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Review

From Smart to Surveillance? Ethical Risks of Data-Driven Urban Governance in Smart Cities

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ABSTRACT

The rapid expansion of smart city initiatives has reshaped urban governance through the extensive use of digital technologies, big data, and artificial intelligence. While these developments promise greater efficiency, sustainability, and improved public services, they also generate significant ethical risks that remain underexplored in both policy and academic debates. This study critically examines the ethical implications of data-driven urban governance by focusing on four key dimensions: privacy and surveillance, social inequality and digital exclusion, power and control dynamics, and environmental sustainability. Using a qualitative critical literature review, this paper synthesizes interdisciplinary research from urban studies, governance, and technology ethics to identify systemic ethical vulnerabilities embedded within smart city frameworks. The findings indicate that pervasive data collection practices increasingly normalize urban surveillance and threaten individual privacy. Furthermore, smart technologies tend to reproduce existing social inequalities by privileging digitally connected populations while marginalizing vulnerable groups. The concentration of data ownership and algorithmic control within governmental and corporate actors reinforces asymmetrical power relations and constrains democratic participation. In addition, the pursuit of technological efficiency often conflicts with environmental sustainability due to increased energy consumption and resource exploitation. This study argues that without a robust ethical governance framework, smart cities risk evolving into technocratic and surveillance-oriented systems. Therefore, integrating ethical principles such as transparency, accountability, inclusivity, and sustainability is essential for ensuring that data-driven urban governance supports social justice and long-term urban resilience.

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1. Introduction

The development of smart cities worldwide is increasingly recognized as a transformative approach to urban growth and governance, driven by advances in technology, data management, and urban planning. The evolution of smart cities integrates multiple components, including sustainable practices, enhanced citizen engagement, and intelligent infrastructure, which collectively aim to improve urban life. Smart cities leverage modern technologies—such as the Internet of Things (IoT), big data analytics, and 5G telecommunications—to create more efficient systems for managing urban resources and enhancing citizens' experiences (Xu et al., 2022; Singh et al., 2022). For instance, advancements in 5G provide the bandwidth necessary to support extensive IoT networks that enable real-time data collection and analysis, facilitating innovation in transportation, public safety, and healthcare services (Xu et al., 2022). The interconnection of devices and systems within smart cities substantially enhances decision-making processes and operational efficiency (Agbali et al., 2019).

One of the primary motivations behind smart city initiatives is to promote sustainable urban development. Cities such as Aarhus in Denmark exemplify this through strong cross-sectoral collaboration and active public engagement in governance (Baraniewicz-Kotasińska, 2022). These governance frameworks not only align with the Sustainable Development Goals but also strengthen social cohesion and public trust in urban management (Lindtvedt et al., 2021). Moreover, given the distinct challenges faced by developing countries, smart city frameworks often emphasize collaborative models involving both public authorities and private sector actors to address pressing urban issues (Maurya & Biswas, 2020; Praharaj & Han, 2019).

Approaches to smart city development vary significantly depending on local contexts and needs. In the United Kingdom, concerns regarding socio-economic inequalities have raised questions about the inclusiveness of smart city initiatives (Caprotti & Cowley, 2019), while cities in India demonstrate a growing trend toward establishing command and control centers aimed at improving urban governance through data integration (Praharaj & Han, 2019). Research suggests that successful smart city projects typically emerge from collaborative environments in which stakeholders—including citizens, businesses, and government institutions—actively participate in planning and implementation processes (Singh et al., 2022; Joss et al., 2019).

Several cities have emerged as prominent case studies of effective smart city transitions. For example, Amsterdam, Barcelona, and Singapore are frequently cited for their innovative approaches to urban management through technology (Joss et al., 2019; Myeong et al., 2018). These cities demonstrate how smart technologies can be integrated to enhance urban quality of life, addressing needs ranging from traffic management to environmental sustainability (Ptichnikova & Antyufeev, 2020; Joss et al., 2019). The sharing of best practices and lessons learned across regions will be increasingly important as urban areas continue to evolve through smart innovation.

At present, the number of smart city initiatives is expanding globally, with many cities adopting IoT applications and big data analytics as fundamental components of their urban infrastructure. According to the Smart City Index, a total of 142 smart cities have been officially recorded worldwide, with Europe and Asia dominating the top 20 rankings (Detik, 2024). In Indonesia, three cities—Jakarta, Medan, and Makassar—are included in the Smart City Index, ranking 103rd, 112th, and

114th, respectively, out of 142 surveyed cities in the IMD Smart City Index 2024. The Smart City Index, developed by the Institute for Management Development (IMD), aims to support the assessment and development of smart cities. The implementation of smart technologies in Jakarta, Medan, and Makassar reflects significant progress in urban governance (Huda et al., 2023; Joss et al., 2019). Such progress is often grounded in interdisciplinary approaches that integrate information technology, governance structures, and urban design, which are essential for achieving sustainable smart city development (Agbali et al., 2019).

Recent studies have highlighted both the challenges and opportunities associated with the evolution of smart cities. Much of smart city development depends on addressing local needs through context-specific solutions, often referred to as "bricolage," whereby cities creatively utilize available resources to construct smart solutions (Offenhuber, 2019). Furthermore, scholars emphasize the importance of human, social, and relational capital in fostering environments conducive to smart city initiatives. This indicates that the success of smart city development depends not only on technological advancement but also on active citizen engagement and strong collaboration among stakeholders (Prasetyo et al., 2023).

2. Method

This study adopts a qualitative critical literature review approach to examine the ethical risks associated with data-driven urban governance in smart cities. A critical review was selected because the objective of this study is not merely to summarize existing findings, but to systematically interpret, synthesize, and critically evaluate theoretical and empirical studies related to smart cities and urban governance from an ethical perspective.

Literature Search Strategy

The literature search was conducted using major academic databases, including Scopus, Web of Science, Google Scholar, and ScienceDirect. Keywords used in the search process included combinations of "smart cities," "urban governance," "data-driven governance," "ethics," "surveillance," "privacy," "digital inequality," and "sustainability." Only peer-reviewed journal articles, academic books, and authoritative policy reports published in English between 2015 and 2024 were considered to ensure relevance and academic rigor.

Inclusion and Exclusion Criteria

The inclusion criteria were: (1) studies explicitly addressing smart cities or digital urban governance; (2) literature discussing ethical, social, political, or environmental implications of urban technologies; and (3) conceptual or empirical works relevant to governance, surveillance, inequality, or sustainability. Studies focusing solely on technical system design without social or ethical analysis were excluded.

Data Analysis and Synthesis

The selected literature was analyzed using thematic analysis. Key themes were identified and grouped into four analytical dimensions: (1) privacy and surveillance, (2) social inequality and digital exclusion, (3) power and control dynamics, and (4) environmental sustainability. These themes were then interpreted through a critical governance lens to explore how data-driven technologies reshape urban power relations and ethical accountability.

Analytical Framework

This study employs an interdisciplinary analytical framework drawing from urban studies, public governance, and technology ethics. Rather than producing generalizable empirical findings, the study aims to generate normative insights and conceptual understanding regarding the ethical risks embedded in smart city governance models. This approach enables a systematic critique of dominant smart city narratives and supports the development of ethically informed urban governance principles.

3. Results & Discussion

Table 1. *Ethical Risks Related to Surveillance and Privacy in Smart Cities*

Ethical Dimension	Key Issues Identified	Main Implications for Urban Governance
Surveillance	Pervasive use of sensors, CCTV, IoT devices, and digital platforms	Normalization of continuous monitoring in public and private urban spaces
Privacy	Weak consent mechanisms and limited data transparency	Erosion of informational autonomy and individual rights
Data governance	Unclear data ownership and secondary data use	Increased risk of data misuse by state and corporate actors
Accountability	Limited regulatory oversight	Difficulty in enforcing ethical standards and citizen protection

Table 1 illustrates how smart city infrastructures systematically intensify surveillance practices and weaken individual privacy protections. The widespread deployment of IoT devices, CCTV systems, and digital platforms creates an urban environment characterized by continuous and often invisible data extraction. The literature indicates that these surveillance mechanisms are frequently embedded into everyday urban services, making monitoring a normalized feature of urban life rather than an exceptional practice.

Furthermore, the findings reveal that data governance frameworks in smart cities remain underdeveloped, particularly with regard to informed consent, transparency, and citizen control over personal data. Data ownership is often ambiguous, while secondary uses of data—such as predictive analytics and behavioral profiling—are rarely communicated to citizens. This lack of clarity increases the risk of data misuse and function creep, whereby data collected for service optimization are repurposed for control or commercial exploitation. Consequently, accountability mechanisms remain weak, limiting the ability of regulatory institutions to protect citizens' rights and enforce ethical standards in digital urban governance.

Table 2. *Social Inequality and Power Dynamics in Data-Driven Urban Governance*

Ethical Dimension	Key Issues Identified	Main Implications for Urban Governance
Digital inequality	Unequal access to smart services and digital infrastructure	Exclusion of low-income and vulnerable populations
Social inclusion	Bias embedded in algorithms and digital platforms	Reinforcement of existing socio-economic inequalities
Power concentration	Centralization of data control by governments and tech corporations	Reduced democratic participation and civic agency
Algorithmic control	Opaque decision-making systems	Transformation of citizens into passive data subjects

Table 2 highlights how data-driven urban governance reproduces and amplifies existing social inequalities while simultaneously concentrating power within a limited set of institutional actors. The analysis shows that access to smart city services is unevenly distributed, favoring populations with higher levels of digital literacy, stable internet access, and economic capital. Vulnerable groups—such as low-income households, informal workers, and elderly populations are often excluded from digital platforms that increasingly mediate access to urban services. Algorithmic systems used in urban management frequently embed socio-economic biases, leading to differential treatment across social groups. These systems shape decisions related to mobility, security, welfare distribution, and urban planning, yet remain opaque and inaccessible to public scrutiny. As a result, power becomes centralized within governmental bodies and private technology corporations that control data infrastructures and analytical tools. This transformation reduces opportunities for participatory governance and shifts citizens' roles from active political agents to passive data subjects within technocratic governance regimes.

Table 3. *Smart Cities and Environmental Sustainability Challenges*

Ethical Dimension	Key Issues Identified	Main Implications for Urban Governance
Energy consumption	High energy demand from data centers and digital infrastructure	Increased urban carbon footprint
Resource use	Dependence on rare materials and electronic devices	Intensification of ecological extraction
E-waste	Short life cycles of smart technologies	Growth of electronic waste and pollution
Sustainability paradox	Efficiency discourse vs real ecological impact	Smart cities may contradict long-term sustainability goals

Table 3 presents the ethical tensions between technological expansion and environmental sustainability in smart city development. Although smart cities are often promoted as environmentally friendly and resource-efficient, the findings indicate that digital infrastructures generate significant ecological costs. The operation of data centers, sensor networks, and high-speed communication systems requires substantial energy inputs, contributing to increased urban carbon emissions. Moreover, smart city technologies depend heavily on electronic devices and rare materials, which intensify resource extraction and generate growing volumes of electronic waste.

The short life cycles of digital technologies further exacerbate this problem, as devices are rapidly replaced in response to technological upgrades. These dynamics create a sustainability paradox: while smart cities claim to optimize resource management, their technological foundations may undermine long-term ecological resilience. This reveals a fundamental ethical contradiction between the discourse of sustainability and the material realities of data-driven urban systems.

Key Characteristics of Smart Cities

Smart cities are characterized by a range of essential components that enhance urban life through the integration of advanced technologies, sustainable practices, and efficient management systems. The main characteristics associated with smart cities can be broadly categorized into six key dimensions: smart economy, smart environment, smart governance, smart mobility, smart living, and smart people.

Smart Economy, this dimension emphasizes the need for a competitive and innovative urban economy. Smart cities focus on fostering economic growth through the application of technology across multiple sectors, promoting entrepreneurial activities, and enhancing the productivity of local businesses (Napitupulu et al., 2019; Zaiţ, 2017). For instance, the integration of information and communication technologies (ICT) into business ecosystems is crucial for stimulating economic development in smart cities, as it facilitates more efficient resource allocation and market reach (Li et al., 2019).

Smart Environment, the environmental dimension of smart cities involves sustainable resource management, including the implementation of efficient waste management systems, energy conservation practices, and pollution reduction initiatives. By leveraging technologies such as IoT sensors and big data analytics, smart cities aim to monitor and manage natural resources more effectively, thereby reducing their ecological footprint (Whaiduzzaman et al., 2022; Nevistić & Bačić, 2022).

Smart Governance, governance in smart cities focuses on improving transparency, accountability, and citizen participation. Smart governance integrates digital platforms that enable citizens to engage with policymakers, making governance processes more participatory and responsive (Zaiţ, 2017; Pavlov, 2021). The shift toward data-driven decision-making highlights the importance of efficient administrative systems that can adapt to the evolving needs of urban populations.

Smart Mobility, this dimension concentrates on creating more efficient transportation systems, promoting public transport, and reducing congestion and pollution. Smart mobility encompasses intelligent transport systems that optimize traffic flows and provide real-time information to commuters. The objective is to develop seamless and environmentally friendly transportation infrastructure that enhances urban connectivity (Napitupulu et al., 2019; Neirotti et al., 2014).

Smart Living, improving residents' quality of life lies at the core of the smart living concept. Smart cities seek to provide safer environments, improved access to healthcare services, and enhanced recreational facilities through the deployment of smart technologies. For example, smart

home technologies contribute to better living conditions by increasing energy efficiency and household security (Allam & Newman, 2018; Nevistić & Bačić, 2022).

Smart People, the social dimension involves education, cultural engagement, and citizen participation in governance and urban development. Human capital development is essential for the success of smart cities, requiring investments in education and the promotion of civic engagement to ensure that citizens become active participants in shaping their urban environments (Muttaqin & Pusvita, 2022).

By integrating these characteristics, smart cities aim to address complex urban challenges arising from rapid urbanization and to enhance overall urban functionality, fostering sustainable economic growth while improving residents' quality of life (Ramaprasad et al., 2017; Gil-García et al., 2015). The successful implementation of these dimensions depends heavily on active collaboration among governments, industries, and citizens, thereby cultivating a culture of innovation and inclusivity (Joss et al., 2019; Karimi et al., 2021).

Overall, the transition toward smart cities represents a paradigm shift in urban management and development strategies, propelling cities into a new era of connectivity and responsiveness (Paksok et al., 2023). As cities increasingly adopt smart technologies, a cohesive framework encompassing technological, social, and economic dimensions must guide this transformation.

Despite the widespread momentum behind smart city development, challenges such as data privacy, cybersecurity, and the maintenance of equitable access to smart technologies persist (Efthymiopoulos, 2016; Guma, 2023). Critics argue that without careful planning, smart city initiatives may exacerbate existing inequalities and create fragmented urban environments in which technologically advanced areas coexist with "analog" zones (Caprotti & Cowley, 2019; Buck & While, 2016). Furthermore, ensuring public trust through transparent governance practices is essential for the long-term sustainability of smart solutions (Joss et al., 2019; Agbali et al., 2019).

Overview of Ethical Issues in Smart Cities

The concept of smart cities has emerged as a central paradigm for urban development in the twenty-first century, integrating technology with urban policy to improve citizens' quality of life. A core driver of smart city initiatives is the integration of information and communication technologies (ICT), which facilitates improved city management, enhanced public services, and more efficient governmental operations (Oke et al., 2020). This evolution involves a diverse set of strategies that prioritize not only technological advancement but also the development of human and social capital. Myeong et al. argue that successful smart city strategies require both high-tech infrastructure investment and strong community engagement (Myeong et al., 2020).

A critical aspect of smart city development is the alignment of technological innovation with the actual needs of citizens. Agbali et al. demonstrate how urban environments such as San Diego benefit from the implementation of sensor-based and IoT-driven solutions designed to improve citizens' well-being (Agbali et al., 2019). This highlights the importance of balancing infrastructure investment with genuine societal needs, countering the assumption that technological sophistication alone guarantees success. The capacity to tailor smart city innovations to local demands is a recurring

theme in the literature, framing technology as a means for social enhancement rather than an end in itself (Fernández-Añez et al., 2018).

Governance plays a crucial role in shaping the effectiveness and inclusiveness of smart city initiatives. As noted by Tan and Taeihagh, financial constraints and informal economic structures commonly found in developing countries can hinder the realization of smart city objectives if not managed effectively (Tan & Taeihagh, 2020). Achieving the holistic goals of smart cities requires integrated approaches that address economic, environmental, and social dimensions. These multifaceted strategies are reflected across different geographical contexts, ranging from structured governance models in Europe to more flexible approaches observed in parts of Asia and Africa (Caird & Hallett, 2018; Alshuwaikhat et al., 2022).

Smart city development is marked by a complex interaction between technological innovation, community engagement, and effective governance. Urban planners and policymakers must recognize that successful smart cities are not defined solely by technological infrastructure, but by their capacity to foster inclusive growth and ensure that all members of society benefit from urban transformation. As cities strive toward these goals, insights from diverse case studies underscore the importance of adapting smart city strategies to local contexts and promoting sustainable and ethically grounded urban development.

Ethical concerns surrounding smart cities have become increasingly prominent, particularly with respect to data privacy, governance structures, social inclusion, and the societal consequences of technological advancement. As urban areas evolve through smart technologies, robust ethical frameworks must be developed and implemented to address these challenges (Chang, 2021; Helbing et al., 2021).

One of the most significant ethical issues relates to data collection and privacy. The integration of IoT technologies and big data analytics requires the generation and processing of vast amounts of personal information, thereby increasing vulnerability to data breaches. Chang proposes an ethical framework to balance these concerns with the benefits offered by smart cities, such as enhanced public safety and improved urban services (Chang, 2021). Kitchin articulates the potential consequences of surveillance and personal data exploitation, emphasizing the need for clear ethical standards and regulatory mechanisms to protect citizens' privacy (Kitchin, 2016). Ethical considerations regarding data governance and their implications for individual freedoms therefore form a foundational element of the discourse on smart city governance (Ryan & Anya, 2019).

Governance and partnership formation within smart cities also raise ethical dilemmas. Ehwi et al. highlight the importance of ethical decision-making in governance frameworks underpinning smart city initiatives, particularly in terms of transparency, accountability, and public engagement (Ehwi et al., 2022). This resonates with Goodman's argument that dominant corporate interests within the smart city paradigm may undermine democratic governance and public participation (Goodman et al., 2020). Ethical decision-making thus requires the inclusion of diverse stakeholders and community input to mitigate inequalities and ensure that technological benefits are distributed fairly across society (Keh et al., 2021).

The ethical implications of smart cities further extend to issues of inclusivity and social justice. Ziosi et al. discuss the potential for smart city technologies to inadvertently perpetuate existing

inequalities, underscoring the need for deliberate design choices that promote social inclusion and participation (Ziosi et al., 2022). Technologies that discriminate against marginalized groups or fail to account for socio-economic dynamics exacerbate existing disparities and may contribute to social unrest (Clever et al., 2018). Advocacy for ethically grounded smart cities emphasizes sustained citizen involvement throughout the development process, ensuring that residents' values and specific needs inform urban planning and technological deployment (Keh et al., 2021).

Privacy and Surveillance in Smart Cities

The implications of privacy and surveillance in smart cities represent a critical ethical issue arising from the intersection of advanced technologies, urban governance, and citizens' rights. Multiple factors contribute to these concerns, particularly regarding data collection practices, public perceptions of privacy, and the complexities introduced by integrated smart technologies. One fundamental cause of privacy issues in smart cities is the volume and nature of data collected through surveillance technologies and IoT systems. As cities increasingly deploy sensors, cameras, and data collection instruments to enhance operational efficiency and security, the risk of extensive and intrusive data gathering becomes evident. Many proposed data governance frameworks lack robust privacy safeguards, leading to potential violations of individual rights (Eckhoff & Wagner, 2018; Alabsi & Gill, 2024). Moreover, the rapid integration of these technologies complicates the establishment of coherent privacy measures, as interactions between diverse data sources generate unforeseen vulnerabilities (Eckhoff & Wagner, 2018).

Another critical aspect concerns public perceptions of privacy in relation to security needs. Many citizens demonstrate a willingness to trade personal privacy for perceived security, often underestimating the long-term implications of surveillance practices (Zoonen et al., 2022). Such trade-offs are frequently justified in contexts of rising urban crime or public health emergencies, as observed during the COVID-19 pandemic, when surveillance measures were rapidly adopted with minimal public deliberation (Bentotahewa et al., 2021; Biesaga et al., 2023). This phenomenon raises ethical questions about consent and the commodification of personal information, whereby individuals inadvertently relinquish privacy in exchange for promised security (Biesaga et al., 2023).

A systemic lack of transparency regarding data use and governance further compounds privacy challenges in smart cities. Discourses on surveillance capitalism highlight how private corporations may exploit personal data for commercial gain, often without adequate accountability or regulatory oversight (Biesaga et al., 2023; Yogi, 2023). The central ethical dilemma lies in balancing the benefits of advanced data analytics for urban planning against the erosion of citizens' privacy and autonomy, a concern exacerbated by limited public involvement in decision-making processes related to technological implementation (Biesaga et al., 2023).

The psychological impacts of surveillance technologies on individual identity and social interaction must also be acknowledged. The omnipresence of surveillance undermines individuals' capacity for free self-expression, as privacy plays a crucial role in fostering community engagement and personal agency (Stuart & Levine, 2017). As technologies continue to evolve, risks related to

personal identity and existential threats to privacy remain paramount considerations for the future of smart cities (Stuart & Levine, 2017; Milaj, 2015).

Social Inequality and Social Inclusion

The drivers of social inequality and exclusion in smart cities are multifaceted, rooted in urban planning practices, socio-economic disparities, and technological interventions. As cities evolve into technologically advanced environments, several factors contribute to the persistence of inequality and challenges surrounding social inclusion. One major driver lies in socio-economic conditions that shape access to smart city resources. For smart cities to be genuinely inclusive, they must not only adopt technological innovations but also address underlying socio-economic inequalities. Areas characterized by pre-existing deprivation are often the last to receive full technological benefits, which may further marginalize vulnerable populations. For example, the implementation of technology-enabled urban parks can trigger gentrification processes, whereby low-income groups are displaced due to rising property values and living costs, resulting in unequal distribution of environmental benefits (Wei et al., 2022). This pattern reflects broader issues of unequal access to urban amenities and underscores the need for equitable urban redevelopment strategies (Praharaj, 2021).

The design and implementation of smart city infrastructure frequently overlook marginalized communities. Urban planning that fails to integrate the needs and voices of diverse populations leads to systemic exclusion. In many cases, participatory governance mechanisms are insufficient or absent, preventing meaningful representation of underrepresented groups (Gils & Bailey, 2021). Scholars advocate for more inclusive planning processes that emphasize community engagement and social capital as means of bridging gaps in representation and resource distribution. When urban spaces are designed without consideration of gender, disability, and socio-economic intersectionality, the potential for equitable urban development is significantly diminished (Otero et al., 2021; Kolodii, 2017).

Another significant contributor to inequality is the digital divide affecting access to smart technologies. Smart city systems often assume a baseline level of technological literacy and device ownership that many low-income individuals do not possess. This digital divide restricts access to essential services and limits opportunities for education, employment, and civic participation among marginalized groups (Azambuja et al., 2020). Recognizing and addressing these disparities is essential for policymakers seeking to design interventions that promote equal access to digital resources and smart services.

Existing urban governance structures may further perpetuate inequality by prioritizing the interests of certain population segments over others. Such frameworks often reinforce privileges for affluent residents while neglecting the needs of disadvantaged communities. Empirical studies indicate that historical inequalities embedded in governance practices result in smart city initiatives disproportionately benefiting specific demographic groups, thereby institutionalizing inequality (Lee et al., 2020). This systemic bias necessitates a critical reassessment of urban governance methodologies and a renewed commitment to inclusivity and equity in smart city development.

Power, Control, and Governance Dynamics

One of the primary ethical challenges in this domain arises from the deployment of advanced technologies such as big data analytics and artificial intelligence (AI). These technologies enable the tracking and prediction of citizens' behaviors, potentially leading to forms of social control that marginalize certain demographic groups (Chang, 2021). Ethical frameworks emphasize the need for vigilance in balancing technological benefits against risks to personal freedoms. Without adequate oversight, data usage may evolve into mechanisms of control, whereby citizens are subjected to monitoring without their knowledge or consent (Chang, 2021). Such power asymmetries erode trust between citizens and authorities, particularly as surveillance capacities expand (Ziosi et al., 2022).

Traditional governance structures in urban planning often reflect top-down approaches that reinforce power imbalances. Many smart city initiatives operate under the assumption that technological "intelligence" inherently leads to better governance, frequently sidelining citizen input and participation (Goodman et al., 2020). This exclusion fosters narratives that prioritize efficiency over equity, generating grievances among communities excluded from decision-making processes. Collaborative governance models, which integrate diverse perspectives from the outset, are proposed as mechanisms to mitigate these issues (Deep & Verma, 2023; Keh et al., 2021). However, such approaches require a paradigm shift away from conventional governance practices toward more citizen-centered models.

The intersection of public and private interests further complicates ethical governance in smart cities. The increasing involvement of private technology corporations in urban management raises critical questions about accountability and the privatization of public spaces. As cities rely on external entities for data management and service provision, governance structures emerge in which power becomes disproportionately concentrated in corporate hands, potentially marginalizing public interests (Vanolo, 2013). This commercialization of urban governance may lead to "creeping control," whereby citizens gradually lose agency over their environments and services as decisions become driven by profit motives rather than public good (Ryan & Anya, 2019).

Ethical dilemmas related to data ownership and usage policies underscore the need for systemic approaches to power dynamics. Data governance is often opaque, leaving citizens uncertain about how their data are collected, stored, and utilized (Deep & Verma, 2023). Such opacity fosters public skepticism and disengagement, reflecting broader concerns about who holds authority in shaping urban development and how power is distributed across society. Addressing these imbalances requires robust ethical frameworks that prioritize transparency, accountability, and participatory governance (Ehwi et al., 2022).

Environmental Sustainability versus Technological Development

A significant ethical concern arises from the potential disconnection between technological adoption and genuine environmental sustainability. Although smart city initiatives frequently promote "sustainable development" through the integration of advanced technologies such as IoT and big data analytics, debates persist regarding their actual environmental impact (Bibri et al., 2023;

Toli & Murtagh, 2020). Critics argue that excessive reliance on technology may generate psychological detachment from natural environments, undermining intrinsic environmental values and weakening ecological consciousness that depends on direct human–nature interaction (Toli & Murtagh, 2020). Consequently, an ethical dilemma emerges concerning whether technology is perceived as a substitute for environmental stewardship rather than a supportive tool.

The prioritization of technological innovation often challenges sustainable practices. Rapid expansion of smart infrastructure may emphasize economic and operational efficiency at the expense of ecological considerations, leading to increased resource consumption and environmental pollution (Shruti et al., 2019). For instance, the deployment of extensive sensor networks, while enabling improved urban management, requires substantial energy and material inputs that may offset the intended sustainability benefits of smart city initiatives (Bibri & Krogstie, 2020). Thus, the ethical dilemma centers on whether short-term technological gains justify potential long-term environmental costs.

Ethical issues also arise from governance processes surrounding technological implementation. Decision-making mechanisms often lack inclusivity, marginalizing communities whose voices are crucial for sustainable urban development (Ugochukwu et al., 2024). The failure to engage diverse demographic groups risks perpetuating inequalities and fostering technocratic governance, where decisions are primarily shaped by technologists and business interests rather than collaborative civic processes (Adenekan et al., 2024; Yiğitcanlar et al., 2020). This raises ethical questions about accountability, transparency, and the balance between pluralism and efficiency in smart city governance.

Another critical ethical issue concerns the uneven distribution of benefits derived from smart city technologies. Empirical studies highlight that technological advancements intended to promote sustainability do not always translate into equitable access or benefits for all urban residents. A lack of inclusivity may result in affluent areas disproportionately enjoying smart city advantages, thereby reinforcing socio-economic disparities in access to clean air, green spaces, and efficient public services (Ugochukwu et al., 2024; Shruti et al., 2020). These inequities underscore broader ethical concerns about whether smart city technologies genuinely align with the principles of environmental justice.

4. Conclusion

The rapid expansion of smart cities reflects a global shift toward data-driven urban governance, where digital technologies are increasingly positioned as solutions to complex urban challenges. While smart city initiatives offer significant potential to enhance efficiency, sustainability, and quality of life, this study demonstrates that such transformations are accompanied by profound ethical risks that cannot be overlooked. The integration of IoT, big data analytics, and artificial intelligence has reconfigured urban governance into highly data-dependent systems, thereby reshaping power relations, decision-making processes, and citizen–state interactions.

This review highlights four core ethical dimensions: privacy and surveillance, social inequality and inclusion, power and governance dynamics, and environmental sustainability. First, extensive data collection practices raise critical concerns regarding privacy, autonomy, and the normalization of surveillance in everyday urban life. Without robust regulatory frameworks and transparent data governance, smart cities risk evolving into infrastructures of continuous monitoring rather than platforms of citizen empowerment. Second, smart city development may exacerbate existing socio-economic inequalities through digital divides, exclusionary planning processes, and uneven access to technological benefits, particularly among marginalized populations.

Third, the concentration of power in data-driven governance systems often dominated by corporate actors and technocratic institutions challenges democratic accountability and public participation. These dynamics risk transforming urban governance into a form of algorithmic control, where efficiency is prioritized over equity, deliberation, and social justice. Finally, although smart cities are frequently framed as environmentally sustainable, the reliance on energy-intensive digital infrastructures raises ethical tensions between technological expansion and genuine ecological responsibility.

Overall, this study argues that smart cities should not be evaluated solely through technological performance indicators, but through ethical and socio-political lenses. Sustainable and just smart cities require governance models that prioritize transparency, inclusivity, citizen participation, and ethical accountability. Without such foundations, the promise of smart cities may shift from enabling urban intelligence toward institutionalizing digital surveillance and structural inequality.

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