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## Governing Smart Cities as Knowledge Commons - Introduction, Chapter 1 & Conclusion

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## **GOVERNING SMART CITIES AS KNOWLEDGE COMMONS**

The rise of “smart” – or technologically advanced – cities has been well documented, while governance of such technology has remained unresolved. Integrating surveillance, AI, automation, and smart tech within basic infrastructure as well as public and private services and spaces raises a complex set of ethical, economic, political, social, and technological questions. The Governing Knowledge Commons (GKC) framework provides a descriptive lens through which to structure case studies examining smart tech deployment and commons governance in different cities. This volume deepens our understanding of community governance institutions, the social dilemmas communities face, and the dynamic relationships between data, technology, and human lives. For students, professors, and practitioners of law and policy dealing with a wide variety of planning, design, and regulatory issues relating to cities, these case studies illustrate options to develop best practice. Available through Open Access, the volume provides detailed guidance for communities deploying smart tech.

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# Governing Smart Cities as Knowledge Commons

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## Introduction

*Madelyn Rose Sanfilippo, Michael J. Madison, and Brett M. Frischmann*

*Smart* is in. The latest buzzword in the technology industry and policy circles is smart. We've built massive networked surveillance systems with the rise of the Internet that seem poised to inject intelligence into every aspect of our lives. Proponents of the Internet of Things, big data, sensors, algorithms, artificial intelligence and various related technologies make seductive promises, including that increased intelligence – “smart” phones, grids, cars, homes, classrooms, clothing, and so on – will minimize transaction costs, maximize productivity, and make us perfectly happy.

Yet society isn't really structured to optimize social institutions and systems to maximize efficiency, productivity, or happiness. It may sound counterintuitive, but we usually take the opposite approach. We don't optimize. The social value of leaving a wide range of opportunities open for the future generally exceeds the value that society could realize by trying to optimize its systems in the present. At least in the United States, Europe, and most liberal democracies, the default operating principle of social governance of people and shared resources is to leave things open and underdetermined; this principle allows individuals and groups to engage in self-determination with different outcomes, depending on the context and changing conditions. As law professor Julie Cohen (2012) succinctly put it, we need ample room for play. We should expect locally appropriate and responsive governance, and are better when cities can experiment.

Can playfulness or experimentation in governance coexist with smart systems? Regardless of the empirical answer, the seductive promises of intelligent optimization are difficult to resist, with adoption often preceding the necessary policy evaluation. Smart cities are exemplary. Around the world, cities have jumped aboard the smart tech bandwagon; others race to catch up, as public officials worry about falling behind. But whenever one sees “smart” in tech discussions, insert “supposedly” in front of “smart” and then ask a series of questions: Who gets

smarter? How? With respect to what and whom? Who gains what power? These and many other important questions need to be asked prior to investment or deployment.

Smart cities require trusted governance and engaged citizens, especially governance of intelligence and intelligence-enabled control. In some very important respects, smart cities should remain dumb, and that will take governance. One way to quickly see the point is by way of analogy to the Internet and the decades-long and still ongoing debate about network neutrality. When an ISP knows who is doing what online, the ISP gains power that can be exercised in various ways, such as price discrimination or prioritization. Network neutrality regulation aims to constrain intelligence-enabled control by infrastructure owners so that users retain their freedom. Cities face very similar challenges for many different infrastructures and services as they pursue smart solutions and innovation. In both cases, new smart systems transform control and influence, enhancing the power of decision-makers, while individuals and grassroots-level communities lose capabilities.

Integrating surveillance, AI, automation, and smart tech within basic infrastructure as well as public and private services and spaces raises a complex set of ethical, economic, political, social, and technological questions that requires systematic study and careful deliberation. The Governing Knowledge Commons (GKC) framework provides a descriptive lens through which to structure case studies examining smart tech deployment and commons governance in different cities. This book presents a series of interdisciplinary social science case studies, deepening understanding of community governance institutions, the social dilemmas communities face, and the dynamic relationships between data, technology, and human lives. It also serves as guidance for communities deploying smart tech. The GKC provides a series of questions that any community should be able to answer prior to or at least during deployment of supposedly smart tech. Using the GKC framework to study smart cities also allows researchers to focus on different resource-user-technology systems within a smart city – e.g., transportation, health, education, and so on.

Chapter 1 of this volume applies the conceptual framework to the context of and governance challenges faced by smart cities. Drawing on the amended GKC framework, as augmented in the conclusion of *Governing Privacy in Knowledge Commons* (2021), this chapter articulates research questions that can guide inquiries to support both improved understanding of the datafied city as a knowledge commons and empirically grounded public policy-making. Drawing on insights from Chapter 1, chapters in Part I explore the nature of social dilemmas around urban data, highlighting two distinct structural frames: polycentricity (addressed in depth in Part II) and the dominance of private actors over public data (explored in Part III). The book concludes in Part IV with lessons for smart cities.

Part I, the Social Dilemmas around Urban Data, explores some of the collective action problems, action arenas, and complexity of urban data resources in the

context of smart cities. In Chapter 2, “The Challenge for Cities of Governing Spatial Data Privacy,” Feiyang Sun and Jan Whittington explore the collective action problems associated with urban data governance in the city of Seattle, highlighting specific transaction costs and externalities associated with different departments and data resources. They argue that longitudinal governance and coordination efforts to prevent weak links from undermining citizens’ privacy are necessary investments and priorities for municipal governance.

In Chapter 3, “Open Governments, Open Data,” Anjanette Raymond and Inna Kouper analyze the Bloomington Open Data Portal as a case study on co-production of participatory digital commons resources and governance in Bloomington, Indiana. They address the conceptual mapping of open data onto the GKC framework, as well as the coordination challenges posed as local governments attempt to work with other types of stakeholders. While these chapters address very different contexts and challenges, they importantly suggest the impact of decision-making structures on outcomes, highlighting the split between polycentric public arrangements and public decision-making arenas dominated by private actors.

Part II, Polycentricity and Urban Data, highlights the impacts of coordination and centralization among the polycentric decision-making authorities among metropolitan agencies and services. In Chapter 4, “Community Land Trusts as a Knowledge Commons: Challenges and Opportunities,” using cases of community land trusts (CLTs) in DC, Boston, and San Francisco, Natalie Chyi and Dan Wu address the challenges associated with CLTs as the community of owners must coordinate to manage physical and informational resources and practice mutually appropriate stewardship. They find that interorganizational information flows increase governance efficiency and make a case for functional polycentricity.

In Chapter 5, “Smart Tech Deployment and Governance in Philadelphia,” Brett Frischmann and Marsha Tonkovitch examine two action arenas: the macro-level action arena, which concerns city-wide governance of smart tech deployment as reflected in a set of smart city initiatives, and which concerns city-wide governance of vacant land management and the various roles smart tech plays. They highlight a series of governance challenges, including around crime, safety, and trash, that intersect multiple decision-making authorities and necessitate involvement of community groups. They also identify some fundamental limitations on what smart tech can do to resolve the vacant land crisis.

In Chapter 6, “The Kind of Solution a Smart City Is,” Michael Madison addresses smart modernization in postindustrial Pittsburgh, exploring present efforts to benefit from data collection and analytics, relative to the complex history of urban technology in the region. In addition to highlighting remarkably salient properties around boundaries and expertise in smart cities, this chapter



explores the material and immaterial layers of data and governance. It notably maps the challenges from historic polycentricity cases concerning physical resources and services onto the modern, digital concerns present in smart cities today.

Part III, *Private Influence on Decision-Making*, moves beyond the coordination and collective action challenges in the public sector to address the impact of industry on public data collection and decision-making. In Chapter 7, “Technofuturism in Play,” Madelyn Sanfilippo and Yan Shvartzshander address the case of Disney World as a quasi-public recreational space in which highly concentrated, ubiquitous, and invisible data collection drives numerous services and innovation. They find that while many data practices are contentious and would not be appropriate for other contexts, the trust consumers have in Disney and their history of responsive governance meets local expectations.

Chapters 8 and 9 both address the case of the Sidewalk Toronto/Quayside smart city project, highlighting the impact of Alphabet on governance approaches. In “Can a Smart City Exist as Commons?” Anna Artyushina explores the action arenas of data-driven planning and data trusts, arguing that the private sector can only manage public infrastructure when public administrators take on intermediary roles between companies and state regulators. This has significant implications for efforts to privatize or outsource public administration in smart cities. In “From Thuri to Quayside,” Richard Whitt explores a historical comparison to Thuri with respect to democratic ownership and city planning, highlighting the ways in which private decision-makers fail to meet the public’s inclusion, balance, and transparency expectations. He builds on this analysis to offer innovative suggestions for designing more inclusive interfaces.

Part IV, *Lessons for Smart Cities*, synthesizes these cases and the broader literature on smart cities to think through what good governance for public data resources might look like and what we can learn from GKC structured case studies. In Chapter 10, “A Proposal for Principled Decision-Making,” Madelyn Sanfilippo and Brett Frischmann suggest a list of conceptually motivated but practically relevant questions that can guide principled decision-making in smart cities, rejecting a single set of design principles as a one-size fits-all approach. This book ends in the GKC framework tradition, with a concluding chapter reflecting on patterns and insights across cases to both understand how commons arrangements best support smart cities and what new questions future GKC studies ought to address. While the GKC framework does not serve as a normative benchmark or a functional panacea for smart cities, it provides a descriptive framework to support comparison, helping cities to learn from one another, and to structure analysis and decision-making. Smart cities are knowledge commons in which data resources generated with new and existing services must be co-produced with appropriate governance.

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## Smart Cities and Knowledge Commons

*Michael J. Madison, Madelyn Rose Sanfilippo, and Brett M. Frischmann*

### INTRODUCTION AND OVERVIEW

Why wonder about “smart” technologies and systems? The rhetoric of intelligence is seductive. With the rise of the Internet over the last twenty-five years, massive networked information systems are injecting ever more “intelligence” into the devices that surround us and even, it seems, into every aspect of our lives. If the evidence from broad acceptance of “smart” televisions and “smart” phones is to be credited, on a broad scale people like their “smart” lives. Adding “intelligence” via the Internet of Things, big data, sensors, algorithms, artificial intelligence, automation, and related technologies seems to minimize burdens, maximize productivity, and make us perfectly happy as both citizens and consumers. Smart technology promises to help us and, in the hands of public authorities, to help the government. It seems to anticipate our needs and desires; it seems to make government flexible, responsible, and error-free.

To invert a line from a classic rock song, sometimes you get what you want but can’t always get what you need. What’s convenient or productive for one person may be harmful for society as a whole. “Smart” technology raises important questions and potential conflicts about individual and collective good that may make us rethink whether “smart” things are so good for the individual, after all. The smart city, the subject of this book, puts those conflicts in stark relief. City life, and the study of city life, is all about the place of individual welfare in a complex social setting.

We’ll remove the quotation marks from “smart” from here on, recognizing that the word is a metaphor and that it conceals as much as it reveals. What it conceals is the fact that devices and social systems are rarely structured to optimize efficiency, productivity, or happiness. They aren’t smart, even if it’s possible to call a device, rather than a living being, smart or dumb. They have functions and meanings; they enable human beings to do certain things and to do them more or less easily or expensively. But optimizing their functions and clarifying their meanings isn’t the

only goal for their designers or for society. Calling something smart conceals the fact that in any given context, including cities (and perhaps especially in cities), we're accustomed to, and expect, significant opportunities to choose and to act however we wish. We can use devices not only as they're intended and designed to be used but also in other ways. And we can behave in ways that we choose and that no one else can see. At least in the United States, Europe, and most liberal democracies, the default operating principle of social governance of people and the resources they share is to leave things largely open, underdetermined, and unmonitored. That enables individuals and groups to develop their own visions for their futures and to engage in self-determination with different outcomes, depending on the context and changing conditions. Calling something smart distracts us from wondering not only about what opportunities to choose and what we might be losing but also about who is making those choices for us, and where, how, and why.

This volume argues for getting past the rhetoric of smart technology and intelligence and for pursuing a different approach. Using the smart city as its focus, it offers a simple thesis: the knowledge, information, and data that constitute smart cities require governance, especially governance of data-focused intelligence and intelligence-enabled control.

Smart city technology has its value and its place; it isn't automatically or universally harmful. Urban challenges and opportunities addressed via smart technology demand systematic study, examining general patterns and local variations as smart city practices unfold around the world. Smart cities are complex blends of community governance institutions, social dilemmas that cities face, and dynamic relationships among information and data, technology, and human lives. Some of those blends are more typical and common. Some are more nuanced in specific contexts. This volume uses the Governing Knowledge Commons (GKC) framework to sort out relevant and important distinctions. The framework grounds a series of case studies examining smart technology deployment and use in different cities. This chapter briefly explains what that framework is, why and how it is a critical and useful tool for studying smart city practices, and what the key elements of the framework are. The GKC framework is useful here and can also be used in additional smart city case studies in the future.

Because the GKC framework for studying resource governance relies on the premise that information, knowledge, and data are key shared resources in a given institutional setting, it's important to set up the usefulness of the GKC framework for smart cities by briefly reviewing relevant perspectives on cities and urbanism generally. That material takes up the next section. The smart city is new because of its reliance on twenty-first-century sociotechnical arrangements and cutting-edge information technology to bring attention to the long-standing informational aspects of the city. A brief summary of the critical changes wrought by the smart city follows the history of research on the city. The chapter concludes by presenting the GKC framework itself, the foundation for the case studies that follow.

## FRAMING THE CITY

Studying the “smart” city has to start with understanding the city itself. Research on smart cities characteristically focuses on nuances of the sociotechnical “smart” (Goldsmith and Crawford 2014) and pays less attention to the details of the material “city.” But research and writing about smart cities necessarily build on generations of practice and critique with respect to cities generally. Several frames emerge from that literature and inform both smart city research generally and the case studies that appear in this book.

*Cities from the Bottom Up and the Top Down*

One frame is how the city adopts, extends, and refracts bottom-up and top-down governance perspectives. Cities are people in places, evolving over time, managing resources at various scales and in various combinations (Cronon 1992; Rybczynski 1996). Who makes those decisions? Who guides the city? Intuitively, we think of political leaders and the experts they hire. The most celebrated urbanist of the latter part of the twentieth century, Jane Jacobs, pointed out the risks of concentrating too much credit and power for urban success in the hands and offices of political and technocratic elites (Jacobs 1961).

Jacobs’ vision of reform, which is still influential today, saw the city not as a machine engineered from above but instead as a complex adaptive system emerging from below, drawing on the wisdom of people experiencing the city in their daily lives, at ground level. Jacobs acknowledged that people in cities often behave selfishly and stupidly. She accounted for diversity in experience and attitude by envisioning the city as a system that is capable of generating and regenerating itself. People in cities could organize themselves via a kind of collective social intelligence, if urban planners and municipal governments would, in effect, allow the city to be as smart as it might be. Jacobs stood up for this vision in opposition to the top-down centralized control exercised by her urban planning adversaries, including most notoriously New York’s Robert Moses, who aimed to govern the city in the name of rationality, efficiency, and order.

Top-down and bottom-up perspectives are rarely either/or. People in cities often fail to realize their collective capabilities. Cities become vehicles for oppression and worse; they fail to provide education, health, wealth, and security as they should. Bottom-up governance strategies need to be married productively and fairly to top-down central, perhaps even technocratic management. Does the smart city do that? If so, how, and with what consequences?

*Cities as Surveillance*

Smart cities today are often critiqued for injecting technologies of citizen surveillance into all manner of practice and places that should remain free of state

intrusion (Sadowski and Pasquale 2015). Asking where and how contemporary information collection is justified lines up with broader, independent histories and critiques of cities as instruments of surveillance and information collection. James Scott provocatively argues that the history of cities can be traced back to the premise that surveilling city residents and collecting information about them, especially for tax purposes, explains the origins of cities in the first place (Scott 2017). That work suggests that certain state-based surveillance functions might be essentially integral to the urban form, rather than contradictory to the aspects of cities that we imagine promote individual freedom and autonomy. It raises a key question: Can cities sustain themselves as institutions without relying in part on technologies of information collection?

The smart city takes this tradition and that question to a technological extreme. If the surveillant city may be, in effect, inescapable, then looking at smart cities as sophisticated surveillance institutions provokes questions about the premises and purposes of different surveillance systems and various urban contexts; about concepts of privacy and private information; about the design and oversight of surveillance instruments; and about relations of trust and authority among urban residents and urban planners and other authorities. Perhaps cities can thrive without deep reliance on surveillance practices. If that's the case, what does a non-surveillant city look like? How does it succeed, and how might it fail?

### *Cities as Expertise*

Since at least the late nineteenth century and the rise of industrial cities, the history of urbanism and urban planning has been a history of expertise – political, administrative, and technocratic. Cities came to be seen as solutions to demands for wealth, health, safety, opportunity, and personal development, as society grew more economically, socially, and politically complex. Cities also came to be seen as posing new problems, often caused by their successes in meeting earlier social demands. Both fueled by and fueling that problem/solution framework, the Progressive political movement of the early twentieth century relied heavily on trained and trusted experts, especially economists and other social scientists (Leonard 2015). Those experts were often educated in newly formed occupational disciplines and professional schools. Degrees in hand, they were primed to lead both governments and businesses away from the era of *laissez-faire* and toward better outcomes for themselves and for workers and citizens. That meant safer food; safer water; better working conditions; safer and less expensive automobiles; expanded opportunities for education, leisure, and personal fulfillment; and so on.

In significant respects, the smart city today is the apotheosis of this tradition of expert-led governance, promoting the good life. Its proponents inherit expectations that experts trained in design are and ought to be trusted by citizens as the city is planned and built (Knox 2020). Critics of the smart city sometimes focus attention

precisely on ways in which smart city practice reinforces the authority of technocratic expertise (Cardullo and Kitchin 2019). Unsurprisingly, today as in the past, the role of trusted and trained experts calls into question the sources and uses of the trust and power that they have acquired.

### *The Political Economy of Cities*

Cities are far from immune to influence by interests associated with wealth and power. In many respects, cities are particularly effective expressions of those forces of political economy: Who is in charge, why, and how that changes through time. In the United States, for example, industrial and financial interests underwrote the expansion and governance of major cities and related regions during the twentieth century from New York to Chicago to San Francisco to Los Angeles (Cronon 1992; O'Mara 2019). In the twenty-first century, those firms have yielded in part to heavy influence by the pillars of the knowledge sector, which include not only the information technology firms that now dominate the economies of many US cities but also the research universities that rival or even exceed tech firms in their economic and political influence (Baldwin 2017). The relationship between the public sector and industry can go both ways. Public funding and related public policy have been key contributors to the growth of the contemporary technology industry (O'Mara 2020). In many respects, smart city governance allows public authorities to follow historical patterns of private sector subsidization with outright privatization of public functions, in everything from data storage to traffic management to certain public safety and policing functions. Cities are wealth and power generators, refractors, and accelerators.

Translated into practice on the ground, the political economy of cities deals in resource management. "Resources" include both tangible resources (food, water, physical infrastructures), intangibles (space, mobility, time, labor, trust, security, political influence, happiness), and blends of these that both constitute and shape resources of all sorts and that are simultaneously independent of them, such as knowledge and information (Glaeser 2012) and, of course, money. In different respects, sustaining and governing the city means that those things have to be produced, stored, distributed, and exchanged. The explicit and implicit governance logics of cities are inevitably tied to stories about economic development (Bairoch 1988).

The smart city appears to be a technology-driven opportunity to extend that economic development narrative. Installing smart systems offers opportunities not only for efficient public administration but also for showcasing a city's productive engagement with the forces of private productivity, profit, and employment. The question is whether that equation adds up. Does the smart city promise economic returns above and beyond the benefits of good governance? If so, at what cost?

*Cities as Contexts for Freedom and Self-Fulfillment*

Individual and collective humanity, of course, lies at the center of both scholarship and practice concerning cities. Long before modern technology prompted us to ask, “what makes cities intelligent?” (Komminos 2013), historians and philosophers of the city were critiquing ways in which the city created and limited opportunities for people to learn, grow, socialize, and otherwise thrive beyond interests in mere subsistence. The literature is as diverse as it is modern (Glaeser 2012) and, in scholars’ attention to ancient forms (Mumford 1961), long-standing. At their best, cities are places where individuals can design their own destinies, both as individuals and in social, political, cultural, and economic combinations with others.

When it comes to the individual city resident, smart city practice has no single trajectory, and no single or simple impact. Smart cities appear to do many things at once. Smart city practice may enable a kind of uber-autonomy for the individual, relieving people of the frictions that characterize almost all aspects of urban life. Or smart city technology may deprive people of opportunities to individuate themselves by acts of choosing and socializing (or not) according to their own values and goals. The contrast in perspectives extends to the political sphere, where smart city technology either enables micro-level oversight and accountability of technocratic administration or obscures the loci of power to an extreme extent. Smart city technology equips individuals with sophisticated tools for managing their civic identities. It also equips the public sector with extraordinary powers of observation, surveillance, and more. It extends to social and cultural spheres. Smart city technology may amplify opportunities to explore new avenues for education and socializing with ease but also impose “choice architectures” that compress or even eliminate opportunities for humans to develop and express themselves via patterns that they develop, rather than via patterns scripted by the affordances of “smart” technology (Frischmann and Selinger 2018).

That summary sketches a series of conceptual extremes. On the ground, the smart city is complex. Smart cities challenge us to ask, “how much ‘play’ should cities give us, and why and how?”

## FINDING THE “SMART” IN THE SMART CITY

The preceding section made the point that smart cities prompt us to reexamine long-standing questions about cities. This section focuses on what’s new and different in the smart city.

Collecting, recording, and sharing information about urban practices and activities aren’t new. One of the most famous uses of bureaucratized information was the system of tally sticks used for centuries by the English Exchequer to track financial obligations, a system whose end led, eventually, to the reckless disposal of unused



tallies in a fire that consumed the houses of Parliament in 1834 (Goetzmann and Rouwenhorst 2005, 111). Information and knowledge are sometimes underappreciated as key layers of the city, in addition to physical, social, cultural, economic, and political layers. Among contemporary scholars, Richard Florida and Edward Glaeser in particular have drawn attention to what each argues is the new, key role of creativity and innovation, and information and knowledge, in the future of the city (Florida 2014; Glaeser 2012). But information and knowledge layers have been there all along.

Two things seem to be different now, in the rise of the smart city. One is the role of technology itself. The smart city is one institutional manifestation of the emergence of so-called Big Data, featuring massive and massively distributed information systems for collecting, storing, and analyzing data. Residents are connected to each other and to governments and other organizations by fiber and wireless connections. Via sensors and other data-collection techniques, “the people” and their environments are rendered and represented digitally in the bureaucracies of public administration and in the dynamics of everyday life.

The smart city is operationalized in multiple forms at the intersection of contemporary information technologies – network-based data acquisition via text and numeric datasets and distributed screens and sensors that detect and project images, sounds, smells, and materiality (including but not limited to systems that form parts of the so-called Internet of Things), algorithmic processing, and data analytics – public administration strategies (housing, public health, safety, finance, utilities, transit, and so on), and resident involvement as potential data subjects, potential beneficiaries of data-enabled public services, and potential participants in system design and administration.

The smart city is a system of systems. It includes data gathering, data pools, and data analytics and a broader ethos that embraces technology in public life. In a smart city one typically finds a combination of: (i) government-endorsed, organized, or directed technology deployment; (ii) in tandem with other public functions (such as policing or garbage collection); (iii) the construction and use of systems, such as data pools, algorithms, and analytics controlled or shaped by public administrators, that improve the second in light of the first; and (iv) normative considerations justifying the design and deployment of those systems.

The emphasis on public sector actors can be misleading. By design, smart city practices can be anchored in private sector activity, and they’re intended to shape personal and private lives as well as systems of public administration. “Big Data” is often characterized by the “three v’s”: its velocity, its volume, and its variety (Batty 2016). The speed with which data in the city is collected and shared is enormously faster than in the “ordinary” city. The amount of data that may be collected and shared is vastly greater. And the character of the data that is collected and shared is far more diverse.

The second is the role of governance, and governance specifically with respect to information and knowledge. We mean governance in a broad sense, to include formal and informal systems of rules and guidelines for acceptable and unacceptable behavior in particular contexts, expressed as law, custom, and technological affordances. We highlight the challenge of governance in the smart city specifically because its information governance dimensions are too often undervalued. When governance conversations do appear, they are often limited to concerns for community participation in smart city design (Goodman and Powles 2019; Komninou and Kakderi 2019).

This volume takes the broader view that information governance concerns should be explored in the smart city in multiple respects. The “voice” of city residents is critical but only one part of the story. Focusing too much on “voice” misses the fact that people can’t speak to what they don’t know or don’t understand. The “smart” character of the smart city elides the fact that resident identities and behaviors are necessarily abstracted in smart city processes in the conversion from their material origins to their digital representations. That makes these digital representations controllable, shareable, and analyzable in ways that living humans being often are not. It also makes it easier to keep the collection and manipulation of the data hidden from the people that the data represent.

Another key part is the looseness or tightness of the alignment between law and policy, on the one hand, and lives of people, on the other. Regulation of actual human behavior is messy, imprecise, and contingent always on the fact that individual human beings are mostly capable of independent and at least somewhat unexpected or unpredictable action. Data are, conceptually, precise and fixed, even if data are shaped by processes of their collection, datasets expand, and the uses and meanings are open to interpretation. The smart city is in a sense a sophisticated Wikipedia version of the material city – an “image of the city,” to borrow the title of Lynch’s famous study of sociocognition among city residents (Lynch 1960) – constructed and managed collaboratively and stored in ICT systems rather than in human brains. Students of the “cognitive city” attempt to operationalize that metaphor (Finger and Portmann 2016). Digital people may live in digital twins (detailed virtual replicas of physical environments), one of the signature technologies of smart city administration (Farsi et al. 2020).

In sum, the “smart” in the smart city means that intelligence lies in and through the data, rather than in and through the people. We know from long experience that people are governed and that people govern. If data somehow represent the people, then data, likewise, demand governance.

Distinguishing the role of information governance from traditional “people” governance – while simultaneously recognizing their linkage – suggests a series of important questions. Does it follow that if the city is smart (or smarter, or better), then it’s the people who are smart, as administrators, residents, citizens, workers, students, and so on? In the smart city, are the people smart, so that public

administration can build on their intelligence? Do the people become smart in their thinking or their acting by virtue of administrators using data and algorithms to shape city life? Are the people generally unchanged, and are the administrators getting smart, or smarter?

Research on those questions has often been conceptual and therefore speculative. The smart city is a goal, or a vision, which may follow or may lead to strategies and tactics. The smart city is often characterized in aspirational terms. A city is “smart,” it may be said, when it uses contemporary ICTs to make the city better in some respect – more accessible, affordable, efficient, clean, safe, equitable, and so on (Goldsmith and Kleiman 2017). Criticisms of the smart city often recapitulate criticisms of ICT deployments in other contexts. The smart city may be a tool of power, elitism, and exclusion; the smart city is indifferent to local conditions; the “smart” city is disempowering and dehumanizing (Eubanks 2019; Morozov and Bria 2018).

Similarly, the character of governance challenges and opportunities has been obscured by the plethora of phrases used to capture what we mean by “smart” city. Related terminology includes “digital communities” (Mendes, Suomi, and Passos 2004), “data enabled cities” (Open Data Institute 2021), and “algorithmic” cities (Psarra 2018). Neutral-seeming references to “civic technology,” also known as “civic tech,” sometimes replace references to “smart” technology (O’Brien 2018). Smart cities may be characterized as “connected” communities (Nam and Pardo 2011). Prompted in part by work by the sociologist Saskia Sassen, some recent scholarship uses the heading “urban technology” (Adler and Florida 2021), species of what Sassen (2006) called sociodigital formations. IBM gave the “smart city” phrase an important boost in 2009 – the Smart City, featuring initial capitals –with a report advocating that cities get “smarter” by using new pervasive technologies of instrumentation, interconnection, and intelligence relative to a city’s core systems (Dirks and Keeling 2009). The role of computers, computing, and other information technology in urban planning and urban geography can be traced back much farther than that (Sui 1997; Wiig and Wylie 2016).

Why the rhetorical pluralism? Governance is, in a word, complex. As Sassen (2006, 208) notes, in part we are asking about the reasons for these systems to exist, in part we are asking about their utility, and in part we are asking about their cultural meanings.

#### THE GKC FRAMEWORK

If it’s possible to do smart cities “right,” then the smart city is, in a way, a novel integration, the best of Jacobs’ vision of ground-level community engagement married to what’s valuable in a vision of central or technocratic management. The smart city is a technology-supported coordinated solution to communal governance problems based on pooled information resources, spanning information and data

resources along with streets, parks, and cultural opportunities. In a broad sense, cities often rely on and are built on commons governance – that is, managing resource flows via structured sharing – in complex community and other social contexts. In the more concrete and specific sense relevant to this volume, cities incorporate knowledge commons, managing information flows via structured sharing of knowledge resources in community settings (Madison, Frischmann, and Strandburg 2010). Knowledge commons governance in the smart city consists of the structured interplay of a city’s people and the information and data generated by their sociability, captured and analyzed in particular smart city systems.

The point of using the knowledge commons framing as a starting point is to give both researchers and practitioners a standard baseline for asking empirical questions about smart city origins and practices. That research should be inclusive of multiple research methods and disciplinary and policy perspectives. This section reviews and describes the GKC research framework, which offers a useful way to build on that baseline in this volume’s case-based explorations of smart cities.

Knowledge commons refers to systems or institutions for governance of shared knowledge and information resources by members of a group or community. Knowledge resources are broadly defined, where knowledge includes “a broad set of intellectual and cultural resources. . . . We emphasize that we cast a wide net and that we group information, science, knowledge, creative works, data, and so on together” (Frischmann, Madison, and Strandburg 2014, 2). In this sense, knowledge resources may lie at any point along the data, information, knowledge, and wisdom hierarchy (Henry 1974).

Commons, as used in the literature upon which we build here, refers to community management or governance of resources. “The basic characteristic that distinguishes commons from non-commons is institutionalized sharing of resources among members of a community” (Madison, Frischmann, and Strandburg 2009, 841). Commons governance can take many forms and need not involve the kind of complete openness often associated with discussions of “the commons” or “the public domain” in the legal literature. Nor should “commons” be conflated with the type of resources that are managed. Commons refers to a mode of governance rather than to a particular good or type of good.

Commons governance of natural resources is often explored through Ostrom’s Institutional Analysis and Development (IAD) framework. Ostrom’s work initially emphasized the appropriateness of commons governance for “common pool resources,” meaning “a natural or man-made resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use” (Ostrom 2005, 4). In economic terms, common pool resources are rivalrous and nonexcludable. Commons governance of such resources generally aims to address so-called tragedies of the commons, social dilemmas associated with overuse – congestion, depletion, and destruction.

The number and range of possibly relevant social dilemmas is a question for research in a specific context, rather than a premise to be assumed. Commons governance is used by a wide variety of communities to manage many different types of resources and responds to obstacles to sustainable sharing and cooperation. Some of those obstacles derive from the nature of the resources. Others derive from other factors, such as the nature of the community or external influences. Data and information collection and analysis in the smart city offers ample opportunities to explore how commons governance might be used in particular institutional contexts to respond to dilemmas associated with smart city practices. Knowledge commons governance is no panacea for those dilemmas. In practice it is important to recognize that commons governance may itself create further obstacles to sustainable cooperation.

Applied to a specific case study, the GKC framework organizes answers to critical questions that emerge from both the history of cities and the study of knowledge systems: who is governing and who is governed; how; using what tools, techniques, and knowledge; and to what ends? How did the city develop? What are the strengths and weaknesses of the city as a social institution, and how might the benefits of the city be refined and amplified and its costs mitigated? Focusing on smart cities as knowledge commons leads to asking how “smart” urbanism contributes to our understanding of why and how cities thrive and decline. Studying the smart city offers the ability to turn urban geography and economics on its side, if not on its head. The GKC framework drives a deeply contextual approach to urbanism that wonders: what’s happening within the critical data and information layers of the city?

The GKC framework supports a systematic investigation of the benefits and drawbacks of sociotechnical solutions to underlying social problems, or dilemmas, without committing the researcher to specific methods, research questions, or disciplinary premises. The framework operates at multiple scales, from the micro to the macro. The GKC framework offers a way to integrate data about background conditions; historical contingencies; resource attributes; community characteristics; cultural and technological affordances; formal and informal rules and norms; money, power, and politics; individual and collective beliefs and behaviors; and diverse levels of access, opportunity, literacy, and expertise. Community characteristics in the city are particularly significant and draw attention to ways in which communities include members, exclude others, and enable or disable effective participation in community governance. Research using the GKC framework complements existing “city as commons” research that builds on Ostrom but that focuses principally on community governance of the city’s material resources, especially housing and the environment (Foster and Iaione 2015).

Those themes are organized via the GKC framework into a series of questions for empirical investigation. Relationships among those themes are represented visually in Figure 1.1, which is adapted for knowledge resources from Ostrom’s IAD framework.

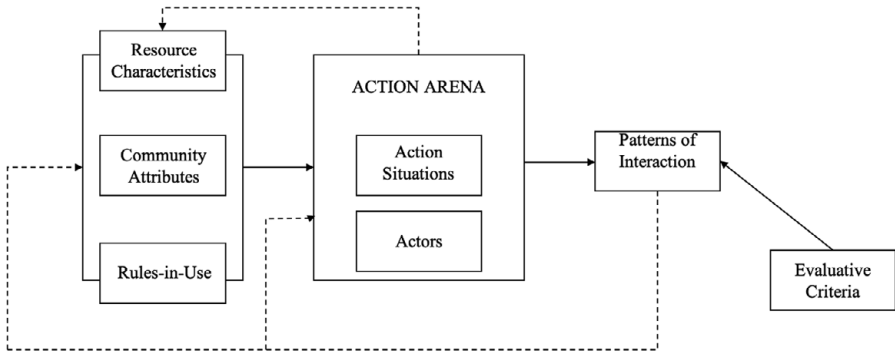


FIGURE 1.1. The GKC framework

Source: Madison, Frischmann, and Strandburg (2010)

Using the IAD framework, Ostrom and colleagues explored patterns of community interactions (McGinnis 2011). Action arenas serve as the core units of IAD and GKC analysis. An action arena is a recurring type of situation in which community actors interact with one another. Interactions in an action arena produce outcomes, denoted here as patterns of interactions, which can then be evaluated according to some community or socially generated criteria. The figure depicts how effects flow among conceptual building blocks. Resource characteristics, community attributes (including members and roles), and sets of governing “rules-in-use” are inputs to an action arena. Patterns of interactions accumulate, feeding back to create new action situations and influencing resource characteristics, community attributes, and rules-in-use. Knowledge resources are often produced and defined by the community. The knowledge outputs of some knowledge commons action arenas must themselves be managed by the community and may be inputs to further knowledge production. This feedback, between a community’s activity and its available knowledge resources, justifies community-level analysis, emphasizing questions related to group interactions and outcomes, rather than user-level analysis, emphasizing questions about individual experiences.

The action arena concept is flexible and can be applied at a variety of levels of generality, depending on the questions being researched and the resources of interest. Governance activities themselves, determining rules to govern knowledge creation or flow or community membership qualifications, may constitute an action arena. Analyzing an action arena is meaningful only if one can identify resource characteristics, community attributes, and rules-in-use that are “exogenous” or fixed over a number of action situations within that context and if one can describe meaningful “patterns” in the outcomes of the interactions. If an action arena is defined too broadly, then identifying those elements will not be possible; if an action arena is defined too narrowly, then identifying meaningful patterns among them is not possible.

The IAD and GKC frameworks include a step in which “evaluative criteria” are applied but do not explicitly provide a yardstick for normative assessment. In the classic studies of natural resource commons, the normative goal is often implicitly assumed to be sustainable use of the resource by the community. Applications of the GKC framework to innovation and knowledge production have generally focused on whether the community is successful in terms of its internally defined goals and objectives, while recognizing that the goals of a knowledge commons community could, in principle, be out of step with, or adverse to, the values and objectives of society at large.

For purposes of applying the GKC framework, the high-level GKC framework shown in Figure 1.1 can be unpacked into a more detailed set of research questions shown in Table 1.1.

The GKC framework has focused primarily on community goals and objectives rather than on values from higher-level social contexts or foundational ethical and moral principles. Focusing on governance thus raises key questions: Who should be in charge of deciding what those goals and objectives are, and whether they have been achieved? In the smart city context, how is knowledge commons governance contested or reinforced? It’s possible to frame the issue in terms of the contextual “appropriateness” of information flows in the smart city, borrowing from the work of privacy scholars (Sanfilippo, Frischmann, and Strandburg 2018). How is appropriateness evaluated?

One strategy for answering those questions focuses on procedural or sociological legitimacy (Habermas 1996), and the GKC framework as outlined earlier suggests directions for exploring that theme in a specific context. Legitimacy raises governance issues that may be addressed through commons institutions. That analysis would consider the development and application of internal and exogenous rules-in-use relative to both members of the community and outsiders impacted by the activities of the community.

As outlined here, however, procedural legitimacy is not the only criterion that might be applied to commons governance. The framework is open-ended with respect to developing possible alternatives. The GKC framework does not adopt a specific normative stance about the ends of information flow governance or how they should be prioritized. It begins by uncovering and understanding the contextualized goals and objectives reflected in the governance of information flows in each case, the ways in which they reflect the interests of various community members, and how they are addressed in rules-in-use for information flow in light of the larger social environment.

#### KEY GKC THEMES

Both the visual representation of the GKC framework in Figure 1.1 and the tabular list of research questions in Table 1.1 are simultaneously broad and detailed, so using

TABLE 1.1. *The GKC framework*


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Knowledge commons framework and representative research questions

**Background environment**

What is the background context (legal, cultural, etc.) of this particular commons?

What normative values are relevant for this community?

What is the “default” status of the resources involved in the commons (patented, copyrighted, open, or other)?

How does this community fit into a larger context? What relevant domains overlap in this context?  
What social dilemmas does the community face relative to the resources involved?

**Attributes**

What resources are pooled and how are they created or obtained?

What are the characteristics of the resources? Are they rival or nonrival, tangible or intangible?

Is there shared infrastructure?

What is personal information relative to resources in this action arena?

What technologies and skills are needed to create, obtain, maintain, and use the resources?

What are considered to be appropriate resource flows? How is appropriateness of resource use structured or protected?

Who are the community members and what are their roles?

What are the degree and nature of openness with respect to each type of community member and the general public?

Which noncommunity members are impacted?

What are the goals and objectives of the commons and its members, including obstacles or dilemmas to overcome?

Who determines goals and objectives?

What values are reflected in goals and objectives?

What are the history and narrative of the commons?

What is the value of knowledge production in this context?

**Governance**

What are the relevant action arenas and how do they relate to the goals and objectives of the commons and the relationships among various types of participants and with the general public?

Are action arenas perceived to be legitimate?

What legal structures (e.g., intellectual property, subsidies, contract, licensing, tax, and antitrust) apply?

What are the governance mechanisms (e.g., membership rules, resource contribution or extraction standards and requirements, conflict resolution mechanisms, and sanctions for rule violation)?

*(continued)*



TABLE 1.1. (continued)

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What are the institutions and technological infrastructures that structure and govern decision-making?

What informal norms govern the commons?

What institutions are perceived to be legitimate or illegitimate? How are institutional illegitimacies addressed?

Who are the decision-makers and how are they selected? Are decision-makers perceived to be legitimate?

How do nonmembers interact with the commons? What institutions govern those interactions?

Are there impacted groups that have no say in governance?

#### Patterns and outcomes

What benefits are delivered to members and to others (e.g., innovations and creative output, production, sharing, and dissemination to a broader audience, and social interactions that emerge from the commons)?

What costs and risks are associated with the commons, including any negative externalities?

Are outcomes perceived to be legitimate by members? By decision-makers? By impacted outsiders?

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Source: Adapted from Sanfilippo, Frischmann, and Strandburg (2018)

them in the context of a specific case study risks obscuring key themes that the framework aims to address. Earlier knowledge commons research has taken preliminary steps to identify those themes by synthesizing the implications of knowledge case studies completed to date (Sanfilippo, Strandburg, and Frischmann 2021). They're listed just below for clarity. Researchers and practitioners applying the framework and analyzing cases, while bearing these questions in mind, can and should tailor their applications to their own specific interests and goals.

1. Knowledge commons governance is often a recursive phenomenon, by which information and data production dynamically constitute and reconstitute the community (or communities) producing that information and data. Exploring the character of relevant communities, including their origins, internal dynamics, and reliance on formal and informal sources of authority and integration, is a complex but critical undertaking. Knowledge commons systems, like the commons governance systems studied by Ostrom and others, may be nested hierarchically, with smaller or more limited commons systems inhabiting larger commons ecologies, and may be arranged polycentrically. Research should be attentive to the potential for effective knowledge commons

- governance in group settings that are not defined as stereotypical small-scale, homogenous communities. Knowledge commons governance brings to the fore possible sociotechnical attributes of community design and governance.
2. Knowledge commons governance relies on community governance strategies to respond to social dilemmas involving knowledge resources. Identifying and describing relevant social dilemmas, and understanding the possible contributions of multiple social dilemmas, is often the first step in applying the GKC framework.
  3. Knowledge, information, and data are central resources in studying knowledge commons governance, but they are not the only relevant resources, and they are not the only resources that might be subject to relevant social dilemmas. Research should focus on patterns by which knowledge commons governance and other systems (such as law) contribute to resource construction and to the production and collection of multiple types of resources.
  4. The pragmatics of community formation and participation bear heavily on eventual normative assessment of knowledge commons governance in a particular setting. Relevant variables include the degree of self-awareness and participation in resource governance by community members; the constitution of trust relationships among community members; the timing and character of the adoption of a knowledge commons governance model by the community; and possibilities for exit from the system by individuals and groups. Those considerations all exist on spectra, and knowledge commons governance may emerge and evolve over time.

## CONCLUSION

As in earlier volumes collecting case studies of knowledge commons governance (Frischmann, Madison, and Strandburg 2014; Sanfilippo, Frischmann, and Strandburg 2021; Strandburg, Frischmann, and Madison 2017), we emphasize that research using the GKC framework is still emerging and evolving but that the breadth of its possible utility is just coming into view. Knowledge sharing and knowledge pooling has roots in practices dating back centuries, but it is a fundamental feature of twenty-first-century economy and society. Knowledge sharing requires governance, a fact that also has roots in history but that is especially essential today. We refer to governance of knowledge sharing as knowledge commons. Understanding knowledge commons requires sustained and systematic empirical research. The GKC framework is designed as a foundation for that research that spans specific research traditions and fields.

The smart city, with its lofty rhetorical ambitions, political and operational complexity, and sometimes hidden costs, is a natural fit for GKC research.

Designers of smart city systems aim to capture the long-standing informational characteristics of the city as data to serve a variety of ends, from transportation management to land use to public health to policing and public safety. The marriage of the city's traditional materiality and datafication enabled by modern computing appears to be a match made in heaven. The smart city appears to be the better city. Is it? Everything depends on how the information is used: how data collection and analysis systems are designed and deployed, by whom, and for what purposes. Those are the topics that the GKC framework aims to explore, with nuance tailored to whether the case study targets one smart city system in particular or the concept of the smart city as a whole, in a particular place.

This chapter has laid out the case for applying the GKC framework in three brief steps. First, it reviewed traditional and historical perspectives on urbanism and the city as important and critical contexts for understanding the turn to the smart city. Second, it described that turn itself, highlighting the features of the smart city that should cause both researchers and practitioners to pause and reflect on the pragmatics and wisdom of deploying smart city technology rather than continuing with other governance modes. Knowledge sharing and knowledge pooling are critical elements in the turn to the smart city. Third, it outlined the GKC framework itself. Each of the case studies in this volume rely in some respect on material summarized in that three-part sequence.

Finally, in part because this work is primarily descriptive, like its predecessors, we note again that this approach requires its own knowledge commons to succeed. That is, it requires an expanded research community that uses and extends the framework and shares research results across cases and sectors. The structure of the GKC framework facilitates comparison across cases. We are optimistic that with greater investment in cases and greater analysis of cross-case comparisons, generalizable lessons and implications will emerge. The “Key Themes” section earlier highlights one early version of those patterns. The smart city theme here is useful in this additional respect, by bringing out details of knowledge commons in a setting that differs in many key respects from the focal areas of earlier work, including research and practice in medicine and health, and practices in privacy and security.

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## Conclusion

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Smart cities require much more than smart tech. Cities need trusted governance and engaged citizens. Integrating surveillance, AI, automation, and smart tech within basic infrastructure, as well as public and private services and spaces, raises a complex set of ethical, economic, political, social, and technological questions that requires systematic study and careful deliberation. Using the GKC framework to structure case studies that examine smart tech deployment and commons governance in different cities has served two fundamental purposes:

First, it provides important, even if incomplete, guidance for communities deploying smart tech. The book has deepened our understanding of community governance institutions, the social dilemmas communities face, and the dynamic relationships between data, technology, and human lives. We have sharpened attention on key areas that practitioners and researchers need to focus on. Much more work is needed, however, to develop and improve guidance in this politically and culturally contentious space. At this stage, we emphasize that design principles for knowledge and data governance institutions (Ostrom 1990) are not available, at least not based on the social science. There are no universal answers, just as there are no panaceas, technological or otherwise, to the many social dilemmas communities face.

Context matters in more ways than one. Cities are incredibly varied and complex. Within every city, there are many unique communities. Nested action arenas at macro, meso, and micro levels involve mixed sets of actors, pursuing various goals and objectives, while grappling with different obstacles. Smart tech may serve as useful tools in these arenas while also generating challenges and even additional social dilemmas. Interdependencies complicate matters dramatically. We could go on painting an incredibly complex picture. But that is neither necessary nor helpful.

We remain confident that a principled approach to smart city governance is possible. It begins, as Chapter 10 suggested, with asking questions and asking them in a structured way. The point of acknowledging complexity and embracing the



contextual nature of social reality in urban environments is to encourage researchers and policymakers looking for a path toward trusted governance and meaningful citizen engagement. They should be empowered to ask relevant questions and explore possible solutions. They should be looking for structured ways to deconstruct and decompose complexity and context.

Second, it is necessary to support interdisciplinary social science. We hope that what we have collected in this volume is the beginning of a sustained, systematic, comparative, and longitudinal research effort focused on smart technologies. More work on more cities and, frankly, more work on the cities studied in this volume, is the only way to develop empirically grounded answers to the many questions raised.

Throughout this book, authors have asked contextual research questions and explored compelling but often distinct answers guided by the shared structure of the GKC framework. In this Conclusion, we discuss some of the key themes across chapters in this volume, considering lessons learned and implications for future research.

#### RECURRING THEMES

##### *Transparency, Superficial and Deep, Necessary but Insufficient Governance*

Across the case studies, cities and communities using smart tech face *transparency* issues. In this context, transparency specifically refers to the *availability* of specific knowledge resources to community members. What is the relevant knowledge and to whom and how it is available varies considerably across and even within cases. The GKC framework provides a useful lens for examining these details. Transparency generally describes features of the governance structure, namely relationships between actors and resources; issues of transparency around who makes data availability decisions, and how, also arise.

In some cases, transparency is an explicit “open government” objective for which smart technologies can be useful tools. Notably, in such cases transparency is not really a primary end. Rather, it is typically part of a broader effort to pursue democratic values, such as government accountability and citizen engagement, and economic values, such as economic growth and entrepreneurship, and to identify and address corresponding obstacles to achieving those ends. Raymond and Kouper (Chapter 3) explain the origins and evolution of open data/government initiatives at the federal government level and how that thinking is reflected in smart city initiatives, such as the Bloomington Open Data Portal. Across the case studies in this volume, there was little direct evidence or detailed discussion of the relationship between transparency and economic values. At best, some lip service was paid to the idea that open data would support entrepreneurship or economic development. For the most part, the focus was on democratic values.

Local governments often aim to make information about their practices, decision-making, and governance processes available to citizens. The idea is to use data and smart tech to educate and enable community members to engage more effectively with government, whether to obtain public services, cast a vote, lodge a complaint, reform or remedy harmful government practices, or pursue other opportunities. Such open government initiatives often take the form of making data publicly available online, through websites and portals, sometimes accompanied by software tools designed to enable citizens to access, interpret, and use data. The results described in the case studies were mixed.

Some cities, such as Bloomington and Philadelphia (Chapter 5), demonstrated moderate success in making datasets and tools available to the public through online portals. These cases suggest two potential lessons (worth bearing in mind as policy guidance and for future research).

First, building transparency and making it useful are not easy. Effective transparency takes resources, planning, coordination among different sets of actors, commitment to shared values, and maintenance. The Bloomington case study provides an especially useful illustration of how using the GKC framework to examine different action arenas can isolate different obstacles to overcome in pursuing an open data/government initiative. Collecting, publishing, and accessing/using the data present different governance challenges for different actors, who need to coordinate with each other over time. As we saw in this case study and others, transparency may present new risks to consider, such as the inadvertent exposure of sensitive personally identifiable information (PII) through an online portal.

Second, transparency may be achieved superficially or deeply. Transparency exists on a continuum, and it varies, based on what resources are made available, to whom, and for what purposes. The GKC framework proves useful for investigating different types and degrees of transparency.

Superficial transparency focuses mostly on making data publicly accessible without consideration of whether and how it is used. At the extreme, nominal transparency would be nothing more than window dressing to appease the public, put off critics, comply minimally with procurement or other rules, or generate the appearance of propriety. For example, smart city critics and open data advocates alike have decried efforts, such as Chicago's open data portal, which does not meet minimum standards of accessibility via the use of proprietary and unstructured datasets that are difficult to use and interpret.

None of the case studies were fully at this extreme, although there were instances suggestive of nominal transparency – for example, in Anna Artyushina's observation that despite hundreds of lengthy public documents describing the plans for Sidewalk Toronto (Chapter 8), details about specific smart technologies and financial aspects of the deal remained hidden.

In the middle of the continuum, we find cases where transparency results from a sincere commitment to support open data/government initiatives as means to

engage and empower citizens. For example, in Bloomington, Philadelphia, and Pittsburgh (Chapter 6), the cities invested substantially in making government data publicly accessible with these ends in mind. Yet in each of these cases, transparency may not deliver fully the intended results if the quality of the data or data portal is poor, or if the public does not know about, trust, and have the capacities needed to effectively use the resources made available. These “transparency dilemmas” demand attention in the design of governance institutions. Just making the data accessible is not enough, which raises a more general point: In these intermediate cases, transparency typically falls short of community needs because of the focus on government data as the only (or the primary) relevant resource to be shared in the smart city knowledge commons.

Deep transparency requires more. Many local governments express intentions (commitments) to use smart tech to become more transparent not only by making government data publicly available but further in sharing information regarding their decision-making processes, the reasoning behind various initiatives, how data collection will occur, and plans for what to do with data and smart technologies. However, we do not see such comprehensive transparency in many of the case studies. As noted in the Bloomington case study, “[b]oth open data and open government are key for advancing government transparency and entrepreneurship, but the transparency does not seem to extend to decision-making in the creation and sharing of the datasets.” Similarly, in the Toronto case study, public documents had the veneer of a strong commitment to transparency, but openness only extended to certain aspects of the project while many important details, such as the specific technologies the partnership planned to implement and financial aspects of the deal, remained secret. With its formal, detailed privacy principles and governance structures for urban data and surveillance technologies, Seattle seems to be an exception, although there are indications that other cities may be following Seattle’s lead (e.g., AlAwadhi and Scholl 2013; Stübinger and Schneider 2020). Notably, Seattle’s commitment to transparency evolved through a series of initiatives and has deepened over the past decade.

It is worth noting that the polycentric and sometimes decentralized character of urban governance generally makes it difficult to practice transparent governance consistently at the level of the city as a whole. Some agencies and city authorities may be better on this score, some may be worse, and some may have more legitimate reasons for blending transparent and nontransparent governance in different ways. The GKC framework usefully enables analysis of these variations across action arenas at different scales.

Related to transparency, clarity, specificity, and other such considerations arose repeatedly in our case studies as challenges to the quality of communications about smart tech decision-making, planning, and governance-related issues. Hype and tech boosterism distort public perceptions, beliefs, and expectations. Ambiguity clouds judgment and disrupts reasoned public debate and deliberation about

supposedly smart technologies, which can lead to failure, as discussed in Chapters 8 and 9 relative to Toronto. These chapters not only identify the inherent limitations in nontransparency with respect to the public, but also in how it shapes interactions and power asymmetries among decision-makers. We can contrast this with efforts such as Seattle, where the focus is on participatory and responsive governance models, coupled with transparency, to cut through the hype and require specificity of features and functions to meet citizens' needs and improve services. We note that this approach to public documentation and responsive governance is not necessarily always coupled with transparency about datasets, as Chapter 7 shows us that even private sector firms and quasi-public spaces, such as Disney World, benefit with respect to public opinion from transparent and participatory mechanisms around data collection and use.

The bottom line – or at least the thematic lesson learned from these case studies – is that transparency may be necessary but insufficient for the achievement of community goals and objectives. Coordination, trade-offs, and participation also play key roles, as explored in the next section.

### *Interest Alignment, Potential Conflicts of Interest, and Community Participation*

Conflicting values, interest (mis)alignment, community participation, and political and economic power cohere as another key theme. It is often difficult to identify and evaluate the relevant set of interests and values at stake in social contexts. It is hard to know what matters, how much, to whom, and how conflicts among different values can or should be assessed. The GKC framework is descriptive and deliberately pluralistic, which means researchers primarily aim to identify different community goals and objectives and to evaluate patterns and outcomes in terms of benefits, costs, risks, and so on based on the community's stated goals and objectives. We are mostly interested in understanding whether and how different governance institutions enable communities who share various knowledge resources to achieve their own goals and objectives.

In this volume, this inquiry is complicated for a few interrelated reasons. First, cities involve many different communities in background contexts with rich political, economic, and cultural histories. Power dynamics are complicated. Communities often have different constituencies and priorities. Values can be highly contested. Second, knowledge commons and corresponding action arenas focused on supposedly smart technologies (including surveillance technologies) often are a layer added onto already existing action arenas – as in the Philadelphia case study's analysis of the meso-level action arena of vacant land management. Smart tech and data may serve as new means to address already existing problems, but they also bring their own set of considerations (resources, community members, goals/objectives, power dynamics, social dilemmas, governance institutions, etc.).

This can mean that new actors become participants in long-standing action arenas. These new actors – whether IT staff working within a government office or a private vendor offering smart tech solutions – bring their own interests to the community. New participants may challenge or reinforce existing governance structures, for better or worse. Third, it can be difficult to figure out how to account for different community members, their roles, and their interests. It is not always clear who to include as a community member. For example, are technology vendors members of smart city communities? Do their interests in making a profit count as community interests – as one of the relevant community goals and objectives? Are all citizens members of smart city communities? Would that mean that the public at large is effectively the community, in which case are we really talking about a commons or commons governance? These and other related questions push toward concepts of nested commons and polycentricity.

These complications surfaced quite starkly in case studies where concerns about potential conflicts of interest arose. A question that emerges in many chapters is whether data collection and usage is more aligned with the interests of the smart tech provider or the interests of the public. The provider could be a government actor (department) or a private company vendor, supplier, or operator. For example, in the Sidewalk Toronto study, Sidewalk Labs proposed new governance entities that superficially seemed inclusive but substantively seemed to “advance the [private] company’s economic and political interests. The heated controversy over the project highlights the underlying tension between the company’s vision of municipal governance as ineffective and the public call for stronger government oversight over the private sector in Canada.” Similarly, from the Toronto case study (Chapter 8):

- “Subsidized by the government, the trusts would seek to maximize profits from the city spaces and infrastructure, often at the expense of the comfort and health of its residents.”
- “My analysis . . . shows that the trusts benefitted some members of the community more than others. Specifically, Sidewalk Labs openly declared its goal to support developers in the project, as well as the businesses coming to operate in the smart city.”
- “Before any technology is implemented, the citizens may want to decide whether they benefit from having an algorithm decide when and where they relocate, or if eliminating municipal jobs harms the community. When designing a trust for the smart city, it is important to know who gets to decide on behalf of the community, and what the community needs are.”

In the Philadelphia case study, “there was a disconnect between the *smart tech planners and users* (mostly government actors but also vendors and consultants, like IBM . . .) and *smart tech beneficiaries*, including residents, businesses, and visitors.”

Recognizing this disconnect seemed to be an important part of the shift in macro-level strategy that led to more deliberate focus on community inclusion in the SmartCityPHL roadmap. Yet, as the authors noted, whether that commitment is realized or constitutes lip service remains to be seen. At the meso-level action arena involving vacant property management, each of the three complications noted above surfaced. While there has been some success in making smart technology tools and datasets publicly available, “the promise of these technologies is not yet fully realized in Philadelphia.” The authors concluded:

“No smart technology can independently overcome the political and organizational issues and the complex economic trends outlined earlier. . . . the implementation of smart technologies must be founded upon effective local efforts to break down city service barriers caused by entrenched political and administrative structures. In addition, equitable, comprehensive, and successful vacant property disposition requires enhanced engagement with residents and community groups. Smart technology can support Philadelphia’s ongoing efforts to address these constraints and put vacant properties back into productive use for its citizens.”

The Bloomington case study similarly observed that

“in many instances of creating an OGD portal, . . . the design process seems to omit citizen cooperation and participation. Instead, legislators and government officials constitute the prime co-creators of such portals through incentivizing or enforcing portal creation efforts. Third parties, whether nonprofit or commercial, also become participants in OGD portal creation, as these organizations provide governments with the technological infrastructure to support these portals.”

In his analysis of modern digital communities, Richard Whitt draws lessons from the Toronto example and suggests: “Our digital communities should embrace the active participation of citizens and visitors alike in the increasingly blended spaces that constitute the self and world, the private and public, and the physical and virtual.”

These patterns echo findings from previous knowledge commons case studies, such as the issues associated with imposed commons governance that are apparent relative to privacy commons arrangements (Sanfilippo, Frischmann, and Strandburg 2021). It is key to understand that those with decision-making power over rules and governance are not always or necessarily the information subjects, thereby limiting fidelity in responsive governance and testing legitimacy in instances where trust is not developed. In the context of this book, the public are the information subjects but have little decision-making power in how the data being collected on them is used and what is being done with it.

*Polycentric Coordination Dilemmas*

Another prominent theme in the case studies concerns coordination dilemmas. As various chapters explored, cities are incredibly complex, with many centers of decision-making, sometimes competing and sometimes compatible, often intersecting and overlapping. Scholarship of metropolitan governance over the past seventy years has explored the nature of polycentric institutions, building on Polanyi (1951) and Ostrom, Tiebout, and Warren (1961) to identify conceptual and structural distinctions between functional and dysfunctional arrangements, issues of efficiency, dynamics, and complexity as associated with this feature of local government. Beyond an explanation for why garbage collection services are replicated or the nested coordination arrangements to solve public safety and school choice dilemmas, polycentricity describes decision-making and control around modern public interest technology, as data is collected and shared across agencies and levels of government. Cities rely on polycentric governance even before smart tech enters the picture. In terms of public administration, cities are comprised of functional departments with incompletely autonomous decision-making and areas of responsibility. Many cities are parts of counties and regions, which may have their own governance, and cities have to coordinate with other government forms (such as utility districts and schools, and other, adjacent cities). When smart technologies are embedded within an already polycentric system, it becomes more complex and exacerbates existing dynamics. The case studies in this book note that technology adoption does not solve issues of coordination or competition among polycentric public utilities or agencies, but rather perpetuates and may exacerbate these tensions.

The theme is captured in a line from the Pittsburgh case study: “Polycentricity may be a problem to be solved rather than a solution to questions of appropriate, effective, and accountable governance.” Across the studies, we saw many different coordination dilemmas. Lack of coordination and consistency led to inefficiencies, redundancies, confusion, and conflict. The following observation made in the Philadelphia case study in the context of the vacant property action arena captures the issue seen in many other cases: “The fact that several different city agencies are involved in vacant property management and disposition in Philadelphia makes it difficult to organize an effective, coherent approach. In the past, many of these agencies operated as relatively self-contained silos, with little cross-agency data sharing or collaboration.” In accordance with its more pragmatic and collaborative (cross-departmental) approach in the past five years, Philadelphia has tried to reform its organization approach to overcome this problem.

Additionally, lack of coordination and consistency can connect back to the transparency problems because if different agencies are compiling the data differently or have different standards for data, it can be difficult to make the data accessible.

Consolidating efforts of city agencies, or assigning responsibility for city-wide smart tech development and deployment to a single city department, may be one solution to this coordination and consistency problem. As described in Chapter 8, relative to polycentric structure and oversight in Toronto:

“In the Master Innovation Development Plan (MIDP), the company suggested establishing new governance entities that would mediate between the technology vendor and Canadian authorities and help members of the community collectively govern and manage smart infrastructure. These five new governance entities were the Urban Data Trust, the Waterfront Housing Trust, the Open Space Alliance, the Waterfront Transportation Management Association, and the Public Administrator.”

Further, the Open Space Alliance (OSA) would be aimed at coordination and support for functional polycentricity:

“Sidewalk Labs argued that the OSA would fix the problem of intersecting responsibilities, which results in public spaces not being properly cared for. Some municipal services, such as the parks and recreation departments, could be eliminated altogether. Data modeling and residents reporting problems through the app would help Sidewalk Labs plan for when additional help is needed and hire temporary workers.”

The creation of intersecting bureaucratic offices to smooth coordination efforts is not unique to Toronto, as similar efforts were documented in Pittsburgh and Philadelphia. For example, Pittsburgh created a new Department of Innovation and Performance in 2014, under a newly inaugurated mayor, specifically to advance and coordinate the city’s uses of up-to-date computer networks and data-focused governance.

The prominence of polycentricity in these cases reflects the pattern observed around privacy-focused GKC cases (Sanfilippo, Frischmann, and Strandburg, 2021), yet offers new insight. Beyond the inherently polycentric nature of knowledge resource governance, reflecting communities that emerge in existing contexts with exogenous or imposed institutions, we recognize that the extent to which polycentricity is functional is critical to smart systems success. As with other contexts, top-down, exogenous rules-in-use are not as often responsive to community needs and norms, as are bottom-up rules-in-use stemming from commons arrangements. Functional coordination between approaches appears to be critical to patterns and outcomes, as evidenced by cases such as Toronto, where coordination efforts were stymied and the project ultimately failed at Quayside. This suggests that a more intentional focus on polycentricity within the framework may be beneficial in future case studies. Inquiries and practical applications should directly assess where decision-making is nested, competing, and/or coordinated among multiple units.



## OBSERVATIONS

Smart cities are complex. It is important to put aside buzzwords and marketing hype and consider the ethical, economic, political, social, and technological implications of deploying and integrating supposedly smart technologies throughout urban environments. Smart cities present a host of governance challenges that are too easily obscured by slick marketing and grand promises of technological solutionism. In this volume, we encountered plenty of examples, but we also observed cities edging toward more pragmatic approaches to smart tech, data, and community governance. The penultimate chapter presented a proposal for principled decision-making that reflected this type of pragmatism.

While much of this book has been critical and focused on governance challenges faced by cities, we feel it is important to emphasize this rather mundane observation: *smart technology can be incredibly useful*. The case studies showed many examples, ranging from improving the quality and efficiency of government services to managing public transit, streetlights, and other infrastructure to making government data sources freely available to citizens. In nearly every action arena imaginable in the context of cities, there is a potential case to be made in favor of deploying some form of supposedly smart technology, bearing in mind that these are just tools that leverage more and potentially better data to develop actionable intelligence. The refrain repeated throughout the book about ignoring the hype is an important reminder, given the flood of tech boosterism in the smart city context and its potential to distort public perceptions and conversations. But the reminder is only to clear the deck and push towards more pragmatic public conversations and principled decision-making. There is often a potential case to be made, but it must actually be made taking into account countervailing considerations, including evaluation of alternatives and governance dilemmas.

What are those considerations? Initially, we described them in terms of patterns observed and lessons learned. As we reviewed what we had written, we realized that was too strong, given the small number of case studies in this volume and the variety of different subjects and action arenas among the small group.

First, intelligent governance of smart cities requires comprehensive public knowledge rather than superficial transparency. This means that community members must be informed and capable of action, whether in using data and tools or in voicing concerns about projects. Of course, as the GKC approach makes clear, the relevant community members and their roles and capabilities vary by action arena and context. Comprehensive public knowledge is not easily achieved, however. Some cities have pursued an open government agenda that entails making government data publicly accessible online along with software tools to analyze, map, or otherwise use the data. This is an important first step, yet it presents its own challenges, as seen in various chapters.

Second, comprehensiveness also relates to a theme from prior GKC research concerning the recursive, dynamic nature of knowledge commons governance and the need for a holistic and longitudinal approach to this type of research. Governance of urban data and smart technologies is multifaceted, dynamic, and continuous. It requires governance structures that interoperate as part of a governance system. At a minimum, smart city governance must encompass city planning, procurement, implementation, and management processes. Yet, as seen in various cities, each of these may operate as independent stages or action arenas with independent sets of actors interacting in particular ways, guided by separate rules-in-use. So, for example, procurement policies and practices may govern specific actors within a city department, such as the IT staff, and their interactions with tech vendors, while data governance and privacy policies and practices may govern actions of a different set of departmental actors, such as city officials, and their interactions with citizens. The case studies – the Philadelphia case perhaps most vividly – suggest that such independence may be an unproductive artifact of politics, public administration, and long-standing departmental siloes. From a more holistic perspective, procurement policies, impact assessments, terms of use, privacy policies, and other governance institutions should be seen as interdependent components of a *governance system*, rather than as isolated and independent institutions. This perspective is essential when each individual governance institution is necessary but insufficient for overcoming the social dilemmas or obstacles to achieving community objectives. The Seattle case study illustrates the emergence of a governance system that encompasses and integrates governance institutions across action situations.

Third, smart city conversations point simultaneously in lots of different directions. Current smart city research and advocacy, on all sides, seems to be speaking multiple languages at once. There's the good governance language. There's the privatization language. There's the surveillance and power language. There's the language of play and scripted behaviors. There's techno-solutionism language (on both sides!). There's the language of obscurantism and black boxing. The GKC framework is like a smart city Esperanto, except that it's not an insane language that no one wants to learn (we hope!). It's an accessible language that builds on common-sense intuitions. What are the resources? What are the problems? Who are the communities? How do we draw directional arrows among those things?

This Conclusion has emphasized themes about complexity and asking appropriate questions. We acknowledge that asking questions about complexity is not always a useful strategy for researchers or practitioners, including people in public administration, private sector partners and funders, and community organizers. We believe the GKC framework can help. The framework shows how to break down complexity into manageable chunks. Again, from all sides of the problem, there's a syntax for question-asking and decision-making that speaks in essentially the same terms to

everyone. There's the resource attribute chunk. There's the social dilemmas chunk. There's the community/collective identity and interest chunk. There's the historical contingency chunk. And so on.

#### LOOKING AHEAD

We have closed previous *Governing Knowledge Commons* books by paying tribute to Elinor Ostrom and other pioneers, thanking our contributors and new community members, and inviting readers to join us in this collaborative, interdisciplinary research and practice community. We do so once more. This volume is just the beginning of a sustained, systematic, comparative, and longitudinal research effort focused on knowledge commons governance in smart cities and other communities.

In a departure from past practice, in this Conclusion, we do not offer amendments to the GKC framework or the list of representative research questions. The framework remains a dynamic work-in-progress, open to future amendment, but we do not have any to propose at this stage.

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