INTERNET POLICY REVIEW
Journal on internet regulation

Volume 12 **Issue** 1

RESEARCH ARTICLE

OPEN ACCESS

PEER REVIEWED

Slow-governance in smart cities: An empirical study of smart intersection implementation in four US college towns

Madelyn Rose Sanfilippo *University of Illinois at Urbana-Champaign* madelyns@illinois.edu
Brett Frischmann *Villanova University* brett.frischmann@law.villanova.edu

DOI: https://doi.org/10.14763/2023.1.1703

Published: 31 March 2023
Received: 6 October 2022 **Accepted:** 7 December 2022

Competing Interests: The author has declared that no competing interests exist that have influenced the text.

Citation: Sanfilippo, M. R. & Frischmann, B. (2023). Slow-governance in smart cities: An empirical study of smart intersection implementation in four US college towns. *Internet Policy Review*, *12*(1). https://doi.org/10.14763/2023.1.1703

Keywords: Smart cities, Data governance, Knowledge commons, Human-centred design, Transparency

Abstract: Cities cannot adopt supposedly smart technological systems and protect human rights without developing appropriate data governance, because technologies are not value-neutral. This paper proposes a deliberative, slow-governance approach to smart tech in cities. Inspired by the Governing Knowledge Commons (GKC) framework and past case studies, we empirically analyse the adoption of smart intersection technologies in four US college towns to evaluate and extend knowledge commons governance approaches to address human rights concerns. Our proposal consists of a set of questions that should guide community decision-making, extending the GKC framework via an incorporation of human-rights impact assessments and a consideration of capabilities approaches to human rights. We argue that such a deliberative, slow-governance approach enables adaptation to local norms and more appropriate community governance of smart tech in cities. By asking and answering key questions throughout smart city planning, procurement, implementation and management processes, cities can respect human rights, interests and expectations.

This paper is part of **Future-proofing the city: A human rights-based approach to governing algorithmic, biometric and smart city technologies**, a special issue of *Internet Policy Review* guest-edited by Alina Wernick and Anna Artyushina.

Introduction

Despite substantial investment, innovation and optimism, smart cities rarely meet expectations. It is easy to criticise the hyperbolic, self-serving claims of smart tech proponents, but it is more difficult to explain why local governments readily accept and act upon promises of data-driven efficiencies and technological solutions. Smart cities are not easily disposable gadgets for the home, nor are they wearable fitness trackers. Smart cities are infrastructural systems for entire domains — transportation, education, health care — as well as complex meta-systems for entire communities, given the interoperability and interdependencies that evolve over time (Coletta et al., 2019). These systems shape and effectively govern important aspects of our lives.

Given such complexity and extent, defining what a smart city is varies from place to place and across academic disciplines. Some unrealistically emphasise techno-utopian visions in which AI and big data will radically transform services and make social problems obsolete (Schuilenburg & Pali, 2020). Others emphasise the extractive nature of digital capitalism that increasingly pervades public spaces in non-equitable, non-democratic ways (Sadowski, 2020), as smart – or supposedly smart – systems are implemented and used in new ways. Supposedly smart tools typically integrate and rely on networked sensors, data, intelligence-generating systems (including AI, machine learning, algorithms and other data processing/analytics tools) and automation/control actuators. While some tools sometimes work independently in particular contexts, these tools often are, and will be, components of complex, interconnected systems that architect, manage, and even constitute our built lived-in and experienced environments (Frischmann & Selinger, 2018, p. 126). Furthermore, the presence of a lot of sophisticated AI and digital networked tech does not guarantee that people are or will be smart(er), or live better (e.g., Frischmann & Selinger, 2018; Green, 2019; O'Neil, 2016). To ensure public benefits and protect human values in urban spaces, we must reconsider what it means to be smart, as well as the appropriate limits on technology in these spaces (e.g., Green, 2019; Mackinnon et al., 2022, p. 1: "Smart, when applied to cities, is an empty signifier").

Smartness is better understood and evaluated in terms of people using specific

tools within environments (systems, contexts) to achieve outcomes. Which people? Which tools? Which contexts? Which outcomes? These questions require attention and deserve elaboration at all stages of smart tech adoption and deployment. Attending to these and other details ultimately presents a rather basic governance dilemma: Who decides and how? What formal and informal policies and practices govern decision-making?

Datafication of city infrastructure and the adoption of systems that process, share and perform based on data-driven insights are intended to address a variety of dilemmas in urban and metropolitan administration (Heeks & Shekar, 2019). These systems are not inherently good or bad; many seek to achieve socially desirable ends, ranging from concerns about security to environmental sustainability to attracting investment and efficiency (Taylor & While, 2017; Silva et al., 2018). However, many cities implement new digital technologies, adding sensors and integrating systems, without fully considering governance questions (Green, 2019; Sadowski, 2020; Juvenile Ehwi et al., 2022; Frischmann et al., 2023). Such implementations may aim to solve an immediate problem, for example, to reduce congestion or optimise for a single objective, such as efficiency, but fail to consider other plausible and often predictable outcomes. Unfortunately, such incrementalism too often ignores interdependencies, function creep, and corresponding governance challenges. A variety of consequences may result, in ways that may overwhelm any benefit and ultimately lead to failure, as well as angering the public along the way (e.g., Goodman & Powles, 2019).

Adoption of many supposedly smart systems and technologies is often driven by the preference to be an early adopter, or to compare favourably to peer municipalities (Gunawan, 2018). Such adoption decisions may focus on procuring the best available technologies (Paroutis et al., 2014), rather than choosing systems that are the best local fit or that best address specific needs or problems (Barth et al., 2006; Cottrill et al., 2020). What is appropriate for a given city or community, in a normative sense, is contextual and does not necessarily correspond with what is best suited for other cities (Kitchin et al., 2015, pp. 18-20). Unfortunately, the race to be a smart city proceeds without any apparent finish line, and race behaviour is not always conducive to deliberation or meaningful participation from community members. City officials, tech vendors and other enthusiasts may justify participation in the race on the grounds that participation itself attracts tech investment and encourages innovation, but those ambitious claims are hardly, if ever, tested.

Our focus is on the community governance of supposedly smart techno-social systems in cities. This focus and framing connects two other stands of research litera-

ture on smart cities: critical social justice discourse (e.g., Heeks & Shekar, 2019; Sengupta & Sengupta, 2022) and institutional approaches (e.g., Bushouse, 2011). Though it also can be an ambiguous and contested term, "community" may be defined geographically, politically or by some other means or measure. We use cities as a rough but widely used conception of communities (set of communities) of people that share resources, interdependent relations, goals and dilemmas. Nonetheless, everything we have to say is easily extended to other communities.

Sociotechnical systems, including smart tech and corresponding governance systems, should be contextually appropriate, justified and fit for legitimate purposes. Governance in this context refers to the wide array of institutional means by which communities make decisions, manage shared resources, regulate behaviour, and otherwise address collective action problems and other social dilemmas. While lawyers and political scientists may associate governance exclusively with laws, regulations and formal rules, we take a broader, more inclusive perspective that recognises other forms and tools for governance. Thus, for our purposes governance in the context of smart cities also includes the design of infrastructural systems, as in traffic calming measures like speed bumps, and the informal policies, strategies and practices of city officials, among others. To that end, we propose a contextually responsive, governance-oriented decision-making framework for the procurement and deployment of smart tech in cities. The framework grounds smart city governance in local, contextual norms and scaffolds decision-making with key questions to pose throughout smart city planning, procurement, implementation and management processes.

Our approach[1] draws on the Governing Knowledge Commons framework (Frischmann et al., 2014; Sanfilippo et al., 2018); the concept of polycentricity, given interdependencies between systems and stakeholders (McGinnis, 2011); and a hierarchy for strategies, norms and rules that reflect informal and formal institutions (Crawford & Ostrom, 1995). We also integrate human rights frameworks and draw on the capabilities approach to deepen consideration of the techno-social engineering of basic capabilities that are essential to the flourishing of humans (Frischmann & Selinger, 2018; Frischmann, 2016).[2] To assist decision-makers and

1. The authors primarily draw on their expertise and associated literature in Law, Economics, Political Science, and Information Science to study smart city governance. Other disciplinary perspectives, such as Science and Technology Studies, Urban Planning, Philosophy and Ethics, are relevant but not explicitly engaged in this piece.

2. Techno-social engineering refers to the use of social and technological tools to shape who we are and can be, including how we think, perceive, act, and relate with one another. See Frischmann & Selinger (2018); Frischmann (2016).

community members, we articulate a concise set of questions (collected in the Appendix) that public administrators ought to be able to answer before implementing smart systems in cities. We call this *slow-governance*, to contrast our proposed approach with the move fast and break things mindset that has migrated from Silicon Valley to other decision-making and governance processes in too many cities around the world.

We do not advocate for best practices or advance general principles for all smart city projects. To do so would be presumptuous and premature, to say the least. Nor do we add to the ever-growing list of tools for impact assessment (see, e.g., Mantelero, 2022 for discussion of various impact assessment tools). Instead, we explore an approach to informed decision-making that benefits from institutional analysis, human rights frameworks and careful consideration of how smart tech re-engineers systems, environments and people (Frischmann & Selinger, 2018). From this critical and theoretically grounded perspective, we assess how collective action dilemmas concerning the re-engineering of society through the deployment of smart tech in cities and other techno-social environments can be addressed by governance that prioritises "capabilities essential to human flourishing". We argue that we need to take a systems approach, not a discrete approach, to explore patterns, outcomes, and social concerns. To achieve better outcomes, we also must explore aspects of interoperability and understand how different facets interact, to develop sound, comprehensive, contextual governance that respects principles of human rights.

This article evaluates and extends a recently proposed governance framework, grounded in institutional theory and human rights principles, through new empirical case studies. We structure this inquiry via a comparative analysis of governance arrangements around smart systems implemented in intersections; we examine the role of dysfunctional polycentricity and decentralisation in contributing to negative outcomes for communities, with particular attention paid toward the misalignment of human rights and contextual values. Our results match other recent research that documents similar alignment around the privatisation of public and low-income housing aimed at environmental sustainability, at the expense of human autonomy and physical wellbeing (e.g., Dillahunt, 2009; 2014). Re-alignment in such contexts, we suggest, requires slow governance and comprehensive public knowledge. Possible approaches to achieve that include participatory governance mechanisms and co-design of public interest technology and associated governance, as explored in other timely research (e.g., Foster & Iaione, 2022).

Conceptual background

Smart cities as knowledge commons

Smart cities depend on *many* knowledge commons. Knowledge commons refer to institutional systems for the governance of shared knowledge and information resources by members of a group or community.[3] All smart cities, and all smart city projects, depend on a wide range of different knowledge resources that are created, curated, shared and used by urban communities; the various resources are both inputs and outputs from supposedly smart technologies, which are often better characterised as techno-social tools and systems, as they often serve instrumental and governance functions; the shared knowledge resources not only are supposed to be part of the smart tech solution to community dilemmas – e.g., managing congestion on roads, improving citizen participation in vacant land management and so on – but the resources present their own dilemmas that generate social demand for governance – e.g., privacy, security and surveillance-related dilemmas, and as we shall see: human rights dilemmas.

In smart cities, the knowledge commons typically are nested action arenas that can be visualised and analysed at different scales (e.g., macro-, meso- and micro-level action arenas). For example, in their study of smart tech deployment and governance in Philadelphia, Frischmann and Tonkovich (2023) distinguished (i) the macro-level action arena and corresponding knowledge commons for city-wide smart tech planning and deployment, reflected in the SmartCityPHL initiative, from (ii) the meso-level action arena and corresponding knowledge commons for city-wide governance of vacant property management, wherein smart tech deployment played varied, context-specific roles. The authors did not examine micro-level action arenas, which could correspond, for example, to neighbourhood-based activities in vacant property management (or another meso-level action arena).

The Governing Knowledge Commons (GKC) framework provides a structured and rigorous approach to understand and evaluate community governance of the data, technology and other resources within smart systems (Frischmann et al., 2014). The descriptive approach enables examination of collaborative governance arrangements, both regarding shared knowledge resources and the data and

3. Knowledge resources in this formulation include "a broad set of intellectual and cultural resources. […] we group information, science, knowledge, creative works, data, and so on together" (Frischmann, Madison & Strandburg, 2014, p. 2). Commons, then, refers to community management or governance of such resources. "The basic characteristic that distinguishes commons from non-commons is institutionalized sharing of resources among members of a community" (Madison, Frischmann & Strandburg, 2009, p. 841).

knowledge resources around other shared physical and infrastructural resources (Frischmann et al., 2014). It allows researchers and practitioners to structure and compare detailed information about the complex reality of their: background and context; attributes, including that of participants and resources; governance processes, institutions and issues; and patterns and outcomes (Frischmann et al., 2014; Sanfilippo et al., 2018). This is highly valuable to understanding unresolved data governance issues, as well as what facets of governance might be undermining key policy objectives or missing, thus leading to unexpected or undesirable outcomes. While GKC does not usually describe policy objectives and outcomes in human rights language, it frames descriptions of such things however the relevant community does; this supports our analysis of the differences between communities' solutions to governance challenges, including the underlying values and specific local rights protected. One such example is our comparison of the vastly different governance arrangements surrounding smart intersections in different urban and university campus environments. The differences stem from contextual norms and offer distinct protections for human rights.

A recent series of case studies (Frischmann et al., 2023) applying the GKC framework to smart cities shows how many different action arenas exist in cities and how uncoordinated and ad hoc the sometimes polycentric governance of smart tech across action arenas in cities can be. In alignment with broader institutional theory, consideration of polycentricity under the GKC framework is understood in terms of multiple centres of decision-making (Frischmann et al., 2023; Sanfilippo, Frischmann, & Strandburg, 2021; McGinnis, 2011). The arrangements between these centres of decision-making may be nested, as in the SmartCityPHL case referenced above (Frischmann & Tonkovitch, 2023), or they may be fragmented and overlapping (Kitchin & Moore-Cherry, 2021); the GKC framework provides descriptive structures to understand the degree to which arrangements are functional and productive or competing and dysfunctional. Furthermore, consideration of the complexity of polycentric urban environments is necessary to avoid the failures of reductionist and technologically deterministic approaches to urban planning (Das, 2020). In addition to considering the action arenas around knowledge governance in this context, cities need to consider technology and infrastructure governance structures and institutions, including the implications of public-private partnerships and the extent to which the centralisation of decision-making impacts outcomes (e.g., Sanfilippo, 2016).

Centring smart cities on humanity and capabilities essential to human flourishing

The moral foundation of smart cities should be human flourishing. This means

that smart technologies deployed in and by cities should serve as a *means* for enabling the *end (social goal)* of human flourishing. Human flourishing "means that a person has the opportunity to live a life as fulfilling as possible for him or her" (Alexander, 2013). Our conception of human flourishing requires *moral pluralism*, in the sense that our conception "rejects the notion that there exists a single irreducible fundamental moral value to which all other moral values may be reduced", and thus human flourishing includes (but is not limited to) "individual autonomy, personal security/privacy, personhood, self-determination, community, and equality" (Alexander, 2013). We agree with Alexander (2013) that four uncontroversially essential capabilities include: "*life*, understood to include certain subsidiary values such health; *freedom*, understood as including the freedom to make deliberate choices among alternative life horizons; *practical reasoning*; and *sociability*" (Alexander, 2013). As we discuss below, the Capabilities Approach provides an analytical framework for measuring and evaluating human flourishing. We intend to piggyback upon it and more applied instruments and methodologies, such as human rights impact assessments, and integrate them with the GKC framework. Such integration is critical because developing these and other essential capabilities ultimately depends on institutions governing relationships among people, communities and shared knowledge, as well as environmental and infrastructural resources. Our focus in this paper is on the governance of shared knowledge resources, but much of what we say can be extended to the others.

Concerns about how supposedly smart techno-social tools support or undermine human development can be concretely understood in terms of basic capabilities essential to human flourishing.[4] Our proposed approach to evaluating smart city projects resonates strongly with the Capabilities Approach ("CA") developed and applied by Amartya Sen (2005, 1999, 1985), Martha Nussbaum (2013, 2007), Alkire (2008) and many others.[5] The CA is a framework for evaluating social arrange-

4. Frischmann and Selinger (2018) diverge somewhat from Sen, Nussbaum, and other strict CA scholars in terms of the specific capabilities they examine. Frischmann and Selinger focus on various thinking capacities, sociality, and free will, for example, and propose a framework for human-focused Turing tests as a means for identifying and evaluating when techno-social engineering undermines the human development of such capabilities.

5. The Capabilities Approach has been used effectively in a variety of disciplines to develop moral prescriptions and tools for evaluation. In the past three decades, it has emerged as the dominant approach to human development policy, and led to the creation of the United Nation's Human Development Index. The HDI provides a useful measurement tool that captures various aspects of human development and capabilities related to education, health and income. The HDI is used in the Human Development Reports produced by the United Nations Development Program and provides an alternative measure to GDP and other output-based metrics. The CA also has inspired other capabilities-based indices, such as the Gender Empowerment Index and the Human Poverty Index. An incredibly rich, interdisciplinary literature has developed involving economics, philosophy, political science, health policy and other social sciences.

ments (such as smart cities) that focuses on capabilities, which are opportunities or freedoms to realise actual, "real-life" achievements. Sen, Nussbaum and other scholars explain how society is and would be better off supporting the capabilities of individuals to be and do what they have reason to value; in Aristotelean terms, these are capabilities for human flourishing.

The CA supports the idea of *moral floors*, understood as moral obligations of the State rooted in human rights, constitutions and other legal institutions. Martha Nussbaum aptly applies and refines the CA to establish a concrete moral floor for society, such that "any minimally just society will make available to all citizens a threshold level of ten central capabilities, as core political entitlements" (Nussbaum, 2007). She articulates the following list:

1. ***Life***. Being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living.
2. ***Bodily Health.*** Being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter.
3. ***Bodily Integrity***. Being able to move freely from place to place; to be secure against violent assault, including sexual assault and domestic violence; having opportunities for sexual satisfaction and for choice in matters of reproduction.
4. ***Senses, Imagination and Thought***. Being able to use the senses, to imagine, think and reason — and to do these things in a "truly human" way, a way informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training. Being able to use imagination and thought in connection with experiencing and producing works and events of one's own choice, religious, literary, musical, and so forth. Being able to use one's mind in ways protected by guarantees of freedom of expression with respect to both political and artistic speech, and freedom of religious exercise. Being able to have pleasurable experiences and to avoid non-beneficial pain.
5. ***Emotions***. Being able to have attachments to things and people outside ourselves; to love those who love and care for us, to grieve at their absence; in general, to love, to grieve, to experience longing, gratitude, and justified anger. Not having one's emotional development blighted by fear and anxiety. (Supporting this capability means supporting forms of human association that can be shown to be crucial in their development.)
6. ***Practical Reason***. Being able to form a conception of the good and to engage in critical reflection about the planning of one's life. (This entails protection for the liberty of conscience and religious observance.)
7. ***Affiliation***.
    1. Being able to live with and toward others, to recognize and show concern for other humans, to engage in various forms of social

interaction; to be able to imagine the situation of another. (Protecting this capability means protecting institutions that constitute and nourish such forms of affiliation, and also protecting the freedom of assembly and political speech.)
    2. Having the social bases of self-respect and non-humiliation; being able to be treated as a dignified being whose worth is equal to that of others. This entails provisions of non-discrimination on the basis of race, sex, sexual orientation, ethnicity, caste, religion, national origin and species.
8. ***Other Species***. Being able to live with concern for and in relation to animals, plants, and the world of nature.
9. ***Play***. Being able to laugh, to play, to enjoy recreational activities.
10. ***Control over one's Environment***.
    1. Political. Being able to participate effectively in political choices that govern one's life; having the right of political participation, protections of free speech and association.
    2. Material. Being able to hold property (both land and movable goods), and having property rights on an equal basis with others; having the right to seek employment on an equal basis with others; having the freedom from unwarranted search and seizure. In work, being able to work as a human, exercising practical reason and entering into meaningful relationships of mutual recognition with other workers. (Nussbaum, 2013, pp. 33-34)

According to Nussbaum, these capabilities comprise "political goals, quite ambitious ones, such as having adequate health care, having adequate free public education, having sufficient protection for one's bodily integrity; and it is a good bet that most of the world's people do not have the whole list, if, indeed, they have any of them" (Nussbaum, 2007). Nussbaum emphasises the fundamental moral objectives of basic human dignity and human flourishing. The nature of certain capabilities – their essentialness to human dignity and human flourishing – elevates their existence and sustenance to an utmost moral priority. For Nussbaum and many others, these fundamental moral entitlements are a minimum threshold, an end to be aimed for even if it is rarely achieved completely (Nussbaum, 2013, pp. 35-36).

These basic capabilities are scaffolds for human development, self-determination, and a host of other fundamental values: freedom, dignity, respect, equality, non-discrimination, participation and autonomy (see, e.g., the Introduction to this Special Issue and the many sources collected therein). Of course, the same is true of human rights. In fact, there is a rich literature examining the many complementary relationships between human rights and capabilities (see, e.g., the entire Special Issue, *On Human Rights and Capabilities* in the Journal of Human Development and

Capabilities (2011)). Human rights treaties[6] are legal instruments that recognise a set of universal, inalienable, indivisible and interdependent individual rights. How, and even whether, international human rights laws impact smart city planning and implementation remains an open question. Davis (2020) explores how in recent decades many local governments have embraced human rights norms, yet those norms have not fully been reflected in many smart city projects. The reasons vary from opaque procurement (Mulligan et al., 2020) to a lack of community engagement and participation (Foster & Iaione, 2023).[7] Foster & Iaione (2023) describe a robust rethinking of the city as an urban, co-governed commons; their project aims to, among other things, directly involve citizens in smart city planning, decisions, implementation and governance. We believe the CA and human rights frameworks can supply relevant moral floors for pragmatic evaluation of smart tech deployment in cities.

In many fields, impact assessments are an increasingly popular methodology for identifying, describing and evaluating different values that may be at stake in a decision, project or policy. Examples include environmental impact assessments, social impact assessments, privacy impact assessments, equality impact assessments and health impact assessments, to name just a few. Human rights impact assessments, in particular, are an established means for identifying and evaluating how governmental and business activities impact human rights. Yet IAs, as traditionally conceived and practised, may be insufficient for the task at hand. In a recent book focused on IAs for Artificial Intelligence, Alessandro Mantelero (2022) explains how IAs can be too narrow in scope and fail to engage with broader governance issues. Mantelero makes a persuasive case for a more holistic Human Rights, Ethical, and Social Impact Assessment ("HRESIA"). The main components of HRESIA "are the analysis of relevant human rights, the definition of relevant ethical and social values and the targeted application of these frameworks to given AI cases. The HRESIA … combines the universal approach of human rights with the local dimension of societal values". Furthermore, HRESIA "adopts a by-design approach from the earliest stages and is characterized by a circular approach that follows the product/service throughout its lifecycle" (Mantelero, 2022, p. 18).

Mantelero's approach is compatible with our own. Thus, since the HRESIA provides a useful, pragmatic framework, we adopt it by reference and supplement it with

6. E.g., Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights, and the International Covenant on Economic, Social and Cultural Rights.

7. Some cities have joined coalitions and endorsed principles reflecting human rights commitments. Davis (2020) describes a few examples of so-called Smart Human Rights Cities and explains how the cities' endorsements generate needed human rights dialogue.

GKC-based questions (see Appendix). HRESIA involves but is not limited to the use of questionnaires, surveys and checklists. Mantelero emphasises the importance of expert evaluation, e.g., by independent panels or committees of experts. We appreciate the emphasis on evaluation by experts and the limits of questionnaires, but we do not take a position in advance on how the governance and decision-making processes should work, as those details are likely to vary considerably based on the action arena, context and community.

Methodology

To evaluate the proposed framework, we will compare four city and university partnerships in the US that adopt smart systems in intersections around campuses. In these cases, we draw on public records and documentation regarding the projects, associated public comments and governance over associated data, as well as press releases and news stories, including op-eds reflecting public announcements and community perceptions. We conduct inductive-empirical content analysis, structured by the GKC framework. Our structured review aimed at characterising the local contexts, identifying relevant attributes, documenting rules-in-use, active action arenas and specifying patterns and outcomes. A total of 253 documents and 62 news articles were identified and considered, published over 15 years.

Content analysis was iterative and inductive, beginning with core GKC questions, to identify alignment between public decision-making processes and procedural, descriptive theory about the co-production of community and knowledge resources. The second stage compared action arenas, social dilemmas and patterns and outcomes across time and cases to identify contextual attributes, such as relevant values and rights. Using a grounded approach, we took emergent codes and returned to the literature for a structural review of human-centred design and policy, human rights and smart cities literature that might be used to augment and extend the framework for this purpose, as well as to connect emergent themes across the cases in support of deeper analysis and understanding through a third phase of re-coding the same materials.

Smart intersections case studies

We considered a set of parallel cases regarding smart intersections to promote pedestrian safety around US Universities. We focused on the University of Maryland College Park (UMD-College Park), Texas A&M University (TAMU), Princeton University (PU) and the University of Wisconsin Madison (UW Madison). Comparing the UMD College Park and TAMU cases, provides lessons from their lack of success

with analogous smart systems, in contrast with the PU and UW Madison cases, which illustrate comparative success in their local communities.

Smart intersections serve in our key cases, as we evaluate the recently proposed and expanded framework and look to further integrate human values and rights in the questions suggested for cities to evaluate possible smart solutions in adoption and procurement. Relative to community objectives, there are multiple legitimate aims that focus on the improvement of communities and citizens' daily lives: from pedestrian safety to rerouting traffic during emergencies, though often the most visible "Smart solutions" in the US have to do with ticketing traffic violations, for which there is much less social consensus. In this sense, efforts to improve public services rather than gain intelligence for police are more aligned with human values in many communities. We specifically compare instances that focus on pedestrian safety around college campuses, leveraging multidirectional crosswalks or scramble crosswalks, sensors detecting foot and bicycle traffic and the leveraging of temporary traffic rules, such as no turn on red or temporarily no U-turns, to reduce drivers' failure to yield to pedestrians. These types of smart techno-social tools have the potential to improve outcomes and satisfaction in communities with lots of foot traffic, such as college campuses.

We can begin with those cases that illustrate major governance and collective action problems around the systems. Two cases document a general struggle to update intersection infrastructure with smart features without adapting to the context. Notably, on one hand, TAMU is in a small town – College Station TX – that has a significant driving culture, and on the other hand, UMD-College Park is in the DC suburbs, notorious for commuting around the contentious beltway infrastructure. In both cases, smart tech adoption focused more on following and keeping up with peers than on local norms. The vendors pitched messages of accessibility and revitalisation via protection of pedestrian safety, but in fact, the length of time default settings provided for often non-existent pedestrians backed up traffic significantly and led to local frustrations. Neither case invested fully in responsive or adaptive sensors for these systems, despite the availability of such technologies. In the case of TAMU, community members' frustrations were significant enough to motivate the Texas A&M Transportation Institute (TTI) to disable some responsive features and revert to normal traffic and crossing patterns, which favour motorists over pedestrians (for example, at John Kimbrough Blvd and Olsen Blvd). The Texas A&M Transportation Institute and its industry partners (Econolite Group, EDI, Iteris, McCain, MoboTrex, Savari, and Siemens) continue to collect and analyse data for evaluation.

In the UMD-College Park case, despite widespread frustration, the systems remain in use as the Traffic Operations and Safety Lab continue to adjust responsive signalling in the "dilemma zone", with many motorists detouring around enhanced intersections. The outcomes do favour pedestrian safety to a greater degree than anticipated, but with very low satisfaction and not necessarily due to features of the system; the same effect could likely be reached simply by limiting through-traffic, and this would be accomplished without any data collection. Public data sets made accessible through Maryland's Traffic Operations and Safety Lab, mandated via funding agencies, do not provide details on traffic accident reduction, which was the primary aim of the changes.

Before moving on to consider how informed decision making can be supported by conceptual frameworks and careful consideration of human values and rights, it is important to consider where these cases went wrong. There may not be one normative right answer to how to govern all smart cities' projects involving smart utilities, for example, but there may be clear indications of what not to do. Projects that do not conduct adequate requirement gathering beyond technical needs – focusing only on questions addressing evidence to support a proposed tool, functionality and how they will use the data produced – are likely to miss out on local contextual practices or the social nuances that are important to the success of the project. Adopting smart traffic lights that have been successful in other communities without considering local traffic flows or potential externalities and ways to mitigate them are not as likely to be successful as the communities which they are trying to compete with and learn from. What is important to take away from these cases is that holistic and thoughtful approaches can overcome many of these limitations.

PU, in Princeton, NJ, offers insight into how even well-intentioned, clearly aimed smart projects require multiple iterations to adapt to community expectations and achieve success. Following a series of accidents, in which vehicles struck pedestrians and bikers, Princeton sought to solve pressing problems around community safety by updating crosswalks with accessible mechanisms and intersection overhauls. While the crosswalks outside of busy intersections provided an improvement quickly, the changes at the intersection of Washington and Nassau proved confusing and moderately more contentious. The simultaneous adoption of video monitoring, multidirectional pedestrian periods and variable light lengths, depending on congestion, required multiple rounds of community feedback to appropriately tailor, including scaling back automated ticketing. Eventually, the community and campus jointly declared success, with a reduction in accidents and clearer

parameters for data collection and use governance.

These cases contrast with Madison, WI which, led by UW Madison, invested heavily in smart intersections only after over a decade of planning and institutionalisation, aligning the project with local values around sustainability, accessibility and a history of walking regardless of viable sidewalks, due to construction and snow. The city of Madison has long been challenged with balancing the needs of the university, the state capital and the surrounding community. While the interests of the state often diverge from Madison, as its capital, reflecting what former Governor Lee Sherman Dreyfus once described as "25 square-miles surrounded by reality", most city residents' interests align with the university's interests on issues like sustainability and safety. However, traffic and pedestrian safety, as well as walkability and bike accessibility, are not always as well-aligned around the campus area. Over the course of a decade, the City of Madison, UW-Madison, and the Traffic Operations and Safety (TOPS) Laboratory developed knowledge about community needs and concerns by integrating data from student and resident surveys, town hall meetings and referendums. Critically, this effort enabled planners to develop a genuine sense of expectations and needs *before* the project began, reflecting fundamentally human centred smart systems and governance. In pairing the pedestrian focused solutions with efforts to reroute vehicular traffic during student passing periods between classes, this human centred smart city project, including both the smart tech and governance mechanism, achieved various community goals, including safety, reduced driver anxiety and accessibility, among others. Overall, the project is widely considered to be successful. It is worth noting that this example depended on community participation and feedback, long before a particular technological solution was ever envisioned. Governance preceded construction, implementation and subsequent data collection.

TABLE 1: Governance comparison across four smart intersections projects

GOVERNANCE ATTRIBUTE	PRINCETON UNIVERSITY	TEXAS A&M UNIVERSITY	UNIVERSITY OF MARYLAND	UNIVERSITY OF WISCONSIN
City	Princeton, NJ	College Station, TX	College Park, MD	Madison, WI
Smart System Specifications	In-Roadway Warning Lights; Intersection Cameras; Scramble Crosswalks; Pedestrian-only Signal Phase	Traffic Monitoring Sensors; Dynamic Rerouting; Intersection Traffic Optimization	Adaptive Traffic Lights; Intersection Cameras; In-Roadway Warning Lights	Safety Sensor Corridor; In-Roadway Warning Lights; Adaptive Traffic Lights and Signs; Pedestrian Only Signal Phase; Dynamic Rerouting; Audible warnings; Haptic feedback

GOVERNANCE ATTRIBUTE	PRINCETON UNIVERSITY	TEXAS A&M UNIVERSITY	UNIVERSITY OF MARYLAND	UNIVERSITY OF WISCONSIN
Timeline	2019-present	2016-present	2019-present	Governance 2007-present; 2021-present
Relevant Values	Safety; Walkability; Human-Centred	Mobility, Efficiency, Safety, Intelligence	Safety; Intelligence; Efficiency	Safety; Accessibility; Sustainability; Walkability; Inclusivity; Human-Centred
Primary Aims	Protect bikers and pedestrians; reduce congestion; reduce confusion around "non-standard geometry"	"improving mobility and enhancing safety for the public"; "Reducing congestion"	Prioritise safety over minimising delays due to volume or congestion	Promoting liveability and accessibility; Balancing safety and mixed-uses of public spaces
Public Participation Mechanisms	Public Comments; Community Meetings			Public Comments; Community Meetings; Surveys; Representation of Communities on Committees
Public Perceptions	Initial concerns resolved over time	Confusion and frustration	Frustration	Community disagreements resolved prior to implementation; high satisfaction
Evaluation Mechanisms	NJDOT Study; Community Surveys; Safety Statistics	Academic and Industry Research	Academic Research	Academic Research; Community Surveys; Safety Statistics
Relevant Data Governance Parameters	Consolidation of Decision-making, with regular feedback mechanisms	DOT guidelines on public data accessibility		Public Data Sets; Transparency and Open Access; Data Commons
Entities with Access to Data	Princeton University; City of Princeton; Princeton Police Department; NJ Department of Transportation	Texas A&M Transportation Institute (TTI); Texas A&M University; City of College Station; 7 Industry Partners; U.S. Department of Transportation	University of Maryland at College Park; Traffic Operations and Safety Lab	City of Madison; Dane County Highway and Transportation; University of Wisconsin Madison; Traffic Operations and Safety (TOPS) Laboratory; TAPCO

Both the UMD college park and Texas A&M cases illustrate how research-led smart city initiatives may be highly functional, living up to technical hype, but still fail to meet community expectations. In contrast, both the Princeton and UW Madison cases illustrate how smart city projects aimed at addressing acute social needs, to solve actual problems, meet human expectations, even if it may take iterative rounds of governance revision and adjustment of technical practice to do so. By design, these two projects were fundamentally oriented around the balance between two questions: "Is there a genuine community problem in need of solution?" and "Will the tool actually deliver what is promised?".

It is also interesting to compare the *pace* of these projects. The UW Madison case reflects extremely slow governance followed by rapid technological change, lead-

ing to the greatest local satisfaction. The Princeton case attempted to quickly use technology to solve a social problem and found multiple iterations of social revision were necessary. It is difficult to compare with the other two cases, given their relative absence of governance, beyond requirements to publish data sets for publicly funded research.

Another important difference among the projects are the values highlighted. On one hand, the cases that are intentionally governed and viewed favourably reflect local contextual values and norms, such as sustainability, safety, accessibility and inclusiveness. On the other hand, the cases that are not viewed as favourably and are met with frustration do not align with either human rights or contextual values. As we apply questions from the framework to evaluate these cases, we find that the differences in why these projects emerged, how quickly they were implemented and the intentionality around values corresponds with structural aspects of governance. For example, it is not possible to answer many of the questions regarding the projects at TAMU and UMD-College Park from public documentation, indicating either that these governance features were never considered or that they are non-public and non-transparent to the impacted populations. To our knowledge, neither of the projects involved a formal IA, much less an HRIA or a HRESIA.

Most illustrative from the applied questions was what became evident about whose rights were privileged and who had a voice in governance. UW-Madison and the City of Madison centred the interests of the broader community and student needs, while using technologies to address real social and transportation challenges. Many opportunities were provided to give notice and voice to citizens and stakeholders, including through a committee on which community representatives and student government had dedicated seats. In stark contrast, TAMU and UMD-College Park grew out of ongoing research projects, whether the interests and objectives of researchers were human-centred or not is not apparent from the public dialogue; these examples did not provide voice or adequate notice to the communities. Worse, and potentially in violation of human rights, the public documentation about the projects gave a broader impression that the researchers (and project administrators) were experimenting on the public; this goes well beyond not including them or entertaining their preferences. Note an important distinction between these two cases: TAMU did simulate the impact of interventions to mitigate externalities before implementation. Thus, TAMU did attempt to address “How is the general public impacted by this smart system?”. However, simplifications and optimisation processes in such a simulation did not ultimately reflect the complex-

ities of reality. A well-structured IA, HRIA or HRESIA could have helped in that regard.

The public records from Madison and Princeton provide support for the benefits of IA and participatory approaches, with clear documentation that many of the questions identified have been evaluated, including:

- What are the alternative solutions? How do they compare along relevant dimensions?
- Who is gaining what intelligence and for what purpose?
- How is the general public impacted by this smart system?
- What specific community goals and objectives will be met by this smart system?
- What human rights are upheld by this smart system? What rights might be infringed upon?
- What problems, challenges or social dilemmas are being addressed by this smart system?
- What are the relevant strategies, norms and rules governing this smart system and its participants?

Princeton viewed implementation, adoption and use as iterative processes, relative to governance, in response to community needs; they demonstrated careful deliberation and responsiveness to feedback when initial responses and outcomes were unexpected relative to the IA conducted prior to adoption. Importantly, relative to "Who is gaining what intelligence and for what purpose", they were willing to rethink data sharing with law enforcement relative to publicly unfavourable practices such as automatic ticketing. UW-Madison also presented great evidence for the privileging of rights and values, clearly considering "What human rights are upheld by this smart system" early in the planning process and iteratively throughout. The other two cases did not clearly document evidence in a transparent way that indicated careful or intentional consideration of many of these questions in planning for interventions.

Another governance feature that differentiated between success and failure in these cases focused around how interventions were evaluated after implementation. Academic and industry research projects at TAMU and UMD-College Park focused on sectorial impact assessments, preventing harms and pursuing optimisation, but not achieving tangible social goods beyond a narrow set of variables. UW-Madison instead focused on more holistic and multiple comparative methods for evaluation, including academic research, but also continuing to incorporate community feedback and safety statistics, reflecting design justice principles.

Finally, a key pattern that emerged centred around functionality and polycentricity. The UW-Madison case provided a coordination mechanism across stakeholder and citizen groups prior to adoption and implementation, preventing redundancy, fragmentation or gaps in governance. Similarly, dedicated coordination mechanisms were needed to overcome initial challenges and produce sound outcomes at Princeton; the campus, City, and NJDOT needed to work together, rather than siloing data or making competing decisions. In contrast, decentralisation, as seen at TAMU and UMD-College Park, was more likely to fragment and produce incomplete governance, as well as infringe on human rights, as opposed to either case in which polycentricity was intentionally engaged to represent many interests and relevant values.

Discussion

Data autonomy, privacy and human rights

Aside from ongoing philosophical debates about privacy as a human right, these cases provide evidence for why and how data autonomy is an essential capability for human flourishing, reflecting both control over one's environment and bodily integrity. Transparency about data lifecycles within public administration, as well as private provision of public and quasi-public services, is critical to community satisfaction and meaningful engagement with digital transformations via public interest technologies and smart city infrastructure. Practices around intersection cameras most clearly illustrate these points. It is necessary to reconcile community expectations around who has access to this footage, how long it is retained and what it is used for. It is also critical to recognise the ways in which these practices differentially impact different social groups, whose right to flourish is equally valid and important. The Princeton University case is a vivid illustration: footage initially collected and shared with law enforcement for uses like automated ticketing diverged from what the community anticipated and ultimately was deemed to be unacceptable, due to social justice concerns. Changes were necessary to assure that rights, including autonomy and human judgement, were respected in that context.

Accessibility considerations present another target objective of smart intersection projects that highlight the capacity for technology to enhance human capabilities, and subsequently, the quality of life within communities. This was a key aim in the city of Madison, WI, while it was only a secondary consideration in Princeton NJ, and it was not considered at all in either College Station, TX or College Park, MD. Ensuring that all members of the community can utilise smart intersections safely,

rather than potentially raising new safety risks to a vulnerable population, should be a baseline expectation for success in most communities. Once again, these issues would have been identified via most permutations of IA, HRIA, or HRESIA.

Across these four cases, both successful and not, we gain insight into the broadly generalisable expectation that technologies and data imbedded in public spaces should improve outcomes for community members. Those instances in which improvements are marginal or outpaced by externalities or unexpected consequences are not examples of successful implementation. This was so obvious to the community of College Station, TX that they rolled back some of the features that were associated with dissatisfaction and externalities. What did it matter if it was safer for those few pedestrians with respect to a small set of parameters, if it slowed down the flow of traffic, disrupted public transit and increased confusion in ways that introduced new risks? Many smart technologies, including the smart intersections systems analysed in this paper, have the potential to support human flourishing and protect diverse citizen rights and interests under conditions in which choices are made intentionally and thoughtfully to align features, protections and uses with community interests.

Moral foundations of human rights and contextual responsiveness

In comparing these four case studies, as well as contextualising them relative to the other empirical works in this special issue, we also gain insight into the relative value of capabilities-based approaches over legalistic human rights-based approaches. Not only does a capabilities approach speak directly to the moral foundations of human rights, but it is also a more adaptable approach that can conform to local polycentric governance regimes and to the values and preferences of individual communities. Reflecting the comparative differences in values and priorities in each of these cases, what is understood to be necessary to human flourishing or local preferences – an expectation of safe pedestrian passage versus automobile traffic minimization – does not always align. With respect to US municipalities, whether urban, suburban or rural, there is little consensus or exogenous obligation toward baseline requirements to protect rights beyond certain federal provisions as conditions of the receipt of federal funding, such as for transportation. This reflects a complex polycentric assemblage that is quite distinct from the EU context, wherein coordinated directives and regulations, such as GDPR, provide an organising mechanism (e.g., Christofi, 2023).

Notably, none of the smart city projects explored in this study engage deeply with human rights approaches, reflecting a larger discrepancy between US and EU gov-

ernance considerations. The City of Madison, WI most closely approaches discussions of human rights in their deep analysis of community interests and direct consideration of values, yet this is both an outlier in the US context and distinct from EU cases. It is for these reasons that we argue that a descriptive and foundational approach to capabilities and moral foundations is appropriate to provide a descriptive and adaptable framework to suit individual contexts which have different interests.

Localism is increasingly recognised as important to governing privacy and technology in ways that correspond with contextual norms and facilitate innovation surrounding governance dilemmas wherein digital resources do not correspond with conventional, historical and political economic insights (see Verhulst et al., 2021; Marcucci et al., 2022). Yet, there may also be further benefits, specifically in considering the ways in which contextual norms around the capabilities and conditions for human flourishing may be more palatable or safe in cities or countries in which discussion of rights may prove problematic, as under autocratic regimes, or those subject to extremism or political polarisation. It is compatible with soft-law approaches to the protection of human rights in Europe (Oomen, & Baumgärtel, 2018; Stürner & Bendel, 2019; Voorwinden, & Ranchordás, 2022), but also facilitates emergent issues and contextualism. An approach that practically embeds capabilities within a knowledge commons structure to governance is further important and useful in providing a more flexible approach to governance, regardless of whether that comes from the government or formal law, on the one hand, or grassroots efforts and community norms, on the other. Finally, it is an approach that bridges distinctions between individualist and collectivist epistemology of harms, rights and information.

A proposal for slow-governance

Despite the hype, pace of innovation and FOMO by being left behind in the race to be smart, supposedly smart sociotechnical systems require *slow-governance*. This means that the sociotechnical systems, including the corresponding governance systems, should be contextually appropriate, justified and fit for legitimate purposes. Governance requires a combination of policy, regulation and management. This perspective is especially important given the impact and interdependence between each of these actions. Institutional governance reflects a hierarchy of strategies, norms and rules, with both informal and formal institutions impacting outcomes in smart cities and in public administration more broadly (Crawford & Ostrom, 1995). Assemblages of governing institutions, sociotechnical systems and regulatory arrangements span agencies and levels of government, and together,

these comprise complex, dynamic, polycentric systems that are often highly localised and not necessarily generalisable. To some degree, each smart city, and many action arenas with any smart city, may have special or even unique characteristics. Nonetheless, there is much that cities and communities have in common and can learn from each other. This is one of the motivations behind the GKC research field and its emphasis on the comparative analysis of case studies. Here we aim to draw on this research tradition to provide a more applied framework for community decision making.

The intersection cases, like many previous GKC case studies, highlight different public commitments to transparency. Transparency exists on a continuum, from superficial to deep, and it varies, based on what resources are made available, to whom and for what purposes. Superficial transparency focuses mostly on making data publicly accessible without consideration of whether and how it is used. "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 data sets that are difficult to use and interpret" (Frischmann et al., 2023). There are many other examples of cities pursuing nominal transparency by making data sets accessible online without sufficient attention to the actual needs of potential users (Frischmann et al., 2023). Deep transparency requires much more than making data publicly available. To enable comprehensive public knowledge, deep transparency includes sharing information about decision-making processes, the reasoning behind various initiatives, how data collection will occur, plans for what to do with data and smart technologies, and so on. It also requires enablement, which may entail capacity-building via education and access to complementary (computational, visualisation or other) tools. The capabilities and diversity of interests of everyday users and citizens must be considered. Comprehensive public knowledge means, at least, that community members are informed and capable of action, whether in using data and tools, or in voicing concerns about projects.

In essence, the approach suggested by the four smart intersection cases explored in this paper and other recent research (Sanfilippo & Frischmann, 2023) is one in which slow (or at least, appropriately paced) governance supports comprehensive public knowledge. Parallel policy action arenas emerge from city to city and project to project around planning, procurement, implementation and management processes. We find support for a knowledge commons approach in which descriptive frameworks utilise practical questions to ensure governance is not only intelligent, but also contextually appropriate. We adapted and extended the GKC frame-

work questions, originally developed to support interdisciplinary social science research, to more fully address issues of rights and practice. These questions should be answered *prior* to investing in or deploying supposedly smart tech. The questions are broad enough to be possible to answer in every case, yet specific enough to ensure that all relevant variables are considered in advance; further, the set has the capacity to evolve over time, just as the questions within the GKC, and its inspiration, the IAD, have evolved. Cities should be able to answer these questions, and crucially, need not answer them in a particular way for them to be of use in selecting, implementing, using and governing smart systems in intelligent ways. By employing a structured, institutional approach to understand context – including the actors, resources, challenges, objectives, planned approaches and likely outcomes – before investing in and deploying new systems, better and more intentional choices and investments will be made. While we argue that these questions should be answered *prior* to investing in or deploying supposedly smart tech, we find they also help to explain project failures in instances where the concepts of interest were not considered or governed, intentionally or implicitly.

Notably, these questions can be deconstructed into subsidiary sets of questions that explore contextual details. For example, when considering who created the proposed smart system and why, a series of questions concerning what values may have shaped design, what objectives were addressed, how the interests of the creator might be served, whose interests will be served in the long-term and so on. As we consider smart intersections and utilities in this paper, it is important to critically analyse whether these new systems privilege the preferences of system creators or the agencies that use these systems at the expense of human rights. Similarly, mandating limits on water or electricity consumption via automated controls should not come at the expense of safety, health or the autonomy of individuals. Moreover, it is critical that the governance of smart cities address human rights, beyond the often more prominent discussions of privacy, security and transparency. Thus, the questions we raise about IAs and HRESIAs should be understood to encompass the sets of questions, methods and values embedded in those frameworks.

Cities should slow down some decision-making processes to question what cities are being sold and for what purpose, as well as to ensure that we are making social choices that respect the rights of those impacted both directly and indirectly, regardless of their citizenship status. Furthermore, while making slower decisions affects adoption timelines, assessing and describing action arenas and governance structures in a smart city will streamline governance of new systems in the long

term, eliminating the duplication of questions to be answered and depending on strong existing infrastructure for support of new systems. Cities are learning the complexity and dynamics of these highly interdependent smart sociotechnical systems. The answers to these questions are necessarily different for different cities, reflecting local norms and needs.

Conclusion

The comparative analysis of cases reveals the utility of this proposed approach to the evaluation of and planning for governance in smart cities, based on the GKC framework and human rights theory. We believe the case analysis affirms the soundness of bringing together the GKC framework and its structured approach to evaluating governance with a human rights perspective. Further, it demonstrates the utility of descriptive questions in generating the necessary contextual responsiveness for local governance and responsive system development, making it a useful framework for research and practice across many contexts and smart city action arenas. However, the approach needs to be applied, tested, adapted and refined over time, through a series of case studies and applications.

Appropriate and responsive local governance of technology and data are important to general social welfare. Different communities have different preferences, politics, histories, and relationships to civil services; they do not all want or need the same things. This research shines a light on some of these patterns, distilling governance action arenas that communities should resolve before deploying new data collection or automated systems. Even if communities have different preferences about, for example, how long data from traffic cameras is retained for or whether or not transportation data is shared with law enforcement, those are questions they need to negotiate and resolve. The implications of such scholarship are on the one hand conceptual. Moving forward, adopting a parallel approach to monitor and evaluate smart cities projects as they evolve in real time will be fruitful to identifying other important governance issues and understanding successes and failures in alignment with other elements of local context.

On the other hand, this work is also relevant to those who practically want to gain perspective on the changes going on all around them in public spaces. This can help communities to think through their decisions.

One way or another, smart cities will reflect answers to our communities' most fundamental questions, and we believe a slow governance approach to human-centred decision-making can help to support systems that enable freedom in the

smart city, grounding governance in the conditions necessary to support human flourishing.

References

Ahlgren, B., Hidell, M., & Ngai, E. C.-H. (2016). Internet of Things for smart cities: Interoperability and open data. *IEEE Internet Computing*, *20*(6), 52–56. https://doi.org/10.1109/MIC.2016.124

Alexander, G. S. (2008). The social-obligation norm in American property law. *Cornell Law Faculty Publications*, *94*, 745–819.

Alexander, G. S. (2013). Ownership and obligations: The human flourishing theory of property. *Hong Kong Law Journal*, *43*(2). https://scholarship.law.cornell.edu/facpub/653

Alkire, S. (2008). *Valuing freedoms: Sen's capability approach and poverty reduction* (repr). Oxford University Press.

Anthopoulos, L., Janssen, M., & Weerakkody, V. (2016). A unified smart city model (USCM) for smart city conceptualization and benchmarking. *International Journal of Electronic Government Research*, *12*(2), 77–93. https://doi.org/10.4018/IJEGR.2016040105

Armbruster, G. (2018, September 4). How Seattle is tackling privacy problems in today's digital age. *Government Technology*. https://www.govtech.com/opinion/How-Seattle-Is-Tackling-Privacy-Problems-in-Todays-Digital-Age.html

Barth, A., Datta, A., Mitchell, J. C., & Nissenbaum, H. (2006). Privacy and contextual integrity: Framework and applications. *Proceedings of the 2006 IEEE Symposium on Security and Privacy (S&P'06)*. https://doi.org/10.1109/SP.2006.32

Bushouse, B. K. (2011). Governance structures: Using IAD to understand variation in service delivery for club goods with information asymmetry. *Policy Studies Journal*, *39*(1), 105–119. https://doi.org/10.1111/j.1541-0072.2010.00398.x

Cavalcante, E., Cacho, N., Lopes, F., Batista, T., & Oquendo, F. (2016). Thinking smart cities as systems-of-systems: A perspective study. *Proceedings of the 2nd International Workshop on Smart*, 1–4. https://doi.org/10.1145/3009912.3009918

Christofi, A. (2023). Smart cities and cumulative effects on fundamental rights. *Internet Policy Review*, *12*(1). https://doi.org/10.14763/2023.1.1701

Colding, J., Barthel, S., & Sörqvist, P. (2019). Wicked problems of smart cities. *Smart Cities*, *2*(4), 512–521. https://doi.org/10.3390/smartcities2040031

Coletta, C., Heaphy, L., & Kitchin, R. (2019). From the accidental to articulated smart city: The creation and work of 'Smart Dublin'. *European Urban and Regional Studies*, *26*(4), 349–364. https://doi.org/10.1177/0969776418785214

Cottrill, C. D., Jacobs, N., Markovic, M., & Edwards, P. (2020). Sensing the city: Designing for privacy and trust in the Internet of Things. *Sustainable Cities and Society*, *63*, 102453. https://doi.org/10.1016/j.scs.2020.102453

Crawford, S. E. S., & Ostrom, E. (1995). A grammar of institutions. *American Political Science Review*,

89(3), 582–600. https://doi.org/10.2307/2082975

Das, D. (2020). In pursuit of being smart? A critical analysis of India's smart cities endeavor. *Urban Geography*, *41*(1), 55–78. https://doi.org/10.1080/02723638.2019.1646049

Davis, M. F. (2020). Get smart: Human rights and urban intelligence. *Fordham Urban Law Journal*, *47*(4), 971–991.

Foster, S. R., & Iaione, C. (2022). *Co-cities: Innovative transitions toward just and self-sustaining communities*. The MIT Press.

Frischmann, B. (2016). Thoughts on techno-social engineering of humans and the freedom to be off (or free from such engineering). *Theoretical Inquiries in Law*, *17*(2), 535–561. https://doi.org/10.1515/til-2016-0020

Frischmann, B. M. (2012). *Infrastructure: The social value of shared resources*. Oxford University Press.

Frischmann, B. M., Madison, M. J., & Sanfilippo, M. R. (Eds.). (2023). *Governing smart cities as knowledge commons*(1st ed.). Cambridge University Press. https://doi.org/10.1017/9781108938532

Frischmann, B. M., Madison, M. J., & Strandburg, K. J. (Eds.). (2014). *Governing knowledge commons*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199972036.001.0001

Frischmann, B. M., & Selinger, E. (2018). *Re-engineering humanity*. Cambridge University Press.

Frischmann, B. M., & Tonkovich, M. (2023). Smart tech deployment and governance in Philadelphia. In B. M. Frischmann, M. J. Madison, & M. R. Sanfilippo (Eds.), *Governing smart cities as knowledge commons* (1st ed., pp. 112–156). Cambridge University Press. https://doi.org/10.1017/9781108938532.008

Goodman, E. P., & Powles, J. (2019). Urbanism under google: Lessons from Sidewalk Toronto. *Fordham Law Review*, *88*(2), 457–498.

Green, B. (2020). *The smart enough city: Putting technology in its place to reclaim our urban future* (First MIT Press paperback edition). The MIT Press.

Gunawan, H. (2018). Identifying factors affecting smart city adoption using the unified theory of acceptance and use of technology (UTAUT) method. *Proceedings of the 2018 International Conference on Orange Technologies (ICOT)*, 1–4. https://doi.org/10.1109/ICOT.2018.8705803

Heeks, R., & Shekhar, S. (2019). Datafication, development and marginalised urban communities: An applied data justice framework. *Information, Communication & Society*, *22*(7), 992–1011. https://doi.org/10.1080/1369118X.2019.1599039

Ibba, S., Pinna, A., Seu, M., & Pani, F. E. (2017). CitySense: Blockchain-oriented smart cities. *Proceedings of the XP2017 Scientific Workshops*, 1–5. https://doi.org/10.1145/3120459.3120472

Juvenile Ehwi, R., Holmes, H., Maslova, S., & Burgess, G. (2022). The ethical underpinnings of smart city governance: Decision-making in the Smart Cambridge programme, UK. *Urban Studies*, *59*(14), 2968–2984. https://doi.org/10.1177/00420980211064983

Kitchin, R., Lauriault, T. P., & McArdle, G. (2015). Knowing and governing cities through urban indicators, city benchmarking and real-time dashboards. *Regional Studies, Regional Science*, *2*(1), 6–28. https://doi.org/10.1080/21681376.2014.983149

Kitchin, R., & Moore-Cherry, N. (2021). Fragmented governance, the urban data ecosystem and smart city-regions: The case of Metropolitan Boston. *Regional Studies*, *55*(12), 1913–1923. https://d

oi.org/10.1080/00343404.2020.1735627

Lev-Aretz, Y., & Strandburg, K. J. (2020). Privacy regulation and innovation policy. *Yale Journal of Law & Technology*, *22*(1), 256–317.

Mackinnon, D., Burns, R., & Fast, V. (Eds.). (2022). *Digital (in)justice in the smart city*. University of Toronto Press.

Mantelero, A. (2022). *Beyond data: Human rights, ethical and social impact assessment in AI* (Vols 36, Information technology and law series). Asser Press. https://doi.org/10.1007/978-94-6265-531-7

Marcucci, S., Kalkar, U., & Verhulst, S. (2022). AI localism in practice: Examining how cities govern AI. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4284013

McGinnis, M. D. (2011). Networks of adjacent action situations in polycentric governance. *Policy Studies Journal*, *39*(1), 51–78. https://doi.org/10.1111/j.1541-0072.2010.00396.x

Meijer, A., & Bolívar, M. P. R. (2016). Governing the smart city: A review of the literature on smart urban governance. *International Review of Administrative Sciences*, *82*(2), 392–408. https://doi.org/10.1177/0020852314564308

Mulligan, D. K., & Bamberger, K. A. (2019). Procurement as policy: Administrative process for machine learning. *Berkeley Technology Law Journal*, *34*, 773–852. https://doi.org/10.15779/Z38RN30793

Nussbaum, M. C. (2007). The capabilities approach and ethical cosmopolitanism: A response to Noah Feldman. *The Yale Law Journal Pocket Part*, *117*, 123–129.

Nussbaum, M. C. (2008). Creating capabilities: The human development approach and its implementation. *Hypatia*, *24*(3), 211–215. https://doi.org/10.1111/j.1527-2001.2009.01053.x

O'Neil, C. (2016). *Weapons of math destruction: How big data increases inequality and threatens democracy* (First edition). Crown.

Oomen, B., & Baumgärtel, M. (2018). Frontier cities: The rise of local authorities as an opportunity for international human rights law. *European Journal of International Law*, *29*(2), 607–630. https://doi.org/10.1093/ejil/chy021

Palfrey, J. G., & Gasser, U. (2012). *Interop: The promise and perils of highly interconnected systems*. Basic Books.

Paroutis, S., Bennett, M., & Heracleous, L. (2014). A strategic view on smart city technology: The case of IBM smarter cities during a recession. *Technological Forecasting and Social Change*, *89*, 262–272. https://doi.org/10.1016/j.techfore.2013.08.041

Sadowski, J. (2020). *Too smart: How digital capitalism is extracting data, controlling our lives, and taking over the world*. MIT Press.

Sanfilippo, M., Frischmann, B., & Standburg, K. (2018). Privacy as commons: Case evaluation through the governing knowledge commons framework. *Journal of Information Policy*, *8*, 116–166. https://doi.org/10.5325/jinfopoli.8.2018.0116

Sanfilippo, M. R. (2016). *An unequal information society: How information access initiatives contribute to the construction of inequality* [Doctoral dissertation]. Indiana University; ProQuest, UMI Dissertations Publishing.

Schuilenburg, M., & Pali, B. (2020). Smart city imaginaries: Looking beyond the techno-utopian

vision. In M. Schuilenburg & R. Peeters (Eds.), *The algorithmic society. Technology, power, and knowledge* (1st ed., pp. 137–153). Routledge. https://www.routledge.com/The-Algorithmic-Society-Technology-Power-and-Knowledge/Schuilenburg-Peeters/p/book/9780367682651

Sen, A. (1985). *Commodities and capabilities*. North-Holland.

Sen, A. (1999). *Development as freedom*. Oxford University Press.

Sen, A. (2005). Human rights and capabilities. *Journal of Human Development*, *6*(2), 151–166. https://doi.org/10.1080/14649880500120491

Sengupta, U., & Sengupta, U. (2022). Why government supported smart city initiatives fail: Examining community risk and benefit agreements as a missing link to accountability for equity-seeking groups. *Frontiers in Sustainable Cities*, *4*(2022), 960400. https://doi.org/10.3389/frsc.2022.960400

Silva, B. N., Khan, M., & Han, K. (2018). Towards sustainable smart cities: A review of trends, architectures, components, and open challenges in smart cities. *Sustainable Cities and Society*, *38*, 697–713. https://doi.org/10.1016/j.scs.2018.01.053

Stürner, J., & Bendel, P. (2019). The two-way 'glocalisation' of human rights or: How cities become international agents in migration governance. *Peace Human Rights Governance*, *3*(2), 215–239. https://doi.org/10.14658/pupj-phrg-2019-2-3

Taylor Buck, N., & While, A. (2017). Competitive urbanism and the limits to smart city innovation: The UK Future Cities initiative. *Urban Studies*, *54*(2), 501–519. https://doi.org/10.1177/0042098015597162

Vaqar, A. (2018, March 30). $40 billion city in South Korea becomes a ghost down as investment runs out. *Wonderful Engineering*. https://wonderfulengineering.com/40-billion-city-south-korea-becomes-ghost-investment-runs/

Verhulst, S., Young, A., & Sloane, M. (2021). The AI localism canvas. *Informationen Zur Raumentwicklung*, *48*(3), 86–89.

Viale Pereira, G., Cunha, M. A., Lampoltshammer, T. J., Parycek, P., & Testa, M. G. (2017). Increasing collaboration and participation in smart city governance: A cross-case analysis of smart city initiatives. *Information Technology for Development*, *23*(3), 526–553. https://doi.org/10.1080/02681102.2017.1353946

Voorwinden, A., & Ranchordas, S. (2021). Soft law in city regulation and governance. *University of Groningen Faculty of Law Research Paper, (19)*. https://doi.org/10.2139/ssrn.3978959

Appendix

Note: Table 2 lists questions to guide decision making, support slow governance and enable public accountability. It organises questions based on their source. We plan to share other more pragmatic displays – for example, forms, flowcharts and templates – on the Workshop on Governing Knowledge Commons website.

TABLE 2: A knowledge commons framework for slow-governance in smart cities

QUESTIONS ADAPTED FROM THE GKC FRAMEWORK (FRISCHMANN & SANFILIPPO, 2023)	REVISED QUESTIONS SYNTHESISING GKC AND CAPABILITIES APPROACHES	NEW QUESTIONS SUGGESTED BY THE CAPABILITIES APPROACH (SEN, 2005, 1999, 1985; NUSSBAUM, 2013, 2007)
1. Is there a genuine community problem in need of solution?	18. Is function creep likely? Along what dimensions might function creep occur (e.g., types of data collected, uses of data, types of activities impacted, action arenas impacted, etc.)?	22. Who created the proposed tool or system? Why?
2. What specific community goals and objectives will be met by this smart system?	19. How do we evaluate investments, expectations and use of these systems?	23. In what and how many action arenas will the smart technology be deployed? If more than one, how will it be managed?
3. What problems, challenges, or social dilemmas are being addressed by this smart system?	20. How do we evaluate success and/or failure in smart cities, or relative to their integrated digital systems? How do we evaluate trade-offs among outcomes?	24. What are the smart tech's pedagogical functions? How does it shape citizens' beliefs, expectations, relationships and behaviour? What "lessons" does it teach?
4. Is the proposed tool a proven solution?	21. What are the objectives and associated underlying values of a smart city or system and what deliverables, timelines or metrics indicate their attainment?	25. What types of impact assessments have been undertaken? By whom? Are IAs publicly available? In particular, has a HRESIA been completed?
5. Will the tool actually deliver what is promised? Or is hype and tech solutionism reducing the burden of persuasion we ordinarily would demand during procurement?		26. What are the relevant default settings? How are defaults set? Do subjects have a meaningful opportunity to actively choose settings?
6. What are the alternative solutions? How do they compare along relevant dimensions?		27. Is the smart technology always on? Is it intermittent or only on when triggered by certain conditions? What conditions trigger application of smart technology? When is it functional and when is it truly inert (rather than seemingly passive but still functional)?

QUESTIONS ADAPTED FROM THE GKC FRAMEWORK (FRISCHMANN & SANFILIPPO, 2023)	REVISED QUESTIONS SYNTHESISING GKC AND CAPABILITIES APPROACHES	NEW QUESTIONS SUGGESTED BY THE CAPABILITIES APPROACH (SEN, 2005, 1999, 1985; NUSSBAUM, 2013, 2007)
7. Besides delivering promised solutions, are there harms, risks or negative externalities to consider? Who bears those burdens?		28. What concerns among the opposition are relevant or legitimate?
8. What interoperable functions should we consider? How does the technology relate to other technologies and other sociotechnical systems?		29. What human rights are upheld by this smart system? What rights might be infringed upon?
9. What data is generated?		
10. Who has access to this data?		
11. Who are the impacted stakeholders? How is the general public impacted by this smart system?		
12. Who are the decision-makers? How are they selected?		
13. Who is gaining what intelligence and for what purpose?		
14. What are the relevant strategies, norms and rules governing this smart system and its participants?		

QUESTIONS ADAPTED FROM THE GKC FRAMEWORK (FRISCHMANN & SANFILIPPO, 2023)	REVISED QUESTIONS SYNTHESISING GKC AND CAPABILITIES APPROACHES	NEW QUESTIONS SUGGESTED BY THE CAPABILITIES APPROACH (SEN, 2005, 1999, 1985; NUSSBAUM, 2013, 2007)
15. What infrastructure will support this system and who controls that?		
16. What are the benefits of or opportunities for this smart system?		
17. What are the costs and risks of this smart system?		

Published by
Alexander von Humboldt Institute for Internet and Society

in cooperation with
CREATe
cnrs centre internet et societe
R&I IN3 Internet interdisciplinary Institute Universitat Oberta de Catalunya
University of Tartu Johan Skytte Institute of Political Studies