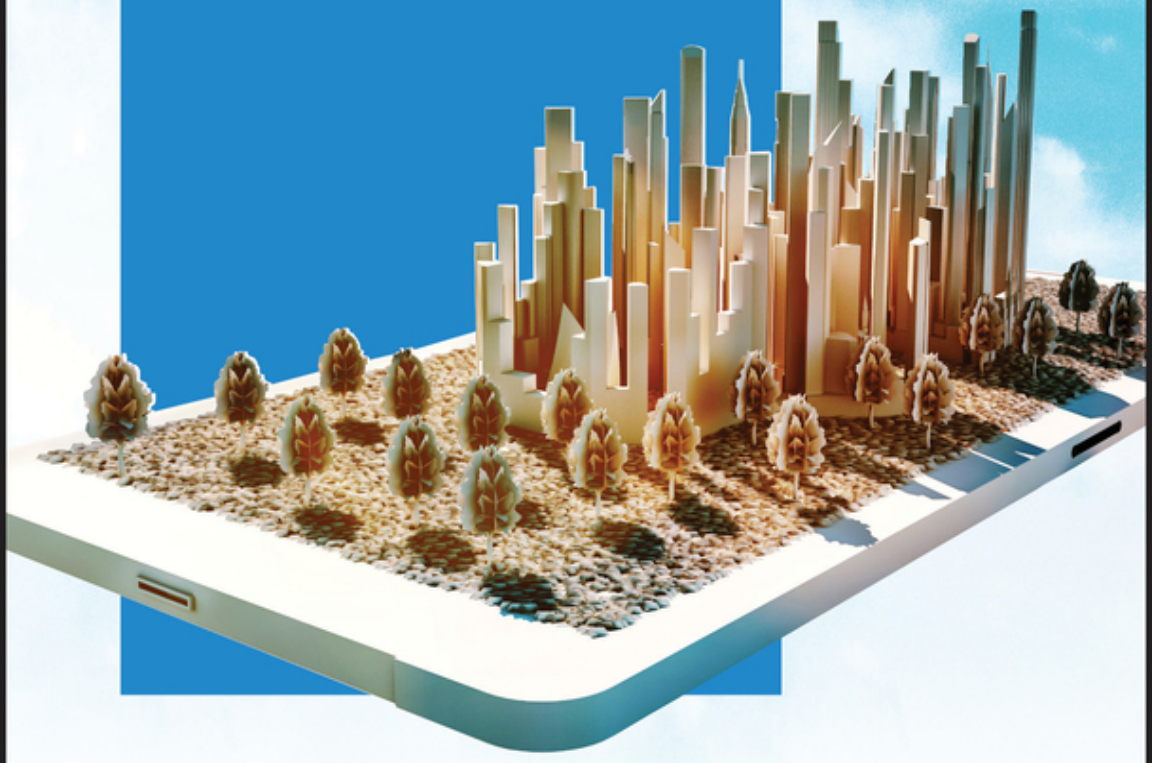
SMART CITIES

SMART FUTURE

SHOWCASING TOMORROW



MIKE BARLOW and CORNELIA LÉVY-BENCHETON

FOREWORD BY DI-ANN EISNOR, DIRECTOR, AREA 120, GOOGLE

INTRODUCTION BY THOMAS MÜLLER, MANAGING PARTNER, BEE SMART CITY

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Showcasing Tomorrow

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Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.

Library of Congress Cataloging-in-Publication Data is Available:

ISBN 9781119516187 (Hardcover)
ISBN 9781119516217 (ePDF)
ISBN 9781119516200 (ePub)

Cover Design: Burt Myers
Cover Image: © mikkelwilliam/iStockphoto

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

For Janine, Paul, and Elliot

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FOREWORD

Authors Mike Barlow and Cornelia Lévy-Bencheton have distilled hundreds of ideas, sources, technologies, and dreams into a thoughtful showcase of tomorrow. Much of the information is widely available, but their analysis, synthesis, and narrative make this a foundational guide for all of us.

And we need it.

Within the next 20 years, 70 percent of the world's population will be living in cities. The exponential change will be staggering. Designing and operating smarter cities is not just a movement—it is the inevitable shape of our future and the culture we are capable of building *together*. It will take an ecosystem—government, citizens, companies, and academics—to make sure that we do this right and hold each other accountable.

We have an opportunity to reimagine our cities and our lives in a way that is more equitable, more just, more sustainable, and just plain happier. But we need to do it *now* and make sure that new exponential technologies and governing bodies are of *service* and enhance the quality of life of our citizens.

As with all change, it will be uncomfortable. Citizens will demand transparency, higher levels of service, and quality

of life. And they will be able to compare their services to their neighbors and to residents of other cities across the globe.

Today, lack of trust is one of the largest barriers to massive collaboration. We assume that each person and entity has an agenda. We've learned that it is hard to trust across borders or outside of our groups.

But one of the most exciting aspects of transformative technologies is the ability to delegate trust across decentralized networks. It will become much harder to incentivize people for actions that are not in the common interest. When we don't have to worry about trust, we can focus on what we can achieve. That level of collaboration has never been seen before and will be a powerful force in design and co-creation.

We are seeing an emerging cultural shift in which technology is the supportive tool set. The key questions are: How do we make tools that allow all of these cities and citizens to improve quality of life, and how do we scale citizen engagement and participation, so we can define and measure quality of life? That's what really matters.

Governments, private companies, and citizens will all need to work together to design these platforms, and to provide knowledge, outreach, and tools that are distributed, decentralized, and available to all. *The work that lies ahead is hard and it requires radical adaptability.*

As an entrepreneur, urbanist, and investor, I'm inspired by the seeds of the platforms outlined in this book. They

speak to supporting citizens, citizen experience, and human-centered design. DigiTel, Tel Aviv's innovative citizen information platform, is a good example of the kind of people-focused technology we need. The goal of DigiTel is helping people to become more engaged with their city and its services. It helps residents form deeper and stronger emotional connections with the urban environment around them.

As a dreamer, I knew from the opening page that I would love this book. I don't think *Blade Runner*, I think Shambhala. If we imagine it, we can build it. And I nodded vigorously at every chapter, especially the book's opener…

> *El Dorado, Atlantis, Shambhala, Avalon, Xanadu, and Shangri-La. Those fabled places inspire our dreams. They are fantasies that nourish our imagination, spark our curiosity and embolden us to envision what could be… This book approaches the smart city from the perspective of the human spirit … This is a book for dreamers and visionaries. We invite you to dream along with us and to imagine the world your children and grandchildren will inhabit.*

As a technologist, I know that our future urban systems will bridge data, provide insights, and be more efficient and transparent, but I feel a heavy responsibility to be a wise steward of these technologies and ensure that they are working for the people and designed with the people.

I started the US office of Waze nine years ago, underestimating the impact we would have on mobility and ultimately

on city operations. One Friday night in 2012, I got a call from the White House during Superstorm Sandy. There was a fuel shortage on Staten Island, N.Y. Motorists were waiting in lines for three to four hours. The government asked for our help in collecting citizen data. For the first time ever, we sent a push notification to all Wazers in the area asking for information on which gas stations had power, which had fuel, and how long the lines were.

By the next day, we had thousands of responses that the Federal Emergency Management Agency (FEMA) could use to figure out where to send fuel trucks. That fundamentally changed my perception of what we were creating. It inspired the launch of the Waze Connected Citizens program to share data on incidents, traffic, events, and construction between Waze and city partners.

Since then, we've worked with over 650 cities, trying to help them use data as infrastructure. Our data has been used to improve emergency response times (e.g., in the United States, 70 percent of crashes are reported through Waze *before* they're reported through 911), close the loop on citizen problems, such as potholes and speed limit changes, redefine waste management and snowplow routes, and reduce congestion. In harnessing the insights of millions of Wazers, we have evolved from a traffic app to a change agent in traffic and mobility innovation.

One of our biggest successes came during the 2016 Summer Olympics in Rio de Janeiro. The city needed to accommodate a million visitors in an area that was already famously congested. We created an ad hoc team of Waze

employees, Waze on-the-ground map editor volunteers, city officials, and citizens—all working together to collect and share the information as quickly as possible. The ad hoc partnerships performed marvelously, and case studies from Rio have now been shared with other cities, which can learn from these tests.

But we didn't stop there. We formed our Connected Citizens program with hundreds of global partners, including city, state, and national government agencies; nonprofits; and first responders. Software code from the program is now on GitHub and other open platforms, where it can be shared and adapted by cities and states all over the world.

Experiments are a start, but ongoing learning, iteration, operational tools, and transparency allow cities to become living laboratories in the best sense.

Based on this work, I'm now currently incubating new urban systems at Google's Area 120. Here are a few guiding motivations:

- Technology can enable cultures to flourish in their own unique ways.
- Technology should remove unwanted friction and allow people to focus on quality of life.
- Technology must evolve hand in hand with ethics, philosophy, and society.
- Technology is the best opportunity we have to discover the needs, ideas, and voices of every citizen.

I look at this as a move toward the self-awareness of cities. Self-awareness describes a process of learning, reflecting, acting on what we've learned, and constant adaptation to become better. A city is a living organism that adapts with every new citizen, event, visitor, and policy.

A city can have its own self-awareness, powered by technology in service of society. Self-awareness is also a cornerstone of a life well lived for individuals within a community. We will screw things up, we will scrap ideas that sounded good and were voted in. We will iterate and learn.

Self-awareness is the most human of goals. We want to improve, see things clearly, and understand our place in the world. This is what the right urban technology platform and planning can enable.

Existential technologies, including robots, artificial intelligence (AI), blockchains, and even self-driving cars, can fundamentally alter society and must be deployed thoughtfully and responsibly as part of an entire intelligent system. We will need to deal with issues, such as privacy in blockchain, bias in AI, fair economic development in robotics, and just use of space, as well as other important policy decisions.

The goal of this effort is the wise stewardship of technology to support culture and society through a new urban system that is dynamic, adaptive, and supportive.

I read this manuscript while in Barcelona, Spain, a city that was referenced multiple times for its quality of support and

civic engagement. I was inspired to visit projects and places mentioned by authors Mike and Cornelia, such as the Institute of Advanced Architecture of Catalonia, where they are 3D printing algorithmic "bricks" of local soil and crafting citizen sensor kits.

I see technology being used to make tools to be used by all. Developed at Barcelona's Laboratory for Democratic Innovation, Decidim is a joint effort of 17 organizations, including software companies, industry consortiums, research institutions, and civic associations. Decidim allows citizens to propose ideas, conduct surveys, call public meetings, and join the debate on whether proposals are good solutions to identified needs. Decidim is currently used by municipalities in other parts of Spain, and by local governments in Finland and France.

For me, this book is a call to action. As they say in Catalonia: *Decidem*. We decide. Let's get on it!

Di-Ann Eisnor
Director Area 120, Google

ACKNOWLEDGMENTS

Smart Cities, Smart Future is our interpretation of a global phenomenon that is rapidly transforming our lives. The book is both a distillation of our research and a window into the future of our planet.

The book also includes a glossary of essential smart-city terms and supplementary lists of worthwhile conferences and strong organizations making a difference in the worldwide smart-city movement.

Smart cities are complex blends of interoperable technologies, systems, and services designed and orchestrated to help people lead productive, fulfilling, safe, and happy lives.

No two smart cities are alike. No one can say with certainty or precision what the term "smart city" means. Clearly, the smart-city movement is a work in progress. There is no standard definition or template.

We have done our best, however, to capture and convey the depth and richness of the smart-city movement, and to explain its potential as a force for positive change.

We take a human-centered approach to the subject, describing the impact of smart-city projects on people in towns, cities, and nations around the world. The book

includes descriptions of ongoing smart-city projects in North America, Europe, Asia, and the Middle East.

As you will see in the chapters ahead, we are more interested in people than in technology. In a very real sense, this book is the story of smart citizens whose lives are transformed by smart-city projects, initiatives, and programs. The book is a guide to an emerging world in which people interact continuously with smart machines, vehicles, buildings, and systems.

Smart Cities, Smart Future is a combination of research and journalism. In addition to studying the subject in exhaustive detail, we interviewed dozens of experts and active participants in the smart-city movement. At the end of the book, we have included short biographies of the sources we interviewed at length and quoted directly.

For sharing their knowledge, time, and energy, we are profoundly grateful to the following people: Hannes Astok, Xabier E. Barandiaran, Jeffrey J. Blatt, Francesca Bria, Boyd Cohen, Di-Ann Eisnor, Andrew Guthrie Ferguson, Christina Franken, Pete Herzog, Mike Holland, Kevin Fan Hsu, Jerry MacArthur Hultin, Jon Jennings, Ariel Kennan, Matthew Klein, Martin Kõiva, Alan Leidner, I-Ping Li, Josh Lieberman, Amen Ra Mashariki, Dale W. Meyerrose, Chris Moschovitis, Emma Mulqueeny, Joseph Okpaku, Gala Pin, Jake Porway, Vijay Raja, Jennifer Robinson, Jennifer Sanders, Eytan Schwartz, Leah Shahum, Zohar Sharon, Dave Shuman, Lisa Smith, Kirk Steudle, Linnar Viik, and James Von Klemperer.

We also thank Morey Altman, Edith Barlow, Michael Batty, Dominique Bonte, Laura Brumley, Barry Coflan, Pilar

Conesa, Joe Cortright, Kate Daly, Robby Demming, Luc De Rooms, Leila Dillon, Lisa Faison, Paul Feiner, Gordon Feller, Ari Gesher, Julie Kerr, Meeli Kõiva, Erin Kuller, Michael Lake, Julia Ingrid Lane, Richard Laudor, Mike Loukides, Areti Markopoulou, Alex Mateo, Roger Millar, Cathy O'Neil, Paula Paige, Edna Pasher, Jonathan Reichental, Natalia Rivas, Euan Semple, Sapan Shah, Sameer Sharma, Ian Slesser, Richard Soley, Debbe Stern, Kirk Steudle, Judith Urbano, Melinda Venable, Noreen Whysel, Miriam Young, and Diana Zitnay for their suggestions, feedback, assistance, and advice.

We offer special thanks to our good friends at bee smart city—Thomas Müller, Bart Gorynski, and Alexander Gelsin—for their generous contributions to our chapter on the stages of smart-city evolution and development.

Additionally, we thank our editor, Sheck Cho, and his assistant editor, Michael Henton, for their guidance and support throughout the project.

We wrote this book with you, the reader, in mind. We hope you find it informative, educational, and enjoyable. We wish you good health, long life, and great adventures.

INTRODUCTION

Thomas Müller

Co-founder and managing partner at bee smart city

What is a smart city? The term itself is a sticky concept in a slippery environment. Most of its definitions revolve around technology and data science.

Unquestionably, technology and data science are critical enablers, but the outcome depends less on the enablers themselves than on how they are applied. What works in the laboratory doesn't necessarily work in real life.

The smartest smart-city solutions target specific groups within a city or a community. They engage directly with citizens and users to generate benefits that can be readily appreciated and understood. Building a smart city is an ongoing endeavor of development, design, implementation, adoption, feedback, iteration, and continuous improvement.

A smart city helps people imagine and create solutions for improving "the place we call home."[1] A smart city provides its residents with the capabilities and resources they need to find happiness, fulfillment, and prosperity.

It cannot be a purely top-down process. Smart cities arise from people working together to achieve common goals. In other words, it's a team effort.

Boyd Cohen, a researcher, author, and visionary entrepreneur, describes three levels, or generations, of the smart cities movement:[2]

Smart cities 1.0: Technology Driven

Smart cities 2.0: Technology Enabled, City Led

Smart cities 3.0: Citizen Co-created

Smart cities don't evolve in lockstep. Cities follow different evolutionary paths, each at its own pace. The smartest smart cities have reached the third level, in which citizens work together to develop solutions that genuinely matter to them, rather than relying primarily on vendors or consultants.

Collaboration Engines

A smart city is an ecosystem of people, processes, and solutions. The most important driver of success is collective effort—the sum of many individual actions taken in pursuit of a shared goal.

In a very real and concrete fashion, smart cities serve as collaboration engines. In the parlance of the software industry, they are platforms. They provide a common hub for individuals, and for groups, organizations, agencies, and companies.

Cities all over the world have recognized the benefits of becoming smarter. The term "smart city" began as a trendy catchphrase that was used somewhat indiscriminately

by technology marketers. Today, smart cities are a global phenomenon with real staying power.

Focused on People

We are especially pleased to see the adoption of human-centric approaches to engaging citizens and other stakeholders early in the process of smart-city solution development, as well as in later trial and roll-out phases.

Human-centric approaches are absolutely imperative. Simply unveiling a new municipal service won't convince people to use it—they need to understand how it will help them.

Smart cities encourage bottom-up innovation and co-creation. At a very deep level, they understand that building a smart city is a democratic process. They also recognize and appreciate the emergence of "smartivists," a term for individual citizens who actively promote or support smart-city initiatives on a voluntary basis.

Smartivists play an important part in the smart-city movement by offering their expertise, energy, and experience. They can work as individuals or in groups. Sometimes they help by establishing or leading coalitions of stakeholders focused on solving specific problems in their city or community. They represent a new and exciting form of civic activism.

Additionally, smartivists become a valuable source of collective intelligence and hands-on knowledge. Their combination of commitment, enthusiasm and local pride bring vitality and a sense of continuity to the smart-city movement.[3]

Dealing with Obstacles

It would be pleasant to imagine that smart cities won't face problems, but that would be an unrealistic hope. There are still barriers, pitfalls, and traps for the unwary. Some cities will opt for quick technology fixes, instead of finding ways to harness the collective energy of their citizens to identify, prioritize, and solve problems.

Data ownership, privacy, and security will become major issues as people become more generally aware of the risks associated with continual surveillance and monitoring. Those concerns must be taken seriously; they can't simply be swept under the rug or kicked down the road. Smart cities will doubtlessly be at the front lines of any battles over data collection and data usage.

The digital divide is often forgotten when people talk about new technology, but it's a real problem that must be confronted. How will cities guarantee that all residents—regardless of age, education, social, or health status—are served fairly and equitably?

Will Government Help or Hinder?

City governments have highly complex structures and they tick in certain ways. Politics, budgetary constraints, legacy systems, and traditional modes of thinking can easily slow down or even derail the development of smart-city projects.

The development of smart cities and communities requires strong leadership and a long-term vision. For some people, the idea of getting involved in local government might seem like a waste of time.

Most government officials want to help, and they are open to ideas from their constituents. They might not move as quickly as you would like them to, but they will move eventually.

Don't use government inertia as an excuse for not participating. If smart cities are important to you, attend a public meeting at your local town or village hall and make your voice heard. You will be surprised at how easy it is to participate in the process and to make a difference.

Connected Ecosystems

We recommend thinking about smart cities in holistic terms and remembering that cities exist within larger regional ecosystems. Cities are not remote islands; they are physically and digitally connected with the rest of the world. Smart cities are part of a global community, so there's no need for going it alone.

There are hundreds of smart cities to learn from. We urge you to visit some of them—especially if you want to become a smartivist. If you can't afford to travel, use a web browser or a smartphone to find out what people are doing in smart cities. It's amazing how much useful information about smart cities can be gleaned from online searching.

Here's an extremely abbreviated list of smart cities that are worth learning more about. Taking a look at these cities will get you off to a good start:

Europe

Amsterdam (Netherlands)

Barcelona (Spain)

Copenhagen (Denmark)

Eindhoven (Netherlands)

Espoo (Finland)

Nice (France)

Vienna (Austria)

The Americas

Columbus, Ohio (US)

Kansas City, Missouri (US)

Mexico City (Mexico)

New York (US)

Palo Alto, California (US)

Portland, Oregon (US)

Rio de Janeiro (Brazil)

San Diego, California (US)

Seattle, Washington (US)

Middle East, Asia, and Asia-Pacific

Adelaide (Australia)

Bhubaneswar (India)

Dubai (United Arab Emirates)

Meixi Lake (China)

Melbourne (Australia)

Moscow (Russia)

Singapore

Tel Aviv (Israel)

Wuxi (China)

Yinchan (China)

In addition to reading this book and visiting the bee smart city website, we recommend downloading the Global Smart City Performance Index[4] created for Intel by Juniper Research. The index ranks smart cities across four dimensions: mobility, health care, public safety, and productivity.

Setting the Stage for Long-Term Success

Establishing an ecosystem of human-centric solutions over time sets the stage for long-term success and takes smart cities to the next level in their journey toward becoming models for all cities.

Not all solutions need to be homegrown. Municipalities should look beyond their borders and the borders of their regions for existing solutions that can be replicated or adapted for local use. Learning from other cities and communities, and sharing best practices, is an integral part of the smart-city journey.

Platforms for Continuous Innovation

We believe that smart cities have the potential to become the world's leading platforms for continuous innovation in areas such as public safety, public health, mobility, education, finance, trade, immigration, energy efficiency, waste management, cybersecurity, data science, robotics, and many other critical domains of modern life.

At bee smart city, we're doing our part to support the development of smarter cities by providing a global platform for adaptable and replicable smart-city solutions that have been implemented successfully in hundreds of cities around the world.[5] On our platform, we connect thousands of government users, solution providers, research, and university specialists—as well as smartivists—so they can take their cities and communities forward. On our global hub, we share successful smart-city strategies and solutions as well as city case studies that provide added value for smart-city development.[6]

Success in smart cities essentially is a result of knowledge and experience drawn from external and internal collective intelligence combined in local collaborative and purposeful