

# Barcelona 5.0: from Knowledge to Smartness?

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## Table of contents

Abstract .....	4
1. Introduction .....	6
2. Defining the ‘smart city’ concept. ....	7
3. From Barcelona 4.0 to 5.0: introducing smartness in the KBE. ....	9
4. 22@: a smart district? .....	15
5. Conclusions.....	20
Bibliographic references.....	22
Resum. ....	26
Resumen. ....	27

# Barcelona 5.0: from Knowledge to Smartness?

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## **Abstract**

The role and relation of information and communication technologies —ICT— with urban political economic restructuring has been widely studied in the last decades. The academic literature has been increasingly aware of the great complexity, rhythms and intensities of the interrelation among urban ICT deployment and urban regeneration and competitiveness.

In the amalgam of concepts derived from this evolution, it has recently taken a growing importance the one of ‘smart city’. Although its definition has remained quite fuzzy, this concept has been evolving from a very technocentred notion of cities and ICT towards a set of policy measures informed by economic, social and environmental goals and processes to achieve an optimal level of quality of life and urban sustainability.

This paper examines the emergence and evolution of the smart city concept and its strengths and weaknesses in explaining the present urban reality. To do so, it analyses Barcelona aims to become a smart city in terms of technical infrastructure, social inclusion and economic competitiveness.

## **Keywords**

Barcelona, ICT, knowledge-based economy, policy, smart city, urban competitiveness.

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# 1. Introduction

Twenty years have passed since Richard Florida and Martin Kenney announced that “capitalism is undergoing an epochal transformation from a mass production system where the principal source of value was human labour to a new era of ‘innovation-mediated production’ where the principal component of value creation, productivity and economic growth is knowledge” (Florida and Kenney, 1991). For many, this argument retains its validity today, evidenced by the proliferation of ‘knowledge economies’ throughout the world. Such economies are said to be “characterised by the dematerialisation of production, a shift away from dealing with raw materials and machines towards dealing with other minds. [...] The term ‘knowledge economies’ is also intended to capture a sense of accelerating technological change and, related to this, the need for continuous innovation” (Bryson *et al.*, 2000). In this ‘new epoch’, cities and city-regions are deemed crucial (Rodríguez-Pose, 2008; Simmie, 2001).

Eminent economists, such as Paul Krugman and Michael Porter, have today popularised an ‘urban hypothesis’ (Drejer and Vinding, 2005) that highlights the importance of industrial location and agglomeration for trade and clustering of industries to foster innovation and competitiveness, with obvious corollaries for urbanism. Others see cities as ideal centres of the kinds of ‘creative industries’ that constitute the new economy (Aage and Belussi, 2008), as well as poles of attraction for the ‘creative class’ (Florida, 2005). This is significant since “the driving force behind the development of a city turns out to be its ability to attract and retain creative individuals” (Lazzeretti *et al.*, 2008), widely referred to in the knowledge economy literatures as ‘talent’ (Karlsson *et al.*, 2009). Generally, such literatures support the OECD’s conclusion that “competitive cities [have become] a new entrepreneurial paradigm in spatial development” (OECD, 2007).

This has been, in general terms, how cities have reacted to the challenges of the knowledge-based economy —KBE—. Competitiveness, entrepreneurialism, innovation and talent have become the key concepts behind urban transformation in the last decades. Also, in the literatures on knowledge economy and urban development there has been a subjacent argument about the centrality of new ICT as a necessary means towards enhancing the previous concepts. Indeed, cities have been pushing in the last decades to improve their technological infrastructure and, at the same time, integrating technological platforms in the deployment of public services. Amongst others, these technological efforts have been labelled by concepts such as ‘intelligent’ and ‘smart

cities'. The later one has been gaining popularity since the World Forum on Smart Cities in 1997. Yet, its real impact—at least in Europe— has come in recent times, and in particular as concerns on both climate change and redefinition of potential exits to the crisis. In this sense, it is worth mentioning the 2007 European Initiative on Smart Cities within the Strategic Energy Technology Plan (OECD, 2010), based on smart growth<sup>1</sup> discourses within the new Lisbon Strategy by EU and its translation to its urban policies framework (EC, 2011).

In this paper we will explore the development of the smart city model in Barcelona. In doing so, in the next section we will briefly introduce what it is meant by 'smart city'. Ahead, we will discuss how Barcelona has been shifting its internationalisation strategy from an emphasis on social issues and public space towards a prominently economic competitiveness strategy in the KBE by ending up in increasing the role of technology and smart concepts. Later, we will explore the case of 22@, the technological district of the city, where many of the smart policies are implemented. Moreover, we will shed light on the very new challenges Barcelona City Council—BCC—is focusing on to strengthen its current position in the smart cities international scenario. Finally, in the conclusions, we will discuss the outcomes in the implementation of smart policies in Barcelona.

## 2. Defining the 'smart city' concept

Within academic literature, the term 'smart city' has been mostly developed and deployed from technological perspectives (Domingue *et al.*, 2011). Alongside these technocentred literature, from environmental sciences has also embarked upon the concept by looking at the technological questions in achieving urban sustainability. In this sense, there is a growing set of works that explore the use of ICT in the environmental design or smart grids to attain low carbon societies (Fujimoto *et al.*, 2009; Fox-Penner, 2010), or how to tackle energy poverty through ICT (Oldfield, 2009). However, these approaches to the smart city do not analyze—or very superficially—the social and economic factors that underlie the use of these technologies.

From the social sciences perspective, the study of smart cities has been focused on very specific areas of the relations between governance, ICT and knowledge economy. From political science, most of the studies concentrate in e-governance apps and the use of open data. They focus on issues such as citizens accessibility, administration-

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<sup>1</sup> The concepts of 'smart city' and 'smart growth' started much earlier, and in the North American framework meant strategies to control or reduce urban sprawl.

citizen relationship and open data governance (Garson, 2006; Paskaleva, 2009). Regarding to the works carried on from an economic geography perspective, the literature has centred on the role of the creative processes, human capital and infrastructure investment in order to encourage innovation and new business models in the economy of knowledge (Komninos, 2002, 2009; Florida, 2005; Caragliu *et al.*, 2009; Glaesser, 2011; Bakici *et al.*, 2012).

To sum up, the smart city concept has been increasingly used in urban policy—and mostly consultancy firms—and academic circles in very vague terms, referring to the use of ICT in the implementation of urban development strategies, but still is a very ambiguous concept, trap between well intentioned discourses and very thin realities (Holland, 2008). In this sense, there is not a general consensus among authors to provide a clear definition, precisely because it “arose in response to complex social, economic and political urban problems facing most modern settings. The need to improve the quality of urban life amidst increasing social, economic and environmental problems prompted technologists and planners in all areas to contribute to the creation of new and more holistic concepts for modern cities” (Mimos, 2001). Thus, smart cities can be understood as “cities with a high capacity for learning and innovation based on the creativity of its people, institutions of knowledge creation and the digital infrastructure for the management of communication and knowledge” (Komninos, 2002) or as “cities where investment in human and social capital and infrastructure of communication, both traditional—transportation—and modern—ICT—, promote sustainable economic growth and a high quality of life with efficient management of natural resources through a participatory governance” (Caragliu *et al.*, 2009).

Hollands (2008) lists a number of features which all smart cities fulfil: using network infrastructure to improve economic efficiency and enable social, cultural and urban development; the interest to achieve residents’ social inclusion into public services; the crucial role of creative and high technology industries in long term urban growth; the role of relational and social capital in urban development; and social and environmental sustainability as strategic component.

Although the definition of smart city—as we have seen— doesn’t enjoy a broad consensus, at operational level have been taking form through different research and policy projects and documents. It is widely accepted as pioneering in this sense, the project European Smart Cities, conducted by the Centre of Regional Science from the Vienna University of Technology. This project distinguishes six dimensions that shape the concept: smart economy, smart mobility, smart environment, smart people, smart living and smart governance, each of which is broken down into various indicators.

Based on this conceptualisation, there is a wide range of public policies carried out by several cities under the label of ‘smart city’ that gather together a varied and diverse

collection of ideas on what to do to achieve the status of intelligent city. As Santinho and De Castro (2010) point out, “there is a difference between what being intelligent in one city means and what being intelligent means in another”. These authors, however, identify some reference public policies to implement both from a city internal point of view and outside. In short, the first group includes promoting cultural and social media in support of creativity and efficiency; attracting qualified talent with diverse cultural backgrounds and skills to set up a diversified human capital; land planning taking into account social and environmental criteria; the provision of quality social and economic services; fostering an innovative climate in terms of implementing the use of ICT by citizens, administrations, organisations, institutions, associations and businesses; and promoting competitiveness and creativity among the business community. The second group emphasizes the integration of thematic networks which make the city more competitive; the production of knowledge which fosters the own city development; and the spread of information following a strategic program.

In this context, public-private partnerships are understood as an optimal mechanism with regard to the organisation of services production and, also, to the design, planning and implementation of public policies in an efficient manner. The collaboration of agents external to government responds to the logic of integrating the full socio-economic potential of the city in its development, and links to the current neo-liberal ideas according to which reducing the weight of the public sphere is necessary to achieve higher levels of efficiency. This view is widely shared, but hides root problems such as compatibility between different interests, pace of action, attitude or ability to access certain key information.

### **3. From Barcelona 4.0 to 5.0: introducing smartness in the KBE**

It seems as though the Mediterranean city of Barcelona has acquired something of an ‘aura’ (Rossi, 2004; Kirby, 2004). Since winning the Royal Institute of British Architects’ Gold Medal in 1999 —the first time it was awarded to a city rather than a specific architect or practice—, the so-called ‘Barcelona model’ has been held aloft as *the* model for successful social, economic and cultural revitalisation at the urban scale (Balibrea, 2001; Degen and Garcia, 2008; García Ramón and Albet, 2000; Marshall, 2004), and an exemplar of ‘universal global best practice’ (De Jong and Edelenbos, 2007). Marshall (2004) comments that “most of the programmes for which Barcelona is renowned, certainly up to the mid-1990s, were not conceived with the aim of boosting the city’s economy, or global competitiveness”. Whether intentional or not, this appears

to be precisely the effect they had (Pareja-Eastaway, 2009). Thus, by the end of the 1990s, the Barcelona model had assumed a more economic logic. In particular, from that time, it emerged a new single vision for the city's 'post-industrial' transformation has proceeded apace, informed by the insights into the dynamics of the 'new economy', and aiming to establish Barcelona as a global 'knowledge city' poised for successful competition in it (Gdaniec, 2000). Thus, at the start of the new century, BCC—and local institutional actors— have been driving forward the process of urban transformation in accordance with the perception that:

“The new economy develops in an international framework, it has a global character, it has made creativity and information processing one of the basic competitive and productivity factors and it is organised around city networks. At the same time, this international framework generates an increasing interdependence between urban areas, and turns competition among cities in a game that takes place in the board of the international economy” (Pacte Industrial de la Regió Metropolitana de Barcelona, 2001: 65).

This has been the consensual guiding principle for Barcelona economic and political elites for the last decade. On that purpose, during the last years have emerged a plethora of projects from the district to the metropolitan level to produce a city according to that understanding (Charnock and Ribera-Fumaz, 2011).

However, in recent times, Barcelona has increasingly adopted technological policies to complement its KBE strategy and to integrate them. In doing so, it has taken a conscious step in designing a smart city, based on the idea that those cities which are able to turn into a smart KBE, taking advantage on the growing avalanche of technological innovations, will have better chances of being more competitive in global markets than the ones which do not. Yet, during the last decade, Barcelona has ranked not very well in the many international comparative studies and rankings exploring productivity and innovation. In other words, performing poorly in the neoliberal competition to attract high value capital. Indeed, with the crisis, two recent reports on urban competitiveness and economic performance have ranked the city 115<sup>th</sup> and 193<sup>rd</sup> in the world (Ni and Kresl, 2010; Brookings Institute, 2011). The other cornerstone of the model, public leadership and social concerns, has been eroded in the last fifteen years by the economic rationale behind the new policies and the increasing role of private actors in transforming the city. In this context, and with the arrival in 2011 of a new liberal mayor in the BCC, the elite consensual vision of the city has been changing. A new radical imaginary has started to impose in city elites:

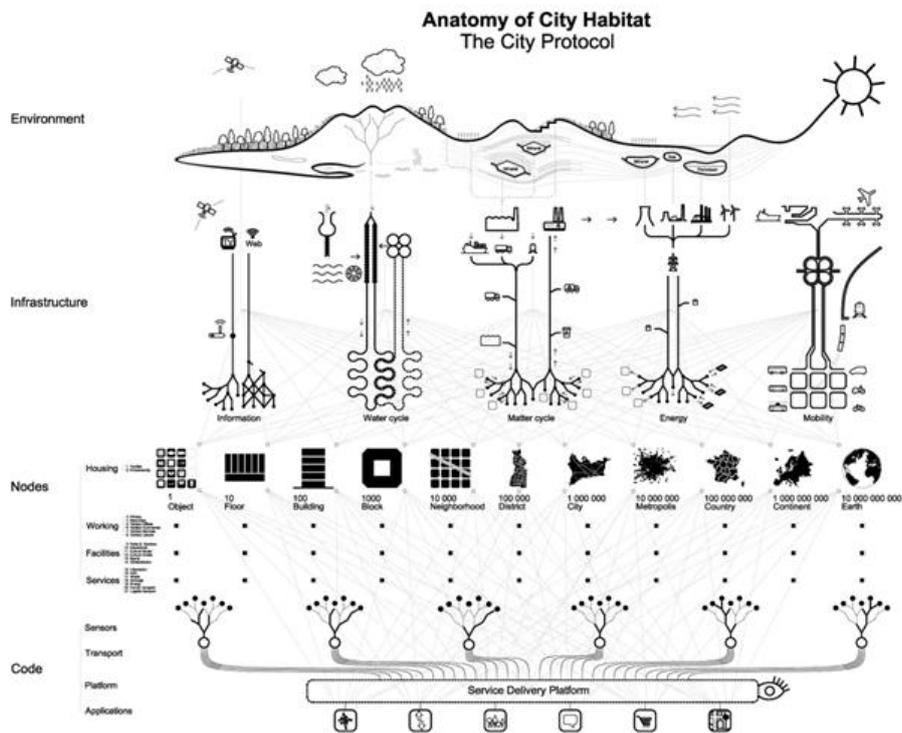
“In the last years, ICT have changed the life of people and business, but cities have been not much affected. In the same way that the first technological revolution—agriculture— contributed to create cities, and the second—industrial one— transformed them in the

urbs that we know today, everybody expects that the informational revolution will transform cities and life in them: it is what is commonly known as the *smart cities* paradigm.

“All the cities in the world want to be the protagonist of these changes, and Barcelona, the city where Cerdà invented and implemented modern urbanism, has the chance of converting this necessity of change in the economic engine for the creation of wealth and welfare for its citizens [...] The new smart cities across the world are an unique opportunity to apply solutions in which Barcelona can be the laboratory and leader at the same time” (Ajuntament de Barcelona, 2012: 2-3).

In this sense, the city is portrayed as an entangled web of intra and inter-scalar networks, from the household and the building to the global, from the environment to ICT infrastructure.

Figure 1. Conceiving the smart city



Source: Ajuntament de Barcelona (2012: 3)

It is therefore worth remembering how Lefebvre wrote in 1980 that “social and political space on a world scale reproduces and accentuates the local and national links to the productive forces, to advanced technologies —notably to information technologies—, to property relations —notably those of states and their territories—, to forms of organisation —notably to transnational firms—, to ideologies —notably the representations of airspace, information, etc—”, and, in this way, “the capitalist mode of production realises itself” (Lefebvre, 2009). The prescience of this passage is plain for all to see, almost thirty years later. To paraphrase Elden (2008) on Lefebvre and ‘the world’, Barcelona’s quest to engineer its own competitiveness in a global economy is a development illuminated by the prior comprehending of ‘the world’ and the process of *mondialisation*.

The deployment of smart solutions is linked to the ideas of knowledge, entrepreneurship, innovation, economic development, business cooperation and management of ICT. In this sense, the ‘smart city’ concept not only brings a technological accent into the KBE competitiveness strategy but also new ones such as to combine economic growth with sustainable urban development, quality of life and environmental sustainability. It is from this perspective, therefore, that Barcelona understands which model of smart city wants and what elements need to be included.

Previously to the arrival of the new local government, BCC had committed to undertake smart city policies in four areas: information, infrastructure, smart services and human capital. Within this four areas are included targets in diverse areas of public intervention such as transport, e-administration, municipal management, security, public infrastructures, mobility, business, heritage management or housing.

**Table 1. Smart city policies in Barcelona**

AREA	GENERAL AIMS	INTERVENTIONS
Information	<p>Increasing the transparency of municipal management.</p> <p>Encouraging social use of public data.</p> <p>Promoting innovation and the economic fabric.</p>	<p>Sensorisation of urban elements, i.e. traffic: installation of cameras in public spaces; magnetic loops and Bluetooth sensors to control the volume, speed and flow, etc.</p> <p>Creation of a unified platform for management:</p>

		<p>administrative procedures through electronic applications such as eContracte, eDocument, eSignatura, inspection electronic files, licensing work files, etc.</p> <p>OpenData BCN project: a platform which makes all municipal government data available to everyone, except those aspects of information subject to privacy.</p>
Infrastructure	<p>Providing direct access to the network and, also, to information and services managed through the online platform — ubiquity—.</p>	<p>Special Infrastructure Plan: 325 km. of optical fiber, mainly used for internal communications —both data and voice— by the local police, the fire department and municipal buildings, as well as traffic management.</p> <p>Free public WiFi service offered through 416 access points located inside municipal facilities.</p>
Smart Services	<p>Provision and management of public services via internet-based applications and devices.</p>	<p>Barcelona virtual office: website to sort out administrative procedures for citizens and companies.</p> <p>iBicing: application for mobile phones to help users of the public rental bicycles service to locate</p>

		bike stations and verify the availability of units.
Human Capital	To attract talent and companies in the KBE related industries.	Urban transformation of the 22@ district.

But, as mentioned before, the last municipal elections held in May 2011 resulted in a change in the government of the BCC. The liberal Xavier Trias —CIU— reached the city government and ousted PSC —centre-left wing party— after 32 years of uninterrupted government. Despite this change, the vision of the new government on the strategy of the city economy internationalisation has not changed because it was mainly shared by the two parties since the beginning. Thus, during the new term a phase of relative policy continuity has begun in which already started projects keep developing while new ones are planned.

The new government approach is based on the will of reinforcing the ‘smart city’ brand of Barcelona as a promoter of a new economy of urban services. The goal is to show Barcelona as an essential reference for all those cities which seek to redirect its economy and its external promotion following this paradigm. The starting point of this policy took place in the first Smart City Expo and World Congress, held in Barcelona in November 2011 under the title ‘Smart society for innovative and sustainable cities’. In this regard, the work of urban planner Ildefons Cerdà, creator of Eixample neighbourhood, has been evoked as a pioneer of a kind of smart city idea applied to Barcelona because of the effects of the rationalisation of urban space derived from the creation of the urban octagonal net —efficient management of resources and integration of technologic innovations in the city—.

From this point of view arises the sketch of the guidelines of the two major future projects for the city, closely interrelated: the Smart City Campus at 22@ and the development of the City Protocol. Both are designed from the creation of public-private partnerships, so that several technology companies which are in Barcelona will become part of the managers of these projects along with public institutions. Overcoming the current economic crisis is one of the recurring arguments in the presentation of the benefits of these projects.

Smart City Campus is conceived as a place of concentration of enterprises, technology centres and research institutions to develop innovative solutions for the urban environment from economic, environmental and technological efficiency perspective. The aim is that new models of urban development can be exported to

other cities, which will reinforce the lead of Barcelona on sustainable urban management, that is, the conversion of urban environments in smart cities linked to the KBE.

The second major future project of the city is the approval of the City Protocol, which aims to define jointly by public and private sector a global standard that indicates “parameters to which cities should be transformed, based on environmental, cultural, social and economic values, led [...] by consumption of resources efficiency and excellence in design” (Ajuntament de Barcelona, 2011). This project has its roots in the situation of uncertainty about what exactly is a smart city that has been developed at the beginning of this paper. Barcelona seeks to limit this uncertainty by opening a meeting between several cities, companies and organisations reserving itself the role of global capital in the development of such cities. This approval would mean that companies located in the Smart City Campus would have a shared vision about what solutions for urban environment fit smart city paradigm and what don't.

Linked to this approach, the BCC created the Institute of Technology for Urban Habitat, a foundation to promote innovation in new urban services which joins planning and infrastructures, housing, environment and ICT departments.

One of the most important projects currently underway in relation to the promotion of the ‘smart city’ brand is ‘iCity: linked open apps ecosystem to open up innovation in smart cities’, funded by The Information and Communication Technologies Policy Support Programme of the European Union. The iCity project aims at making a step forward in fostering the co-creation of services of public interest by third parties pushing for their space as services provisioners in smart cities’ urban spaces. The project responds to the growing demand from social stakeholders to provide services of public interest based upon the exploitation of available public information, digital assets and infrastructure. The available municipal ICT networks already deployed in urban spaces will be made available and accessible to open innovation ecosystems, specially small and medium enterprises —SME—, with the objective of maximizing the number of deployed services of public interest. The services will be finally deployed through a technological platform integrating the four participant cities, which are Barcelona, Bologna, Genoa and London.

The combination of all these policies have led, over time, to the creation of an aggregated transformation of the KBE Barcelona economic model towards a smart city model. Based on the idea that collaboration with several companies devoted to deploy smart city applications through public-private partnerships is a cheaper way of delivering new public services or managing old ones, several fragmented policies initially designed with no clear model have been interlinked in major discursive and

institutional shifts to produce a new setting for Barcelona transformation around the 'smart city' brand.

## 4.22@: a smart district?

This new shift towards the smart city will be first implemented and tested in the primary laboratory for the smart city, the 22@ district in the neighbourhood of Poblenou —'new town' in Catalan—, the former industrial manufacturing heartland of the city, located on the coast to the south of the river Besòs delta.

Poblenou was from the mid-nineteenth century a vibrant and successful textile sector, earning the moniker 'the Catalan Manchester'. Since then, an historical process of largely unplanned industrialisation has produced a relatively haphazard layout that has long distinguished it from the main city, and in particular the modernist, gridiron-like Eixample district it borders. Since 2000, the city has designated Poblenou a new 'knowledge district' and re-branded it '22@Barcelona'. The district is being transformed in accordance with the conceived goals of engineering urban competitiveness and quality of life for its inhabitants into a new space for knowledge and people and ecologically sustainable. Furthermore, it is clear that the logic servicing the transformation of this specific space is at once local *and* global.

This championing of the 22@ Plan by BCC reflects the concerted effort made since 2000 to transform Poblenou into 'a new model for a *compact city*, where companies on the cutting-edge of innovation co-exist with universities, research, training and technology-transfer centres, as well as homes, infrastructures and green areas' (Ajuntament de Barcelona, 2008 [original emphasis]). The project is on a considerable scale, covering 198.26 hectares, and leading to the estimated transformation of 1,159,626 m<sup>2</sup> of existing industrial land and the potential creation of around 3,200,000 m<sup>2</sup> of new construction. It will involve the legal recognition of 4,614 existing homes and the construction of around 4,000 new subsidised units; 114,000 m<sup>2</sup> of green area land, and a total investment in infrastructure of around €180 million making it the largest project of its kind in Europe.

The project is being marketed in terms of large-scale urban redevelopment, but also economic, environmentally and social dimensions. First, the area is being remodelled to facilitate innovation and enhanced competitiveness in the global economy, and primarily through the promotion of clusters—in the specific areas of 'media', 'information and communication technologies', 'medical technologies', 'energy' and

‘design’—, the establishment of technology and R&D centres in collaboration with the main Catalan universities. The emphasis is on attracting SME, starts ups and entrepreneurs, who are seen as the critical dynamic agent for the economy and the basis of the Catalan economy. Second, the neighbourhood is the basis for implementing a ‘new special infrastructure plan’ oriented to meet sustainable development goals but also to enhance digital telecommunications provision throughout the district. And third, the district is said to be designed to promote the quality of work and life in the district, this being defined in terms of aiding entrepreneurs and supporting vocational training and labour market entry,<sup>2</sup> promoting knowledge-based learning in schools, making ICT more accessible to the elderly, and making the most of the district’s proximity to the city’s famed beaches and entertainment centres so as to attract and retain that all important ‘talent’.

In terms of social innovation, several platforms have been created specifically for the networking activities of professionals working in the district. In the area of innovation support and access to technology, there are two main specific initiatives: 22@UrbanLab and 22@Innovation. The first one is a platform for the development of pilot projects on new technologies offered to technology companies in the district. The idea of creating an urban laboratory is an old aspiration of the BCC and 22@ district acts, in this sense, as an environment through which companies can test technologies and, eventually, improve their competitiveness. Some tests have been installed such as sensors for parking, air and noise pollution levels and public lighting, among others.

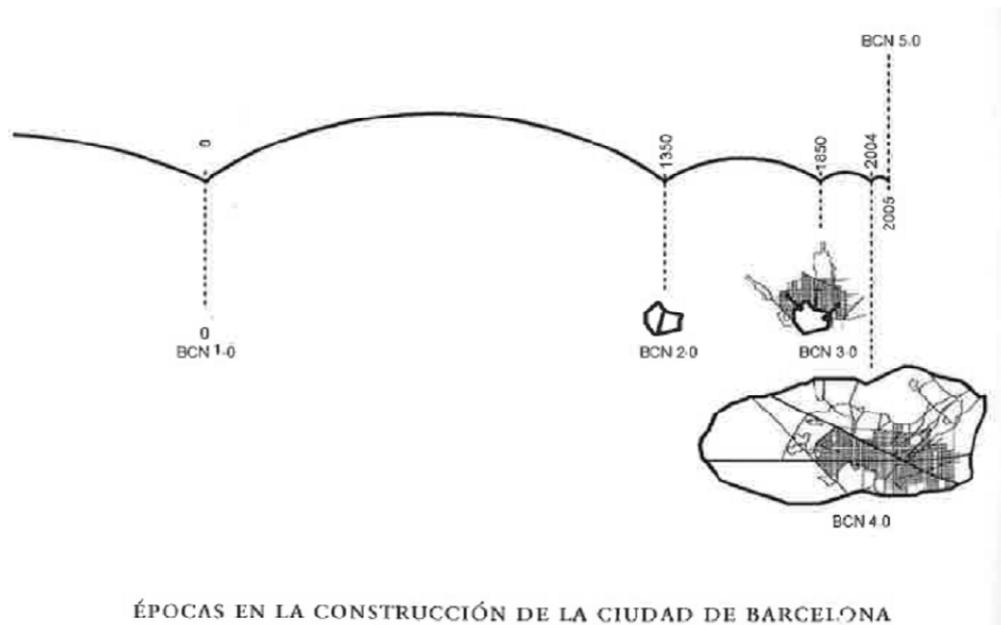
The Barcelona Urban Innovation Lab and Development program, recently created, connects urban labs and urban research programs. Instead, the 22@Innovation fosters innovation through specific public and private initiatives, enabling SME to access new customers and new markets. One of the most advanced pilot projects is LIVE — Logistics for the Implementation of Electric Vehicle—, a public-private platform that supports and promotes the development of electric mobility.

In this sense, the 22@ has been portrayed by the BCC in many documents and speeches as the urban lab, the innovative ecosystem of the city, and now, the Barcelona 4.0, the transitional pilot for the smart factory: Barcelona 5.0.

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<sup>2</sup> Barcelona Activa, the city’s local development agency, is now located in Poblenou and is the key component of the city’s competitiveness strategy, promoting entrepreneurialism and business creation, incubation facilities, job seeking facilities tailored to knowledge economy human capital needs, and knowledge-based vocational training (OECD, 2009). Its most recent initiative is ‘Do it in Barcelona’, a strategy to attract global entrepreneurs and foreign ‘talent’ to the city ([www.doitinbcn.com](http://www.doitinbcn.com)).

Figure 2. Epochs in the construction of Barcelona City



Source: Guallart (2012: 28)

When assessing whether the 22@ project contributes decisively transforming Barcelona into a smart city, it should be emphasised that there are several elements of analysis that come into play, as a result of the multidimensional conception of its meaning taken previously. The overall result has lights and shadows: on the one hand, the adjective 'smart' links with a positive conception of the changes related to technological innovations and the economic, urban and social transformations; on the other hand, it may downplay some negative effects of the development of new infrastructures or overlook alternative critical analysis of urban development (Holland, 2008) in which residents in the neighbourhood have been especially involved.

At economic level, the most recent census of companies located in 22@ (2010) shows 1,502 records, 75% of which have their activities in knowledge and technology intensive sectors. These companies generate an annual turnover of 6,000 million euro. The personnel is made of 44,600 workers, 72.5% of whom are university graduates.

Taking this data into account, attracting and retaining talent as a goal of the project seems to have succeeded. The BCC has always made a positive evaluation, repeatedly expressed in various local media. This has remained constant even in times of economic crisis, when the Mayor stated that “in the last census [...] we could see that despite the crisis, 22@ created jobs in sectors considered @” (press release of the BCC, 21.12.2010). However, there are also less optimistic opinions about the overall success of the project, such as the study of London’s Imperial College Business School (Leon, 2008), indicating that 22@ hosts a little educated human capital, a low level of local entrepreneurship, venture capital scarce resources, little presence of large international firms—which prefer to be located in Madrid—and little connectivity to businesses located in other European and Latin American cities (Charnock and Ribera-Fumaz, 2011). In this regard, companies based in 22@ with a turnover of over 15 million euro are only 8.1%, 68% are micro enterprises with up to 10 employees and less than a quarter part export goods or services to other countries.

Regarding the implementation of ICT in the public sphere, it’s important to stress that their mere existence does not necessarily drive cities to be labelled as ‘smart’. Having this technology does not mean it can be used by citizens, which can lead to what is known as ‘digital divide’ (Schiller, 1996). However, we believe this is not the case of Barcelona as a leader city by the volume of offered services, the ease of access and use by citizenship and the ubiquity of most of its applications. Nevertheless, Barcelona has received 2.0 e-Government Award for best overall strategy for eGovernment in the Local and Regional Government Solutions Forum 2009.

From an urban point of view, the last 22@ State of Implementation Report (Ajuntament de Barcelona, 2010) shows that the renovation of approximately 65% of the industrial areas of the district has already begun. The set of approved plans include the construction of over 2.8 million m<sup>2</sup> of floor plant, of which 82,000 have been built for facilities and other 21,000 are being executed. Regarding social housing, 35% out of 4,000 projected for the whole area are already built or under construction. Approved planning devotes 120,000 m<sup>2</sup> of land to open spaces where, to the present, eight public parks have been set. Finally, the Special Infrastructure Plan is completed in 39%.

The urban model proposed on the basis of 22@ is the traditional of Mediterranean cities: compactness, with moderately high population and building densities which

forms an urban heterogeneous continuous. The replacement of the previous urban key 22a —which provided only industrial land— for the new 22@ —which enables the coexistence of various urban activities— allowed an increase of the old density, too low. This model, thus, avoids spatial segregation because leads to a centralisation of economic activities as well as enabling social cohesion and, especially, economic competitiveness. “Talent is attracted to sociable communities —places with destinations, public and civic spaces, environmental amenities— where they can come together with colleagues and friends, either through planned or chance encounters. [...] The new economy demands physical infrastructure that reduces the cost of business. This means buildings that can be quickly reconfigured and constructed, housing of varying types and costs, development patterns that are predictable, and transportation systems which increase mobility”.<sup>3</sup> It has also cared about a fully integration in the urban octagonal plot designed by Cerdà, linking open spaces, opening streets that had been occupied by industrial space and proceeding to the extension of Avinguda Diagonal, which crosses the city from west to east.

From a city global point of view, the addition of urban key 22@ has made possible to allocate land to new technological activities, which until the beginning of the project was not provided and, therefore, did not exist. In this sense, the city has won urban uses, although requalification of former industrial land have not always gone to the location of technology companies but have been allocated to residential or tertiary land, with great benefits to real estate developers (Capel, 2005). However, the commitment to transforming the area into a district of technological activities has led to their concentration in a particular area of the city and generated, as a consequence, a space that, in itself, doesn't enjoy a comparable level of mixture of urban uses to the rest of the city. Residence and, to a greater extent, technology industry with high added value monopolise the use of the district, which means that the cultural, sports, education, health and commercial facilities have a significantly smaller presence than in other urban areas. In this regard, land qualification maps in the area of 22@ show an overwhelming predominance of areas of tertiary industrial development.

This functional specialisation has advantages and disadvantages, because while favouring the concentration of talent, facilitating the exchange and transfer of opportunities, ideas and resources and reducing the cost of moving between companies, institutions and universities that work similar areas, also impoverishes urban quality and mixture of uses and functions that traditionally has characterised the city. The presence of several singular buildings integrated into the urban grid, built to accommodate companies that wanted to add an element of distinction to the symbolism of space, reinforces the perception of an unbalanced mixture of uses and a continuous splintering and inconsistent urban environment.

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<sup>3</sup> “Smart growth issues areas: economics” ([www.smartgrowth.org](http://www.smartgrowth.org)).

In purely social terms, the 22@ district has helped to the advent of a new type of residents labelled as ‘creative class’, linked to a strategic planning that has given priority to capture and retention of talent. However, in parallel with the emergence of this phenomenon, it has been another one before, which is the invasion-succession. It hasn’t taken place only in the district of innovation but also in the whole northeast triangle of the city as a result of a large-scale urban renewal which must be understood comprehensively (Vilà and Gavaldà, 2006). The displacement of part of the population residing in the district —mostly low-middle socioeconomic class, vulnerable in terms of housing— and its replacement by a new middle class has created a situation of increasing social polarisation and dualisation pointing a classic process of gentrification. The market, spurred by the housing boom of the entire city, has acted as a filter by which people living in low rent housing have had to leave the area. The phenomenon is not new in Barcelona, it had been given previously in other areas subject to urban renewal as Diagonal Mar or Born. Also occurred in other cities, where transformations have been under discussion since the Chicago School to the present.

Through a complex process directed by both the municipal administration —which, as already mentioned, yearned for the transformation towards a KBE city to compete in the global market— and other urban agents in general and urban market in particular —who looked for substantial economic benefits associated with the construction of singular buildings and re-linking of interstitial spaces—, a phenomenon that escapes a merely demographic perspective has arisen: also constituents of the process are urban area conversions, changes in the housing market —both in terms of types and prices— and transformation of services and activities. Population is younger now and their purchasing power has increased, while the renovation of buildings —either through new construction or rehabilitation— has turned housing more expensive even though there is a significant percentage of social housing of about 30%. This increase has led to a migration of the residents with less economic capacity —voluntarily or forcibly— while has attracted younger immigration with higher education levels and socio-economic capacity because of the transformation of the area. This model of gentrification has led, inevitably, to greater homogenisation of the social profile of residents.

## 5. Conclusions

There has been a serious and important effort by the BCC to transform Poblenou through 22@ from a shrinking and deprived area to a KBE node to dinamys

Barcelona and to make the city economically more competitive, better placed in the map of innovation, technology and industry talent, more tertiary and better known in the field of international urban design. However, after twelve years of the start of the project, results are mixed. Indeed, the number of companies, investment and employment concentrated in 22@ has consistently grown. The official naming of Barcelona as the resident place of the World Mobile Congress and the investment related to it appears as one of the most positive aspects in the last year. Yet, it is still not completely clear how many of these new localizations and employment in the district can be directly attributed either to new creation or simply to a relocation of already existing companies in the metropolitan area. In this sense, most of the key companies in the area —Telefónica, Mediapro, Agbar, T-Systems or Indra— were already in Barcelona and just changed location. Also, according to the real estate services firm Jones Lang LaSalle (2011), the real estate market in 22@ is quite dependant on the relocation of big service companies from Barcelona city centre in search of bigger and modern office space. One of our next steps in the research will be to analyse these processes.

It is also unclear the outcomes of the branding of Barcelona within the field of international urban design. Recent research on that issue has brought again contradictory results. On the one hand, the number of awards, citations, visits to Barcelona and presence in urban policy circles seems to indicate that the city plays a role of model for other cities. On the other hand, after following some of the foreign visits to Barcelona and interviews with key actors in the European policy circles, the actual impact of the Barcelona model is seen important regarding its handling of public space but little regarding its economic and smart strategy (Purcell *et al.*, 2010).

The symbolic value of the innovation district has been strengthened and revalued by the physical improvement of the district and the rehabilitation of the industrial heritage. However, this repositioning has also had its costs, which were not always compatible with the idea of smart city, as Barcelona has become more fragmented and elitist. The idea of ‘splintering urbanism’ devised by Graham and Marvin (2001) makes full sense on a functional level. The negative social externalities that have arisen due to the commitment of the city for the KBE have found opposition from several neighbourhood associations and social organisations which have questioned the benefits of the social and urban model and have reported some urban practices (Charnock and Ribera-Fumaz, 2011). Therefore, new challenges must be faced such as achieving a better balance between economic growth, urban sustainability, social justice, equity or social heterogeneity.

As suggested above, BCC has been complementing its KBE strategy with the launching of technological policies to move towards a new goal: to arise Barcelona as a referential cornerstone in the field of smart cities at international level. This is, the

transition from Barcelona 4.0 to 5.0 has turned the ‘regular KBE’ promoted since the end of the 1990s into a ‘smart KBE’ —seen as a logical evolution of the first one— through the integration of several tech-based innovations in the deployment of public services to citizenship and the approval of new projects. These projects are not ideas anymore as its start-up has already begun. On the one hand, a preliminary draft of the City Protocol was developed at the first Smart City Expo world conference on the subject which took place in Barcelona in July 2012, and in November the definitive agreement has been presented as part of the second one. On the other hand, Smart City Campus’ final location is already decided and most of the planning designed, with 230,500 m<sup>2</sup> intended to productive uses, 30,310 m<sup>2</sup> to facilities and 46.100 m<sup>2</sup> to green areas.

From this perspective, we argue that the 22@ district, whose implementation started more than a decade ago, has been integrated to some extent in the reformulation of the general discourse of internationalization of the city, too. Consequently, it has been a light shift in the argument that explains, promotes and legitimizes the technological district. Apart from the presence in the traditional argumentation of the urban, social and, especially, economic vectors linked to ICT —crucial for the project’s justification from a perspective focused on KBE—, its aspect of testing area of several technologies in the deployment of public policies has been gradually boosting. The 22@ has been portrayed by the BCC as the urban lab, the innovative ecosystem and the transitional pilot for the smart factory.

One of the motivations for this change is the search of economic and environmental maximization in the provision of services, a popular idea in the current times of crisis which may be accepted by large layers of population under the argument that the deployment of public policies and the provision of services by governments should be, above all, efficient in economic terms. Also led by this economist logic, they may give their blessing to public-private partnerships with companies providing technology solutions. Yet, most projects are conceived in close collaboration with private ones, with whom the BCC has signed strategic agreements. The landing of such companies —Abertis, Accenture, Agbar, Capgemini, Cisco, Citigroup, Endesa, Fujitsu, GDF-Suez, Grupo Etra, HP, IBM, Indra, Italtel, Microsoft, Opentext, Oracle, Philips, Ros Roca, Sap, Schneider-Telvent, Siemens and Telefónica, among others— is thought to re-shape the physical and digital form of the city through the development of smart solutions. It will be necessary, therefore, to study the impact that this new way of structuring urban governance will have in the privatisation of mechanisms of public policies management, public spaces and provision of municipal services to citizens. Indeed, the opening of the 22@ as a lab of public space, infrastructure and data to the private sector rises many questions on the reshaping of collective resources to private interest and the re-definition of the public in the city.

However, trying to do a critical assessment of the ‘smart city’ concept in Barcelona, we understand that the model applied by BCC has included more elements than those strictly technological, as it also takes into account some sustainable urban development —mainly linked to the deepening of the ‘compact city’ concept— and a theorization of achieving a better quality of life related to this urban development. But the effects of the economic crisis have put in stand-by the achievement of higher levels of quality of life and have paralyzed investments in environmental sustainability at macro level. A high dependence of smart policies implementation to economic situation and a deferral to overcoming the current crisis are evident. It is still unclear to what extent the crisis will allow the creation of these projects —and, if so, what success in achieving the initial objective will register— and to what extent will change the commitment of the participating companies in involving in the city future projects, both increasing or decreasing it.

So, the economic situation, together with the lack of development of an environmentalist leg to be comparable to the others, and the non-predominance of bottom-up policies driven by users are seen as the most important limits of the ‘smart city’ concept implemented in Barcelona. Regarding to the latter idea, Burkhalter and Castells (2009) argue that the depth of the crisis offers an opportunity to rethink the city and to implement new urban planning strategies focusing on people’s needs and desires, and on environmental conservation. Theoretical contributions have been done from the innovation debate literature, which briefly shows that the era of linear, top-down, expert driven development, production and services is giving way to different forms and levels of coproduction with consumers, customers and citizens. There is an increasing trend to broaden the base of innovation policies and public services deployment to make them more decentralized and horizontal. All this leads to a general shift from planning-oriented policies towards a more flexible, user-oriented policies focusing on community knowledge-based developments. The theoretical model which embrace this challenging approach is the quadruple helix model, which takes into account not only administration, companies and universities but, also, a broadly understood user to refocus the traditional innovation concept. This new role of citizenship in the launching of public policies to make Barcelona smarter is absolutely missing, which leads us to think in a possible evolution to Barcelona 6.0 in which users, not only the traditional stakeholders involved in triple helix, can play also an important role in shaping the city and its public services.

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**Resum**

*El rol i la relació de les tecnologies de la informació i la comunicació —TIC— amb la reestructuració economicopolítica urbana han estat àmpliament estudiats a les darreres dècades. La literatura acadèmica ha mostrat cada cop més consciència de la gran complexitat, ritmes i intensitats de la interrelació entre el desplegament urbà de les TIC i la regeneració urbana i la competitivitat.*

*En l'amalgama de conceptes derivats d'aquesta evolució, recentment ha anat adquirint una major importància el de 'ciutat intel·ligent'. Malgrat que la seva definició s'ha mantingut força difusa, aquest concepte ha anat evolucionant des d'una noció molt tecnocèntrica de les ciutats i de les TIC cap a un ventall de polítiques amb objectius econòmics, socials i mediambientals i processos per assolir un nivell òptim de qualitat de vida i sostenibilitat urbana.*

*Aquest article examina l'emergència i evolució de la ciutat intel·ligent i les seves fortaleses i debilitats a l'hora d'explicar la realitat urbana present. Per fer-ho, analitza l'objectiu de Barcelona de convertir-se en una ciutat intel·ligent en termes d'infraestructura tècnica, inclusió social i competitivitat econòmica.*

**Paraules clau**

*Barcelona, TIC, economia basada en el coneixement, polítiques públiques, ciutat intel·ligent, competitivitat urbana.*

**Resumen**

*El rol y la relación de las tecnologías de la información y la comunicación —TIC— con la reestructuración económico-política urbana han sido ampliamente estudiados en las últimas décadas. La literatura académica ha mostrado cada vez más conciencia de la gran complejidad, ritmos e intensidades de la interrelación entre el desarrollo urbano de las TIC y la regeneración urbana y la competitividad.*

*En la amalgama de conceptos derivados de esta evolución, recientemente ha ido adquiriendo una mayor importancia el de ‘ciudad inteligente’. A pesar de que su definición se ha mantenido bastante difusa, este concepto ha ido evolucionando desde una noción muy tecnocéntrica de las ciudades y de las TIC hacia un abanico de políticas con objetivos económicos, sociales y medioambientales y procesos para alcanzar un nivel óptimo de calidad de vida y sostenibilidad urbana.*

*Este artículo examina la emergencia y evolución de la ciudad inteligente y sus fortalezas y debilidades para explicar la realidad urbana presente. Para ello, analiza el objetivo de Barcelona de convertirse en una ciudad inteligente en términos de infraestructura técnica, inclusión social y competitividad económica.*

**Palabras clave**

*Barcelona, TIC, economía basada en el conocimiento, políticas públicas, ciudad inteligente, competitividad urbana.*

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