Artificial Intelligence in India - Vol. 11

FRIEDRICH EBERT STIFTUNG

Artificial Intelligence and Future Cities

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This publication was first published by the authors under auspices of erstwhile Tandem Research.

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April 2020

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TANDEM RESEARCH

Preface

"After all, we make ourselves according to the ideas we have of our possibilities."
V.S. Naipaul

There is no doubt that the technological advancement has become the game changer of our times. From the Industry 4.0 discourse launched in Germany in 2011 to the scientific advisory report presented to the former US president Barrack Obama on big data and privacy concerns in 2014, to India's NITI Aayog Artificial Intelligence for All strategy of 2018. A lot of debates have culminated in the questions about the Future of Work in the context of the International Labour Organisation's Centenary in 2019. Triggered by the disruptive forces of technology based start-ups and new business models, a new race for innovations and war for talents has arisen and with it, a new form of global and fierce competition.

Technology has become the holy grail of progress though it did not take long to realise that there is a social dimension attached to it. The platform economy has had severe effects on the bargaining power of suppliers and workers. Data analytics opened a whole array of ethical questions regarding personal tracking and privacy. Further, technological upgrades create productivity gains by efficiency which in turn requires reduced human labour. This poses a particular threat to emerging economies, like India, which need to create new jobs on massive scale for its young and growing population.

The utopia around Artificial Intelligence in the times of jobless growth presents a whole new set of challenges. Is the Indian economy ready to ride the AI wave? Who will benefit from AI: investors, big tech, users, or society as a whole? What is and can be India's role in this global race for innovation? Is tech gender neutral? What about privacy and user protection? How to ensure decent work and social protection in this new age tech revolution? But mostly, how can we turn AI FOR ALL into a reality?

To foster this debate, the FES India Office has teamed up with several experts and organisations across the country to explore ground realities with the objective to understand how technology is already unfolding in selected sectors, draft scenarios of what might happen and to ensure proper safeguards are put in place at the right time.

Artificial Intelligence like any other technology is neither good nor bad. It is what we make out of it - the rules and regulations – which define the outcome of the game. Just like other countries, in India too, a mass scale application of AI is far from being established. It is still in a nascent phase and can be moulded into a success story. A success story in India AND an Indian success story for all.

Patrick Ruether and Mandvi Kulshreshtha
April 2020
Friedrich-Ebert-Stiftung, New Delhi

Note of thanks

Friedrich-Ebert-Stiftung India office is thankful to its partner Tandem Research for preparing this research paper. Tandem Research is an interdisciplinary research collective that generates policy insights at the interface of technology, society, and sustainability. FES India and TandemResearch have co-organised six policy labs to unpack AI applications in key sectors likesustainability, healthcare, education, agriculture and urbanity.

We are grateful to our colleagues at Tandem Research for preparing the research, drafting this paper and refining the manuscript to reflect our joint vision. We have to express our appreciation to all the experts and resources persons who participated in these labs, for their constructive contribution and valuable time during the course of this research.

Tandem Research's Technology Foresight Group (TFG) brings together multiple stakeholders to collectively and iteratively diagnose issues and challenges pertinent to technology and society futures in India. The present paper was developed at the AI Lab held in November 2019. The brief is based on discussions of the TFG but should not be seen as a consensus document — participant views differ and this document need not reflect the views of all participants.

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Contents

List of abbreviations

AI	Artificial Intelligence
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
DSCI	Data Security Council of India
DoS	Denial of Service
GSM	Global System for Mobile communications
ICCC	Integrated Control and Command Centres
ICT	Information Communication Technologies
IoT	Internet of Things
IUDX	India Urban Data Exchange
MoHUA	Ministry of Housing and Urban Affairs
NCT	National Capital Territory
NITI Aayog	National Institution for Transforming India
RFID	Radio-Frequency Identification
SCM	Smart Cities Mission
ULB	Urban Local Body

1. Introduction

Today, more than half of the world's population lives in urban areas[1] – in increasingly dense, inequitable, and resource-strapped cities. It has been projected that, by 2050, more than two-thirds of the world population will live in urban areas.[2] Mirroring these global trends, India has also been witnessing an unprecedented growth in urban population over the past two decades.[3] By 2050, India's urban population of 483 million is expected to almost double.[4] Rising population density in urban areas and the increasing expansion of urban settlements have given rise to questions around sustainability, equity and inclusion in the context of urban transitions. In India, a large fraction of the urban population needs access to affordable housing, sustainable transport solutions, water, energy and civic services, to improve their material standards of living. Ensuring that urban development takes place in an equitable manner so as to ensure societal well-being is a greater challenge.

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Digital technologies—aimed at improving the delivery of urban services, optimising resource use, and facilitating better interactions between citizens and governments—are increasingly becoming central to new models of urban development, both in India[5] and globally.[6] The idea of deploying technology in cities is, however, not new. Smart cities are one amongst a series of technology-fueled urban visions, tied to the use of Information Communication Technologies (ICTs) and the development of different forms of networked urbanism, such as wired cities, cyber cities, and intelligent cities.[7] The substance of a smart city today, is increasingly being envisaged as one that can be monitored, managed and regulated in real-time using ICT infrastructure and ubiquitous computing.[8]

In light of the growing demographic shift in India, the government envisions a primarily urban-led, economic development and growth strategy, through initiatives such as the Smart Cities Mission (SCM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), and other allied urban programmes. The Government in India defines the objectives of the SCM as the provision of 'core infrastructure, a decent quality of life, a clean and sustainable environment and application of 'smart solutions'.[9]

The Government in India defines the objectives of the Smart Cities Mission as the provision of 'core infrastructure, a decent quality of life, a clean and sustainable environment and application of 'smart solutions'.

Artificial Intelligence (AI) is now being posited as a new way of integrating 'smartness' within urban infrastructures. While the SCM uses the broader terminology of 'IT and digitization'[10] without explicitly referring to AI, NITI Aayog's National Strategy for Artificial Intelligence recognises that smart cities "are especially amenable to (the) application of AI"[11]. Further, the use of AI is implicit in the SCM's vision of applying 'smart solutions' to address infrastructure and services in smart cities, ranging from smart meters, smart parking, intelligent traffic management systems, electronic service delivery, to video crime monitoring.[12]

With growing financial investments for the development of AI across different sectors in India, and the government's expressed intent to drive AI innovation,[13] there is likely to be an expansion in the use of AI for smart city solutions. Smart cities such as Pune, Bengaluru and Hyderabad[14] are already becoming hubs for AI innovation and development in the country. AI applications for traffic management, surveillance and security are also being implemented in cities such as Delhi[15] and Pune.[16] However, smart cities articulate not just a vision of the use of technology in cities, but also social and normative visions of the future of cities themselves, and about the people who inhabit them. What kind of societal values and norms are being imagined in these cities of the future? Will these cities be made equitable, sustainable, and inclusive of all? Even as

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the use of AI is believed to be beneficial for cities with oft-repeated narratives of efficiency, optimisation and progress, challenges and risks posed by the problematic use of AI could have negative outcomes for societal well-being.

Rather than understanding AI systems as neutral technological artefacts, they need to be understood as complex socio-technical systems—systems that do not function autonomously, with an inner 'technological logic' only, but instead are the outcome of socially-embedded decisions related to the production, diffusion, and use of technology.[17] To understand AI-based technologies as socio-technical systems, it is essential that the focus should extend beyond analysis of technological innovation and efficiency, to include their necessity and socio-cultural impact on cities.

In light of the proposed 'smart' urban development projects and AI-based applications, this paper examines various use cases of AI being developed for cities in India, in order to identify key challenges and risks. The paper is a diagnostic exploration of the likely impact of the use of AI for cities and is based on inputs from the AI and Future Cities policy lab as well [18] as desk research. Part II of this paper provides an overview of emerging use cases of AI in Indian cities. This is followed by a discussion of the challenges and risks associated with the development of AI-based solutions, and their deployment in Indian cities.

II. The promise of AI for cities

The use of AI is seen by governments and technologists as being particularly beneficial for developing technologically-driven cities, due to the potential of AI-based solutions to: improve the delivery of urban services, reduce resource consumption, and facilitate interactions between citizens and the government. As a field, AI is difficult to define, as its definitional and conceptual scope is constantly evolving. Some of the field's earliest founders broadly defined it in terms of human intelligence, arguing that AI-enabled devices 'could do any work a human can do'[19]. The vast majority of AI-based applications that are used in the context of cities—such as intelligent traffic management systems, facial recognition and predictive modelling — are possible due to advances in techniques such as machine learning, deep learning, natural language programming, and computer vision.[20]

Globally, there are many examples of AI being employed in the context of urban areas; use cases range from the use of AI for the management of various urban systems to the AI-driven area development in cities. For instance, Virtual Singapore, a three-dimensional city model of Singapore and a collaborative data platform with renderings of buildings, parks, and waterways, is being developed to help policymakers and urban planners visualise urban data.[21] The simulation would enable planners to zoom in on actual buildings to analyse their real-world energy use, or spot trends in pollution levels. Amongst other functions, it could also be used to simulate emergencies and test out possible solutions.

Another well-known example of AI implementation for urban development is Sidewalk Labs. The goal of Sidewalk Labs is to develop Toronto's Quayside into a digital 'city-within-a-city'. The planned use of AI and a network of Internet of Things (IoT) sensors in Quayside spans applications in mobility, citizen services and engagement, public security and sustainability.[22] The project intends to create a subterranean city where automated robots would transport mail and garbage via underground tunnels, while surface-level IoT sensors embedded across the neighbourhood would monitor driverless cars and public activity. Data collected through these processes would be used in a digital replica of the city, that could be used by planners to simulate urban changes.[23] Sidewalk Labs envisions Quayside to become "the most measurable community in the world"[24].

For purveyors of technology, collecting vast amounts of information is seen as valuable not just for current applications being developed, but also for any potential uses in the future. For instance, the stated plans for Sidewalk Labs in Quayside suggests that, "with heightened ability to measure the neighbourhood comes better ways to manage it"[25]. However, plans for the deployment of an elaborate network of sensors and AI-based technologies, which would generate vast amounts of data on how citizens interact with the city, have seen pushbacks from Toronto residents. Fears of data harvesting, privacy and surveillance concerns, and overall lack of transparency, have led to increased scrutiny of the project.[26] Bianca Wylie at Canada's Centre for International Governance Innovation writes, "At the heart of the model is data. All the ways that people use the neighbourhood – from transportation to retail, from park space to community amenities – will be tracked and measured. Both environmental and behavioural data will be analysed, revealing the complex patterns and habits of civic life."[27]

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Additionally, AI-based technologies are also being developed for specific functions and services within cities such as transportation, public safety and security, and resource optimisation. In India, the use of AI for cities extends to several of these broad categories, with the exception of building virtual replicas of cities. Broad categories of use cases in India along with a few global use cases are discussed below:

Transportation

A majority of AI-based technologies for transportation focus on increasing passenger safety, managing traffic flows, and reducing accidents. AI systems are being used to collect traffic data to improve the scheduling of public transport, identify risks, reduce carbon emissions and pollutants, and analyse travel demand and pedestrian behaviour. For example, Siemens has developed its AI-powered Intelligent Traffic Systems, which is meant to enable management of road traffic in cities.[28] The AI system has previously been piloted and deployed in Las Vegas[29] and Ann Arbour,[30] and is expected to be deployed in Singapore as a critical component of its 'Smart Nation 2030' initiative.[31] Data from connected vehicles and infrastructure systems and road users is transmitted to MindSphere, Siemens' IoT platform to manage traffic congestion and pollution levels, enforce tolling solutions, and manage parking spaces in cities.

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In India, researchers at the Indraprastha Institute of Information Technology, Delhi have collaborated with the Department of Transport, Government of NCT of Delhi, to provide transit datasets for enterprises, third-party developers, researchers, and other members of the public.[32] The Open Transit Data portal provides free of cost static and real-time datasets generated from 1,700 buses in Delhi. This is used by application developers and researchers in a machine-readable format. Based on these datasets, a real-time dashboard has been developed which monitors bus movements all over Delhi. In addition, commuters could use the chartr mobile application to plan trips using real-time location and live status of buses. The multi-modal trip planning feature uses real-time information from metro train and bus services, and pedestrian data to suggest optimal routes. Additionally, plans are also underway across traffic police departments in Bengaluru,[33] Jaipur,[34] and Delhi [35] to adopt AI systems for monitoring traffic, and to identify traffic violators.

Monitoring and planning

AI is being used to allow city officials to remotely monitor, control and optimise city infrastructure in order to simplify and automate city operations. AI methods are also being used to develop virtual replicas of cities, to visualise and monitor cities in real-time, with layered data sources of urban infrastructure, utilities, and the movement of people and vehicles. These applications could be used to simulate extreme weather events, and to help planners visualise urban changes. Descartes Labs, founded by a team of scientists at the Los Alamos National Laboratory, is a geospatial data refinery to generate predictive AI models. Its applications range from mapping green cover in cities[36] to identify lower-income urban areas that are at risk of dangerous heat levels through analysis of satellite imagery.[37]

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In India, Blue Sky Analytics, a Big Data and AI start-up, has built an AI-based geospatial data platform for environmental monitoring.[38] The application allows users with independent air quality monitors to connect their devices to an open data platform. The data is fed into their proprietary air quality application, which then combines data from satellites to measure air quality in cities and provide near-real-time, high-resolution data and insights about environmental conditions. Similarly, Ahmedabad-based Oizom's, an environmental monitoring solutions company, uses AI and IoT devices to monitor ambient air quality, odour and dust levels. Multiple data points are analysed by Oizom's AI system to predict the environmental conditions of surrounding areas. The application has been deployed in smart cities such as Surat, Varanasi and Kakinada.[39]

Public safety and security

Advances in AI methods- facial recognition, image recognition, video analytics, and predictive analytics- allow the provision of real-time actionable insights regarding public spaces. Such AI applications are increasingly being adopted by law enforcement agencies, government authorities and businesses as safety and security

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measures. For example, Dell Technologies has developed public safety solutions based on computer vision, edge computing and IoT, which are now being deployed in airports and cities across the globe.[40]

Safety and security in Indian cities have been key concerns for many. SafetiPin provides a number of technology solutions to make Indian cities safer, with a specific focus on women's safety. SafetiPin claims to use machine learning to analyse multiple images of city routes in order to gauge levels of safety.[41] Additional data points are then added, based on which safety scores for city routes are generated. Another example is the Kumbh Mela Experiment, an ongoing Indo-Dutch collaborative research project, set up to predict crowd behaviour.[42] In 2019, the project used AI to monitor crowd movements, using data from 1,000 cameras spread across a 32 square kilometre venue in Ujjain. Qognify, a security software provider, has deployed AI-based public safety software as a part of smart city solutions in Ahmedabad and Nagpur.[43]

Optimising distribution and consumption of utilities

Machine learning algorithms are being used to monitor usage, demands, and faults in distribution systems for energy, water and utilities in cities. For example, Washington D.C.'s Water & Sewer Authority uses autonomous robots and drones to collect video and feed it to Wipro's Pipe Sleuth AI application.[44] Pipe Sleuth uses deep learning to identify and tag defects, based on which a report is then generated for water supply department officials to see if any areas need further attention. The rollout of fifth-generation wireless technology (5G) and smart metres in cities is expected to create networks of IoT devices, for gaining utilities efficiency in cities using data analytics and predictive AI.

In India, AI and IoT technologies for managing resources in cities are being adopted in pockets amongst energy distributors. AI solutions seek to improve energy efficiency by monitoring distribution networks, identifying demand and usage patterns, and providing predictive analytics on energy consumption. In 2018, energy provider Tata Power Delhi Distribution (TPDDL) launched an AI solution, in collaboration with SAP Technologies, to detect electricity theft and cut down on transmission losses.[45] Indian start-up, Avrio Energy's energy management platform makes use of machine learning algorithms to identify appliances running in buildings and optimise consumption.[46]

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In addition to some of the above use cases, India's Smart City Mission has plans to roll-out city-wide software and data analytics applications, to derive data insights for better urban planning. However, such applications have not been implemented at scale, although there have been developments in the direction of pan-city AI applications. For instance, in 2017, the Pune Smart City Development Corporation signed a memorandum of understanding with the University of Toronto and the Indian Institute of Technology, Bombay for developing AI-based solutions for affordable housing, cybersecurity and digital systems interoperability.[47] The collaboration also aims at developing data standards that could help Pune and other Indian cities improve the analysis, design and delivery of city services. The potential of the project is also to develop Pune as a template for AI-driven cities that could be replicated by other smart city projects in India.

III. Challenges and risks

The use of AI to address social, economic, and infrastructural issues in cities present several challenges and risks. While on the one hand, AI applications using incomplete datasets can entrench historical biases and pre-existing forms of inequities, on the other hand, the underlying political-economy of AI development also raises equally pertinent questions around the collection, use, and ownership of data. This is further exacerbated with the evolving role of private corporations in taking over responsibilities traditionally provided by governments — extending their influence over urban spaces.

While on the one hand, AI applications using incomplete datasets can entrench historical biases and pre-existing forms of inequities, on the other hand, the underlying political-economy of AI development also raises equally pertinent questions around the collection, use, and ownership of data.

This section outlines some of the challenges and risks associated with the use of AI-based technologies in Indian cities.

Data gaps

Much of the development of AI-based technologies in cities rests on the availability of reliable and structured datasets. While there is an imagination of abundance and magnitude associated with data in emerging narratives of India as a data-rich country, existing inequities signal several gaps in existing data sets. Jasmine McNealy at the Berkman Klein Center for Internet & Society at Harvard University suggests that data is not a singular unattached object.[48] Instead, it is a messy network of representations and observations in the system of the internet, consisting of information generated through digital interactions and transactions between citizens, corporations, and governments. This messy network of relations through which data is generated, also reflects the politics of historical practices of surveys and data collection in general.

While there is an imagination of abundance and magnitude associated with data in emerging narratives of India as a data-rich country, existing inequities signal several gaps in existing data sets.

In India, there is a general paucity of data pertaining to cities - across national, state and district levels. Both the Government of India's periodic census, conducted every 10 years, and the Indian statistical system surveys, contains very little information on cities.[49] Further, the administration of urban areas in India is spread across multiple levels - centre, state, municipal bodies, and wards. This makes it harder to aggregate data, as there are no uniform data collection and digitisation practices across any of these levels. Recognising the existence of data silos across different governing bodies and organisations, the Ministry of Housing and Urban Affairs (MoHUA) released the DataSmart Cities strategy in early 2019. Its strategy document acknowledges that "despite the availability of a large amount of useful data with different agencies, not much of it is used to draw insights and create actionable intelligence for city governance".[50]

The Government of India's National Data Sharing and Accessibility Policy has framed open data as a tool to promote data sharing between public and private actors and enable data-driven governance and policy formulation. As part of the DataSmart Cities strategy, the MoHUA has set up the India Urban Data Exchange (IUDX) — an open data platform that is meant to facilitate secure, authenticated and managed exchange of data among various city departments, governments, citizens, and the private sector. Going forward, the initiative seeks to scale up data sharing between cities and stakeholders on a national-level data sharing platform. However, very little public information exists on the current status of IUDX, and the outcomes of this effort. Even as plans for the development of 100 smart cities in India are underway, there are also no enforceable laws regulating the use of personal or non-personal data. Further, there is greater propensity within the state to view data as a national asset. [51]

Additionally, fundamental safeguards regarding city level data and data policies, identified by the MoHUA as the "first significant step in the direction to provide conceptual clarity over accessing and sharing protocols over city data"[52], are still not in place for most smart cities in India. As of July 2019, only one Indian city had managed to submit a city data policy to the MoHUA.[53] Moreover, the merits of open data infrastructures have also been questioned by scholars. While open data may be seen as creating new forms of citizen empowerment,[54] it can also end up creating a scenario where there is less control and accountability over data.[55]

Privacy and surveillance

Smart cities are increasingly looking to create modelling tools as well as Integrated Control and Command Centres (ICCCs), which collect data from dispersed network of sensors and AI-based technologies. Immense amounts of granular data collected through smart meters, digital platforms, mobile phones, and smart solutions deployed in cities, could be used to create virtual profiles, revealing intimate information about citizens. For instance, the Government of India, announced plans to convert all electricity meters to smart meters by 2022.[56] Research on smart meters shows that several types of data can be collected through them, including: contact and billing details, payment history, and usage patterns.[57] Such information, researchers point out, could subsequently be sold on data black markets or abused for marketing purposes as well as used to monitor and target citizens.[58] The Draft Personal Data Protection Bill 2019 mandates consent for processing of personal data. However, with multiple AI-based technologies, and sensor networks embedded in cities, issues around consent will likely be a key challenge from the perspectives of privacy and surveillance. Particularly in relation to how consent is obtained, and how the data is then used. Although consent requirements have led to a proliferation of complex privacy notices by corporations, they are seldom read and rarely understood. With the automated processing of data in order to avail certain civic services, residents may have no option but to consent. Highlighting the limited scope of privacy notices and consent, Amber Sinha and Scott Mason at the Centre for Internet & Society write, "an overly narrow focus on the necessity of consent at the point of collection, risks diverting our attention from the arguably more important issue of how our data is stored, analysed and distributed by data brokers following its collection"[59].

With multiple AI-based technologies, and sensor networks embedded in cities, issues around consent will likely be a key challenge from the perspectives of privacy and surveillance.

Indian cities have already begun to deploy AI technologies for public safety and security. For instance, automated facial recognition systems are being installed in states such as Telangana and Gujarat.[60] Automated facial recognition systems and various computer vision applications being deployed for traffic management, and smart policing in cities, could also be used to profile, track or target unsuspecting citizens. Further, connecting different databases would enable the creation of a 360-degree profile of users. Without adequate regulations and accountability measures, there is grave potential for abuse by the state and private corporations. For instance, political organisations in the past have used utility data such as electricity bills, in order to profile and target voters belonging to particular socio-economic classes.[61]

Without adequate regulations and accountability measures, there is grave potential for abuse by the state and private corporations.

Widespread deployment of AI-based surveillance tools can cause a 'chilling effect'[62] on people's actions, leading to self-censorship and regulation of behaviour, which would negatively impact the democratic participation of citizens. This is not only a case of intrusion of privacy but also a scenario that will hamper free movement of residents and change their interaction with the urban landscape.

Skewed distribution of technology gains

The deployment of AI-based solutions in Indian cities presents the challenge of ensuring that access to applications, and gains arising from the use of AI-based solutions are equitably distributed. Inequities along the lines of caste, gender and socio-economic dividers are incontestable features of Indian cities. These inequities also shape the usability and relevance of technological

interventions for communities and determine their access to it. It is likely that certain social groups that have digital literacy and access to resources would benefit the most from AI-based solutions. Consequently, the kind of AI applications that are prioritised and deployed could likely be driven by these social groups, potentially leading to inequitable distribution of technology gains in society.

It is likely that certain social groups that have digital literacy and access to resources would benefit the most from AI-based solutions.

A pertinent example of technology favouring the already empowered can be found in the work of Solomon Benjamin and his colleagues looking at the impact of the digitisation of land records in Bengaluru.[63] Findings of their study suggest that newly digitised data allowed the well to do to leverage the information to their benefit. These groups were able to directly translate their enhanced access to the information—along with their existing access to capital and professional skills—into unequal contests around land titles, court actions, and competitive offers of purchase - further entrenching those already disadvantaged.

With the government's growing focus on data-driven planning and development, lack of access to technology could consequently lead to a lack of representation, both of people, and the areas that they inhabit. There are several inconsistencies in the existing data emanating out of socially produced structural invisibilities — especially in case of data relating to disadvantaged sections of society living in Indian cities. For instance, it has been reported in Bengaluru, ward-level data concerning the number of informal settlements in some wards have been misrepresented as zero, leading to the false assumption that there are no informal settlements in those areas. This could then lead to digital invisibility of disadvantaged groups as well as derelict parts of cities due to their concealed view within data-driven AI solutioning.

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As studies of previous attempts at data capture have shown, for example in the case of biometric data for Aadhaar,[64] technological processes do not overcome socially mediated practices that create conditions of marginality and exclusion, rather these processes only add another 'technical terrain that people must (now) navigate'.[65]

Privatisation of city governance

Analysing the increasing interactions between digital technologies, platforms, and urban spaces, legal scholar Frank Pasquale argues that corporations are seeking to exert influence over urban spaces and take over governmental responsibilities, replacing territorial sovereignty with functional sovereignty, where urban citizens will be increasingly "subject to corporate rather than democratic, control." [66] The increasing outsourcing of public services and reliance on technology solutions provided and controlled by private corporations are, in effect, "converting citizens into clients"[67]. This could have grave implications for all aspects of urban life - from housing and transport, to issues of data privacy, surveillance and accountability.

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The growing use of AI solutions owned and controlled by private corporations could be particularly challenging from the perspective of accountability, since corporations are not obligated to disclose trade secrets such as proprietary algorithms. The opacity of information channels and algorithmic decision-making pertaining to citizens and city governance could become more problematic in India, as the Right to Information Act does not mandate disclosure of information by private corporations. Since cities are likely to be hotspots for the deployment of several AI-based technologies, transparency and explainability are generally seen as safeguards against flawed algorithmic decision-making.[68] Pointing at the inadequacy of the transparency ideal for algorithmic systems, Ananny and Crawford argue that achieving transparency over algorithmic processes alone, without transparency regarding corporate and

state actions, would be insufficient to address issues of accountability.[69]

The increasing involvement of private corporations in building smart city infrastructure may give them considerable control over the hardware, software, and data involved in city operations, which could bring long-term technology lock-ins and path dependencies for cities. Governments procuring AI-based technologies may want to be able to understand and edit them as required throughout the lifecycle of the application. However, vendors are likely to object to this, as AI systems are protected by a combination of intellectual property rights, including trade secrets, which lose all value when made public. Additionally, the high costs of developing AI-based technologies may also mean that private corporations might seek to generate revenues, or at least focus on uses and areas with large profit pools, which could create a tradeoff between access and profit-generation.

The high costs of developing AI-based technologies also mean that private corporations might seek to generate revenues, which could create a tradeoff between access and profit-generation.

Cybersecurity and failure risks for interconnected systems

Increasingly smart city solutions have become enmeshed in a number of critical infrastructures of the city: including water supply, electricity, and transport. Urban infrastructures of the smart city include cyber-physical components, such as cameras and sensors which are connected through communication networks like WiFi, 4G, RFID, GSM and others. [70] Many of the components of cyber-physical systems rely on communication networks that use relatively new technologies such as IoT which are not completely cyber-secure.[71] In particular, it has been argued that wireless sensors used in the public domain are often of poor quality and do not have built-in security architecture, making them easy targets for cyber-security attacks.[72]

While the creation of networked infrastructure could enhance efficiencies through data analysis and enable better coordination amongst all parts of a system, a networked system also becomes vulnerable to cyber attacks at multiple touch points through modalities such as phishing, DoS (denial-of-service) attacks, injection of malware, or exploitation of weak passwords. Globally, there have been an increasing number of cyber attacks on city systems. Attacks on critical urban infrastructures can have far-ranging consequences and threaten the security and wellbeing of citizens. [73]

Attacks on critical urban infrastructures can have far-ranging consequences and threaten the security and wellbeing of citizens.

While these ambitious networked systems are being explored and implemented across different cities, there is a need to ensure proper cybersecurity measures. As per a report by the Data Security Council of India (DSCI), India was the second-most affected country by targeted cyberattacks between 2016 and 2018.[74] Awareness of cyber security risks, and capacities to address vulnerabilities are limited among smart city stakeholders.[75] Strengthening of cybersecurity measures needs to be parallel to the expansion of interconnected systems in cities.

Equally concerning is the risk of failure in large-scale interconnected cyber-physical systems. The deployment of AI-based technologies in smart cities is intended to integrate and overlay various services within the cities' infrastructure. For instance, using cell phone location signals to manage traffic integrates road networks and ICTs; using IoT devices in energy meters integrates ICTs and energy infrastructure. Failure in one system therefore could have a cascade effect on other systems and expanding its impact across the city. For example, the 2018 cyberattack on Atlanta, crippled many city services such as utilities, parking and court services.[76]

Given the pervasiveness of IoT in smart cities, and the fragility of interconnected systems, it is imperative for smart cities to establish minimum baseline standards for operations and security, and robust procurement policies that ensure sub-optimal solutions are not deployed.

IV. Conclusion

Although AI could help facilitate sustainable urban transitions, it is unlikely to be the panacea for urban challenges. For many Indian cities, the issue is not whether technology can solve problems; rather, it lies in the way problems are defined.[77] The autonomy of Indian cities to identify problems and shape their growth is seen as being inadequate.[78] While India's Smart Cities Mission envisages that state governments and urban local bodies (ULBs) would play key roles in the development of smart cities, the devolution of powers to ULBs has not happened adequately.[79] On the contrary, with the introduction of several urban initiatives in recent years, vision-making and planning have moved further away from cities and their citizens. Datta succinctly emphasises that "the diversity of 100 smart cities across the country has begun to stand for a centralised vision of governance, overseen by the state and in partnership with the private sector."[80]

Although AI could help facilitate sustainable urban transitions, it is unlikely to be the panacea for urban challenges.

While smart cities are hailed as the future of urbanism, many Indian cities are riddled with systemic problems that need innovative programmes and policies. Many cities in India slated for smart city projects, and AI interventions, face persistent developmental challenges which are not necessarily solved through AI. Instead, basic infrastructure and services, and proper management and oversight are needed. AI is being imagined as a way to leapfrog towards new forms of economic growth in cities. Even though there is growing impetus to use AI to solve urban challenges in Indian cities, its use needs to be considered within local contexts, with measures being able to match the problem at hand. Some of the challenges highlighted in this paper, such as data gaps, would require building strong institutional and infrastructural capacity, and better protocols for standardisation and digitisation. Many others require clear policies and regulation to ensure the application of AI is not harmful to societal wellbeing.

The use of AI in cities must be guided by strong citizen participation and must take into account the views and needs of the plurality of socio-economic classes in Indian cities. Not everything will require an AI-based solution. New frameworks that seek to analyse how people are represented and treated as a result of their data, must feed into policy deliberations and plans for the deployment of AI in cities. The data justice framework, proposed by Heeks, views the interconnectedness of data and development from the lens of distributive rights-based justice, encompassing rights of privacy, access, ownership and representation; and instrumental data justice, in evaluating fairness in the results of data being used.[81] This provides a useful framework for steering AI-based applications in cities.

The use of AI in cities must be guided by strong citizen participation and must take into account the views and needs of the plurality of socio-economic classes in Indian cities.

Indian cities, looking to adopt AI-based technologies, must chart their own course rather than build on global trends. While technology can support policies for sustainable urban growth, it cannot be the driving force. Narratives around cities as centres of economic activity, smart innovation and expanding infrastructure, often mask the acute challenges of unplanned growth and development, over-utilisation of environmental resources, and social exclusion. It is imperative to understand the various socio-technical entanglements of the use of AI in urban contexts and develop planning and governance frameworks to shape the complex transitions that are already underway.

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Imprint

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This publication is part of a series on Artificial Intelligence in India, a collection of papers developed under the Socio-Economic Transformation program coordinated by the FES India office.

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