

Innovation, Technology, and Knowledge Management

Marta Peris-Ortiz

Dag R. Bennett

Diana Pérez-Bustamante Yábar *Editors*

# Sustainable Smart Cities

Creating Spaces for Technological, Social  
and Business Development

 Springer

# Innovation, Technology, and Knowledge Management

*Series Editor*

Elias G. Carayannis

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Editors

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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**<sup>1</sup>, **sustainable entrepreneurship**<sup>2</sup>, and **democratic capitalism**<sup>3</sup>, 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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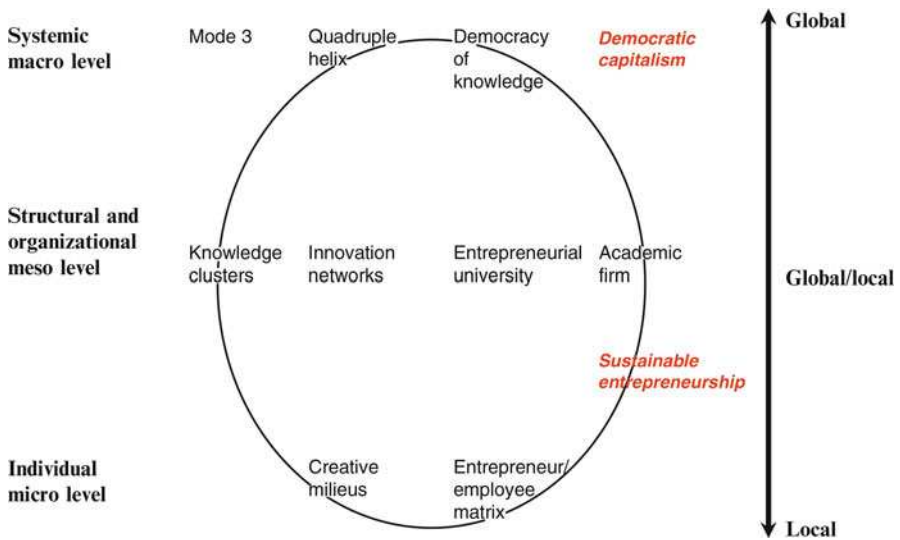
<sup>1</sup>We define *sustainable entrepreneurship* as the creation of viable, profitable, and scalable firms. Such firms engender the formation of self-replicating and mutually enhancing innovation networks and knowledge clusters (innovation ecosystems), leading toward robust competitiveness (E.G. Carayannis, *International Journal of Innovation and Regional Development* 1(3), 235–254, 2009).

<sup>2</sup>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).

<sup>3</sup>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 socio-economic, 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<sup>4</sup>, 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.

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<sup>4</sup>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 Perriñez-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 Cáceres 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 Cáceres 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, Martínez 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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# 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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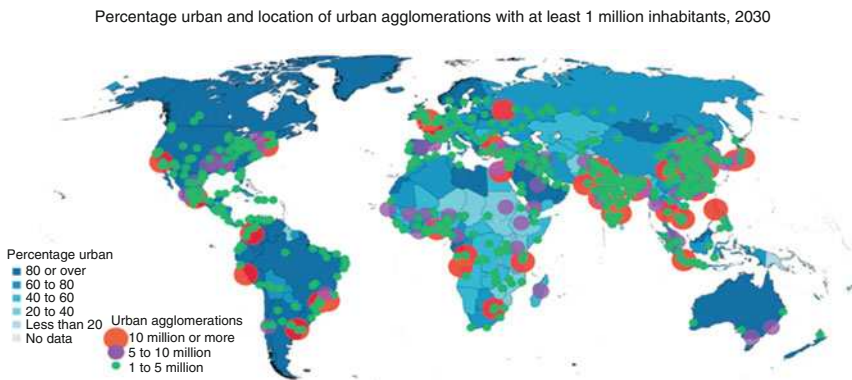
Population Situation, 2014). Although population growth is slowing, the United Nations project that the world's population will reach around 9.6 billion by 2050.

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.

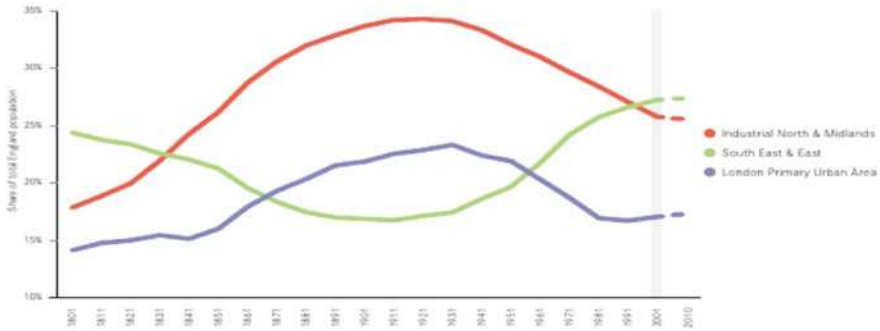
The evaluation of performance or success of cities here is primarily economic and based on indices of economic distress (joblessness, benefits claims), income,



Data source: World Urbanization Prospects: The 2014 Revision  
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

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





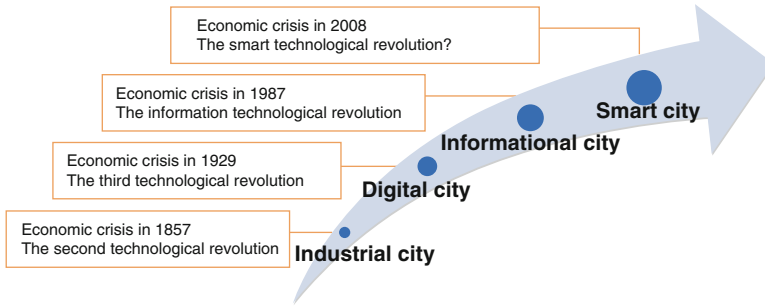
**Fig. 1.2** Change in population share across England, 1801 to 2010. Sources: Southall H/University of Portsmouth, 2010. NDMIS, Mid-Year Population Estimates, 2010

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)

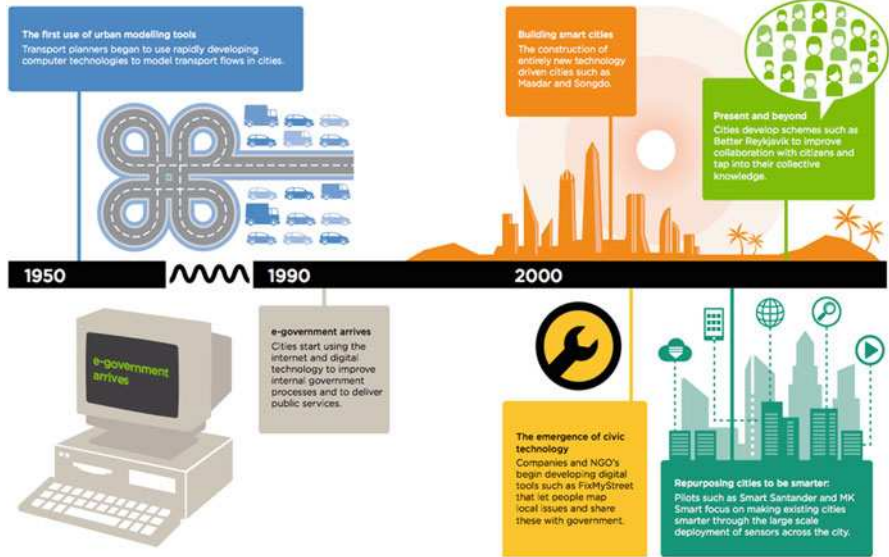
These are not new issues, planners, scholars, authors and architects have been talking about the future of cities since ancient times (Fainstein, 2014). In the past century, after Ebenezer Howard’s landmark *Garden Cities of Tomorrow* (1902), urbanism itself, as a distinct term and discourse has grown 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