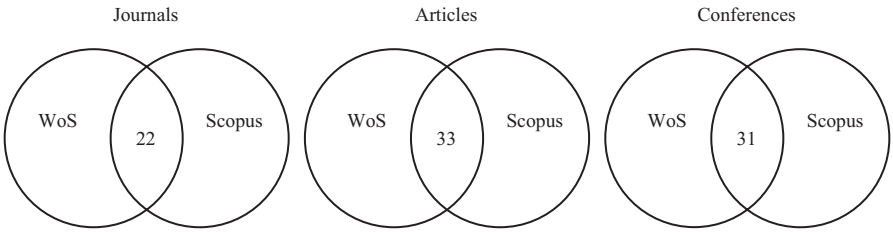

Fig. 12.9 Data of overlapping between WoS and Scopus. *Source*: Own elaboration

12.4.3 Overlapping

We found 28 journals, 42 articles, and 45 papers in WoS and 54, 74, and 97 in Scopus, respectively. Both analyzed databases provided 83 different articles published in 60 journals and 111 conferences (Fig. 12.9).

A calculation of a percentage of traditional overlapping (TO) of sources between WoS and Scopus (Gluck, 1990:45) produces a result of 36.6 %:

$$\%\mathrm{TO}_{\mathrm{Journals}} = 100 \times \left(\frac{\left| \mathrm{Wos} \cap \mathrm{Scopus} \right|}{\left| \mathrm{WoS} \cup \mathrm{Scopus} \right|} \right) => \%\mathrm{TO}_{\mathrm{Journals}}$$

$$= 100 \times \frac{22}{28 + 54 - 22} => \%\mathrm{TO}_{\mathrm{Journals}} = 36.6\ \%$$

In other words, we can say that there is a 36.6 % of similarity between WoS and Scopus or a 63.4 % of difference in relation with primary sources.

In the same way, a percentage of TO of articles is similar to the sources' one (% $\mathrm{TO}_{\mathrm{articles}} = 40\,\%$), but it is higher than the conferences' one ($\mathrm{TO}_{\mathrm{conferences}} = 28\,\%$).

Table 12.1 Relative overlapping

Database	Journals (%)	Articles (%)	Conferences (%)
WoS	79	79	69
Scopus	41	45	32

Source: Own elaboration

Table 12.2 Singularity of WoS and Scopus

	% Single documents			Meyer's index		
Database	Journals	Articles	Conferences	Journals	Articles	Conferences
WoS	21	21	31	0.61	0.61	0.66
Scopus	59	55	68	0.80	0.78	0.84

Source: Own elaboration

To calculate a percentage of coverage of WoS in comparison with Scopus and vice versa, we use a relative overlapping (Bearman & Kunberger, 1977), calculated as

$$\%\mathrm{TO}_{\mathrm{Journals}}\mathrm{WoS} = 100 \times \left(\frac{\left|\mathrm{WoS} \cap \mathrm{Scopus}\right|}{\left|\mathrm{WoS}\right|} \right)$$

In other words, Scopus covers a 79 % of the sources and articles of WoS and a 69 % of its conferences (Table 12.1).

12.4.4 Singularity of the Databases

To carry out a study on singularity of the databases, a percentage of the unique documents in each of them and the Meyer's index that includes a degree of overlapping between the databases as well were used. The results (Table 12.2) show a higher degree of singularity of Scopus in comparison with WoS.

12.4.5 Authors

As we have already said in the Methodology part, from this point and following the structures of similar studies, only articles would be included in the analysis.

No authors with more than two published articles have been identified between the chosen ones. 98 % of the authors from Scopus wrote just one article, this percentage being a 100% in case of WoS (Fig. 12.10). In other words, an average productivity in Scopus is of 102 articles per author and of 1 in WoS (Table 12.3).

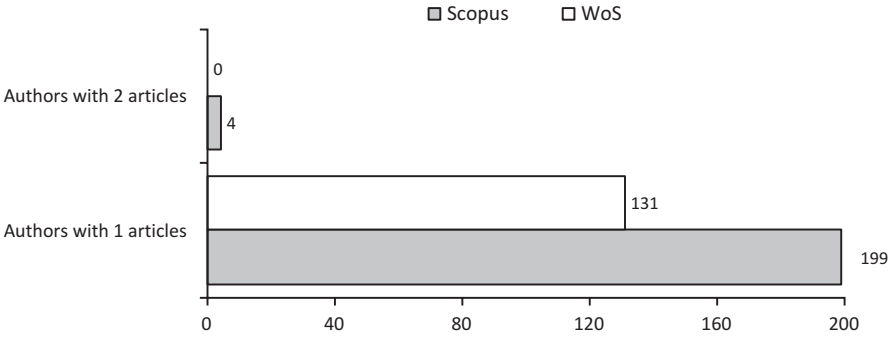

Fig. 12.10 Productivity. *Source*: Own elaboration

Table 12.3 Authors with more than one article published in WoS or Scopus

	Scopus	WoS
Höjer, M	2	1
Komninos, N	2	-
Schaffers, H.	2	-
Wangel, J	2	1

Source: Own elaboration

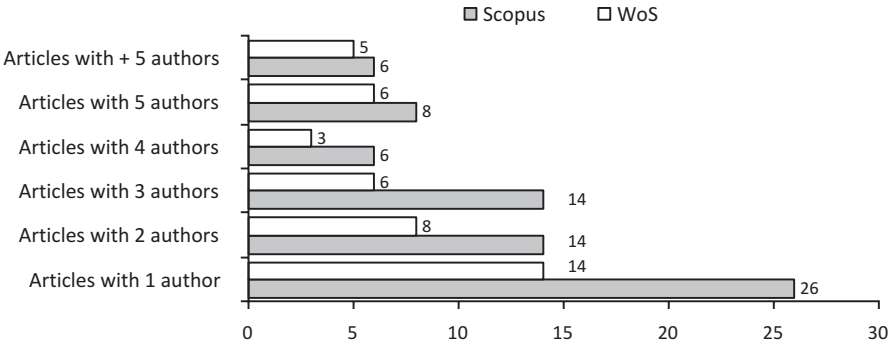

Fig. 12.11 Authors per article. *Source*: Own elaboration

As Fig. 12.11 shows, a high percentage of the found articles are written by more than one author, a 65 % in Scopus and a 69 % in WoS.

To calculate the index of collaboration among authors (Fig. 12.12), an average number of authors per article, 2011 was excluded because it was uncommon for the time series, so it would twist the result. The index of collaboration is 2.75 for Scopus and 3.02 for WoS, showing an increasing tendency of collaboration among authors.

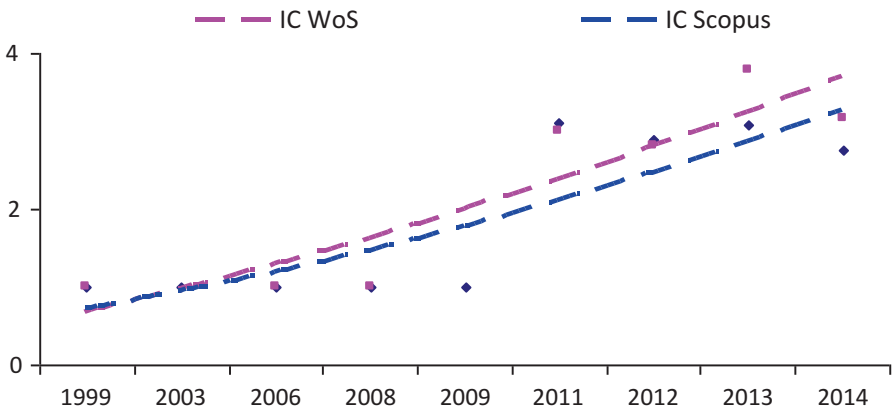

Fig. 12.12 Index of collaboration among authors. *Source*: Own elaboration

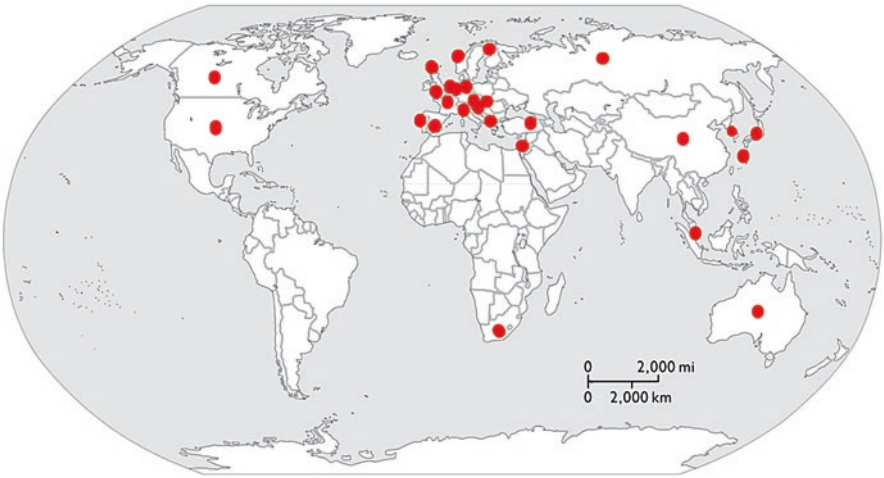

Fig. 12.13 Map of countries of affiliation of authors. *Source*: Own elaboration

12.4.6 Affiliation

According to their affiliation, all the researchers from both databases come from 27 different countries (Fig. 12.13).

The affiliation of the authors being analyzed, it can be seen that WoS and Scopus show the same result on the most important countries for researches on the smart cities, sustainability, and life quality: Italy, Spain, and the USA. The centers of IBM Corporation (USA), Universitat Oberta de Catalunya (Spain), and Universita degli Studi Roma (Italy) can be especially mentioned (Table 12.4).

Table 12.4 Centers, authorships, and authors according to their country of affiliation

	Centers		Authorships		Authors	
Country	Scopus	WoS	Scopus	WoS	Scopus	WoS
Armenia	1	–	4	-	4	-
Australia	3	3	5	5	5	5
Austria	1	–	2	-	2	-
Canada	3	1	4	1	4	1
China	6	4	10	6	10	6
Finland	2	–	5	-	4	-
France	2	2	4	2	4	2
Greece	3	1	11	6	10	6
Ireland	1	1	2	1	2	1
Israel	1	1	1	1	1	1
Italy	18	13	43	36	43	36
Japan	8	1	15	5	15	5
The Netherlands	3	3	6	3	6	3
Poland	1	–	1	–	1	–
Portugal	1	–	1	–	1	–
Romania	1	1	1	1	1	1
Russian Federation	1	–	3	-	3	–
Singapore	1	1	1	1	1	1
Slovenia	1	–	3	–	3	–
South Africa	–	1	–	3	–	3
South Korea	2	4	2	5	2	5
Spain	15	6	32	16	32	16
Sweden	3	2	7	4	5	4
Switzerland	3	2	3	2	3	2
Taiwan	2	1	2	1	2	1
UK	8	7	11	9	11	9
USA	17	9	28	20	28	20
Undefined	–	3	–	3	–	3
$\sum$	108	67	207	131	203	131

Source: Own elaboration

12.4.7 Journals

A certain degree of similarity between classifications of articles on thematic areas in WoS and Scopus can be seen. Table 12.5 shows a multidisciplinary character of our area of study, although the most part of the works are included in computer science (23 and 22 %) and engineering (11 and 22 %). Other relevant areas are environmental science, business, and economics or social sciences.

According to the Bradford's law (1934), a reduced number of journals pool the most part of articles in each area. So, this law allows us to identify those journals that are used more by researchers to make public their studies.

Table 12.5 Classification of articles according to the thematic areas

Scopus			WoS		
Categories	Art.	%	Categories	Art.	%
Computer science	29	21.97	Computer science	17	22.67
Engineering	29	21.97	Engineering	8	10.67
Social sciences	21	15.91	Environmental sciences	8	10.67
Environmental science	12	9.09	Telecommunications	7	9.33
Business, management, and accounting	9	6.82	Urban studies	7	9.33
Energy	7	5.30	Planning and development	3	4.00
Chemistry	3	2.27	Business and economics	5	6.67
Economics, econometrics, and finance	3	2.27	Chemistry, analytical	2	2.67
Psychology	3	2.27	Electrochemistry	2	2.67
Arts and humanities	2	1.52	Geography	2	2.67
Chemical engineering	2	1.52	Instruments and instrumentation	2	2.67
Materials science	2	1.52	Multidisciplinary	2	2.67
Mathematics	2	1.52	Public administration	2	2.67
Medicine	2	1.52	Energy	1	1.33
Physics and astronomy	2	1,52%	Physics	1	1.33
Agricultural and biological sciences	1	0,76%	Political science	1	1.33
Biochemistry, genetics, and biology	1	0,76%	Public, environmental, and health	1	1.33
Earth and planetary sciences	1	0,76%	Social sciences	1	1.33
Multidisciplinary	1	0,76%	Sociology	1	1.33
			Thermodynamics	1	1.33
			Transportation science and technology	1	1.33

Source: Own elaboration

We can name these journals chosen by the authors and found in both databases (Table 12.6): Fujitsu Scientific and Technical Journal, IBM Journal of Research and Development, and IEEE Communications Magazine. La Revista de Obras Públicas, despite being the journal with the higher number of published articles (5), was found only in the Scopus database.

74 articles of Scopus and 42 of WoS were published in, respectively, 54 and 28 journals. An average number of articles per journal or their dispersion is 1.37 in Scopus and 1.5 in WoS.

The Lorenz curve (Fig. 12.14) shows us that concentration of articles in both databases is not as high as it has been expected. In the case of WoS, an 18 % of journals have a 34 % of articles; meanwhile in Scopus the same percentage of journals published a 38 % of the articles.

Table 12.6 Ranking of journals with more than one published article

Journal title	Scopus		WoS	
	Art.	%	Art.	%
Revista de Obras Publicas	5	6.76	–	–
European Transactions on Telecommunications	3	4.05	–	–
Fujitsu Scientific and Technical Journal	3	4.05	3	7.14
IBM Journal of Research and Development	3	4.05	3	7.14
IEEE Communications Magazine	3	4.05	3	7.14
Transactions on Emerging Telecommunications Technologies	–	–	3	7.14
Technological Forecasting and Social Change	3	4.05	2	4.76
Cities	2	2.70	2	4.76
Intelligent Buildings International	2	2.70	–	–
Journal of Theoretical and Applied Electronic Commerce Research	2	2.70	1	2.38
Sensors	1	1.35	2	4.76
Journal of Urban Technology	2	2.70	2	4.76
Lecture Notes in Computer Science	2	2.70	–	–
Sustainability	2	2.70	2	4.76
Urban Studies	1	1.35	2	4.76
Rest of Journals with one article	40	54.05	17	40.48

Source: Own elaboration

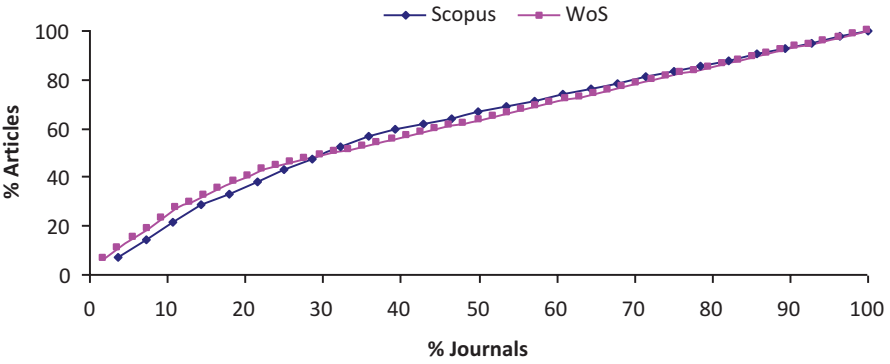

Fig. 12.14 Lorenz curves. *Source*: Own elaboration

12.5 Conclusions

Until Scopus database was created in 2004, WoS had been the main multidisciplinary and international available source of documentation. Currently, with both databases competing for the same space, there is a need to identify which one responds better to the needs of researchers in each area of knowledge. So, the main

aim of this study has been to determine whether WoS or Scopus covers better the topic of smart cities and their relation with sustainability and life quality. Having analyzed the results and extensive bibliography, we are ready to introduce our main conclusions:

(a) The studies on the smart cities, sustainability, and life quality are very recent in scientific literature. Despite the fact that the first article was published at the end of the 1990s, more than two-thirds of existent documents were published in 2013–2014.
(b) Other proof that could show that this topic is really original is a high number of papers of conferences found in both databases, because news on research are normally exposed in congresses. Annual distribution of the number of articles and papers reveals a strong correlation between both databases, Scopus being the one that grows more quickly and has a higher number of documents.
(c) Scopus is a database that has a higher degree of singularity; in other words, it has a higher number of the unique documents. This fact can be used for a correct selection of a documental source for future studies. It covers a 79 % of the sources and articles of WoS and a 69 % of its conferences, so a 20 % of articles would be lost, if only Scopus database was consulted.
(d) Almost all the authors in both databases wrote just one article, a fact that would confirm that this area of research has been hardly studied. The analysis of co-authorship index, about a three in both databases, reveals that researchers prefer to collaborate between them writing their articles.
(e) Italy, Spain, and the USA are the countries that have a higher number of articles and centers of research. In this area both universities (Universitat Oberta de Catalunya (Spain), Universita degli Studi Roma (Italy)) and technological centers (Corporation (USA) and Fujitsu (Japan) stand out).
(f) There is a clear similarity between WoS and Scopus when the articles are classified according to a thematic area. The most part of the studies form part of the computer science and engineering areas, but other relevant areas as environmental science, business, and economics or social sciences show that researches on the smart cities are multidisciplinary.
(g) In spite of the fact that the index of dispersion of articles among journals is less than in other areas of knowledge, "Fujitsu Scientific and Technical Journal," "IBM Journal of Research and Development," and "IEEE Communications" were identified as journals more used by the authors to make public their studies.

Summarizing all of this and as an increase of the number of articles and conferences indexed in WoS and Scopus databases shows, the researchers' interest in studies on the smart cities, sustainability, and life quality has been rising in the last 2 years. Despite the fact that WoS and Scopus databases differ in terms of range, data volume, and policies of coverage (Lopez-Illescas, Moya-Anegon, & Moed, 2008:314), the documents and their analysis are similar in many aspects. Comparing their coverage, the winner would be Scopus, having a higher number of journals, works, and authors.

As we focused on the smart city study, the results should be set in a context within this area of research. The study's aim was not to analyze the quality of chosen documents, although it could be a possible aim for a future research. It would be interesting to extend this study adding to it other databases and to do an analysis of quotations as it has been done in other areas of knowledge.

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Chapter 13
Measuring the Country Brand Image: Implications to Manage the Smart Cities

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Abstract The purpose of this research is to validate the country brand image of Spain. This measurement permits to assess if the country brand image is positive or negative, and its implications for governments. If the Spanish companies perceive positively the image of Spain then support policies related to smart cities will be easier to approve and apply. The chapter concludes that the image of Spain is experiencing a dynamic and positive development. Spain is perceived as a country with friendly, creative, and qualified people. This perception reinforces that one of Spain's best assets is its human capital. However, Spain is perceived as a country developing a reputation with regard to innovation and technology. These results indicate that the implementation of policies of smart cities will strengthen the brand image of Spain and therefore its implementation will be supported by public-private institutions.

13.1 Introduction

A strong country brand stimulates exports, attracting tourism, investments, and immigration (Fetscherin, 2010). In recent years, academic researchers have used different country brand terms as destination image, national image, national identity, national stereotypes, or country of origin (COO) (Beerli & Martin, 2004; Dinnie, 2008; Hosany, Ekinci, & Uysal, 2006; Kavaratzis, 2005; Skinner & Kubacki,

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2007). The country brand can be defined as the union of elements that provide the nation's cultural differentiation and relevance for all target audiences (Dinnie, 2008). It refers to the application of marketing and branding strategies by different countries. Unlike advertising campaigns and public relationships used for specific purposes at short term, the country brand is another way to improve the country's reputation and adapt the stakeholders, for example visitors, institutions, and small caps (Anholt, 2007; Dinnie, 2008).

A strong and positive country brand development has a direct and measurable impact on the country (Anholt, 2007). As the usefulness of a product brand offers an additional value to the consumer, a strong and positive country brand management has a direct or an indirect impact on the interests of stakeholders (Anholt, 2009). It can increase the international power and the relevance of international partners (Dinnie, 2008). Economically, those countries with strong brands export more and invest better, as a consequence of a higher relevance in the international sphere (Kavaratzis, 2005). Those countries have remained more stables (Dinnie, 2008). Moreover, countries that successfully manage their country brand are more accepted or generate greater trust between citizens, consumers, and/or visitors (Anholt, 2009). Definitely, a country which overlooks political, social, and economic matters cannot go further, so branding should be developed in those cases (Anholt, 2002; Dinnie, 2008; Olins, 2002).

People choose certain countries when selecting a product or a destination (for living, business, or tourism) or making an investment. This election raises an advantages when comparing countries (Anholt, 2007; Papadopoulos & Heslop, 2003). The brand value gives countries the strength to compete in a global world (Dinnie, 2004) throughout its own differentiation providing them leadership (Anholt, 2009; Dinnie, 2008). The countries which adopt marketing strategies and branding of government experience increase in others' trust (Johnston, 2008).

When measuring the country brand image the politicians have information about weaknesses or strengths, and they can approve policies for improvement. At this point, issues related to the country brand as innovation and technological progress can produce results that favor the development of policies relative to smart cities. Moreover, if those responsible for foreign trade detect that the image of the country shows negative values in innovation, development, progress, and prestige they can generate strategies with local governments to make up these perceptions. Also, the city branding strategies followed by the cities can contribute to strengthening the country's international image which creates virtuous circle country-cities that feeds.

The concept of the smart city is focusing on the power/knowledge implications for the contemporary city (Vanolo, 2014). On the one hand, smart city policies support new ways to fancy, organize, and manage the city and its flows. On the other, they set a new moral order on the city by introducing specific technical parameters in order to distinguish between the "good" and "bad" city (Vanolo, 2014). The smart city's discourse may generate political legitimacy. For this reason, there must be collaboration between public and private institutions in the implementation of policies of smart cities (Erkkilä, 2014).

Therefore, the purpose of this research is to validate the country brand image of Spain. If the Spanish companies perceive positively the image of Spain its politicians will be able to obtain collaboration from many sources. Dinnie (2008) has proposed that the country image management is a complex and controversial phenomenon with great value for the countries. It is complex because it involves the analysis of multiple levels, dimensions, and disciplines on image management. It is necessary to manage this image in order to eliminate obstacles, approve goals of smart cities, and manage efficiently countries and cities.

The structure of this chapter is as follows: first, we establish a theoretical framework about the importance of country brand image. Following that, we carry out an empirical study to test these assumptions and present the results. Finally, we interpret the relationship between country brand image and the implementation of the objectives of smart cities.

13.2 Conceptual Framework

The country brand image refers to how the country is projected to others, while reputation is the "feedback" received from the other (Whetten & Mackey, 2002). The image and the reputation are concepts involved in the communication process between the country and its stakeholders. Thus, the image of a dynamic nation is perceived as an area of national differentiation (Highhouse, Brooks, & Gregarus, 2009), while the country's reputation is a feedback received from abroad, concerning the credibility of the nation.

Some studies (Papadopoulos & Heslop, 2003) have researched the influence of major events (for example, Olympic Games, world soccer) in the country's image. Kim and Chung (1997) believe that the country brand image in the global market may lead to the popularity and reputation of the country if properly managed.

Like traditional brand, country brand can be defined in terms of human characteristics. For example, a brand can be described as honest, reliable, robust, and charming (Sung & Kim, 2010). When the brand personality is used properly, it increases the presence and use by consumers, provides stronger emotional benefits (Biel, 1993), trust and brand loyalty (Sung & Kim, 2010), and increases the level of recommendation. The personification of nations has always existed (D' Astous & Boujbel, 2007) which is the stereotype that people have on the countries. Some researches show that the image of a country is related to the image of their political leaders (Dinnie, 2008).

The universality of human personality is another component of brand personality countries. This personality provides standards to interpret and predict human behavior. Accordingly, based on the country brand personality it is possible to predict certain effects on the behavior and decisions of a country always (D' Astous & Boujbel, 2007). Moreover, the country brand personality influences attitudes towards nations, the development of a country, and the decisions and behaviors (Bigné, Sá nchez, & Sánchez, 2001).

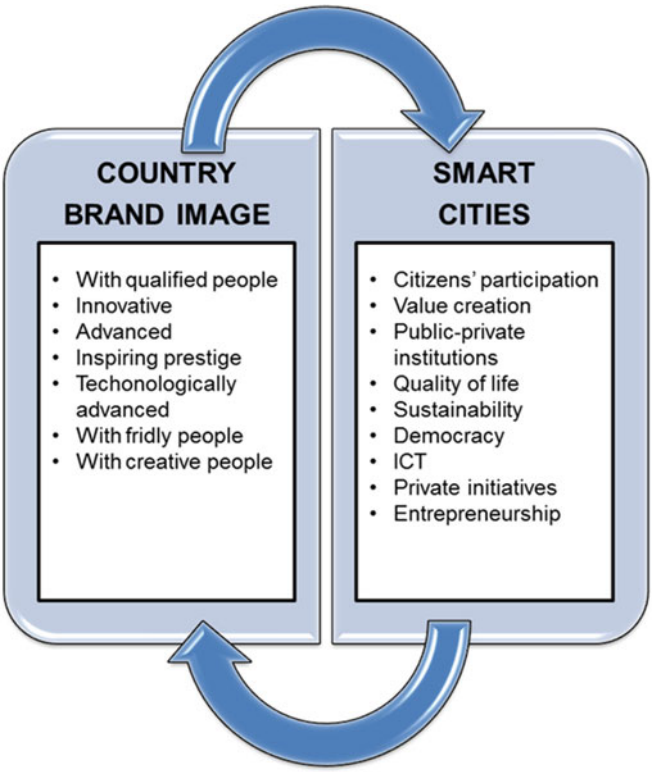

Fig. 13.1 Relationship between country brand image and smart cities. *Source*: Own elaboration

Factors such as innovation, prestige, technological progress, creativity, qualifications of people, or the friendliness of citizens influence the brand image of the country (Chaudhuri & Holbrook, 2001; Delgado-Ballester, Munuera-Aleman, & Yague-Guillen, 2003; Lehman, Lane Keller, & Farley, 2008). The politicians should influence how to improve the valuations of these factors to improve their country brand. At this point, the implementation of policies of smart cities is a good strategy (Fig. 13.1).

As indicated by Cubillo, Sánchez, and Cerviño (2006) the country's image and the image of the city interact reciprocally in the mind of the stakeholder as part of a construct. These images are mutually reinforcing and, therefore, a virtuous circle is established between the country's image, the image of the city and its effect on the perceived quality of products and services, the purchase intent, the intent to visit, and the investment in a territory. This field of territorial synergies in terms of perception, attitude, and intention justifies the alignment of objectives between the territories and their respective governments. This will result in a common, organized, and coordinated strategic.

But, what is a smart city? Smart city is a new concept in the academic literature and in the mindset of politicians (Chourabi, Mellouli, & Bouslama, 2009; 2012). This concept refers to the growth market considering the sustainability and information technology and communication in cities. The cities can offer innovative products and services as well as an opportunity to improve the welfare of citizens and the industrial development of the city. It is necessary that in the cities there are great urban services to satisfy a high quality of life of its inhabitants. For this, the public institutions have to consider strategic of smart cities.

The great objective of smart city is to provide a supposed "intelligence" to the city in order to obtain a more efficient management of infrastructure and services. The politicians have the right environments to develop strategies to promote innovation and entrepreneurship (PNR, 2015). The smart city is formed by different factors. First, the use of network structures to improve economic and political efficiency that allows the social development: In this case, the public institutions should provide new and better services (Caraglui et al. 2009). Second, the citizens are a key of political system. Third, the social and environmental sustainability is a strategic element of the smart city which is a balance between the environment and natural resources. And finally, information technology and communication is a support and tool that facilitates the provision in a smarter way.

13.3 Sample and Methodology

The research is a part of project "Mesias: Intelligence of Brand Spain" that is developed by ESIC Business and Marketing School (Madrid, Spain) and the Department of State (Spain). The empirical research data have been provided by online surveys to 1,204 Spanish export companies in March 2014 (Table 13.1). The sample was diversified by region and sector. The response rate was higher than 70 %. The sampling for convenience was achieved by the collaboration with ICEX España Exportación e Inversiones, Foro de Marcas Renombradas Españolas, and Cámara de Comercio de Valencia.

This sample is made of a mix of companies (Table 13.2) that are representative of exportation business. The 43 % are small caps and the 23 % are micro companies. Their international presence is between 6 and 15 countries by 34 %.

Table 13.1 Technical specifications

Universe	Exportation business
Sample unit	Executive management
Geographic area	Spain
Data collection method	Online questionnaire
Sampling	Convenience
Number of surveys	1204
Information collection period	March 2014

Table 13.2 Characteristics of sample

Company size		International presence	
Employees	*Percentage*	*Number of countries*	*Percentage*
11–50	43 %	>25	25 %
50–250	24 %	16–25	13 %
>250	10 %	6–15	34 %
0–10	23 %	0–5	28 %
Total	*100 %*	*Total*	*100 %*
Foreign turnover		Company positions	
Turnover	*Percentage*	*Positions*	*Percentage*
>50 %	41 %	Specialists	8 %
0–15 %	22 %	Assistants	31 %
15–35 %	22 %	Executives	61 %
36–50 %	16 %		
Total	*100 %*	*Total*	*100 %*

Table 13.3 Items of country brand image

Items	Value
With qualified people	64.2
Innovative	46.4
Advanced	51.6
Inspiring prestige	49.8
Technologically advanced	45.5
With friendly people	73.7
With creative people	68.6

The measurement of country image is based on researches of Chaudhuri and Holbrook (2001), Delgado et al. (2003), Lehman et al. (2008), Papadopoulos and Heslop (2003), and Yasin, Noor, and Mohamad (2007), and the theoretical support of smart cities is based on Glaeser and Berry (2006), Erkkila (2014), Vanolo (2014), and Winters (2011).

13.4 Results

It asked the companies that rated in an scale of 0–5 items the country brand image and proceeded to transform them into percentages (Table 13.3). The results show that Spain is perceived as a country with friendly (73.7 %), creative (68.6 %), and skilled people (64.2 %). These data reinforce the fact that one of the best assets available to Spain is its human capital. By contrast, the worst rated aspects are those related to the image of an innovative country (46.4 %) and technologically advanced country (45.5 %).

Table 13.4 Groups of attributes associated with the image of Spain

Groups	Items	Percentage (number of companies)	Value
A	With friendly people With creative people With qualified people	77 % 65 % 58 %	High value
B	Advanced Inspiring prestige	33 % 30 %	Medium value
C	Innovative Technologically advanced	28 % 26 %	Low value

The human capital endowment of Spain is very good; it constitutes one of the greatest assets of the country and one of the main pillars on which to base the development of the prestige and reputation of Spain. Instead, the attributes of "innovative" and "technologically advanced" are presented as developing areas. Hence, it is necessary to reinforce the presence of these attributes in the international perception that stakeholders have of Spain. Likewise, the former should reinforce the idea that Spain is an advanced country.

Following, Table 13.4 shows the answers by groups of attributes associated with the image of Spain. The percentages show that the ranking of the items valued by the companies are grouped in dimensions or groups. First, the Group A, which consists of the most valued attributes, is friendly people, creative people, and qualified people. Those attributes refer to human capital. Second, the Group B, which obtains values below 50 %, consists of advanced and inspiring prestige. And finally, thirdly, the Group C consists of the least valued attributes: innovative and technologically advanced.

13.5 Discussion, Conclusion, and Implications

The results of this research establish that the implementation of the objectives of smart cities is very relevant to improve and reinforce the country brand image of Spain. The adaptation of the cities to the demands of the smart cities not only promotes sustainable growth, adaptation to information technology, or the involvement of citizens in the political sphere, but also helps to improve the image of cities, regions, and even countries.

The relationship between country brand image and smart cities has been demonstrated. The country brand stimulates export, investment, economic growth, and political and social development. A positive country brand image has a direct measurable impact on the country and an impact on the urban stakeholders (Dinnie, 2008). In the country brand aspects of innovation, progress and human capital technologic have a direct impact. Therefore, the implementation of strategies for smart cities, such as the application of information technology, can have a positive influence on the country brand image.

This chapter concludes that the image of Spain is experiencing a dynamic and positive development. The country brand index, which can take values from 0 to 100, has grown from 53.2 in 2013 to 54 in 2014. Also, in 2015 the index, predictably, will take a value of 49.2. Spain is perceived as a country with friendly, creative, and qualified people. This perception reinforces that one of Spain's best assets is its human capital. However, Spain is perceived as a country which should develop and reinforce its reputation. Spain should reinforce aspects related to innovation and technology. In line with the former, the implementation of smart cities is the proper strategy.

The attributes of country brand can be grouped into three groups (high value, medium value, and low value). Spain takes high values for the Spaniards themselves (friendly people, creative people, and qualified people), medium values for aspects of reputation (advanced and inspiring prestige), and low values for aspects related to the development of the country's technologic aspect (innovative and technologically advanced).

On the one hand, this research validates the relationship between the image of country and the image of the city. This research validates the scale to measure the country brand image in a representative sample. These results are not purely theoretical profile; it will be taken into account in the development of policies developed by the Spanish politicians, public institutions, export companies, and the citizens.

This research establishes the importance of including aspects of smart cities in research about country brand. Therefore, they should be considered globally (foreign affairs) and locally (municipalities). It is essential to coordinate the different levels of government to achieve common goals.

On the other hand, this study establishes the positive and negative aspects perceived by companies on the image of Spain, and concludes that key objectives of the smart cities are one weak point to improve this country. In this case, the objectives of smart cities related to innovation, technological advances, business involvement in the public sphere, or sustainable management of countries and cities can improve the country brand.

Finally, it is necessary to validate these findings with the global citizens and to analyze the relationship of the country brand image with other variables such as reputation, trust, or commitment. These new variables may also establish the necessary implementation of the objectives of smart cities.

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Chapter 14
Living in a Smart City Affects the Value of a Dwelling?

Josep María Raya, Pablo García Estévez, Camilo Prado-Román, and José Torres Pruñonosa

Abstract From 1998 to 2007, Spain has experienced one of the most important housing booms among developed economies. In this line and against the background of economic and technological changes caused by the globalization and the integration process, the cities face the challenge of combining competitiveness and sustainable urban development simultaneously. Smart cities are those that have a system of innovation and networking to give cities a model for improving economic and political efficiency by allowing the social, cultural, and urban development. The aim of this chapter is double: first, to know if the physical characteristics and location of a dwelling affect the selling price of the same, and second, to know if living in a smart city affects the value of a dwelling, and if the buyer is willing to pay more for a dwelling if it is located in a smart city.

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14.1 Introduction

From 1998 to 2007, Spain has experienced one of the most important housing booms among developed economies. This housing boom was one of the main engines for economic growth in Spain. During that period, more dwellings were built in Spain than in Germany, France, and Italy put together.

For instance, according to the official statistics of the Departamento de Obras Públicas (Department of Public Works) 860,000 dwellings were started in 2006. The average number of conceded mortgages was more than 1.1 million per year. These amounts are quite remarkable if we consider that in Spain the annual average number of households in that period was 15.5 million. A higher competitive pressure implied that managers of financial institutions could only increase profits drastically by originating a large number of new mortgages. Both the softening of the credit standards and the extreme dependence on the housing industry led to the financial and economic crisis hitting Spain more harshly than in other countries.

In this line and against the background of economic and technological changes caused by the globalization and the integration process, the cities face the challenge of combining competitiveness and sustainable urban development simultaneously. This challenge is likely to have an impact on issues of urban quality such as housing, economy, culture, social, and environmental conditions.

Smart cities are those that have a system of innovation and networking to give cities a model for improving economic and political efficiency by allowing the social, cultural, and urban development. To support this growth a bet is made by the creative industries and high technology to the urban growth based on the momentum of capacities and networks articulated all through participatory strategic plans to improve the innovation system local (RECI). A smart city is a city well performing in six key fields of urban development: smart economy, smart mobility, smart governance, smart environment, smart people, and smart living (Giffinger, Kramar, Haindlmaier, & Strohmayer, 2015).

Smart cities should promote the automatic and efficient management of urban infrastructure and services and reducing public spending and improving the quality of services, thereby achieving attractive economic activity. The goal of building a smart city is to improve the quality of life by using technology to improve the efficiency of services and meet residents' needs.

Innovation and knowledge, supported by the information and communications technology (ICT), are the keys on which to base the progress of cities in the coming years, making life easier for citizens, achieving a society more cohesive and supportive, creating and attracting human talent, and creating a new economic fabric of high added value. The cooperation of the public and private sectors, social collaboration without exclusions, and development work on the network are key elements that develop among all an innovative space that fosters talent, opportunities, and quality of life in the environment urban.

The aim of this chapter is double: first, to know if the physical characteristics and location of a dwelling affect the selling price of the same and second, to know if living in a smart city affects the value of a dwelling, that is, if the buyer is willing to pay more for a dwelling if it is located in a smart city.

The chapter is structured as follows: Sect. 2 provides the database used and the variables analyzed. The methodology that has been used is analyzed in Sect. 3. Thereafter, the performance results of the model created are shown and discussed in Sect. 5. Finally, Sect. 6 ends with conclusions and a proposal for further research.

14.2 Sample

We use a dataset from a real estate company belonging to a bank which has 3.40 % of the total housing stock of the financial institutions. Data ranges from 26/01/2010 to 07/03/2013 and belongs to the Catalonia region. 2,735 observations were provided. Data contains information about housing characteristics (surface, bathrooms, floor, the fact of having a pool at the building, the condition of the new house and location) and the transaction (selling price, the fact that the dwelling has received a previous offer and the appraisal company). We have added a dummy variable which takes a value 1 if the city is in the Spanish Smart Cities Network (which is the case for Barcelona, L'Hospitalet de Llobregat, Sabadell, Sant Cugat del Vallés, and Tarragona). Table 14.1 depicts the descriptive statistics.

The Spanish Smart Cities Network (RECI) began to take shape in June 2011 with the signing of the "Manifest for Smart Cities. Innovation for progress," whose commitment was to create an open network to promote economic, social, and entrepreneurial progress of cities through innovation and knowledge, relying on information and communications technology. The network was formally constituted in June 2012 in Valladolid. Its aim is to exchange experiences and work together to develop a sustainable management model and improve the quality of life of citizens, focusing on aspects such as energy saving, sustainable mobility, eGovernment, attention to people, or security.

Currently, RECI consists of 65 cities: A Coruña, Albacete, Alcalá de Henares, Alcobendas, Alcorcón, Alicante, Almería, Alzira, Aranjuez, Arganda del Rey, Ávila, Badajoz, Barcelona, Burgos, Cáceres, Castellón, Ciudad Real, Córdoba,

Table 14.1 Descriptive statistics

Characteristic	Mean	Std dev
Selling price	149,118.9	90.872
Surface	85.85	30.70
Number of rooms	2.51	0.19
Number of bathrooms	1.44	0.58
Pool	0.04	0.18
New house	0.53	0.01
Floor	2.23	2.07
Offer	0.48	0.50
Smart	0.28	0.45

Guadalajara, El Puerto de Santa María, Elche, Fuengirola, Getafe, Gijón, Jaén, L'Hospitalet de Llobregat, Huelva, Las Palmas de Gran Canaria, Logroño, Lugo, Huesca, Madrid, Majadahonda, Málaga, Marbella, Mérida, Molina de Segura, Móstoles, Motril, Murcia, Oviedo, Palencia, Palma de Mallorca, Pamplona, Paterna, Ponferrada, Pozuelo de Alarcón, Rivas Vaciamadrid, Sabadell, Salamanca, San Cristóbal de La Laguna, Sant Cugat, Santa Cruz de Tenerife, Santander, Santiago de Compostela, Segovia, Sevilla, Tarragona, Toledo, Torrejón de Ardoz, Torrent, Valencia, Valladolid, and Vitoria-Gasteiz y Zaragoza.

14.3 Methodology

To value a housing, a widely used approach to deal with its heterogeneity, in terms of quality, is hedonic analysis. The hedonic analysis is used to relate the price of a heterogeneous asset with the differentiating features that this presents. This method attempts to identify all the attributes of an asset that define its price, and also tries to give a quantitative value to each of them. Currently the method is widely used in housing markets and labor markets.

The economic literature on hedonic prices arose in the context of the car market. This was the framework for the classical work by Griliches (1971), who popularized these models. Once the technique had been popularized in the 1950s (Tinbergen, 1951), it took more than a decade to provide it with a theoretical foundation. This was provided by Rosen (1974), who shows how marginal prices are determined implicitly for the characteristics of heterogeneous products. The hedonic technique rests on modern consumer choice theory, according to which the consumer derives utility not directly from the good but from its characteristics. See Lancaster (1966).

Good examples of hedonic studies of the housing market include the following: Bartik (1987), Bin (2006), Bover and Velilla (2002), Garcia and Raya (2011), Mendelsohn and 4 (1984), Mills and Simenauer (1996), and Palmquist (1984). In this chapter, the functional pattern used is the semilog.

14.4 Results

Hedonic price model for the full sample has been estimated (first column of Table 14.2). The functional pattern used is the semilog, one of the most used in the literature. The R-squared shows that the characteristics and location account for more than 60 % of the variability of the sales price of the home.

Our model is controlled by zip code, the year of assessment, and Real State Assessment Company. The results show the expected behavior for the physical characteristics of dwelling. Each additional square meter increases the price per square meter in a 0.754 %, while each bathroom does in 13.7 % and each upper floor where is located the floor increases its value by 1.1 %. Also, if the dwelling is new, its value increased by 32.5 %, while if the building has a pool makes 19.4 %. Finally,

Table 14.2 Estimation results. Dependent variable: selling price (in logs)

	(1)	(2)
	Whole sample	New dwelling
Surface	0.00754***	0.00844***
New home	0.325***	–
Bathrooms	0.137***	0.0631***
Pool	0.194***	0.205***
Floor	0.0112**	0.0149***
Smart city	0.0457	0.186**
Offer	–0.168***	–0.186***
Intercept	10.46***	10.53***
Appraisal company	Yes	Yes
Postal code	Yes	Yes
Appraisal year	Yes	Yes
N	2,735	1,445
r2	0.629	0.707
aic	2064.9	765.4

if the property has received any offers, its selling price has decreased by 16.8 % showing that the properties most traded suffer further erosion in its final price.

As for our variable of interest, if the city is a smart city, it has no significant effect on the price of dwelling. Although the coefficient shows a value of 4.57 %, this effect is not statistically significant at 5 % (it is only 10 % significance level). In the second column of Table 14.2 it has replicated the same model but solely for the subsample of new dwelling. The results of hedonic coefficients are very similar to those observed in the whole sample (excluding the effect of an additional bathroom which is reduced to slightly less than half). However, the most interesting change is that the coefficient of the dummy smart city value increases and is statistically significant. So, living in a smart city increases by 18.6 % the value of the dwelling, if it is new. It is likely that this effect is associated with age and educational level of the buyer, being a hypothesis to test whether differential effect on new dwelling compared to that used is because of the buyer profile of new dwelling, usually somebody relatively young, and with higher level studies.

14.5 Conclusions

In the chapter hedonic pricing model using the functional pattern of the semilog has been estimated. An R-squared of 60 % has been obtained, which shows that the characteristics and location account for more than 60 % of the variability of the sales price of the dwelling.

There are two main conclusions related to the physical characteristics of the property, and those related to living in a smart city. Regarding the physical characteristics of housing the conclusions are expected. Each additional square meter

increases the price per square meter, each bathroom increases the price per square meter, and each upper floor and its location increase its value. There are also differences if dwelling is newly created or not. If the dwelling is new, its value increases, and if the building has a pool it also increases its value. Finally, if the property has received any offer for purchase, its selling price will decline, showing that the most traded property suffers further erosion in its final price.

About living in a smart city, here we have found an important relationship. Smart living in a city increases the value of dwelling. This relationship can only be found in new dwelling. This can be explained because it is likely that this effect is associated with age and educational level of the buyer. This would be a hypothesis to be tested in the future, if such differential effect on new dwelling compared to that used is because of the buyer profile of new dwelling, which is usually someone relatively young with a level of relatively higher studies. What we can conclude is that living in a smart city increases the value of new dwelling.

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Chapter 15
Smart City and Tourism: An Analysis of Development of Caceres (Spain) as a Smart City

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Abstract Smart city is a new model of a city based on the use of information and communications technologies (the ICT) with the aim to improve its economic, social and environmental sustainability. The aim of this study is to analyze the development of Caceres as a smart city, this being one of the first incorporations to the Spanish Net of Smart Cities, and to compare Caceres as a smart city with those five cities that, according to the report published by the International Data Corporation (IDC), have been the first smart cities in the ranking of the smart cities in Spain since 2012: Barcelona, Santander, Madrid, Malaga and Bilbao. This analysis can let us find out strong and weak points of Caceres as a smart city. The methodology of this study is based on a descriptive analysis of initiatives that have been carried out in each of these cities based on eight factors used for an elaboration of the International Data Corporation ranking. The analysis exposes that Caceres, despite standing out due to its project of Jetty Building or Smart Water Caceres, still shows several weak points in other areas, as smart mobility, smart services or smart information and communications technologies. A SWOT analysis has been done to

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end the study; it shows the main strengths, weaknesses, opportunities and threats that have helped us to carry out a number of suggestions and recommendations that can help Caceres to progress as a smart city.

15.1 Introduction

A smart city concept appeared more than 20 years ago with the aim to find answers for a number of difficulties or problems that were published in reports by the United Nations (UN), the European Union (EU) and the World Bank (WB) that could be summarized as "an increase of the number of residents and their concentration in urban areas" (Dirks, Keeling, & Dencik, 2009; Dirks, Gurdgiev, & Keeling, 2010). The United Nations (UN, 2012) indicates that currently more than a half of the world inhabitants live in urban areas, and in 2015 a 70 % of the world inhabitants lived in cities; this concentration is explained by the inhabitants' need to access to a more developed social and economic environment.

This way, the cities offer more work opportunities and a high number of services and resources. However, this increasing the number of residents in urban areas will create several problems of management of services and infrastructures that will mean difficulties with social organization and management of the area, and at the same time it will cause a higher deterioration of the environment. In this context, smart cities appear in the areas where their managers look for satisfaction of the need of their citizens and for a way to offer them a higher life quality through an efficient way of usage of the resources (Caraglui, Del Bo, & Nijkamp, 2009; Jessop & Sum, 2000; Maier, 2000) and a participatory government (Nam & Pardo, 2011), offering wide efficient services of high quality, but always trying to guarantee sustainable development (IDAE 2012), taking advantage of technological progress (Caraglui et al., 2009) that is of information and communications technologies.

The European Union indicates that smart cities are those ones where nets and traditional services are provided in the most efficient way, due to the use of the ICT for their residents and enterprises' profit (UN, 2013). However, according to other definitions (Caraglui et al., 2009; Nam & Pardo, 2011), a concept of a smart city has to go beyond a simple use of the ICT. The definition of smart cities made by Telefonica Foundation (2011) or Kanter and Litow (2009) says that cities use the ICT to provide more interactive, efficient and appropriate public services as per the citizens' needs, so it includes services of smart nets of urban transport, water supply, rubbish collection, lighting, improvement of public areas and more interactive and transparent with the citizens' management (UE, 2013). Chourabi et al. (2012: 2289) say: "One way to conceptualize a smart city is as an icon of a sustainable and livable city."

In Spain smart cities, development can be situated in the last decade; in June of 2012 Spanish Net of Smart Cities (RECI) appeared. Its aim was "to exchange experiences and to co-work to achieve a model of sustainable management and to

improve the quality of life of the residents, taking in account some factors as energy conservation, sustainable mobility, e-management, customer service or security" (RECI, 2015). Currently, 65 Spanish cities belong to this net, and according to the IESE Cities in Motion Index 2015 by the IESE Business School (Berrone & Enric, 2015) that creates a smart cities' ranking on a worldwide level (it evaluates 148 cities in 57 countries and offers an approximate analysis of their strong and weak points), only seven Spanish cities, Barcelona, Madrid, Valencia, A Coruña, Bilbao, Seville and Malaga, are among the 80 best smart cities.

Taking into account everything said before, the aim of this study is to analyze a case of Caceres, as a city that belongs to the Spanish Net of Smart Cities (RECI), and to analyze its strong and weak points in comparison with the best Spanish smart cities.

To achieve this aim, we have structured this chapter in four parts. First of all, a smart city concept and its relation with tourism will be explained in the part of the theoretical framework; then the methodology of this study is exposed. In the third part a comparison between Caceres and the best Spanish smart cities is made, and finally, the conclusions are drawn up, where recommendations and more relevant conclusions are exposed.

15.2 Theoretical Background

15.2.1 Contextualization of a Smart City Concept

A smart city concept has experienced some modifications since its creation; it has been changed basing on the number of areas of urban environments that form a smart city. Initially, energy was a fundamental element of the smart cities, and little by little the concept has been becoming more complex and wide, including sometimes a usage of the ICT by the government of a city or for providing public services (AMETIC, 2012)[1].

There are many interpretations of this concept (Mosannenzadeh & Vettorato, 2014), and none of them is better than the other one, but each of them can be applied to one or several areas of different studies, either economic, social, environmental, technological, etc., and these interpretations highlight the role of human capital, education on urban development or the ICT (Batty et al., 2012; Caraglui et al., 2009; Giffinger et al., 2007; Hall, 2000; Harrison et al., 2010; Nam & Pardo, 2011; Pohl & Pohl, 2013; Toppeta, 2010; Washburn et al., 2010). This concept is still under development; it has to be defined and conceptualized (Hollands, 2008). This study made in Spain is focused on two definitions, provided by Achaerandio, Curto, Bigliani, and Gallotti (2012) and Spanish Net of Smart Cities-RECI (2015).

[1] Association of enterprises of electronics, and technologies of information, telecommunication, and digital contents.

> "A finite unit of a local entity that makes an conscious effort to count on an integral approach to apply the technologies of information and communication to make an analysis in real time with the aim to change its modus operandi in one ore several areas: generation, supply and usage of energy, environment, government, mobility and construction. The last goal is to improve the quality of life of city residents, guaranteeing this way a sustainable economic development" (Achaerandio et al., 2012:1).

> "Smart cities are those that have a system of innovation and networking to provide the cities with a model of improvement of economic and political efficiency, allowing this way social, cultural and urban development. As a basis for this increasing, creative industries and high technologies are supported; they allow this urban development based on the impetus of abilities and nets, managed both of them through strategic participatory plans that allow to improve the system of local innovation" (Spanish Net of Smart Cities-RECI, 2015).

Summarizing, a smart city is the one that uses the technologies of information and communication (ICT) to achieve efficient management of all the spheres of a city, and at the same time to satisfy the needs of cities and their residents, guaranteeing them sustainable development, and as a consequence being responsible with the environment (Enerlis, Young, & Madrid Network, 2012).

There is not any universal consensus about indispensable dimensions or elements that are really needed to analyze a level of smartness of cities. A White Book of Smart Cities (Enerlis et al., 2012) says that a smart city is formed by a number of essential elements, as urban area, system of infrastructures (good enough to deal with residents' needs), a complex system of smart nets and platforms, and residents that act as a key element. In this sense, we cannot forget that smart cities appeared with the aim to manage a city functioning and to provide a higher level of life quality to their residents.

According to the definition by the Expert Committee of Normalization 178 by Aenor of the smart cities (www.aenor.es), there are four vectors that define the smart cities: the ICT, efficiency, integration of critical infrastructures of a city (energy, telecommunications, water supply, transport, rubbish management, security and health service) and sustainable development. The Telefonica Foundation (2011:21–48) says that the main elements of a smart city are the following:

- Urban mobility: Sustainability, security and efficiency of infrastructures and transport, and local, national and international accessibility. It includes traffic management in real time, the one of public transport, of parkings, use of bicycles, paid roads, etc.
- Energy efficiency and environmental management: It means sustainability and improvement of resources. It includes smart energy grid (this concept offers a bidirectional diagram of communication to adjust production with real consumption, and to improve this way distribution and to reduce expenses), smart metering (this concept makes reference to smart meter boxes that help to observe consumption in real time), garbage collection, parks and public garden management and measuring of environmental parameters.
- Management of infrastructures and public buildings: It means technology application to improve management of buildings and other infrastructures that form

the cities and include some services as management of public buildings, management of public infrastructures and urban equipment and reporting of urban incidents by the residents.
- Government and citizenship: These terms make reference to the services that are related to the government of a city and its relationship with the residents as for transparency and their participation in decision making. E-Administration, e-Participation, Open Government and Open Data and analytical applications are applied to achieve the objective.
- Public security: Management of public security makes reference to an effort necessary to coordinate several resources and agents through a management of public services of emergency and civil protection, video surveillance and security of residence and fire prevention and detection.
- Health: In this context, a health concept makes reference to the application of technologies to contain the costs of health care and to contribute to keep the desired levels of quality of services. Telemonitoring and telemedicine, teleassistance, social services and public health care are applied to achieve the objective.
- Education, human capital and culture: These three terms make reference to the use of technologies to create, build and sustain public educational centres, and to take part in their management and to control the compliance with obligatory schooling (e-learning and telework, e-tourism and service of cultural information).
- E-commerce: Electronic commerce eases a platform that provides a service of payment of multiple services (payment platforms).

One of the most relevant studies on areas of influence of the smart cities, carried out by Giffinger et al. (2007:12), makes reference to six features that smart cities must have to be a real smart city: smart economy, smart people, smart governance, smart mobility, smart environment and smart living. These six dimensions are used as an efficient tool to detect strengths and weaknesses, and to improve competitiveness of a city through a number of strategic efforts (Giffinger & Gudrun, 2010). These dimensions are defined by a number of factors that are shown in Table 15.1.

The report made by the research platform IESE Cities in Motion Strategies (IESE Business School) in 2015 (Berrone & Enric, 2015) contains a ranking of the smartest cities of the world (148 cities in 5 continents are considered); it takes into account ten dimensions that are used to evaluate the level of smartness of the cities (Table 15.2).

An Oslo manual by the OCDE and EUROSTAT (OECD & EUROSTAT, 2005) that emphasizes the role of innovation in ICT provides a number of tools for identification of indicators, providing a work framework for the researchers on urban innovation. A study carried out by the Centre of Regional Science Vienna University of Technology (2012) identifies six dimensions: a smart economy, smart mobility, a smart environment, smart people, smart living and, finally, smart governance. "The axes are based respectively—on theories of regional competitiveness, transport and ICT economics, natural resources, human and social capital, quality of life, and

Table 15.1 Features of a smart city

Feature	Factors
Smart economy (competitiveness)	Innovative spirit, enterprising spirit, economic image and brands, productivity, flexibility of labour market, international support, ability for renovation
Smart people (social and human capital)	Level of qualification, ability for constant learning, social and ethnical plurality, flexibility, creativeness, cosmopolitanism/lack of prejudice, participation in public life
Smart governance (participation)	Participation in decision-making, public social services, transparent government, perspectives and political strategies
Smart mobility (transport and ICT)	Local accessibility, national and international accessibility, availability of infrastructures and ICT, systems of sustainable, innovative and secure transport
Smart environment (natural resources)	Favourable natural conditions, pollution, environmental protection, sustainable management of resources
Smart living (life quality)	Cultural facilities, health conditions, individual security, housing quality, educational facilities, attractive tourism, social connection

Source: Giffinger et al. (2007:12)

Table 15.2 Ten dimensions to be evaluated in smart cities

Dimension	Concept
Governance	"*Dimension related to a level of participation and collaboration of residents*"
Public management	"*It refers to efficiency and searching of innovation by the Administration*"
Urban planning	"*A sustainable*, *accessible and scalable urban design*"
Technology	"*It impacts on quality and sustainability of employment and offers competitive advantages*"
Environment	"*Environmental sustainability*, *alternative energies and efficient management of water*"
International protection	"*It happens because the brand of a city is being improved through strategic plans of tourism*, *attraction of foreign investments and its representation abroad*"
Social connection	"*Inequality and immigration*, *cares of elderly persons*, *efficiency of health care system*, *residents security*"
Mobility and transport	"*Good connectivity and easy access to many public transport services*"
Human capital	"*To attract and contain talents*, *to creates plans of improvement of education and to encourage creativeness of a research*"
Economy	"*Promotion of local economy*, *strategical industrial projects and innovation*"

Source: SEGITUR (2015:29)

participation of societies in cities" (Caraglui et al., 2009). Chourabi et al. (2012) in their study offer eight clusters of factors that include (1) management and organization, (2) technology, (3) governance, (4) policy, (5) people and communities, (6) the economy, (7) built infrastructure and (8) the natural environment.

15.2.2 Smart City and Tourism

Nowadays the importance of tourism is easily seen analyzing some data; it is the fourth exporting industry in the world, and a 9 % of the world GDP, a 6 % of the world export and a 30 % of the service exports are generated by tourism. Moreover, it increased during last decades, and it became one of the industries with the highest speed of growing (Blanco Herranz, 2015). Rifai in White Book of Smart Tourist Destinations (Blanco Herranz, 2015:31) says that "despite the crisis, tourism is going ahead faster than world economy".

In Spain it does not only plays an essential role in the country's economy, but also generates about 11 % of the GDP and 12 % of employment, and 2.2 million people worked in tourism in 2014. At the same time tourism is a transverse industry that means that it acts as a positive impulsion for other industries, as commerce or food industry (SEGITTUR, 2015).

However, Spanish tourist industry must go on spreading and diversifying, and must go on innovating to become a distinguishing one. This way, an initiative by the Ministry of Industry, Energy and Tourism appeared, wanting to create smart tourist destinations in 2012, transforming a Spanish touristic model into a new model supported by the concepts of innovation, technology, sustainability and accessibility (SEGITTUR, 2015) with the aim to find more efficient and sustainable tourist management. The main objective of this project of the smart tourist destinations is "to improve positioning of Spain as an international tourist destination, so it is mandatory to find new tools that could impulse innovation in designated areas, that would develop the ICT, and that would improve accessibility and sustainability, so distinguishing and highly competitive services could be created" SEGITUR (2015:34).

As it has been already mentioned, the appearance of the smart cities created the appearance of the so-called smart tourist destinations that means an adaptation to a new digital economy where the ICT plays an essential role, allowing to improve a competitive profile of a destination (Caragliu, Del Bo, & Nijkamp, 2011). However, there is no any exact definition of the term "smart tourist destination" (STD) because there are no any experiences or studies that could be considered effective (Blanco Herranz, 2015). It is a very wide term, open to several possible interpretations, although it is oriented to be transformed in a smart city concept, because currently it is very difficult to find a smart city that does not have any tourist activity.

Table 15.3 Features of smart tourist destinations and their difference with a smart city

Smart tourist destinations	
Features	Differences between a smart tourist destination and a smart city
An innovative tourist space Avant-garde technology Sustainable development Efficient management of resources Competitiveness of tourist industry Quality of tourist experience Interaction and integration Accessibility	A smart tourist destination is encouraged by the tourist industry, both public and private. A tourist and not a citizen is an objective audience; however, the citizens will also obtain the benefits. Geographic boundaries can be the same as those of a municipality or not (examples: Costa del Sol, Camino de Santiago) Interaction goes beyond a stay in a city. In smart tourist destinations it begins before a visitor comes to his or her destination, and goes on after he or she leaves. Smart destinations are bound to the increasing of its competitiveness and to the improvement of a tourist's experience. Smart cities are oriented to improve their governability and to increase quality of life of their residents.

Source: Own elaboration based on SEGITTUR (2013)

López and Gracía (2015: 61) carried out the following definition of the STD: "an innovative area based on a territory and an avant-garde technologic infrastructure. A territory committed with environmental, cultural and socioeconomic factors of its habitat, equipped with a system of intelligence that could get information in a legal way, that could analyze it and understand the events in real time with the aim to facilitate an interaction between a visitor and the environment, and a decision-making of the managers of the destination, increasing its efficiency and improving quality of tourist experiences". The main features of these destinations and their differences in relation to a city can be seen in Table 15.3.

Speaking about a STD, smart tourism is also mentioned. It is a quite new concept, and digital means are becoming highly important in the area of leisure and free time, and little by little tourists are more aware of the advantages of use of the information and communication technologies in relationship with tourist destinations. Nowadays, it is usual to use social nets, mobile apps or other technologic tools to explore, search or choose a tourist destination.

15.3 Methodology

Descriptive methodology was used to carry out this analysis. An analysis of Caceres as a smart city has been carried out (tourist destination) with the aim to observe how a smart city concept can work; to achieve it, the city was compared with the top five cities of the Ranking of Spanish Smart Cities done by International Data Corporation (IDC) (Achaerandio et al., 2012): Barcelona (chosen due to its efficient mobility), Santander (due to its mobility and environment management), Madrid (due to the smartness of emergency services), Malaga (due to the criteria of eco efficiency) and Bilbao (due to the smart character of its services and its mobility system). This ranking

has been elaborated by International Data Corporation (the last report was done in 2012), and it has in mind the most important Spanish cities.

The report done for this report elaboration is based on eight factors; the first five ones refer to smart dimensions (smart government, smart buildings, smart mobility, smart energy and environment, smart services), and the last three ones are facilitative forces (persons, economy, information and communications technologies) (Achaerandio et al., 2012). There are indicators for each of these factors, 94 in particular, to evaluate the cities and to be able to establish a ranking of smart cities.

In our study, the initiatives that have been carried out in each of these Spanish five cities that belong to the top five cities of the ranking are collected, specifying the eight factors that the ranking takes into account to classify the smart cities.

15.4 Comparison Between Caceres and the Top Spanish Smart Cities

Each city has its strengths and weaknesses in different areas, as the environment, entrepreneurship, public security, etc., and each of them has its own plan to become a smart city; however, these models and experiences can be useful for improvement and development of new projects.

In our study the initiatives that have been carried out in each of these Spanish five cities that belong to the top five cities of the ranking are collected, specifying the eight factors that the ranking takes into account to classify the smart cities: smart government, smart buildings, smart mobility, smart energy and environment, smart services, persons, economy and information and communications technologies.

15.4.1 Initiatives of Caceres as a Smart City

Caceres has been Heritage of Humanity since 1986; nowadays it has 96,712 inhabitants; it became part of the net of smart cities on 27th June of 2012 according to the Minute of the Foundation of an Association Spanish Net of Smart Cities (RECI). The main objective of Caceres as a smart city is to use the tools, as wifi, fibre optic, communications, etc. to give integral solutions for smart management of urban services and infrastructures (RECI, 2015).

Although in economic terms Caceres does not have the same possibilities for investment in projects as big cities have, Caceres has carried out some special initiatives, and it stands out due to its effort to be better as a smart city, and to be at the height of its competitors (Table 15.4).

Rehabilitation and restructuring of the jetty building: This building used to be a mining industrial unit of Aldea Moret, and now it is a building used for public services and as a centre of knowledge and innovation. This rehabilitation meant elimi-

Table 15.4 Initiatives of Caceres

Area	Initiative
Infrastructures	• Rehabilitation and restructuring of the Quay Building • Smart lighting • Biometric authenticity
Tourism	• Invigoration of the local hotel industry
Communications	• Mobile apps
Public services	• System of geographic information of Caceres
Environment	• Smart Water Caceres
Research and innovation	• Caceres Innovation • Creative Caceres

Source: Own elaboration

nation of the façades, rehabilitation of arcades and openings, digging of a basement of about four meters deep and urbanization of the area and construction of three buildings, called "a building inside the building". Hydrothermal functioning of the building is based on principles of sustainable architecture (Cáceres Smart City, 23rd September, 2013); Factoría de Innovación).

Smart lighting: The jetty building counts with smart lighting system due to the Project EmbarcaDomo, presented on the 16th July 2013 in the same building. The project consists of a system which monitors a group of sensors of brightness, light levels and users' preferences. This way the behaviour of people who stay in the monitored offices is analyzed, and the lighting system can be adapted to the needs of each user, depending on hour or season. It pretends to achieve energy saving, and as a consequence energy efficiency (Cáceres Smart City, 23rd September, 2013). The software has been developed by students–researchers of the University of Extremadura and by researchers of the Cátedra Telefónica (Pablos Lamas, 2013).

Biometric authenticity: This initiative was born thanks to the local government of Caceres who analyzed the importance of a personalized access to the rooms of the Innovation Factory (located in the Garage 2.02) to protect the content and to allow the access only to persons that are authorized to enter. This act was carried out thanks to a project Fenix, forming part of an Operative Program of Cross-Border Cooperation Spain–Portugal 2007–2013, co-financed by the European Foundation of Regional Development. With this technology (the biometric one) the access to these rooms will be allowed only for persons who could be identified through their own features, as for example iris, voice or signature (Ayuntamiento de Cáceres, 2012; Cáceres Smart City, 23rd September, 2013).

Invigoration of local hotel industry: Caceres stands out thanks to the quality of its gastronomy. That is why it has been decided to create a tool, iTag app, based on the use of the information and communications technologies and developed by ITAG MOBILE Ltd. Using this app, the users, using the QR3 codes, can get to the additional information on hotels and restaurants, as the menus or the hotel description. Moreover, this app can generate employment taking advantage of potential resources of the area. This initiative belongs to the project RED NOVA SOSTENIBLE

co-financed by FEDER within the Operative Program of Cross-Border Cooperation Spain–Portugal 2007–2013 (ITAG MOBILE, 2013; Ayuntamiento de Cáceres, 2013; Cáceres Smart City, 23rd September, 2013).

Mobile Apps: As for the actions that have been carried out in the area of mobile apps, four initiatives can be highlighted:

- App Caceres View: It is a mobile app for smartphones that allows to find tourist attractions using an orthophoto of the city (drugstores, hotels, schools, monuments, routes, etc.). The search of an attraction can be done using a street name, the attraction or a street name and a number; the app allows to download the information in pdf. All the information comes from a database of the System of Geographic Information of Caceres (SIG Cáceres, 2015).
- App Cáceres Histórica: This mobile app allows to know the history of Caceres through pictures. Information for this tool has been collected thanks to the Historic Municipal Archives and the System of Geographic Information of Caceres (SIG Cáceres, 2015).
- App Agenda Caceres: This tool gives information on the events that are organized in the city, specifying place and date. Moreover, through this app all the information can be shared with other contacts or those from social nets, marked as favorite, or an agenda with the most interesting for the user events can be created (Agenda Caceres).
- Abilidade: Unlike three previous apps, this one is not still available, because it is still under development. The aim of this tool is to ease an access to the city's routes for disabled people using a mobile phone. It will be done in three languages: Spanish, English and Portuguese (Cáceres Smart City, 23rd September, 2013).

System of Geographic Information of Caceres (SIG Caceres): This system contains data of a very diverse information. It has several services as mobile Apps, WMS and KMZ for Google Earth. It allows to download files as City Street Guide, TM of Caceres, administrative boundaries, Caceres urban bus, Drugstores of Caceres, Cycle lane of Caceres, Routes in Caceres, Stock routes in Caceres or Vía de la Plata (Silver Way) in Caceres.

Smart Water Cáceres: This initiative forms part of the project SmartWater4Europe, a research being carried out in Europe with 21 entities taking part in it (technologic enterprises, universities, research centres and enterprises of water sector) (Iagua, 2013). This action is carried out by ACCIONA Agua, and it consists on setting up of a system of management of the supplying chain of drinking water, meter box consumption and the state of the net. This project has 4 years' duration, and as a result, it is expected to get environmental benefits, to improve models of management of services of the enterprise and to optimize investment plans according to future needs. We can say that Caceres is a pioneering city incorporating the concept of a "smart city" into water supply (Iagua, 2013).

Caceres innovation: This project is an initiative promoted by the Ministry of Industry, Energy and Tourism through a School of Industrial Organization and the Local Government of Caceres. It is co-financed by the European FEDER funds. Its main objective is to improve competitiveness of the small and medium enterprises

of Caceres through innovation. This project pretends to make enterprises to take the initiative of carrying out some actions that bring to light a need to innovate and improve wealth and employment of the city (Ayuntamiento de Cáceres, 2014; Escuela de Organización Industrial).

Caceres Creativa: The Project "Caceres Creativa" ("Creative Caceres") was born to encourage creativity and innovation both in organizations and enterprises with the aim to have a sustainable city and to set up a basis of a new socioeconomic model that would set the beat of the city during 2010 and 2016 (Ayuntamiento de Cáceres, 2009).

In 2014 an Executive Commission of a Group of Cities that are Humanity Heritage met in Alcala de Henares, a city that is a presidency of the net, with the aim to analyze projects of three work commissions that form part of the association: Culture and Education, Heritage and City, and Representation, Promotion and Tourism. The Commission of Heritage and City worked on a concept "Smart City-Smart Heritage", so the actions addressed to generate innovation and wealth in heritage cities with the support of new technologies and within a context of the smart cities. It is also planned to make a "digital archaeological guide" of 15 cities (Grupo Ciudades Patrimonio de la Humanidad de España, 2013).

All these considerations and efforts have as the main objective improvement of quality of life of the residents, having a sustainable city on the basis of taking a responsible advantage of the city's resources.

Table 15.5 contains a SWOT analysis that allows us to have a better idea of the strengths and weaknesses of Caceres as a smart city.

15.4.2 Initiatives by Top Five Smart Spanish Cities

15.4.2.1 Barcelona (Local Government of Barcelona)

– Smart government: e-Administration, Virtual Office of Resident Service, Web for Procedures, Open Data BCN, Cloud BCN- Open Data Multiple Local Governments.

Table 15.5 SWOT Caceres as a smart city

Weaknesses	Strengths
• Lack of initiatives in the area of smart mobility • Limited actions in the area of public services • Few projects and plans to promote Caceres as a smart city	• Important actions in the Quay Building. • Project Smart Water Caceres • System of geographic information of Caceres
Threats	**Opportunities**
• Good promotion of other smart cities as Barcelona • Initiatives to get e-tourism carried out by competing smart cities. • Quick spreads of the ICT in other smart cities	• To spread information on the use of the ICT • To create projects to improve smart mobility • Creation of a platform smart city Caceres

Source: Own elaboration

- Smart mobility: bicing, a new net of buses, school roads, smart traffic lights, smart parking, micro platforms for goods delivery; "Barcelona a la Butxaca": ApparkB, App&Town.
- Smart energy and environment: Smart lights (general plan of lighting), smart rubbish collection (recycling of urban residues, green points), smart mobility (electric car LIVE), smart water (telecontrol of irrigation, telecontrol of ornamental fountains), energy self-sufficiency (smart grid, net of cold and heat), urban transformation (Plan BUITS, Super-islands), resilience (table on infrastructures and public services).
- Smart services: Health and social services (teleassistance, Rdars, Vincles BCN), education and culture (mSchools, Smart Hort, Infantium, Libraries, Quaderm Cultura, La Ciutat on vull viure), Plan Barcelona a la Butxaca (Mobile ID), smart tourist destination (new tourist products, directional marks, Bus Area, System of Geographic Integration, Touch Screens), smart urban furniture (Smartquesina), urban transformation (Service of information about Works).
- Persons: Participation of residents (Open Government, citizen sensors, cultural centres, Map Barcelona + Sustainable, Calendar 21 and citizen commitment, citizen mailbox).
- Economy: International projects (City Protocol, BESOS, EUNOIA, CitySDK, Commons4EU, DC4Cities, INSIGHT, iCity, Open-DAI, CloudOpting).
- Information and communications technologies: Smart innovation (Barcelona Growth, Smart City Campus, Bit Habitat, Spark Lab), urban platform (CityOS, BCN Cloud, Sentilo), smart innovation (CIC), net of telecommunications (a new net of telecommunication, Plan of antennas, Barcelona WIFI), "Barcelona a la Butxaca" (Barcelona contactless, Apps4BCN, Services in Mobile Phones), net of telecommunications (Display of Smart Infrastructures in public space), Infrastructure and logistics (Industrial Ring).

15.4.2.2 Santander (Santander Smart City Plan Director de Innovación, 2012)

- Smart government: Open Data (Consultancy and Definition of a Strategy, Web of Open Data, Infrastructure Real Time Open Data, Data Modelling and Publishing), centre of demonstrations (Furniture Project, Audiovisual Project, Project of Creation of Images, Project related to Equipment, Operation and Maintenance Service), E-Administration.
- Smart mobility: Urban mobility (demonstration of 3.0. shelters, fleet management, traffic state in real time, mobility apps (Residents Mailbox, Traffic App, Visual Santander, Youth App, Platform of Mobilization of processes)).
- Smart energy and environment: Energy efficiency of a group of schools, energy efficiency of municipal buildings, energy efficiency of public lighting, use of new technologies in rubbish collection.
- Smart services: Digital marketing (citizen information through screens of dynamic screens, citizen information through interactive totems multi-administration), emergencies (optimization of the emergency service, optimization of

the system of warning-automatic voice calls), citizens administration (definition of a model of citizen service, evolution of the platform of a citizen service, campaign for consciousness-raising for an employee and a citizen, continuous education can guarantee quality of a service, viability analysis for implantation of a window for enterprises service).
– Persons: Participation of citizens.
– Economy: Local economy (near-field communications (NFC), E-tourism, dynamization of trading), projects (Smart Santander, Out Smart, Burba Project, Smart Search).
– Information and communications technologies: City Platform/Smart City Platform, Technological Innovation on Services Connected to the City Platform, Open Innovation (start-up of the Programme Entrepreneurs of Santander, Plan of Development of the Entrepreneurs Programme, Educational Plan, Access to the Technical Tools), TI infrastructures (Optimization of the TI Infrastructures on a Cloud Computing Model, Proactive Management of the LAN, Optimization and Improvement of SSOO Management and Software Base).

15.4.2.3 Madrid (López Fuensalida, 2015; Local Government of Madrid, 2014)

– Smart government: Open Government, Open Data.
– Smart mobility: Management of the service of regulated parking (SER), SER authorizations for the residents, control of the access to the areas where traffic is forbidden, signposting, management of a service of public bicycles, management of a hoarding service.
– Energy and environment: Subsystem of management of public lighting, subsystem of management of urban cleaning, subsystem of management of urban furniture, subsystem of management of green areas, system of management of rubbish and containerization.
– Smart services: Traffic lights, subsystem of management of ornamental hydraulic installations, subsystem of management of road surfaces, bridges and structures, system of open geographic information.
– Persons: Participation of citizens.
– Economy: Project MiNT Smart Madrid.
– Information and communications technologies: Platform MiNT Smart Madrid.

15.4.2.4 Malaga (Smart City Málaga & eficiencia energética y laboratorio urbano, 2014; Local Government of Malaga, 2015; Bueno Vallejo, 2012)

– Smart government: Electronic government, open government.
– Smart buildings: Headquarters of multiple local services, headquarters of the observatory of urban environment, incubator of excellence pro-Malaga.

- Smart mobility: Vehicles working with natural gas, biologic fuel, hydrogen, contactless card and NFC payment, information panels (GPS), accessible buses + system for blind people, planning of bus routes, Web monitoring of buses in real time, system of regulation of parkings, centre of traffic control, integral system of access to the old city, contactless card, information in bus shelters, QR code, increased reality, closed circuit of television CCTV.
- Smart energy and environment: Use of energy obtained from rubbish and wastewater through plants of co-generation obtaining biologic gas; this energy would be provided to the plant, and the remainder would be sold; net of smart meter boxes for water monitoring and detection of leaks and scams; two sounding lines of radio electric measurement for monitoring of the levels of electromagnetic radiation of the environment, Telematic net of acoustic limiters, system of urban indicators of the urban observatory of the environment.
- Servicios inteligentes: Planificación Urbana (Recuperación del Casco Histórico, Rehabilitación de edificios, Ampliación del PTA, CAT-MED (Manzana verde), Reserva para Parque Solar Municipal, Normativa para la instalación de sistemas de generación por fuentes de energía renovable).
- Persons: Participation of citizens.
- Economy: Smart city Malaga, Zem2All.
- Information and communications technologies: Dynamic posters, information points, fiber optics nets, corporative wireless net, mobile apps for the following areas (parking locations, bus location, city audio guides, holy week).

15.4.2.5 Bilbao (Enerlis et al., 2012:63; Local Government of Bilbao, 2012; Agenda Digital Bilbao, 2012; Bizkaia: talent, without date)

- Smart government: Improvement of the internal municipal management, intensification of the institutional collaboration, new governance, support to the development of emergent sectors, online local government, courses promoted by the government for enterprises and citizens, expanse of the web of civil service.
- Smart buildings: San Ignacio Sport Centre.
- Smart mobility: Project "Share your car", installation of information points in the bus shelters and of the information billboards in the buses, adaptation of the urban buses for blind persons.
- Smart energy and environment: Action plan for the Sustainable Energy of Bilbao 2020, Project Agenda 21, Sustainable Tourism.
- Smart services: Multichannel system of citizens service, Web for procedures, folder of citizens and enterprises, ELECTRONIC BILLING, "Payment à la carte", online payment, electronic signature, news and information à la carte, "Your local Government listens to you", App iBilbao, system of geographic information GEOBILBAO, Project "Share your car", public area (installation of information points in the bus shelters and of the information billboards in the buses, expanse of the number of WiFi points, computer resources for the citizens, employment centre and workshop of entrepreneurial project), digital literacy for

groups at risk of social exclusion, unemployed people, the elderly people, childhood and youth, associations.
- Persons: Participation of the citizens through forums and discussions in Web pages (online participation).
- Economy: Digital Agenda Bilbao 2012, Agenda of Bilbao Innovation, Project of International Cooperation.
- Information and communications technologies: Expanse of the net of fibre optic in public spaces, diffusion of knowledge on how to use the ICT, forums and international nets, projects (OpenCities, Freilot …), strategic local and global alliances, reinforcement of the incubator of the new technologies enterprises of Kastrexana, plan of recycling of the PC.

15.5 Conclusions

The cities are more and more aware of a huge social and economic development, and the smart cities are an appropriate model of a city that could help them to face cultural, social and economic changes that are caused by evolution. In this sense, a smart city has to guarantee an improvement of quality of life of the residents in an integral way, basing on an appropriate use of the information and communications technologies, allowing an improvement of resources and economic efficiency, and achieving sustainable development.

A smart city concept has to be still defined in a clear way, because there is no rule that could express the objectives that must be achieved by a smart city. From the tourist point of view, the same thing happens, there is no any clear definition of the terms "smart tourist destination", "smart tourism" or "smart tourist", and there is very different information on the objectives, initiatives and actuations that have to be carried out in a smart city in this industry.

After having done this study, we can say that despite the fact that Caceres stands out due to a big project of the Quay Building or Smart Water Caceres, the city shows a lot of weak points in other areas, as Smart Mobility, Smart Services or the ICT.

Currently, a smart mobility project for urban transport has been launched in the XXII National Congress of Urban and Metropolitan Transport, but any step has been made yet. Regarding smart services, Caceres focused all its forces on the tourist industry (invigoration of local hotel industry) due to its spectacular historic heritage, and the importance of this industry in the city's economy. However, many things must be done to achieve sustainable tourism and the so called e-tourism. In this way, it is highly important to recognize the advantages of a system of geographic information of Caceres, because it does not only offer multiple services, but it can also allow to know more about the territory. Regarding the area of the ICT, Caceres has carried out very few initiatives, focused basically on the elaboration of mobile apps, while a detailed analysis of their profitability must be done.

Regarding smart government, Caceres needs a project that includes all the initiatives that have been carried out and will be carried out in the city, and it also needs

that its residents are more conscious. To achieve this, Caceres needs more effective advertisement as a smart city, and to set in some courses with the aim to give the residents more knowledge on the use of the ICT. On the other hand, it is necessary to include a higher number of initiatives in this smart city, as projects of smart mobility applied to urban transport, as information billboards in buses or actuations in the area of public service and the ICT. It is also necessary, for example, to introduce more electronic services with the aim to improve citizens' service. Summarizing, there are many projects to be done in Caceres to put the city on the same level with other Spanish cities that belong to the top five.

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