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SMART CITIES

The sustainable program
of six leading cities

Bertrand Quélin and Isaac Smadja

Bouygues – HEC Paris Chair
Smart City and the Common Good

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Acknowledgements

This book is the result of a rather long writing process marked by the Covid-19 pandemic in 2020-2021, but above all by several types of collaboration.

The Bouygues-HEC Paris Chair entitled 'Smart City and the Common Good' was officially ratified in June, and launched in October 2020. Since then, it has enabled the development of numerous interactions and exchanges between the Bouygues group and HEC Paris. Among the first notable achievements, a business case, entitled Montrennoble, has been written. It simulates the responses of companies to the expectations of a large city. For its part, this ebook represents another outcome. It is devoted to the challenges of tomorrow's city and offers an assessment of six cities in the world, all exemplary in their policy choices and orientations in terms of mobility, energy saving and citizen participation, and many other dimensions.

At HEC Paris, the Department of Corporate Partnerships and Public Funds, jointly with Bertrand Quélin, spent nearly ten months negotiating the content and scope of the Chair with various players in the Bouygues group. This HEC department also worked to successfully launch the Chair during the first year of the pandemic. It initiated various events to give concrete expression to this partnership and strengthen the links with the Bouygues group.

In close collaboration with the Society and Organizations Institute at HEC Paris, this Chair naturally contributes to advancing our knowledge of the major issues of tomorrow's city, its carbon footprint, and the effective solutions to be found to meet the challenges of climate change and urban demographic concentration.

Lastly, the Bouygues-HEC Paris 'Smart City and the Common Good' Chair has enabled us to deepen our collaboration with various HEC programs, including the Sustainability & Social Innovation (SASI) and Strategic Management MSc programs, as well as with the start-ups and entrepreneurs who revolve around Station F in Paris.

In sum, placing this book under the sign of the Chair and of the collaboration implies, of course, highlighting how the collaboration took shape between the two co-authors. The writing process began under the classic auspices of a student's work with a professor, even before the Chair was officially signed. The scope of the project and the quality of the collaboration made it possible to become aware of the urban challenges and the exemplary nature of the solutions initiated and started by certain large cities in the world. The project has taken shape. However, health conditions gradually reduced the ability to travel and focused the interviews with the different actors on technological media: it was almost impossible

to conduct a face-to-face interview. This demanding context explains why our studies of the six cities focused on identifying what the municipal teams in charge of urban policy had said, were saying, and were publishing about their projects and achievements to make their cities more sustainable.

The genesis of this book has therefore benefited from the support of many people. We would like to first thank Gilles Zancanaro, Senior Vice President-Digital, Innovation & Risks at Bouygues SA, and sponsor of the 'Smart City and the Common Good' Chair, Philippe Cuenot, Group Director of Innovation and Social Development, and Marianne Gallon, Group Director of Career Development, as well as all the members of the Chair's Steering Committee, Yves Legrand, Director of Technical Operations at Bouygues Telecom, Etienne Gaudin, Director of Development and Mobility at Colas, Arnaud Mopin, Director of Innovation at TF1, Gérard Lodetti, Deputy Managing Director of Linkcity, Claire Boilley Forestier, Head of Sustainable Development at Bouygues Construction, Yann Aubry, Managing Director of Urbanera, Stéphane Slama-Royer, Deputy Managing Director Île-de-France at Linkcity, as well as the thirty or so executives and managers who have agreed to be interviewed between October 2020 and March 2021.

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We would like to thank all of them for the warm welcome given to this ebook project.

Biographies



Bertrand V. Quelin

Bertrand V. Quelin is the Bouygues Chair holder of Smart City and the Common Good at HEC Paris, where he is Professor of Strategy.

He earned a PhD degree in Economics from the University of Paris, and his research areas are about the new inter-organizational forms, contracts between companies, and the transaction cost economics. His recent publications cover hybrid organizations, public-private partnerships, strategic outsourcing and contractual disputes between companies. Bertrand V. Quelin has published numerous academic articles, chapters in collective books and three books. He is currently a member of the editorial boards of the Global Strategic Journal and Journal of Management Studies. In 2017, he co-edited a special issue on "Public-Private Collaboration, Hybridity and Social Value: Towards New Theoretical Perspectives."

He has been twice a Visiting research scholar at the University of California at Berkeley (USA). In 2012, he was Visiting Professor at Insper (São Paulo - Brazil) and Fundação Getulio Vargas (Rio de Janeiro - Brazil). He has also lectured seminars, and participated in many conferences and workshops around the world.

In parallel with his research and teaching activities, Professor Quelin was, at HEC Paris, Director of the HEC PhD program (1999-2005) and Academic Director of the MSc in Strategic Management (2006-2012). He has been Head of the Strategy and Business Policy Department (2013-2018). To complement, he has served to the HEC Executive Committee, the Promotion and Tenure Committee and different Committees at HEC Paris. From 2013-2015, he has been an international expert to the National scientific qualification committee in Italy.

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Isaac Smadja

Isaac Smadja is a Project Manager Officer for Invent for Society and Digital Inclusion at Capgemini, where he helps to develop solutions focusing on positive impact for society and the environment.

He earned a Master of Sciences in Sustainability and Social Innovation from HEC Paris, where he had the occasion to develop deep knowledge on various topics, from environmental sustainability to social impact. During his master's degree, he also earned a certificate on Social and Inclusive Business. Before that, he spent few years studying the impact of the implementation of Green Roofs in cities and developed a master thesis intitled "The Case of Green Roof: How can we build a model, based on green roof implementations, that could help cities mitigate risk related to climate change while contributing to a positive societal and environmental impact?".

He is also really engaged on climate related topics and became a facilitator of the Climate Fresk to help raising awareness about climate change.

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Executive summary

This project, undertaken within the activities of the **Bouygues-HEC Paris Chair held by Bertrand Quélin** (Bouygues Chair Professor in Smart City and the Common Good and Professor of Strategic Management at HEC Paris), **identifies and analyzes six leading smart cities** located across the globe: Amsterdam (Netherlands), Barcelona (Spain), Copenhagen (Denmark), Singapore, Toronto (Canada), and Vienna (Austria).

Although our analysis of these six smart cities is based on the IMD World Competitiveness Centre Smart City Index,* **we have challenged the structure of the IMD's investigation and complemented its findings with additional information sources** (newspapers, reports, and chapters) that we obtained by **examining cities' websites and digital platforms**.

This Executive Summary is a synthesis of the six reports, which we prepared in 2020 and 2021. It summarizes all the essential information on each city and presents it through comparative charts. This ebook also includes a first chapter that identifies the main challenges and issues involved in urban transformation. In the final chapter, we set out some perspectives on smart cities and discuss further steps for cities to develop and implement sustainable initiatives and policies.

One of the key objectives of the six detailed case studies that comprise the ebook's main chapters is **to report and centralize all information on these smart cities** that could be accessed via the **cities' official websites, documents, and frameworks**.

Therefore, our data are the decisions and deliberations published by the actors (generally elected officials) in charge of urban transformation. After we conducted a detailed review of cities' publications and websites, we decided to break down our approach into five main topics that are of common relevance to the six cities we study, even if the local forms they take are specific to each city.

The boxes below summarize the main topics that are common to the six smart cities. We have given the topics the following labels: Objectives, Frameworks, Technologies, Citizen Participation, and Actors.

OBJECTIVES

Identify the **key objectives of each smart city initiative** to understand its timeline and focus.

FRAMEWORK

Identify and report the **official framework and plan** of each smart city program to assess the credibility of the policies and initiatives implemented.

TECHNOLOGY

Understand and identify the **main technologies used to achieve each city's objectives** and ensure sustainable development there.

PARTICIPATION

Identify **citizens' role** in smart city initiatives as well as the **mechanisms for their participation in them**.

ACTORS

Identify smart city programs' **key actors** and **the connections between them**.

BOX 1 – Research process and methodology

Our approach is based on a detailed analysis of the decisions made by the six smart cities' governments, as well as on the publications and news stories that appear on the cities' official websites.

We invite you to take a moment to imagine a person who considers herself to be a "citizen of the world." Owing to the COVID-19 pandemic, she is stuck in one place, but she is interested in finding out more about the different things cities are doing to meet the urban challenges of tomorrow and the kinds of urban transformations they anticipate future generations will face.

Unable to travel, our curious virtual globetrotter visits the official websites of the cities that interest her in order to find out about their policies and projects. She wants to know: Are the projects that the sites describe already being implemented? How focused on the future are they? How are they structured and organized? What messages do the websites emphasize? How are priorities ranked on the websites? What time frames have been established for policy formulation and delivery? What achievements, work-in-progress milestones, or completed projects are described? Have any projects been revised since they were launched?

This bottom-up exercise in imagining how an ordinary person might be curious about smart cities was the

starting point for devising this study. It soon became clear that we would have to narrow our scope to specific cities. To do so, we focused on the small set of cities that had received one or more awards in recent years.¹ Having identified a dozen cities that met this criterion, we discovered that some of them had already been covered in depth by other researchers owing to their uniqueness or their status as trailblazing or world-leading cities. After setting those cities aside, we were left with the six cities that are examined in this study. Four are located in Europe, one in North America, and one in Southeast Asia.

To design our study, we first used the list of criteria that IMD Business School uses to compile its Smart City Index. Second, we compared the different city rankings from the Smart City Index with each other. At the same time, we conducted a thorough reading of the websites and documents that many cities now produce on their policies and projects. Third, we created a shortlist of candidate cities to become the focus of our case studies. In drawing up the shortlist, we chose cities that had already received some form of relevant award. We then picked six cities from the shortlist as our case studies and refined and finalized the set of dimensions that we would use to analyze those cities' sustainable urban policies.

We are happy to acknowledge at this early juncture that we could have

picked many other cities besides our chosen six, and also that the restriction of our focus to six cities is a limitation of our work. However, covering each of the world's smart cities exhaustively would have required us to develop a very different methodology. Moreover, a work covering a large number of cities would have required us to use a very large and broad mix of indicators. That approach might form the basis of our next research project.

After we developed a good understanding of the IMD's work and tools, we decided to supplement the selection of main dimensions that its ranking uses. We did so to ensure that our approach would be consistent with emerging dimensions that the IMD's ranking did not fully cover until 2020—for example, citizen participation and health.

After critically assessing the basic indicators that the IMD uses to compile its Smart City Index, we obtained a list of eighteen dimensions to be used in our analysis of the six smart cities that we selected as case studies. Then, in order to make it easier to offer an overview of each smart city's characteristics, we grouped the dimensions into seven analytical categories. This framing of eighteen dimensions divided across seven analytical categories is intended to provide our curious observer with a reading grid for the six selected cities.

[1] The IMD Smart City Observatory (SCO) has annually published an index ranking 109 cities. The IMD uses economic and technological data, which it pools with citizens' perceptions of their cities. In 2017, the IMD started a collaboration with the Singapore University of Technology and Design (SUTD) (<https://www.imd.org/smart-city-observatory/Home/>). The private company 2ThinkNow also produces a ranking of cities. That ranking is based on between two and ten data points that are used to deliver benchmark scores. (<https://www.innovation-cities.com/>).

* <https://www.imd.org/smart-city-observatory/smart-city-index/>

BOX 2 – Seven analytical categories and scoring

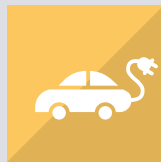
We have undertaken our research within a three-layer framework. At a very general level, the five topics set out at the start of this chapter (see the boxes labeled “Objectives,” “Frameworks,” “Technologies,” “Citizen Participation,” and “Actors”), synthesize the major priorities that each smart city focuses on. At an intermediary level, there are seven analytical categories that express the key priorities within a city policy: Health, Mobility, Activities, Opportunities, Governance, Housing and Energy, and Data Management. The first five of these come from the IMD Smart City Index; the final two are our own formulations. These seven analytical categories host the bottom layer of the framework, which comprises eighteen analytical dimensions that deal with the specifics of each smart city’s policies.

We assessed each of the six cities in our selection using the bottom layer’s eighteen dimensions that are grouped into the middle layer’s seven analytical categories.



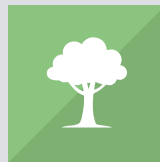
HEALTH

- Access to basic Sanitarion
- Recycling services
- Public safety
- Air pollution
- Medical Services



MOBILITY

- Public transport
- Traffic congestion



ACTIVITIES

- Green Spaces
- Cultural Activities



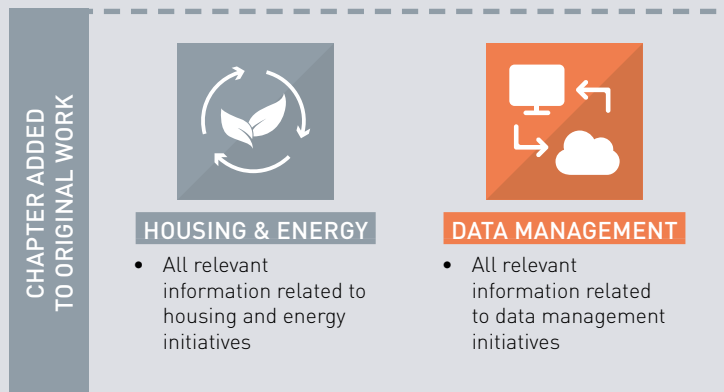
OPPORTUNITIES

- Employment finding services
- Access to school
- Lifelong opportunities
- Business create jobs
- Minorities feel welcome



GOVERNANCE

- Information on local government decision
- Feedback from citizens



Our six smart cities: overview, main lessons, and outcomes

The United Nations' seventeen Sustainable Development Goals (SDGs) identify challenges that need to be addressed if we are to achieve a better and more sustainable future for everyone across the world. Among these challenges are poverty, inequality, climate change, environmental degradation, peace, and justice. The UN also promotes

policies that aim to bring about greener, more inclusive economies, and stronger, more resilient societies.

These are the seventeen Sustainable Development Goals that aim to transform our world:

	GOAL 1: No Poverty		GOAL 10: Reduced Inequality
	GOAL 2: Zero Hunger		GOAL 11: Sustainable Cities and Communities
	GOAL 3: Good Health and Well-Being		GOAL 12: Responsible Consumption and Production
	GOAL 4: Quality Education		GOAL 13: Climate Action
	GOAL 5: Gender Equality		GOAL 14: Life Below Water
	GOAL 6: Clean Water and Sanitation		GOAL 15: Life on Land
	GOAL 7: Affordable and Clean Energy		GOAL 16: Peace, Justice and Strong Institutions
	GOAL 8: Decent Work and Economic Growth		GOAL 17: Partnerships for the Goals
	GOAL 9: Industry, Innovation and Infrastructure		

Source: <https://sdgs.un.org/fr/goals>

Many different organizations are currently running or trying to establish their own indexes, rankings, awards, and measurements of cities. These organizations come from a wide range of fields, including academia, the consulting sector, services providers, and media and press outlets. However, none of the work that these organizations do in this area can ignore the UN's seventeen priorities for the planet, because the UN enjoys a unique level of universal recognition and has received very strong support for its SDGs, which seem to have triggered a tipping point.

Among the seventeen goals, the eleventh squarely addresses cities and metropolitan areas: "Make cities and human settlements inclusive, safe, resilient and sustainable." (SDG #11). To precisely define what a smart and sustainable city might be, the UN has combined different key elements. However, we would argue that the UN has overlooked two important dimensions: technology as a tool, and innovation as a means to meet the big challenges that all cities across

the world face. In this ebook, our first chapter identifies the key challenges and huge difficulties inherent in conceiving the city of the future, which will face an extreme emergency: climate change. What shape will the urban way of life take in the twenty-first century? What will a smart and sustainable city look like?

Local authorities face growing complexity when it comes to managing cities. Concerns about environmental sustainability lie at the heart of the smart city, and this is reflected in the fact that many smart city initiatives address air quality, clean energy, or transport solutions.

The smart city provides a lens through which to look at the city as a system. Analysts and researchers who focus on smart cities are now promoting cross sector collaboration and partnership among stakeholders; they see the smart city as a space within which collective strategies for social innovation can be developed. The smart city's stakeholders

include private companies, public decision makers, civil society actors (citizens, associations, NGOs), and, sometimes, startups, academic institutes, or venture capital funds. The aim of smart city policies is to deliver a new social infrastructure.

In the first chapter of this report, we analyze the main challenges involved in urban living—those of today as well as those of tomorrow. We demonstrate how new information, communication, and energy technologies are creating opportunities for cities to save on resources. However, these technologies are nothing more than tools that are conducive to implementing proactive urban policies aimed at reducing pollution, greenhouse gas emissions, and social costs (for example, high rates of poor health, disease, death, and unemployment).

The development of smart cities is progressing slowly, and several factors are critical to accelerating momentum.

A geographical overview

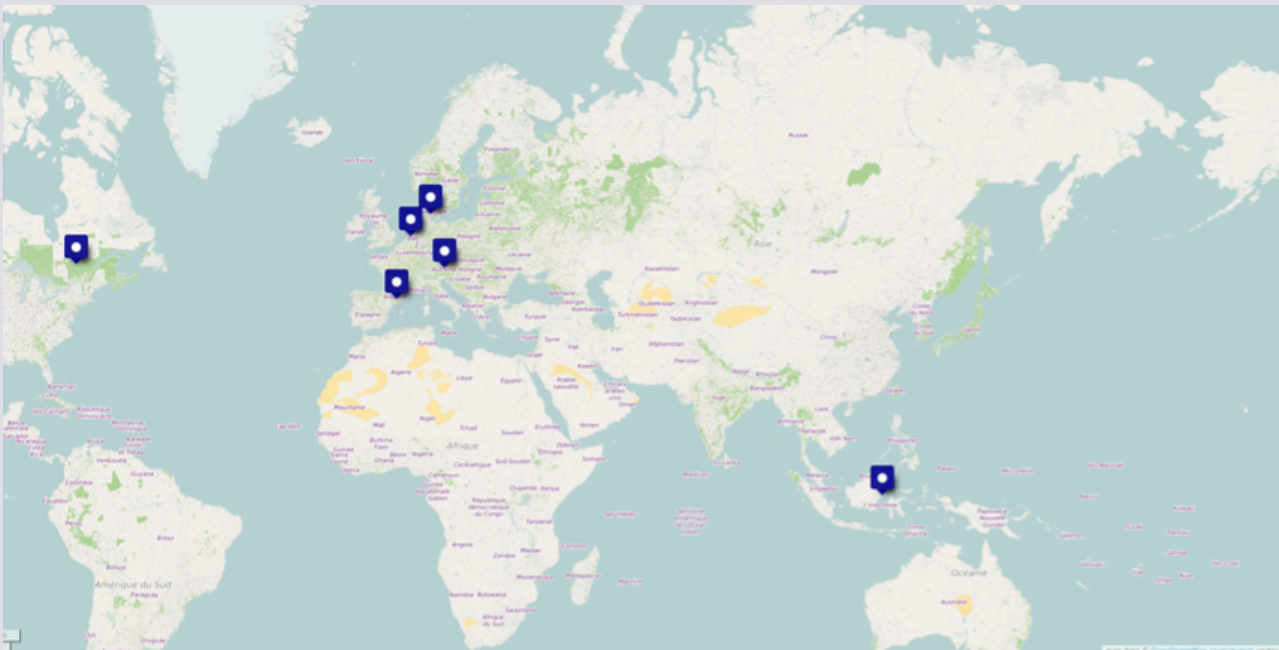
In addition to looking at four European cities, we examine two very interesting cities that are located further afield. All the cities that we look at in this ebook have been recognized,

Speeding up implementation of urban projects requires close collaboration between key stakeholders. Building a culture of initiative, innovation, and collaboration is also key.

Indeed, the smart and sustainable city is multidimensional, and diverse visions of the city of the future have been formulated. A city's implementation of any type of urban policy or planning initiative requires a vision of that city's future to be developed. The involvement of the wide range of stakeholders that the local community comprises should contribute to the development of this vision. In an urbanized world, public and private interventions are essential for giving citizens the experience they need and want. Moreover, novel technologies and funds are required to innovate and deliver the city of the future.

Chapters 2 to 7 of this ebook cover the six smart cities selected for this study: Amsterdam, Barcelona, Copenhagen, Singapore, Toronto, and Vienna.

through awards and rankings, as innovative cities that are developing solutions for coping with the consequences of climate change.



Our analysis reveals that each of these six cities' approaches to becoming a smart city corresponds to its own unique profile. We have labeled these profiles according to the challenge that each city's government prioritizes. We set out these six profiles below:

- Amsterdam: The Collaborative City
- Barcelona: The Digital City
- Copenhagen: The Green Growth City
- Singapore: The Smart Nation
- Toronto: The Google City
- Vienna: The Framework City.

Each label describes a feature that is unique to that city. However, our study identifies additional characteristics, some of which are shared by some or all of the cities, some of which are not. To give some examples of such partially shared characteristics, Amsterdam and Barcelona rely on an active decentralization, while Barcelona and Singapore prioritize data sharing.

For each of the eighteen dimensions that we used to analyze each smart city's policies, we assigned a numerical score indicating the intensity and the scale of the city's activities in that given area. We based our scoring on our reading of the cities' official websites and other official publications. To show how the different cities' scores along the different dimensions compare to one another, below we use a simple data visualization tool: a radar chart.



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