

a planet of civic laboratories

THE FUTURE OF CITIES,
INFORMATION, AND INCLUSION



INSTITUTE FOR THE FUTURE

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2020 FORECAST: the future of cities, information, and inclusion

a planet of civic laboratories

Over the next decade, cities will continue to grow larger at a rapid pace. At the same time, new technologies will unlock massive streams of data about cities and their residents. As these forces collide, they will turn every city into a unique civic laboratory—a place where technology is adapted in novel ways to meet local needs. This ten-year forecast map charts the important intersections between urbanization and digitalization that will shape this global urban experiment, and the key tensions that will arise.

The explosive growth of cities is an economic opportunity with the potential to lift billions out of poverty. Yet the speed of change and lack of poor foresight has led to a swarm of urban problems—poor housing conditions, inadequate education and health care, and racial and ethnic inequalities. The coming decade holds an opportunity to harness information to improve government services, alleviate poverty and inequality, and empower the poor. Some key uncertainties are coming into view:

- What economic opportunities will urban information provide to excluded groups?
- What new exclusions might arise from new kinds of data about the city and its citizens?
- How will communities leverage urban information to improve service delivery, transparency, and citizen engagement?

As information technology spreads beyond the desktop into every corner of city dweller's lives, it will provide a new set of tools for poor and excluded groups to reengineer their relationship with government, the built environment, and each other.

Funded by a grant from the Rockefeller Foundation, the Institute for the Future has identified this challenge—harnessing data for development and inclusion—as a critical cross-sectoral urban issue for the next decade and beyond. Integrating designed solutions from industry and government with the tremendous innovative potential of an engaged citizenry will be a powerful tool to address this challenge.

THE CHALLENGE:

Harnessing sensory information for development and inclusion

Historically, our ability to measure and monitor the city has been limited. Census demographics are but a coarse snapshot of the recent past. In the burgeoning cities of the Global South, huge informal settlements and complex migrations outstrip limited survey resources. What data is collected often ends up within fragmented silos of bureaucracy.

The next decade will be a period of rapid expansion in the supply of urban data and increasing sophistication in its use. The supply will expand as inexpensive sensors increase the kinds of indicators that can be measured, and the level of detail. Smart personal devices and embedded sensing in buildings and infrastructure will collect observations about human activity and urban habitats. Demand will be driven by urban management, planning and policy simulations, which take advantage of cheap computing power but require massive archives of fine-grained data. These sensory data streams and city simulations will increasingly be connected through open sharing standards and technologies.

Until now, the impacts of this shift on the poor and marginalized residents of cities have not been deeply discussed. The potential is clear, as urban data will play a central role in future strategies for poverty reduction, capacity-building and resilience, and citizen engagement. The challenge is identifying the intersections of social and technological trends that will create opportunities for innovation.

COMBINATORIAL LOCAL INNOVATION

Realizing the opportunity from urban data will require combinatorial local innovation: continuous, rapid, dirt-cheap cycles of prototyping. Already, the world's urban poor are creating many technology usage and service innovations enabled by the basic capabilities of mobile phones. The future won't just be a flow of advanced technologies from North to South, but a complex web of innovation. These experiments will create new templates for commons creation, design, and planning, markets and governance at the scale of individual citizens, networks, and cities. This map anticipates some of these templates, and emerging intersections of urban challenges and digital innovations.

THE RESPONSE:

Integrating designed and grassroots solutions

It's still unclear how value will be created from new urban data. But battle lines are being drawn over the future of the smart city.

Global technology companies are offering “smart city in a box” solutions. Governments are responding to their pitch: a smarter, cleaner, safer city. But there is no guarantee that technology solutions developed in one city can be transplanted elsewhere. As firms compete to corner the government market, cities will benefit from innovation. But if one company comes out on top, cities could see infrastructure end up in the control of a monopoly whose interests are not aligned with the city or its residents.

An opposing force of entrepreneurs, hackers, and “citizen hacktivists” are pursuing a different vision of the future city. Their pitch: urban data can support cities that are more democratic, more responsive, and more resilient. These do-it-yourself (DIY) urbanists take a lightweight approach to exploiting urban data. They use off-the-shelf components, open-source hardware and software, and cooperative strategies.

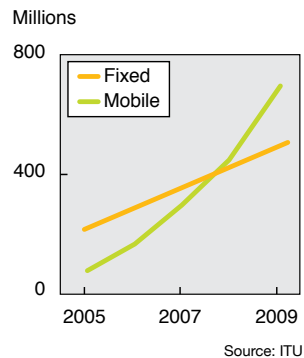
In the future, successful cities will need to integrate both models. Solutions will combine the scale of big platforms with citizen-driven innovations. To a degree, this integration is well under way, but urban leaders need to educate themselves and frame an agenda of openness, transparency, and inclusiveness. Without this catalyst for cooperation, we may repeat the devastating urban conflicts of the 20th century that pitted central planners like Robert Moses against community activists like Jane Jacobs.



Technologies that matter:

THE FOUNDATIONS FOR INCLUSION IN 2020

More broadband subscribers



If current trends continue, mobile broadband will become dominant, especially in the developing world.

BROADBAND CONNECTIVITY

from fixed to mobile

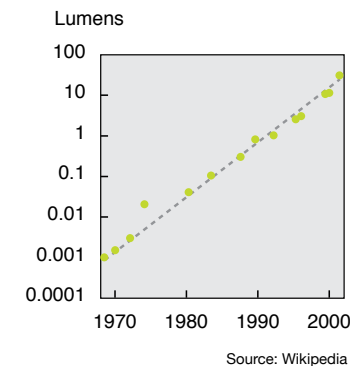
Telecommunications networks are the most costly and time-consuming foundation to build, but the connectivity they provide is an essential fabric for cities to unlock the potential of urban information.

Globally, video communications will drive an exponential growth in bandwidth consumption. A new round of investment in long-haul fiber optic networks will bring the needed capacity to cities in the Global North. The linking of coastal cities in the Global South into undersea fiber grids will reinforce their integration into the global economy. The net result: falling costs and increased access to networks will spread to a greater share of urban populations worldwide. Still, the poorest countries may lag behind, unable to stimulate private investment or sustain grassroots connectivity projects that can displace state-run telecom monopolies.

Investment in mobile wireless networks will heat up as demand grows throughout the urban world. Most cities are fully “lit-up” with mobile voice today. By 2020, most cities in the Global North and many in the Global South will be blanketed by 4G wireless networks offering 100+ Mbps mobile broadband. Voice will become just another kind of data carried on mobile networks alongside data and video.

Local social, economic, and political forces will shape the urban information explosion in every city over the next decade. But five technologies that matter—broadband connectivity, smart personal devices, open data infrastructures, public interfaces, and cloud computing—will lay the foundation for urban development and inclusion in 2020. The forecasts for these technologies are not point predictions: too many variables will shape how they play out in any specific time or place. Instead, they describe the broad, global advances in technologies that will enable change over the next decade. If properly harnessed, these changes have the potential to support the growth of vibrant cities and to empower all city residents, including the most marginalized and powerless.

Better, cheaper urban screens



Haitz's Law describes the steady improvement of LEDs, which will enable larger, brighter, and less expensive public screens.

PUBLIC INTERFACES

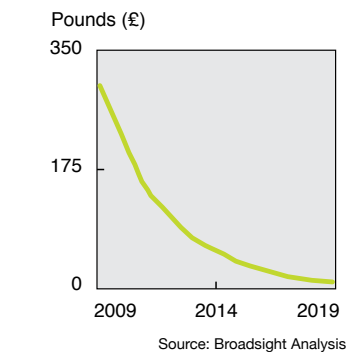
from terminals to natural interaction

Many new kinds of public interfaces to information will pervade cities by 2020. The falling cost of digital displays and sensing will allow computing to be embedded in buildings, kiosks, and furnishings.

Some interfaces will deliver “supercharged” interactions that combine speech and gestural inputs with immersive, high-definition graphics. These highly visual, natural and aware interfaces will supplant text and typing, which will have profound impacts on the ability for traditionally excluded populations – the illiterate, the elderly, the disabled, and those of limited education – to access digital information and create media. Public interfaces in media-rich urban environments will facilitate a shift toward interacting with computers in groups, rather than individually, which will also help expand access to computing and information services.

Yet, the future of public interfaces won't only be supercharged, it will sometimes be deliberately lo-fi. Ambient interfaces, which boil down complex streams of data to one or two simple indicators, will lurk in the background of everyday urban life, quietly signaling in our periphery.

Falling cost of smart phones 2009-2019



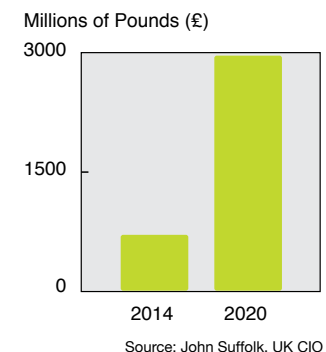
Highly-capable mobile devices will increasingly become affordable to many of the world's urban residents.

SMART PERSONAL DEVICES

from voice to multimedia

Today, well over half the world's population has a voice-capable mobile phone—and most of the five billion mobile subscriptions are concentrated in cities. If trends continue, by 2020 most of the world's population will have basic mobile voice communications, and more than half will have access to a smart phone or inexpensive tablet computer. These devices will be capable of voice and text communications, high speed Internet, high-resolution interactive video, location sensing, and considerable computing power and data storage. New locally-sourced designs will drive technology diffusion within the Global South—such as the \$35 tablet developed this year by Bangalore, India-based AllGo—and provide new scalable design solutions for the Global North. Manufacturing economies of scale will drive down costs, as hundreds of millions of devices are produced annually. Sophisticated personal devices will become important sources of sensory data about their owners and their urban surroundings.

Annual savings from the UK G-cloud



The United Kingdom's G-cloud will be a leading model for urban cloud computing infrastructure, because of both cost savings and new capabilities.

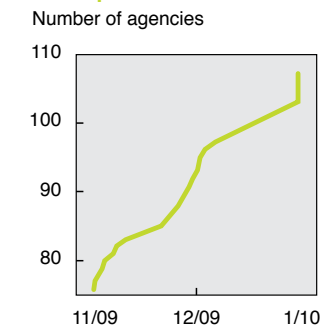
CLOUD COMPUTING

from the personal computer to the network computer

The next decade will see a dramatic centralization of the world's computing power, as cloud computing delivers new economies of scale. Cheaper devices will seem more powerful, as computing power can be moved to the cloud. Development and deployment of software and apps, multimedia content, and public data repositories to poor and excluded groups will be faster and less expensive. Cloud computing will also drive innovation in new services and experiences that leverage supercomputing capabilities. Data mining and analysis and intensely realistic simulations, for instance, will have widespread applicability in health, education, and business.

While in the short-term, cloud computing will be served by large, commercial clouds like Google and Amazon, the United Kingdom's national “G-cloud” initiative is a promising model for the megacities of the Global South. Government clouds will reduce IT costs for governments, and potentially provide a platform for small businesses to deploy services and applications.

The spread of open transit data feeds



Over 100 municipal and regional transit agencies in the United States have built data-sharing mechanisms.

OPEN DATA INFRASTRUCTURES

making transparency effective

As democratic governments continue to strive for greater transparency, the movement to expand access to public databases will spread and evolve. Today's crude sharing of database snapshots will still be widespread in 2020, but steady improvement in the flexibility and sophistication of data-sharing mechanisms such as application program interfaces (APIs) will allow third parties to not only read, but add to public databases as well. These tools will empower pro-poor innovation by broadening access to government data.

In cities in the Global South, where existing systems may be less robust, future data-sharing infrastructure will depend less on central sharing points and more on many-to-many networks of exchange between diverse sets of public agencies, NGOs and crowdsourced data repositories. The need to scale these micro-networks will drive innovation in distributed data-sharing standards and support systems.



Key tensions and implications

The growth of urban data is creating many opportunities for new products, services, and systems innovation; it also generates threats, conflicts, and dilemmas. To understand how urban data will shape the future of cities, we must consider the possibilities and the potential tensions and implications that urban data will generate.

BATTLE FOR THE SMART CITY | market growth vs. inclusive planning

Managing rapid urban growth and global warming will give rise to a multi-trillion dollar global market for smart cities and infrastructure. But achieving truly disruptive innovations that create lasting value from urban data will require a diversity of inventors. Competing visions of how smart cities should be built and run will create tensions between closed and open models, and ultimately between the drive for “smart” market growth and the evolution of a smart urban democracy.

Industry leaders will have clear visions for the growth of cities—and will promote those agendas with city officials. But the real opportunity for innovation and inclusion in the smart city is inclusive foresight. Open innovation networks, simulation, gaming, and visualization are all tools of engagement in anticipatory governance and inclusive city planning.

CITIZENS: What skills will citizens need to interface with the smart city and what new interfaces will engage them in helping shape their own urban futures?

NETWORKS: How can cities leverage social networks for sharing urban data and engaging diverse publics in urban decision-making?

CITIES: How can cities develop pro-poor foresight to set the agenda for future information infrastructures for everything from services to security to energy?

MORE DATA, MORE MODELS | visible vs. actionable

High-resolution visualization tools and computational simulation will dramatically improve our ability to see urban ecosystems at multiple scales. An improved understanding of the mechanics of social networks and increased mining of behavior patterns, along with sensor feeds and mobility tracking will in theory enable more anticipatory public interventions. However, a considerable gap will develop between the ability to collect data and the theoretical models needed to make sense of it. A diverse set of actors—academics, policy-makers, private organizations, hackers—will derive important insights from parsing the data, but models will lag behind. In many situations, data won’t eliminate the value of wisdom and intuition, but make it more valuable by creating even greater uncertainty.

CITIZENS: In a high-resolution city, how will individuals connect the dots between their own behavior patterns (which will be increasingly visible to them) and the potential for increasing the livability of their cities?

NETWORKS: To share rich data sets, computational modeling and visualizations across global cities, is a “global urban observatory” necessary to curate and standardize these models?

CITIES: How will urban planning and design respond to increasingly high-resolution urban data about the city? What new layers of inclusion and exclusion will emerge in a high-resolution urban future?

PROLIFERATING DIGITAL DIVIDES | access vs. agency

For the last 20 years, development strategies focused on increasing access to networks and devices. Today, the focus is shifting towards digital illiteracy. But falling costs of connected devices and advances in natural language and gestural interfaces will enable rapid progress on these “digital divide” challenges. A new set of more complex challenges will replace them. The web will continue to fragment into many different, unequal cyberspaces: privately-controlled application marketplaces, political jurisdictions that censor and block data services, and geopolitically-sensitive cloud computing infrastructures. How will “access” be defined in a complex network landscape? Urban data will present its own new set of challenges. Teaching residents and planners how to find, integrate, and use data streams will be critical to create value for marginalized communities.

CITIZENS: How can the structure of interfaces, regulation, and even pricing mechanisms for accessing data be designed not only for equal access but also for equal agency by individuals?

NETWORKS: How can social networks and social media be leveraged to engage broader participation in building smart infrastructures that meet the needs of diverse users?

CITIES: How can public policy enable private sector involvement in public access points and, more generally, in increasing digital literacy?

DATA CONTROL | safeguards vs. public good

Passive sensing and surveillance of individual mobile devices—physical locations, financial transactions, and social interactions—has tantalizing value to public managers for fine-tuning the design of cities and services. However, ensuring the security of personal data that charts the daily routines and habits of individuals will be paramount. There won’t be any easy solutions for privacy, because of the great variation in expectations across world cultures and the dynamic shift in norms that has been unleashed by social technologies. However, it is clear that flexible frameworks will be needed to constantly evolve new balances around privacy and transparency of both publicly- and privately-controlled data.

CITIZENS: What are the tenets of good digital citizenship and what kinds of safeguards will individuals want before participating in the urban digital commons?

NETWORKS: Who will control the data streams in various networks and how will that differ among cities?

CITIES: What new urban roles and functions will be required to undertake an innovative and proactive—rather than reactive—approach to safeguarding personal data streams?

PARTICIPATORY PUBLIC SERVICES | cooperation vs. offloading

Active and organized involvement by groups of engaged citizens suggests a more collaborative and participatory approach to the delivery of public services. For many, however, this level of engagement will be a luxury: the day-to-day realities of work and family life may hinder any notable upswing in communal participation. In cities where crowdsourced solutions fill gaps previously served by government, the appearance of an inefficient and ineffective public sector will be difficult to avoid. In cities where crowdsourcing fills gaps in which the provision of municipal services has always been inadequate, they may be viewed as nothing more than a formal offloading of government’s obligations.

CITIZENS: How can crowdsourced services be designed to leverage the things that people are already doing in their daily lives rather than adding to the burden of urban life?

NETWORKS: How can crowdsourcing via social networks support hyper-localization of public services to better meet the needs of diverse population segments?

CITIES: How can crowdsourced solutions be supported and integrated into formal service delivery systems without merely offloading responsibilities?

PRO-POOR CITIES | economic gap vs. knowledge gap

For the past several decades, poverty has been defined in economic terms, and aid programs have sought to bridge the economic gap by modernizing systems and practices among the poor to bring them “up to the standards” of the rest of the world. Many of these efforts have failed, often because they didn’t take into account existing knowledge in poor communities. Slums in cities as diverse as Caracas and Nairobi are complex adaptive systems that have emerged outside of the formal structures of the city to support the needs of the poor. Embedded in these systems is a wealth of knowledge that could reshape urban policy and produce novel pro-poor solutions.

CITIZENS: How can poor and excluded citizens redefine the categories of data collection to track the data that is most important to their communities?

NETWORK: How can data infrastructures tap and support the knowledge networks embedded in slums and impoverished communities to enhance pro-poor solutions?

CITIES: How can cities balance the promise of economic development and poverty reduction through digitalization with the opportunity to use urban information to strengthen the existing adaptive capacity of marginalized groups?



commons
self-organized and participatory efforts

markets
Demand and supply-driven offerings and experiences

design & planning
Open and enabling platforms for collaboration and decision making

governance
Public oversight and intervention



2020 Forecast Legend

This map highlights the advances and innovations that will harness urban data to reduce poverty and promote inclusion. These advances are placed on a matrix organized around three scales of response and four drivers.

SCALES OF INTERVENTION
Technology and governance will enable responses at multiple scales. This map lays out forecasts systematically along three scales of intervention, from people to networks and environments.

governance
CATEGORIES OF RESOURCES
This map lays out four approaches that we can use to increase our capacities in responding to this challenge: commons, markets, design & planning, and governance. These are the key mechanisms by which urban data will be used to shape the future of cities.

13 FORECASTS
Thirteen forecasts anticipate emerging intersections of urban challenges and digital innovations. Each forecast represents a directional shift in the approach to developing solutions, and is a template for future designs.

TRENDS AND TECHNOLOGY ADVANCEMENTS
Trends and technology advancements point out social and economic shifts, new technologies, and sources of urban data that, in combination, point us towards areas of innovation.

SIGNALS
Signals support each forecast with concrete examples from the world today that embody the trends and technology advancements and show the direction of the forecast as a whole.

KEY TENSIONS
Ions remind us to consider not only the forecasts, but also the potential conflicts that may emerge at this dynamic intersection. Remembering such dilemmas increases our capacity to respond to the challenges and opportunities of the next decade.

How to use this map:

INFORM, EXPLORE, INSPIRE

The Institute for the Future created this *2020 Forecast: A Planet of Civic Laboratories Map* to highlight future innovations that will harness urban data to reduce poverty and promote inclusion. These forecasts will inform and inspire your thinking about how technological and social trends may converge to create new opportunities; they will also highlight the tensions that may arise.

THINK about new interventions across scales and about the resources that will be needed to address poverty and exclusion.

FOCUS ON the big forecast stories at the intersections of social and technological trends.

DRILL DOWN into details and look ahead for similar developments in your area of expertise.

CONSIDER the potential tensions, or conflicting implications, that may arise from the forecasts.

About the ...

[Institute for the Future](#)

The Institute for the Future is an independent, nonprofit strategic research group with more than 40 years of forecasting experience. The core of our work is identifying emerging trends and discontinuities that will transform global society and the global marketplace. We provide our members with insights into business strategy, design process, innovation, and social dilemmas. Our research spans a broad territory of deeply transformative trends from technology to health, the workplace, and human identity. The Institute for the Future is located in Palo Alto, California.

[Rockefeller Foundation](#)

The Rockefeller Foundation fosters innovative solutions to many of the world's most pressing challenges, affirming its mission, since 1913, to "promote the well-being" of humanity. Today, the Foundation works to ensure that more people can tap into the benefits of globalization while strengthening resilience to its risks. Foundation initiatives include efforts to mobilize an agricultural revolution in Sub-Saharan Africa, bolster economic security for American workers, inform equitable, sustainable transportation policies in the United States, ensure access to affordable and high-quality health systems in the Global South, accelerate the impact investing industry's evolution, and develop strategies and services that help vulnerable communities cope with the impacts of climate change. For more information, please visit www.rockefellerfoundation.org

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