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## **Second Order Smart: City Systems**

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### **Introduction**

The “smart” in digitally enabled smart cities<sup>1</sup> is often conceptualized as an extension of individual intelligence to city agencies or the city itself: more data, greater ability to aggregate information from participants, and more processing capacity enables “better” decisions. The mechanisms for amassing intelligence vary, as does the specific definition of better, but the underlying mental model of a decision-making “actor” of some sort is common.

The persistence of this actor-focused model of “smart,” however, limits our ability to anticipate and achieve the full impacts of information investments on cities as social systems. The information investments involved in becoming smarter - from sensing to aggregation to analysis and pattern recognition - can do much more than inform decisions by individuals or entities. They can also create new institutional possibilities – new options for formal and informal constraints<sup>2</sup> on individual behaviors - by establishing a mutually recognized representation of the world and its dynamics that social arrangements can be built around.

Information investments – investments in a mutually recognized representation of reality - change the range of social transactions between city stakeholders by weakening some relationships and enabling others. In language of social networks, information investments alter the properties of edges as well as the capabilities of the nodes in ways that have important consequences for the overall social system. These changes, in turn, open up new possibilities and risks for urban governance in India and beyond. Cities are, after all, “social reactors” driven as much by the energy of the interactions between the people who live in and move through them as the choices of people themselves.<sup>3</sup>

The information investments that can create new institutional possibilities are often slightly different from those that inform particular decisions. Consider three prominent urban challenges, for example: air pollution, fragmented social safety nets, and labor markets. More information on pollution sources could motivate or enable better decisions about which

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<sup>1</sup> I use the term “digitally enabled smart cities” to make it clear that this paper focuses on the subsection of the “smart cities” discussions, policy initiatives, and investments that emphasizes means (collection, analysis, and movement of information) rather than ends. The “smart” denotes use of information as an input to achieve various goals, rather than identifying a certain outcome (e.g. less sprawl, more inclusion, greater proportion of tech industry jobs) as “smarter” than another and working backward to devise a strategy. Hollands (2008) provides a tour of the wider use of the term “smart.”

<sup>2</sup> Following North (1991), “institutions” means rules, norms, customs, laws, etc.

<sup>3</sup> Luis Bettancourt, quoted in Santa Fe Institute (2013).

emissions to invest in controlling. Ongoing, reliable, judicially and legally recognized tracking of the contributions of non-urban sources to city pollution opens up new options for transboundary governance such as financial compensation between upwind and downwind areas or institutionalized options for one administrative jurisdiction to invest in controlling emissions in another. Counting the poor and vulnerable helps plan for resource requirements; reliably identifying the individuals in need enables social protection programs to deliver benefits to the right people. This is one of the arguments for India's Aadhar and Unique Identification Authority of India: giving a person the ability to prove identity across settings allows her to claim benefits that are not linked to her original address. Similarly, surveying skill levels contributes to planning for vocational education. Testing and certifying prior learning – “recognition of prior learning” - makes it possible for many more to find jobs that use their skills.

The next section of the chapter provides a brief overview of the evolution of the concept of “smart cities” in India and beyond. The first section traces the trajectory of the term from its origins in techno-visions of the future to a supply-driven marketing effort and, today, as a means to achieve various urban goals ranging from sustainability and resilience to service delivery. It also highlights how the means of being smart has alternated between an emphasis on networking, or information flow between city stakeholders, and data collection through sensors, monitoring, and analytics. The section also describes the trajectory of critiques, from concerns that emphasis on technology overlooked more fundamental aspects of governance to deeper concerns about how the distribution of intelligence can affect the balance of power within cities. On the one hand, optimists have highlighted the potential for “smart cities” to enhance citizen voice and influence on government decisions. On the other hand, fears that the growing accumulation of information would enable surveillance and misinformation campaigns have also grown.

While attention to the impact of information investments on the distribution of power is important and relevant for India's cities, the narrow emphasis on relative strength of stakeholders misses a range of other consequential social relationships that information investments can affect. The third section argues for more attention to the effects of information investments on the relationships that shape urban outcomes. It draws on sociology, microeconomics, and applied management strategy to illustrate various ways in which investments in information alters the potential range of relationships between individual actors in ways that have logical implications for cities as social systems. It argues that this definition of intelligence opens up new ways of understanding, anticipating, and shaping digital technologies' impact on cities as social systems.

The final section discusses the implications of this expanded conceptualization of smartness for those interested in mapping, evaluating, and designing or otherwise influencing the trajectory of “smart cities” in India.

## **A Brief History of Smart Cities in India**

Early writing (c. 1960s onward) on the intersection of information technology and cities focused on the potential impacts of faster, easier information transmission on urban form, service delivery, and economic geography. Much speculation, including that telecommunications would render cities extinct as more interactions were moved into the digital plane. Gottman (1983) anticipated urban sprawl and the formation of extended, linked, metropolitan regions and Cairncross (1997) declared “the death of distance” as the consequences of technology, for example. Dutton (1987) explored implications of networking for delivery of municipal services. The exploration of the implications of more “wired” cities spent less time on the ways in which intelligence, or the availability of new forms of information or analytical power, would change city governance, services, or other functions.<sup>4</sup> Many of these discussions of the geography and practices of the information society were more future-focused than applied (e.g. Atkinson, 1998; Aurigi, 2006).

The conversion to a specific area of urban policy and planning practice occurred in the mid 2000s, as the costs of technologies for distributing information, connecting actors, and collecting information dropped. Angelidou (2015) traces the history of the current understanding of smart cities – wired and intelligent – through two phases: first, a supply push driven by vendors and appealing to city constituents’ comfort with technology as a benign part of urban futures; second, a demand-led pull for technology as cities sought to use new sensing, analysis, and information movement to solve long-standing challenges and enable new interactions with residents. The commonly understood definition of a smart city also evolved slightly by adding a new dimension to the earlier analysis of how information transmission – the wired part of smart – could contribute to city performance. Networking could contribute to intelligence as well by enabling cities to more effectively harness, aggregate, and process citizen inputs. The evolution of international and national standardization<sup>5</sup> of the term “smart cities,” reflects this combination of attention to technology, process changes, and impacts of the two on urban outcomes.

India’s smart cities trajectory roughly mirrors the global evolution of the concept. E-governance, the precursor to India’s explicit embrace of “Smart Cities” in the 2014 national mission, began in the 2000s as a collection of state and local government efforts to take advantage of their more “wired” context to deliver documents and information to residents. The first initiatives focused on easing access to documents such as birth and death certificates from city and state governments. Many of the first-generation efforts were simply one-way interfaces, rather than any more fundamental incorporation of technology into government workflows. Efforts to push technologies deeper into automating workflows in the name of efficiency and transparency (since progress on a more digital workflow can be more readily seen and monitored) were slower to move. The Comptroller and Auditor General of India’s audit of the Chennai Metropolitan Development Authority (CMDA)’s 2006 foray into e-governance is telling. The project aimed to reduce processing time for planning permits, increase transparency of decision-making, and support web-enabled interaction between departments and petitioner involved in planning, but

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<sup>4</sup> See Batty (2012) for a brief reflection on the transition from a smart city as a “wired city” to one where “big data” informed new practices and choices.

<sup>5</sup> <https://blog.worldsensing.com/smart-cities/smartcitystandards/>

six year and more than Rs. 1 crore later, CMDA “could not achieve any of its planned objectives.” (GoI, CAG 2012)

The eGovernments Foundation, a non-profit established with a grant from Infosys co-founder Nandan Nilekani, was among the first to shift to efforts that addressed internal city workflows for procurement, financial and works management, management, payroll and other aspects of urban management including interaction with citizens through a public grievance and redressal model. (Seddon & Nadhamuni, 2008; Seddon, 2010). Their approach also emphasized productization, or development of workflow modules that were designed to meet the new, more standardized national municipal accounting guidelines developed in the early 2000 and may thus be appealing to multiple cities. These products were, in fact, often incorporated into other companies’ urban management and service delivery consulting services across India.

The market for panels, dashboards, and IT-enabled management overhauls in India’s cities continued to grow in the 2010s. Adoption of some form of e-governance was mandatory under the 2005 Jawaharlal Nehru National Urban Renewal Mission. The 2011 Report of the High Powered Expert Committee on Urban Infrastructure and services listed e-governance as a “key enabler” for improved service delivery and highlighted various examples of cities collecting and applying new information to reduce traffic, improve streetlighting and solid waste management and more. (GoI, 2011; Fig 4.4) The subtext of e-governance as a means of curbing corruption by forcing decisions into digitized (and thus visible) workflows also continued.

The more explicit “Smart Cities” initiative began later with the 2015 budget announcement of a new national mission to select and support 100 smart cities across India. The mission emphasized the “end” of better cities via the “means” of technology from its inception. “In the approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of ‘Smart’ Solutions. The focus is on sustainable and inclusive development.”<sup>6</sup>



The selection criteria and the more detailed definition of “smart,” highlighted the role of data and digital enabling for achieving these outcomes. (Figure 1, from MoUD 2015) The pan-city

<sup>6</sup> MoUD (2015), Section 2.3. Ministry of Urban Development, Government of India (2015) “Smart City Mission Statement and Guidelines” available at [http://164.100.161.224/upload/uploadfiles/files/SmartCityGuidelines\(1\).pdf](http://164.100.161.224/upload/uploadfiles/files/SmartCityGuidelines(1).pdf)

development required in each city's application<sup>7</sup> "envisages application of selected Smart Solutions to the existing city-wide infrastructure. Application of Smart Solutions will involve the use of technology, information and data to make infrastructure and services better." (MoUD, 5.1-5.4) Fifty-six out of 81 components in the 20 round 1 winners, and 29 of 37 components proposed by the 13 winning fast track cities included explicit investments in decision support or IT infrastructure.<sup>8</sup>

Cities also had to demonstrate progress on use of technology to enhance participation.<sup>9</sup> "The Smart Cities Mission requires smart people who actively participate in governance and reforms ... The participation of smart people will be enabled by the SPV through increasing use of ICT, especially mobile-based tools." (15.5) Two out of three of the scoring parameters for evaluating smart city proposals include a digital component. While the first cluster focuses on quantifiable improvements in infrastructure, the second question is "In the last three years, what have been the changes in Administrative Efficiency due to the use of Information and Communication Technology (ICT)?" The third question on a city-level Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis emphasizes need to ground responses in findings from large-scale (implicitly digitally enabled) citizen consultation.

The dimensions of the 2020 MHUA Smart Cities Report Card were largely consistent with this vision of "smart."<sup>10</sup> "Climate" is based on progress on environmental projects; "Ease of living" based on economic, social, and health aspects of quality of life as well as citizen participation; and "municipal performance" is based on parameters such as service provision, finance, and governance in addition to technology. Progress on project implementation varies. As of 2021, just 23% of the funds for tendered projects (projects described to attracting bids) had been released.<sup>11</sup> The national government set up a 20-20 program in which the leaders of the 20 most advanced cities help the 20 cities with the least progress formulate and tender projects.<sup>12</sup>

Empirical inquiry and popular writing about smart cities also evolved from debates about alternate futures to arguments about opportunities and risks associated the current practice of smart cities. Claims and concerns about the potential for the investments in "smartness" to alter the balance of power within cities became more prominent.

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<sup>7</sup> Cities could choose between retrofitting, redevelopment, or greenfield development for a smaller sites, though retrofitting expected that "a large number of smart applications will be packed into the retrofitted Smart City."

<sup>8</sup> Available at: [http://smartcities.gov.in/upload/smart\\_solution/58df96fc6afacSmart\\_Solutions\\_Components.pdf](http://smartcities.gov.in/upload/smart_solution/58df96fc6afacSmart_Solutions_Components.pdf) and

[http://smartcities.gov.in/upload/smart\\_solution/58df96e1ac038Pan\\_Solutions\\_Components\\_13Fasttrackcities.pdf](http://smartcities.gov.in/upload/smart_solution/58df96e1ac038Pan_Solutions_Components_13Fasttrackcities.pdf)

<sup>9</sup> Hoelscher (2016) argues that the citizen participation part of the Smart Cities initiative was an afterthought and hastily developed response to a critique of the original apparent emphasis on land, infrastructure, economic development.

<sup>10</sup> <https://economictimes.indiatimes.com/news/economy/infrastructure/centre-to-release-report-card-of-smart-cities-in-june/articleshow/73660912.cms>

<sup>11</sup> <https://www.orfonline.org/research/indias-smart-cities-mission-2015-2021-a-stocktaking/>

<sup>12</sup> <https://economictimes.indiatimes.com/news/economy/infrastructure/smart-city-mission-centre-devises-2020-model-to-boost-laggard-cities/articleshow/74234953.cms>

Promotional material and more optimistic surveys smart city potential focused on the value of such social *and* sensor-driven intelligence for performance. Smart cities “try to improve urban performance by using data, information and information technologies (IT) to provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration amongst different economic actors and to encourage innovative business models in both the private and public sectors,” write Llacuna et al (2018) (p.619). The World Bank defines smart cities as: “a technology-intensive city, with sensors everywhere and highly efficient public services, thanks to information that is gathered in real time by thousands of interconnected devices” as well as a “a city that cultivates a better relationship between citizens and governments - leveraged by available technology. They rely on feedback from citizens to help improve service delivery, and creating mechanisms to gather this information.”<sup>13</sup> Jennifer Pahlka of Code for America argued that, in smart cities, service delivery and citizen engagement could converge – leaders could “start with users and their needs,” rather than the priorities of city agencies and service delivery systems.” (Bollier, 2015, p. 5) IBM, an early leader in creating intelligence through instruments and sensors, also adjusted its goals: “So how do we get the eight million experts in our city to participate in governing decisions?,” asked Steve Adler, Chief Strategist, IBM, in discussing support for services in New York. (Bollier, 2015, 4))

The critiques on the other hand, focus on the ends to which such intelligence and network-derived information would be put. The milder version is that technology would simply be ineffective, besides the point. One strand of this work focused on the origins of the term, arguing that a business-driven shift would be unlikely to contribute substantially to better planned or executed cities. A related critique focused on the disconnect between the push to promote technology packages widely applicable generic responses to varied local settings and social systems. (Greenfield, 2013).

The more pointed critique focuses on the potential for such intelligence to enable increased surveillance that, in turn, could be used for positive as well as negative purposes. Poole (2014) encapsulates the potential for the network and the sensors to be dual-use technologies well:

“One take-home message of the Futures Cities conference (2014) seemed to be that whatever the smart city might be, it will be acceptable as long as it emerges from the ground up: what Hill calls “the bottom-up or citizen-led approach”. But of course, the things that enable that approach – a vast network of sensors amounting to millions of electronic ears, eyes and noses – also potentially enable the future city to be a vast arena of perfect and permanent surveillance by whomever has access to the data feeds.”<sup>14</sup>

The initial concerns about smart cities focused on the danger that those with access to the feeds would use the intelligence to target and punish opposing groups or whistleblowers or discriminate in access to public services and benefits. More recently, the use of surveillance to

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<sup>13</sup> <https://www.worldbank.org/en/topic/digitaldevelopment/brief/smart-cities>

<sup>14</sup> <https://www.theguardian.com/cities/2014/dec/17/truth-smart-city-destroy-democracy-urban-thinkers-buzzphrase>

target influence and misinformation campaigns to shift electoral outcomes or public perceptions of government performance have been added the list.

It is too early to establish the Smart Cities program's impacts on urban infrastructure, service delivery, livability, sustainability, and other goals, but early commentary on the program has largely matched the global themes. Initial skeptics commented on the disjunct between the emphasis on technology and data and the more prosaic gaps in urban infrastructure and services. "Can we first work towards becoming a functioning city before aspiring to be a smart city? We lack even the basic services that a city should typically provide," asked Suresh Mathur, a teacher quoted in the Washington Post.<sup>15</sup> Architect and planner Gautam Bhatia wrote that "dressing [a city] up with technology" would not be enough to meet India's urban needs.<sup>16</sup> Praharaj et al (2018) focused on the smart cities special purpose vehicles, asking how well these new integrated hubs were integrated into the rest of the city agencies, planning processes, investments, and ordinary governance.

The answer almost surely varies by city. The special purpose vehicles have limited official power to shape or influence broader city governance, but can also be a catalyzing force for "orphan" ideas that have already been developed through prior informal collaboration and discussions. Raj Cherubal, CEO of the Chennai Smart City SPV, for example, attributes the pace of project implementation in Chennai to the prior history of offline discussions fostered by Chennai City Connect (Cherubal interview, Artha Dialogues 2019).<sup>17</sup>

Others echo the global concern with the ownership and use of "smartness." Hoelscher (2016) argues that the Smart Cities mission seeks to re-form cities in the interest of elite private capital. Arun (2019) raises the possibility that India's Smart Cities project is part of a broader rise in surveillance as a condition of modernization, development, and technology-enhanced production of security. Karki (2022) and Suresh et al (2022) highlight the limited inclusivity of smart city projects, particularly relative to stated goals.

The tensions that Poole (2014) highlights continue to play out. National, state, and local governments in India used drone surveillance, traffic and CCTV cameras, geofencing, and other means to enforce COVID-19 related policies. The Ministry of Housing and Urban Affairs (MoHUA), however, for example, boasted that "cities are developing predictive analytics using heat maps and taking action in monitoring the movements, using geo-fencing, as well as periodic health status of suspected cases."<sup>18</sup> Contact-tracking app Aarogya Setu, which monitors movements and interactions has been highlighted as both essential infrastructure for protecting public health and

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<sup>15</sup>Quoted in Lakshmi, R. (2014).

<sup>16</sup> Bhatia, Gautam (2014). "To Make a City Smart," *Indian Express* November 22, 2014.  
<https://indianexpress.com/article/opinion/columns/to-make-a-city-smart/>

<sup>17</sup> <https://www.youtube.com/watch?v=bllcXZxUuFQ>

<sup>18</sup> <https://www.theweek.in/news/india/2020/04/08/how-indias-smart-cities-help-health-officials-in-fight-against-covid-19.html>

a potential “privacy disaster.”<sup>19</sup> The national government mandated that all employees download the app as part of its guidelines for re-opening economic activity; the Kerala High Court heard a petition from the General Secretary of a local district committee of the Congress Party challenging the directive.<sup>20</sup>

### **An Argument for a Wider Lens: Second-Order Smart<sup>21</sup>**

The current “smart cities” commentary and scholarship concerned with the relationship between information and the balance of power is important, but is just a small part of a much broader set of ways in which information investments can change relationships between city stakeholders by changing the understanding of the context in which they exist. The focus on power is an important advance from the emphasis on information and “better decision” but it still obscures important areas of social return on – and risks from – investments in information. “Smartness” opens up new institutional design possibilities, new scaffolding for relationships *between* city stakeholders in addition to new possibilities for decisions *by* leaders, communities, or other actors.

Relationships are often overlooked or relegated to the background as social science – and social science data collection – has honed in on individuals’ motivation, knowledge, capabilities, and idiosyncracies as the microfoundation for understanding collective outcomes. Efforts to highlight the relevance of relationships as well as agents’ impulses as determinants of social system dynamics have gained limited traction. Coleman (1988)’s concept of “social capital,” originally coined in an effort to draw greater attention to a class of intangible, but productive and important assets embedded in terms of interaction between individuals<sup>22</sup>, was later effectively summarized as “trust.” Coleman (1990)’s emphasis on “structures of action” along with individual characteristics as a foundation of social theory has not traveled as far across social science as the inquiry into individual knowledge, motivation, capabilities, and other attributes. Similarly, Pue et al (2015)’s recent effort to draw attention to relationships as the factor that social innovation seeks to change – articulating social innovation as “a process encompassing the emergence and adoption of socially creative strategies, which *reconfigure social relations* in order to actualize a given social goal” has seen limited traction.

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<sup>19</sup> <https://qz.com/india/1838063/modis-aarogya-setu-coronavirus-app-for-india-a-privacy-disaster/>  
<https://www.forbes.com/sites/simonchandler/2020/04/13/how-smart-cities-are-protecting-against-coronavirus-but-threatening-privacy/#2130b8f1cc3c>

<https://www.thehindu.com/news/national/coronavirus-municipalities-using-smart-cities-command-centres-turn-into-war-rooms/article31274714.ece>

<sup>20</sup> <https://www.thehindu.com/news/national/kerala/plea-in-kerala-hc-against-centres-directve-on-aarogya-setu-app/article31535285.ece>

<sup>21</sup>This section draws on a broader project looking at the social returns on information investment. In that project I argue that new relationship possibilities – new “structures of action” in Coleman (1990)’s vocabulary – are an important form of return on investments in data, science, processing capabilities.

<sup>22</sup> “If physical capital is wholly tangible, being embodied in observable material form, and human capital is less tangible, being embodied in the skills and knowledge acquired by an individual, social capital is less tangible yet, for it exists in the relations among persons. Just as physical capital and human capital facilitate productive activity, social capital does as well.” (Coleman, 1988 - S101)



This is a mistake. Relationships are at the heart of social systems, and cities are nothing if not social systems. Our statistical representation of cities focuses on objects – people, places, things, resources (Seddon 2011) – but our hopes and fears for urbanization all rest on the relationships that cities support within their boundaries and between cities and the rest of the world. The theories connecting cities to outcomes as diverse as innovation, individual self-realization, resource efficiency, and human development all rest on assumptions about relationships, as do concerns about environmental degradation, crime, insecurity, and other urban ills.

Not only are relationships important parts of the overall functionality and evolution of social systems, they are substantially shaped by the presence and distribution of information. Perceptions of others and readiness to trust, for example, are in part a function of narratives running in the background of peoples’ minds. Anticipation of accountability, rewards, or punishment – the driving force in most mechanism designs - depends on the expectation that actions and their consequences can be seen and recognized. Many of these influences are relevant for city functionality – and for anticipating the way that smart city investments will or could shape city outcomes.

Information asymmetries, for example, are well known to limit certain types of transactions and prevent some markets from forming. Akerlof (1970) for example, illustrates the broader concept of adverse selection by showing how the presence of private information about the history of used vehicles depresses the value of all used cars and limits the scope for their trade. As long as knowledge of quality is private, buyers remain skeptical of sellers’ claims, and offer lower prices. The lower prices, in turn, discourage sellers from offering better cars for sale, increasing the proportion of “lemons” in the market and further discouraging buyers. An information investment in publicizing quality information, such as third-party certification can reinstate the possibility of a vibrant market.

Investments in information that reduces the potential for adverse selection in rental markets and creditworthiness could shape city outcomes by opening up new possibilities for people to choose where they live. Similarly, surveillance that limits the extent of private information about income, history, or extent of disadvantage could enable expansion of public benefit programs that encourage mixed-income neighborhoods or otherwise attempt to improve equity without “leakage” of benefits. This is not to argue that surveillance is good, just that it changes the options for program design.

Second, investments in information can enable greater use of outcome-based financing, management, and contracts by making outcomes measurable, auditable, and attributable so that they can be the basis for setting rewards and incentives. These kinds of relationships, in turn open up new possibilities for innovation, public management, and partnerships between city stakeholders. It is challenging to reward the employees who deliver the best customer service when customer satisfaction is invisible, or to ensure that public investment supports cleaner air when the link between action and air quality cannot be verified. Given the need to set up some

basis for collaboration, agencies use proxies for performance: showing up at work, for example, or requiring a particular pollution control technology. Shifting to outcomes allows more precise allocation of awards to those who show up and go the extra mile. It also encourages people to find new ways of achieving outcomes, often leading to the discovery of lower cost, lower-effort approaches than the known, safe technology or practice. The importance of information structure, specifically measurability of outcomes and outputs, for public management has long been recognized – it is the basis, for example, of Wilson (1989)'s typology of bureaucracies.

Investments in information that makes outcomes visible and attributable also open up new possibilities for accountability and sharing the burden of governance. Environmental governance, for example, is evolving as the cost of accurately identifying and attributing violations of emission standards declines. The conventional approach left environmental oversight to governments, given the costs of tracking violations, with community oversight as a last bulwark against egregious, visible, abdication of enforcement mandates. This has changed, as citizen groups armed with lower-cost sensors, increasingly accurate open satellite products, rapid testing kits, and new IT-enabled abilities to aggregate and process individual reports to detect patterns, have identified more subtle violations. This trend toward community governance is likely to accelerate – and could move faster with strategic state and non-state investments in open environmental data and communication.<sup>23</sup>

The same information investments in visibility and attributability of both goods and bads support new forms of inter-governmental coordination that can be useful for managing externalities across metropolitan regions and wider sphere of urban influence. A vague sense of interdependency across labor markets, eco-regions (watersheds, airsheds) or infrastructure networks is often enough to motivate some effort to coordinate policies and investments. Such collaborations can be fragile, however, since the resources each party puts in are visible and the returns may not be. More precise quantification of the exchange puts the value of the collaboration on firmer footing in settings that do not have the foundation of some kind of shared sense of community.<sup>24</sup>

Finally, information investments that help build new narratives can change the outcomes of cities as social systems. Information that enhances familiarity with fellow residents, for example, enables trust, which in turn provides a foundation for cooperation. Information is not the only determinant of trust - Murtin et al (2018) summarizes a wide range of influences from altruism to governance context – but familiarity is consistently found to increase reported and behaviorally demonstrated trust.<sup>1</sup> Familiarity, in turn, is a function of the media, advertising, and communication environment in modern digital (urban) settings. Smart city investments in public campaigns, art, and other efforts to break down the silos that can form in social networks and everyday life and in physically segregated environments change the foundation for valuable

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<sup>23</sup> Glicksman, et al (2016)

<sup>24</sup> This kind of transactional approach to coordination may crowd out other reasons to collaborate, as summarized and discussed in Sandel (2012) This seems more relevant for individual interactions than for group-to-group coordination through inter-governmental agreements.

relationships. Behavioral trust, or situations in which a person “consciously places resources at the disposal of another party without the means to guarantee that these will be returned” (Fehr, 2009) recognized as important contributor to resilience, for example. It is also likely to help advance some of the smaller-scale community infrastructure technologies embedded in visions of environmental sustainability.

As a final example, information also shape norms – and behavior - by altering peoples’ mental models, perspectives, and sense of the consequences.<sup>25</sup> A growing body of research, for example, suggests that enabling comparisons of one’s own behavior to others alters actions as disparate as alcohol consumption to electricity use.<sup>26</sup> The granular information and the analysis and communication infrastructure to allow these comparisons may require different investments than the information needed for more conventional management functions such as, say, anticipating electricity demand. Information that increases the visibility of ones’ role in creating larger problems (or agency to advance their solutions) may also change intrinsic motivations to contribute to social goals. Furlong (2010), for example, discusses the impact that greater visibility into the water system had on urban residents’ willingness to participate in municipal water efficiency programs.

### **Realities & Possibilities**

The discussion of the impacts of information on the potential range of relationships/transactions/“structures of action” between city stakeholders seems far from the immediate and growing concerns that India’s smart city policies, public investment, and general trajectory will be at best marginally effective in improving living conditions and sustainability and at worst the means for surveillance, greater social marginalization and exploitation. These concerns are valid. It is important to avoid letting grand data strategies and software-themed initiatives built around “stacks” distract attention, financial resources, and political energy away from physical and social infrastructure environments. It is important to develop the data policies, governance and enforcement capacities, and consumer knowledge that will be needed to contain the growing capabilities for surveillance, social control, and segmented, inflammatory, disorienting messaging.

Yet it would be a shame to assume that information investments are either beside the point or potentially evil. The second order smart framework provides a new map of where to look for the positive and negative impacts of information investments. This map can be used to evaluate interventions, but also to identify new priorities for the next round of “Smart City” development.

The key question for India’s cities is not what to do to create economic opportunity, expand access to housing and services, reduce pollution, reduce traffic and make walking and cycling

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<sup>25</sup> “When a norm exists and is effective, it constitutes a powerful, though sometimes fragile, form of social capital.” (Coleman, 1988, S104)

<sup>26</sup> See Brandon et al (2018) on electricity use; Taylor et al (2015) on alcohol use; Sunstein and Reisch, ed (2017) on Nudges more generally.

safer, and otherwise meet goals that have been outlined in manifestos and voter surveys alike.<sup>27</sup> It is how to motivate the broad array of actors involved in any city to work together in concert to make it happen.

India's urban governance famously spatially and administratively fragmented, in spite of a decades-old constitutional amendment that recognized the validity of local government, two Finance Commissions and a national urban development program (JNNURM) that tied funding to institutional markers of decentralization, reams of recommendations by government committees, scholars, and activists across the political spectrum. Most cities of any size are actually economically and geographical contiguous agglomerations of dozens or more individual administrative units and a few districts. Central, state, and local politicians and civil servants share responsibility – often within the same projects and sectors. Private sector and community voice, actions, and choices about compliance with plans visibly shape cities. As H.E. Mr. Rahul Chhabra, High Commissioner & Permanent Representative of India to UN-Habitat, put it succinctly in his address at the first session of the U.N. Habitat Assembly in May 2019: “Urban development remains a shared responsibility of the different tiers of government and of the public and private sectors.” This spatial and administrative fragmentation of India's urban governance is not going away.

Many of India's cities, and particularly the larger and fast-growing metropolitan areas are also socio-economically divided. Delhi and Mumbai ranked 101 and 107 respectively out of 113 cities surveyed in the Inclusive Prosperity Cities Index; Bengaluru came in at 83.<sup>28</sup> Income inequality in India's cities is visible spatial – a contrast between densely packed slum areas with limited infrastructure and services and the gleaming new high-rises filled with office-going professionals, and Sidhwani (2015) finds evidence that some of this residential segregation runs along caste lines in his study of India's ten largest cities.<sup>29</sup> Mukhopadhyay and Urzainqui (2018) show a more subtle trend of rising within-block income inequality 2004-2011.<sup>30</sup> There is little reason to believe that these urban realities and trends have changed in the last decade.

A second order smart agenda should invest in information that starts to reduce this fragmentation by creating new possibilities for constructive, institutionalized relationships between the stakeholders in India's urban future. I suggest three possibilities here; there are undoubtedly more.

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<sup>27</sup> On voter priorities, see Association for Democratic Reforms (ADR) (2018). “All-India Survey on Governance Issues and Voting Behavior,” ADR Report available at [https://adrindia.org/sites/default/files/All%20India%20Survey%20Report%202018\\_English\\_9thDec19\\_update\\_0.pdf](https://adrindia.org/sites/default/files/All%20India%20Survey%20Report%202018_English_9thDec19_update_0.pdf)

<sup>28</sup> [https://www.picsaindex.com/wp-content/uploads/2019/11/Creating-an-Inclusive-Prosperity-Cities-Index-final-PICSA-report\\_Nov2019.pdf](https://www.picsaindex.com/wp-content/uploads/2019/11/Creating-an-Inclusive-Prosperity-Cities-Index-final-PICSA-report_Nov2019.pdf)

<sup>29</sup> Sidhwani, P. (2015). “Spatial inequalities in big indian cities,” *Economic and political weekly* 50(22):55-62 · May 2015

<sup>30</sup> Mukhopadhyay, A., and D.G.Urzainqui (2018). “The dynamics of spatial and local inequalities in India,” WIDER Working Paper 2018/182 December 2018

First, greater investment in tracking key urban outcomes in robust, auditable, ongoing, and timely ways could pave the way for more outcome-focused financing and new public-private partnerships. The performance-linked component of the 2020-21 budget allocation to cities for air quality, based on the Fifteenth Finance Commission's vision recommendation both significantly increase air quality funding and link it to pollution reduction achievements, offers a glimpse of a new approach to public investment that shifts city and state incentives and options. Rather than prescribing a list of approved actions, which may or may not be locally relevant given varying sources of pollution and differing routes to reducing emissions, the performance-based approach encourages cities to determine their own approaches or even develop new programs and rewards the good bets. It encourages city and state officials to mainstream air quality into public investments in transportation, waste management, and other contributing sectors rather than treat air pollution as a matter of regulation. It discourages sectoral silos and incoherence by rewarding cities for the overall outcome, not individual agencies' progress on to-do lists. The specific terms of the grant are yet to be detailed, however, and the ability to link transfers to pollution reduction as intended depends on the quality of air quality monitoring and its ability to accurately detect annual differences in pollution.<sup>31</sup> The ability to extend this framework to other areas of city performance depends on having the option to measure outcomes accurately.

Measuring more particular local outcomes accurately and cost-effectively also opens up new possibilities for partnerships and contracts between city leaders and private or community partners. Outcome-linked contracts or pay-for-performance shifts the risk of failure to the service provider rather than the public sector, which in turn means that cities can afford to take a bit more risk in selecting new partners, including entrepreneurs and those offering new approaches to service delivery. This risk-taking ability is obviously constrained by the city's ultimate accountability for delivering services, and but outcome-based contracts limit financial exposure from choosing the wrong partner.

Second, investment in understanding the flows of people, resources, pollution, and finance between cities and their surroundings could lay the groundwork for new forms of metropolitan and regional coordination. There is a difference between knowing that people commute, air pollution flows across boundaries and peri-urban wetlands mitigate seasonal flooding and knowing exactly how many people commute, when and how, how much of local pollution for a given week is attributable to out-of-boundary sources, and the volume of flow modulation from wetlands. The former points to the need for transboundary coordination; the latter makes a more

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<sup>31</sup> Air quality progress is not always readily visible in simple before-and-after comparisons. Before-and-after comparisons that do not model and estimate the impact of background factors on air pollution, would not always show a strong link between effort and achievements. In this setting, there are two problems that could come up. Outcome-based rewards do not create as strong incentives to exert effort in such settings. Cities may not respond as strongly to the "carrot" of rewards for clean air achievement since they run the risk of taking costly action but missing the rewards due to factors beyond their control. Determinations of achievements may be contested by cities that have reduced emissions in ways that should have improved air quality, all else equal. It would seem "fair" that their efforts be acknowledged, even if the results are not achieved due to weather and or other intervening variables. Third, strong financial incentives to produce cleaner air also create incentives to tamper with monitoring data to produce the appearance of cleaner air.

precise allocation of contributors and impacts of the transboundary interaction possible. This allocation, in turn, enables governance mechanisms that institutionalize compensation related to impacts and clarify the local returns on investments in other jurisdictions so that they can be compared to comparable ways to achieve the same level of air pollution, flood resilience, or other goal. The need for coordination across boundaries has often been cited as a reason for higher levels of government to retain powers rather than decentralize authority, but quantified interactions allow for management through horizontal bargaining or compensation.

Third, investments that help make private knowledge of capabilities and intentions more public could support more inclusive labor markets and expanded economic opportunity. Urban labor markets share some characteristics with the market for lemons – individuals know their skills, but employers have reasons to be skeptical of job-seekers' claims and offer lower wages or fewer opportunities than the worker would like. The analogy is imperfect, because productivity is a matter of both skill and effort, there are a variety of payment arrangements that can align incentives more than is possible for buyers and sellers of used cars, and employment allows workers to display their skills and earn job security or wage increases over time. Still, a person who cannot provide visible evidence of their skill claims (or absence of a criminal record, or reliability, etc) may never be offered the chance to start a job. Mamgain (2019)'s study of urban labor markets highlights the role that social networks and employee referrals play in screening job applicants. Investing in programs that assess skills, certify pre-existing or informally acquired knowledge could help create more inclusive labor markets by making private information public.

Focusing on the impact of information investments on institutional possibilities would also, inevitably, force more specific consideration of some of the smart cities' side effects on surveillance, exclusion, invasion of privacy and other less desirable new relationships that information opens up – not as an unfortunate side effect of the pursuit of more informed decisions, but as a central and powerful impact of the information investment in question.

There are many practical questions involved in shifting to “second order smart” design guidelines. First, who, or what agency, would champion and sustain this kind of effort? The returns on new social capital typically accrue to the system as a whole, rather than individual agents. Who represents the system in the case of India's cities? In the traditional approach to smartness as improved decision support, the agency that gets the new data, dashboard, system for tracking its employees and contractors, or something else gains. In second order smart, the leader seen as responsible for system-wide performance gets the credit. Would that be the Chief Minister? A Commissioner? A mayor and the party leadership behind his or her position? Second, how can priorities be discovered and validated? Institutional voids – absence of the underlying infrastructure to make a relationship possible – are harder to spot than user needs. One can survey Chief Engineers about data gaps and decision support needs; asking people to imagine and rank the importance of new relationships involves more subtle qualitative research. Third, information investments are necessary but not sufficient for forming new relationships. How can India's urban stakeholders build the momentum to seize the opportunities that second order smart investments make possible? “If you build it they will come” sometimes works, but more often is magical thinking.

Nevertheless, acknowledging and developing a strategy for “second order smartness” is important because the success of India’s urban future relies precisely on reconfiguring relationships between residents, agencies, and the patchwork of administrative jurisdictions across space and levels of government involved in shaping India’s cities. Information investments are a start in creating new opportunities for systemic change.

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