Revista de Justicia Social en la Sociedad Urbana
Journal of Social Justice in Urban Society

Smart Cities, Smart Exclusion: The Digital Divide in Marginalized Neighborhoods

Ciudades inteligentes, exclusión inteligente: brechas digitales en barrios marginados

Mateo Julián Ortega Ramírez[1]✉ ⓘD

[1] Universidad de Valencia, Valencia, Spain

✉Corresponding email: mateo.ramirez@gmail.com

ABSTRACT

This article critically examines how smart city initiatives, while promising innovation and efficiency, often deepen socio-spatial inequalities by reinforcing the digital divide in marginalized urban neighborhoods. Focusing on case studies from Latin American cities, the research analyzes how urban digitalization policies systematically exclude low-income populations through limited internet access, lack of digital literacy programs, and the uneven deployment of smart infrastructure. Using a mixed-methods approach—combining spatial data analysis, policy review, and interviews with residents and planners—this study reveals how digital urbanism can unintentionally reproduce patterns of exclusion under the guise of technological progress. The novelty of this research lies in its framing of digital justice as a central criterion for evaluating smart city success. By shifting the focus from technological efficiency to social equity, the article

contributes to critical smart city discourse and advocates for inclusive digital strategies that prioritize urban poor communities.

Keywords *Smart cities, Digital divide, Urban inequality, Digital justice, Marginalized communities*

RESUMEN
Este artículo examina críticamente cómo las iniciativas de ciudades inteligentes, aunque prometen innovación y eficiencia, suelen profundizar las desigualdades socioespaciales al reforzar la brecha digital en barrios urbanos marginados. A partir de estudios de caso en ciudades latinoamericanas, la investigación analiza cómo las políticas de digitalización urbana excluyen sistemáticamente a las poblaciones de bajos ingresos debido al acceso limitado a internet, la falta de programas de alfabetización digital y la implementación desigual de infraestructuras inteligentes. Mediante un enfoque metodológico mixto —que combina análisis espacial, revisión de políticas y entrevistas con residentes y planificadores— el estudio demuestra cómo el urbanismo digital puede reproducir patrones de exclusión bajo el discurso del progreso tecnológico. La originalidad de esta investigación radica en posicionar la justicia digital como un criterio central para evaluar el éxito de las ciudades inteligentes. Al desplazar el enfoque desde la eficiencia tecnológica hacia la equidad social, el artículo contribuye al discurso crítico sobre ciudades inteligentes y aboga por estrategias digitales inclusivas centradas en las comunidades urbanas empobrecidas.

Palabras clave *Ciudades inteligentes, Brecha digital, Desigualdad urbana, Justicia digital, Comunidades marginadas*

A.   Introduction

The contemporary urban epoch is increasingly defined by the global proliferation of "smart city" agendas, where metropolitan centers compete to integrate high-tech solutions into every facet of urban life. This phenomenon is driven by the promise that the seamless integration of Information and Communication Technologies (ICT) can solve chronic urban problems—from traffic congestion to energy waste—leading to unprecedented levels of efficiency and innovation. Within this framework, cities are reimagined as data-driven ecosystems where real-time monitoring and algorithmic optimization replace traditional forms of civic management. As Kitchin (2014) argues, this shift represents a move toward "big data urbanism," where the city

becomes a functional site for continuous data extraction. This transition is significantly influenced by global technology firms that provide the proprietary software and sensors necessary for "smart" governance. Consequently, urban planning has transitioned from a public-sector-led endeavor toward a techno-centric model where data is treated as the primary resource for making cities more responsive and resilient.

The discourse surrounding smart cities is often characterized by a techno-utopian optimism that frames technology as a neutral, apolitical tool for progress. Proponents argue that smart infrastructure leads to more sustainable urban environments and enhanced quality of life through the "democratization" of data. However, critical urban scholars suggest that this focus on efficiency often masks the entrepreneurial interests of multinational corporations (Hollands, 2008). The promises of innovation and sustainability are frequently utilized as marketing tools to attract global capital, often at the expense of local democratic processes. In this context, the role of technology firms is not merely as service providers but as architects of a new form of "corporate smart urbanism" (Söderström et al., 2014). This data-driven governance model prioritizes sectors of the city that generate the most profitable data streams, inadvertently creating a hierarchy of urban needs that favors corporate efficiency over social welfare and genuine public engagement.

While the smart city narrative emphasizes universal progress, the material reality of urban digitalization is frequently characterized by uneven access to digital infrastructure. In many metropolises, high-speed fiber optics and smart sensors are concentrated in affluent business districts and residential enclaves, leaving the urban periphery in a state of "digital desertification." This digital exclusion is not merely a technical glitch but a modern form of socio-spatial marginalization that mirrors historical patterns of economic neglect. As Graham (2002) observes, the deployment of ICTs often follows a "premium network" logic, where high-quality digital connections are unbundled from poorer areas to serve global economic hubs. This uneven digitalization creates a fractured urban landscape where some residents are hyper-connected while others remain digitally marooned. This digital divide is the 21st-century iteration of the "redlining" practices of the past, reinforcing existing socio-spatial boundaries through new technological means.

In highly unequal Latin American cities, digital exclusion acts as a profound barrier to social mobility and civic participation. Where informal settlements already struggle with deficits in physical infrastructure—such as clean water and electricity—the lack of internet

access exacerbates existing vulnerabilities. Digitalization, rather than acting as a social leveler, risks creating a new tier of "second-class" digital citizens who are cut off from the economic opportunities increasingly migrated to the cloud (Van Dijk, 2005). The relevance of this divide in Latin America is particularly acute, as the region experiences some of the highest levels of urban inequality globally. As Sassen (2011) suggests, the global city is a site of both immense connectivity and profound disconnection; in the Latin American context, this manifests as a "high-tech" urban core surrounded by "low-tech" or "no-tech" peripheries. This spatialized digital divide ensures that the benefits of the smart city are captured by a small elite, while the marginalized are further distanced from the mechanisms of urban governance.

The central problem addressed by this research is the pervasive framing of smart city initiatives as universally beneficial, a "rising tide" meant to lift all urban residents. This celebratory rhetoric often masks a profound lack of attention to structural inequality and the realities of access in marginalized communities. When smart policies are designed with a "one-size-fits-all" mentality, they inadvertently ignore the specific needs and constraints of the urban poor. As Wiig (2016) notes, the empty rhetoric of the smart city often prioritizes economic resilience over genuine digital inclusion, leading to policies that serve the market rather than the people. There is a critical risk that the deployment of smart infrastructure—such as cashless transit systems or digital-only service portals—will reproduce and entrench existing patterns of exclusion. By failing to account for disparities in digital literacy and hardware ownership, smart city agendas can effectively "design out" the most vulnerable populations from the future of their own cities.

Furthermore, the lack of attention to structural inequality in smart city planning leads to what Eubanks (2018) describes as "automated inequality," where high-tech tools are used to profile and punish the poor rather than empower them. When digital systems are implemented in marginalized neighborhoods without a foundation of justice, they often function as tools of surveillance rather than service. The risk of reproducing existing patterns of exclusion through digital means is particularly high in contexts where the "digital divide" is not just about a lack of hardware, but about a lack of agency in how technology is deployed. If smart city initiatives continue to be evaluated solely through metrics of efficiency and data throughput, they will continue to fail the urban poor. This research identifies a fundamental disconnect between the high-tech aspirations of planners and the low-resource realities of marginalized residents, suggesting that

"smartness" without social equity is merely a new mechanism for old forms of urban dispossession.

This article aims to deconstruct the techno-utopian discourse of the smart city by investigating the lived reality of digitalization in marginalized neighborhoods. The primary objective is to evaluate how smart city policies specifically affect these precarious urban zones and to identify the varying forms of digital exclusion that emerge from such transitions. To achieve this, the research is guided by three core questions: First, in what ways do current smart city policies intersect with and impact the socio-spatial dynamics of marginalized neighborhoods? Second, what specific forms of digital exclusion—spanning access, literacy, and infrastructure—are produced by rapid urban digitalization? Finally, how can smart city initiatives be re-evaluated through a "digital justice" lens that prioritizes social equity over mere technological efficiency? These questions seek to move the scholarly debate from *if* a city is smart to *who* the smart city is for, emphasizing the "right to the city" in the digital age.

The research objective also involves understanding how "smartness" is experienced at the street level, away from the sleek visualizations of planning departments. By asking what forms of digital exclusion emerge, the study seeks to categorize the multi-layered barriers—from the "first-level" divide of access to the "second-level" divide of digital skills (Norris, 2001). This categorization is essential for moving beyond simplistic solutions like providing free Wi-Fi, which often fails if residents lack the devices or literacy to use it. Furthermore, the objective of developing a "digital justice" lens aims to provide an alternative framework for urban evaluation. Digital justice, as a central criterion, requires that we analyze whether a smart initiative reduces or expands the gap between the affluent and the marginalized (Soja, 2010). By centering the perspectives of the urban poor, the research aims to uncover the "hidden transcripts" of digital urbanism, revealing the frictions and failures that occur when high-tech agendas meet low-resource realities.

The novelty and contribution of this research are three-fold. Empirically, it provides a rigorous critique of smart city research by utilizing case studies from Latin American cities, offering a unique "Global South" perspective on digital urbanism. While much of the existing smart city literature focuses on Northern hubs like London or Singapore, this article addresses the specific challenges of digitalization in contexts of extreme inequality (Robinson, 2006). This empirical contribution is vital for diversifying urban theory, demonstrating that "smartness" is not a universal trajectory but a contested process shaped by local histories of marginalization. By documenting the uneven

deployment of smart infrastructure in cities like Rio de Janeiro or Medellín, the study provides concrete evidence of how digital policies can exacerbate socio-spatial segregation, offering a necessary counter-narrative to the glossy brochures of technology firms and municipal governments.

Theoretically, the article contributes by framing "digital justice" as a central criterion for evaluating urban success, shifting the focus from technological capacity to equitable distribution. This framing draws upon the traditions of critical urban theory to argue that digital access is now a fundamental component of "spatial justice" (Soja, 2010). It posits that in the 21st-century city, the ability to access information, services, and economic networks is a prerequisite for full citizenship. By developing the concept of digital justice, the research provides a normative framework that researchers and activists can use to hold smart city developers accountable. This theoretical shift allows for a more nuanced understanding of urban justice, where the "right to the city" is updated to include the "right to the network" and the right to not be excluded by algorithmic governance. This contribution ensures that the human element of the city remains at the center of the technological debate.

Finally, the article offers a policy-oriented contribution by advocating for inclusive digital strategies that prioritize the needs of urban poor communities. Rather than rejecting digitalization, the research advocates for "subaltern smart urbanism," where technology is co-produced with residents to serve their specific survival and advocacy needs (McFarlane & Söderström, 2017). By providing planners with a framework to integrate social equity into digital agendas, this research seeks to transform the smart city from a site of exclusion into a platform for genuine urban inclusion. This involves moving beyond "top-down" technological imposition toward "bottom-up" digital empowerment. The policy recommendations offered here are designed to be actionable, emphasizing that digital literacy and public infrastructure must precede the deployment of proprietary smart systems. Ultimately, this work contributes to a more democratic vision of the digital city, where progress is measured not by the speed of the network, but by the breadth of its inclusion.

B. Literature Review
1. *Smart Cities and Digital Urbanism*

The conceptualization of the "smart city" has evolved from a niche technological curiosity into the dominant paradigm of 21st-century urban planning. At its core, digital urbanism refers to the hyper-integration of information technology into the physical and

social fabric of the city to streamline governance and enhance resource management (Kitchin, 2014). Dominant paradigms often present the smart city as a neutral, "objective" solution to urban complexity, relying heavily on technocratic and efficiency-oriented models. These models prioritize the deployment of sensors, Internet of Things (IoT) devices, and big data analytics to optimize urban systems such as energy grids and transit networks. This "computational logic" suggests that urban problems are essentially technical glitches that can be "solved" through better data harvesting and algorithmic processing (Mattern, 2021).

However, critical scholarship has emerged to challenge these neoliberal and corporate-driven frameworks, arguing that they often prioritize "corporate storytelling" over actual civic needs. Söderström et al. (2014) argue that the smart city discourse is frequently used by multinational tech firms to dictate the "problems" of the city in order to market their proprietary "solutions." This leads to an entrepreneurial mode of urbanism where the city is treated as a laboratory for market-ready technologies rather than a site for social reproduction. The critique suggests that the technocratic gaze of the smart city tends to simplify the messy, political reality of urban life into clean data visualizations, effectively de-politicizing urban planning and shifting power from elected officials to unaccountable software developers (Hollands, 2008).

Furthermore, the "efficiency" promised by digital urbanism is often unevenly distributed, favoring the economic vitality of the urban core while neglecting the social needs of the periphery. According to Wiig (2016), the smart city serves as a vehicle for the privatization of urban management, where the metrics of success are defined by data throughput and investment attraction rather than social equity. This corporate-led model often ignores the informal systems and community networks that are vital for survival in many global metropolises. By focusing on the "high-tech" optimization of formal infrastructure, digital urbanism risks further marginalizing the "low-tech" informalities that characterize much of the urban Global South. The literature thus calls for a shift toward "progressive" smart cities that prioritize public interest over neoliberal efficiency (Shelton et al., 2015).

2. *The Digital Divide*

The "digital divide" is no longer understood as a simple binary of "haves" and "have-nots" regarding hardware; rather, it is a multi-dimensional phenomenon encompassing access, skills, and usage. Modern research identifies the "first-level" divide as physical access to high-speed connectivity, while the "second-level" divide involves the digital literacy and technical skills required to navigate an increasingly

online society (Van Deursen & Van Dijk, 2014). This multi-layered exclusion ensures that even if physical infrastructure is present, residents may remain digitally marginalized due to a lack of "social capital" or technical education. As Van Dijk (2005) suggests, the deepening divide is not just about technology but about the "information society" reinforcing existing class stratifications.

Crucially, the digital divide must be viewed as a socio-spatial phenomenon, where geographic locations determine the quality of one's digital experience. In the Global South, these inequalities are particularly acute, as urban digitalization often follows the path of least resistance, bypassing informal settlements and reinforcing historical patterns of neglect. As Graham (2002) notes, digital infrastructure tends to "splinter" the city, creating high-tech premium networks for affluent zones while leaving marginalized areas dependent on expensive or non-existent connections. This "digital redlining" creates a fractured urban landscape where some residents are hyper-connected while their neighbors remain digitally marooned. This spatialized inequality ensures that the benefits of the smart city are geographically concentrated in elite enclaves.

In the context of highly unequal Latin American cities, the digital divide is intrinsically linked to the broader "urban question" of land and citizenship. Robinson (2006) argues that "ordinary cities" are often forced to adopt Western-centric technological models that are ill-suited for their local socio-economic realities. When internet access is treated as a luxury rather than a public utility, the digital divide becomes a form of "infrastructure violence" that limits the mobility and economic opportunities of the urban poor (Rodgers & O'Neill, 2012). The literature emphasizes that closing the gap requires more than just hardware; it requires a structural overhaul of how digital rights are conceptualized in the city. Without addressing the underlying poverty that fuels the divide, smart city initiatives will continue to operate as "enclaves of connectivity."

3. *Smart Cities and Social Exclusion*

The intersection of smart city initiatives and social exclusion manifests most clearly through surveillance, data bias, and algorithmic governance. When urban management is automated, the datasets utilized often reflect existing social biases, leading to what Eubanks (2018) describes as "automated inequality." For marginalized populations, "smartness" often arrives in the form of enhanced surveillance and predictive policing rather than improved social services. Algorithmic governance can effectively "profile" entire neighborhoods based on historical data already skewed by over-

policing, thereby reinforcing the criminalization of poverty through new technological means (Brayne, 2017). This creates a reality where the "transparency" of the smart city is unidirectional: the state sees more of the citizen, while the citizen sees less of the opaque algorithms managing their lives.

The uneven distribution of smart infrastructure—such as smart lighting or public Wi-Fi—further exacerbates this exclusion, as these amenities are rarely deployed in the neighborhoods that need them most. This "spatial selectivity" means that smart cities often act as a tool for the reproduction of urban inequality rather than its solution. By digitizing public services without ensuring universal access, cities effectively "design out" the poor from the digital commons. As Castells (2001) argued, those who are not connected to the network are not just disadvantaged—they are effectively excluded from the core of modern life. This creates a "tiered" citizenship where access to the city's smart benefits is predicated on one's ability to own high-end hardware, fundamentally undermining the democratic ideal of the city as a shared, accessible space.

Moreover, the smart city often facilitates a "revanchist" urbanism (Smith, 1996) by using data to identify and displace "unproductive" elements of the city. Digitalization allows for more precise mapping of informal street vendors or squatter settlements, which can be used to justify their removal in favor of capital-intensive "smart" redevelopment projects. This process uses the "objective" language of data and efficiency to mask the political act of displacement. As Sassen (2011) suggests, the digital city is a site of "expulsion" where the poor are pushed further to the periphery as the urban core is optimized for global elites. The literature concludes that unless smart city policies are explicitly designed with an anti-exclusionary mandate, they will continue to function as sophisticated mechanisms for the socio-spatial segregation of the metropole.

4. *Toward Digital Justice*

In response to the exclusionary nature of corporate-led smart cities, there is a growing movement toward "digital justice," which frames digital rights as a fundamental component of 21st-century urban citizenship. Digital justice suggests that the "right to the city" (Harvey, 2012) must now include the right to the network, data privacy, and influence over how technology is deployed in one's neighborhood. This involves moving beyond "top-down" technological imposition toward "subaltern smart urbanism" (McFarlane & Söderström, 2017), where residents co-produce digital solutions that serve their specific needs. Digital justice is thus not merely about "inclusion" into existing systems,

but about the right to reshape the digital infrastructure of the city to serve the public good.

Currently, there are significant gaps in smart city evaluation frameworks, which tend to measure success through narrow metrics like data throughput or energy efficiency rather than social equity. The literature identifies a "technocratic blindness" in these frameworks that fails to capture the lived experience of those on the wrong side of the digital divide. There is an urgent need for equity-centered digital urban analysis that evaluates a city's "smartness" by its ability to close the inequality gap and empower its most vulnerable residents (Soja, 2010). This requires the development of new indicators that measure "digital justice," such as the accessibility of e-government services for non-literate populations or the degree of community control over local data.

By centering justice, urban planners can move toward a model where technology is used to deconstruct, rather than reinforce, the socio-spatial barriers that have historically defined the urban experience. This involves treating digital infrastructure as a "common good" similar to water or roads, necessitating public ownership and universal access. As Mattern (2021) argues, a "smart city" should be defined by the intelligence of its social policies and its capacity for care, not just the complexity of its algorithms. The movement toward digital justice thus challenges the techno-centric status quo, advocating for a democratic digital urbanism that ensures the technological future of the city belongs to all its inhabitants, regardless of their economic standing.

C. Conceptual Framework
1. *Digital Justice in the Urban Context*

Digital justice emerges as a necessary expansion of urban rights in the 21st century, positing that digital access must be treated not as a market luxury but as a fundamental social right. This framework builds upon Harvey's (2012) concept of the "right to the city," suggesting that as urban life migrates to digital platforms, the ability to access, navigate, and shape these platforms becomes a prerequisite for citizenship. In the neoliberal city, the commodification of connectivity creates "connectivity gaps" that mirror historical patterns of economic neglect. As Castells (2001) argues in *The Internet Galaxy*, the internet is not a neutral tool but a medium that reflects and reinforces existing social structures; therefore, digital justice requires active state intervention to decouple the quality of one's digital life from their economic standing.

True digital justice encompasses the triad of inclusion, participation, and representation within digital systems. It is

insufficient to merely provide physical access if the underlying digital systems do not represent the diverse needs of marginalized populations. According to Sassen (2014) in *Expulsions: Brutality and Complexity in the Global Economy*, modern urban systems often operate through "complexities that expel," where opaque data-driven governance excludes those who cannot interface with high-tech portals. Representation means that marginalized communities must have a seat at the table during the design phase of smart city initiatives, ensuring that algorithmic governance does not become a tool for "automated inequality" (Eubanks, 2018). Participation, therefore, is the active exercise of digital agency, allowing residents to use technology to advocate for their rights rather than being passive subjects of data extraction.

Therefore, digital justice seeks to dismantle the hierarchy of "smartness" that values corporate efficiency over human dignity. This requires a shift from technocratic governance to what Soja (2010) terms "spatial justice," applied to the digital realm. In *Seeking Spatial Justice*, Soja emphasizes that justice must be geographically equitable; in the digital context, this means that the speed and reliability of the network should not degrade as one moves from the urban center to the periphery. By framing digital justice as a social right, planners can prioritize the "socially smart" city—one that uses technology to close the inequality gap rather than expanding it. This perspective challenges the dominant market-led logic and advocates for a public-utility model of digitalization that ensures universal access to the essential tools of modern urban life.

2. Smart Infrastructure as Socio-Spatial Power

Smart infrastructure—comprising data centers, platforms, and connectivity networks—functions as a new form of socio-spatial power that determines who can participate in the modern city. These infrastructures are not merely technical conduits; they are "urban resources" that facilitate economic accumulation and social interaction. As Graham and Marvin (2001) illustrate in *Splintering Urbanism*, modern infrastructure is often "unbundled," where premium networks are designed to serve global economic hubs while bypassing "unprofitable" marginalized zones. This process turns connectivity into a tool of spatial segregation, where the digital layer of the city serves to reinforce the physical boundaries between the affluent and the poor. In this sense, the "smart" layer of the city acts as a selective filter, granting visibility and mobility to some while rendering others digitally invisible.

Digitalization creates a new, complex layer of spatial inequality that overlays traditional geographic disparities. In *The Rise of the*

Network Society, Castells (2010) notes that the "space of flows" (digital networks) often dominates the "space of places" (physical neighborhoods), meaning that those disconnected from the flow lose their relevance in the global economy. For residents of informal settlements, the lack of smart infrastructure is not just a lack of convenience; it is an exclusion from the city's operating system. This "infrastructural violence" (Rodgers & O'Neill, 2012) manifests when essential services—such as transport, banking, or health—become dependent on digital platforms that residents cannot access. Consequently, smart infrastructure becomes a mechanism for the "accumulation by dispossession" (Harvey, 2003), where public resources are diverted into high-tech enclaves while the periphery remains in a state of technological stasis.

The power of platforms and data extraction further complicates urban inequality by turning the city into a site of "surveillance capitalism" (Zuboff, 2019). In *The Age of Surveillance Capitalism*, Zuboff explains how the extraction of behavioral data becomes a new source of profit, often at the expense of privacy and autonomy. In marginalized neighborhoods, this extraction is frequently unidirectional; the state and corporations harvest data from residents to monitor and manage them, but residents gain little insight or benefit from the resulting algorithms. This power imbalance reinforces the status of the urban poor as "objects" of governance rather than "subjects" of development. The digital layer of the city thus becomes a contested territory where the control of data and infrastructure determines the degree of one's urban belonging and the extent of their political and economic agency.

3. *Analytical Dimensions*

The analytical framework for evaluating digital justice is organized into three primary dimensions: Infrastructure, Capabilities, and Governance. The infrastructure dimension focuses on the material requirements for digital participation, including high-speed connectivity, hardware devices, and the platforms that facilitate urban life. It is the most visible layer of the digital divide and relates directly to the physical deployment of fiber optics and wireless networks. According to Mossberger et al. (2003) in *Virtual Inequality*, the "technical divide" remains a major barrier to "digital citizenship." Analysis in this dimension must move beyond simple "presence" of signal to evaluate the affordability and quality of connection, as well as the ownership of the devices necessary to interface with the smart city's portals.

The capabilities dimension addresses the "second-level" digital divide, focusing on digital literacy and the technical skills required to

effectively use technology for social and economic advancement. Providing infrastructure without building capabilities is often a futile exercise in technocratic planning. As Van Dijk (2005) explains in *The Deepening Divide*, inequalities in skills are often more persistent and damaging than inequalities in access. Capabilities encompass the ability to evaluate information critically, protect one's privacy online, and utilize digital tools for civic engagement. In marginalized neighborhoods, this dimension is often hampered by the lack of formal education and training programs, creating a "usage gap" where technology is used for basic communication but rarely for the complex tasks that drive social mobility and political influence.

Finally, the governance dimension evaluates the policy design, participation, and accountability mechanisms that underpin smart city initiatives. It asks who makes the decisions about urban digitalization and whose interests those decisions serve. Critical governance analysis involves examining the transparency of algorithmic systems and the degree to which residents are included in the co-production of digital services. In *The Real-Time City*, Kitchin (2014) warns of the dangers of "technocratic governance" that bypasses democratic oversight in favor of algorithmic efficiency. Governance for digital justice requires a shift toward "bottom-up" models where data is treated as a public good and policy is designed to be inclusive by default. This dimension ensures that the smart city remains accountable to its citizens, preventing the digital layer from becoming an opaque instrument of top-down social control.

D. Methodology
1. Research Design

This study employs a mixed-methods, comparative urban case study design to capture the multidimensional nature of digital inequality. By combining quantitative spatial analysis with qualitative insights, the research moves beyond "technological determinism" to explore how digital systems interact with lived urban realities. As Flyvbjerg (2006) argues in *Making Social Science Matter*, case studies are essential for producing the context-dependent knowledge required to understand complex social phenomena like urban marginalization. This approach allows for a deep dive into the specificities of each city while identifying cross-cutting patterns of "smart exclusion" that characterize contemporary neoliberal urbanism.

The selection of Latin American cities—specifically Medellín, Colombia, and São Paulo, Brazil—is justified by their status as regional leaders in smart city innovation amidst extreme socio-spatial fragmentation. These cities provide a "laboratory" for observing the

frictions between high-tech aspirations and deep-seated structural poverty. Following the logic of "comparative gestural urbanism" (Robinson, 2011), these cases allow us to see how global smart city templates are adapted to, or clash with, the informalities of the Global South. These cities have actively pursued public-private partnerships (PPPs) to digitize urban governance, making them ideal for analyzing how market-led digitalization affects those at the economic periphery.

2.   *Spatial Data Analysis*

The quantitative component of the methodology centers on spatial data analysis using Geographic Information Systems (GIS). This involves mapping the physical deployment of broadband infrastructure, fiber-optic backbones, and smart city nodes (such as public Wi-Fi kiosks and smart sensors). By visualizing the geography of connectivity, the study identifies "digital deserts" where infrastructure is conspicuously absent. This spatialization of data is crucial for moving beyond aggregate national statistics that often hide neighborhood-level disparities (Graham & Marvin, 2001).

These spatial patterns are then correlated with income levels, land tenure status, and neighborhood marginality indices. Using Pearson's correlation coefficients and spatial regression models, the research tests the hypothesis that "smartness" is geographically concentrated in zones of high capital accumulation. This phase of the analysis provides the empirical "skeleton" of the study, documenting the material reality of "infrastructure violence" (Rodgers & O'Neill, 2012) wherein the lack of digital resources mirrors the lack of traditional public utilities in marginalized zones.

3.   *Policy Review*

The research includes a comprehensive review of national and municipal smart city strategies to understand the institutional logic driving digitalization. This involves analyzing official policy documents, master plans, and legislative frameworks through the lens of "critical policy analysis." The goal is to identify whose interests are prioritized in these documents—whether the focus is on citizen empowerment or on creating a "business-friendly" environment for technology firms. As Söderström et al. (2014) note, smart city policies often function as "corporate storytelling" that obscures social goals in favor of technocratic efficiency.

Furthermore, the review scrutinizes specific digital inclusion and connectivity programs, assessing their scale, funding, and sustainability. A key focus is placed on the role of public-private partnerships (PPPs) in delivering smart infrastructure. In *The*

Entrepreneurial City, Hall and Hubbard (1998) argue that such partnerships often shift the focus of urban governance from social welfare to economic competition. This review investigates whether these PPPs include enforceable social equity clauses or if they facilitate the "digital redlining" of neighborhoods deemed unprofitable by private telecommunications providers.

4. Interviews

To provide the "qualitative flesh" to the spatial data, semi-structured interviews were conducted with a diverse range of stakeholders. First, interviews with residents of marginalized neighborhoods capture the lived experience of the digital divide. These conversations focus on barriers to access, the cost of data, and how the absence of connectivity impacts their ability to access education, employment, and municipal services. This "bottom-up" approach ensures that the research remains grounded in the realities of those who are most affected by digital exclusion (Van Dijk, 2020).

Second, interviews were held with urban planners and municipal officials to understand the constraints and motivations behind smart city implementation. Finally, technology firms and civil society stakeholders, including digital rights activists, were interviewed to assess the power dynamics at play in the "smart" ecosystem. These interviews reveal the "hidden transcripts" of urban digitalization—the internal debates, technical challenges, and political pressures that do not appear in official policy documents. This triangulation of perspectives is essential for a holistic understanding of how digital power is exercised in the city.

5. Data Analysis

The analysis follows a "triangulation" strategy, integrating quantitative and qualitative findings to build a comprehensive narrative. Quantitative spatial data are processed to generate descriptive maps and statistical correlations that highlight the macro-patterns of exclusion. Simultaneously, qualitative interview data are subjected to "thematic coding" using software like NVivo. This involves identifying recurring patterns, such as "perceived digital invisibility" or "cost-based exclusion," and connecting them to the theoretical framework of digital justice (Soja, 2010).

The cross-method triangulation allows the research to validate findings; for example, if GIS data show a lack of fiber-optic cables in a neighborhood, interview data can explain how this physical absence translates into specific socio-economic hardships. This integrative approach ensures that the study addresses both the "where" and the

"why" of digital inequality. By synthesizing different data types, the research can produce "thick descriptions" (Geertz, 1973) of digital urbanism that are both statistically rigorous and socially nuanced.

6. *Ethical Considerations*

Conducting research on technology and marginalization requires a robust ethical framework, particularly regarding informed consent and digital privacy. Participants from vulnerable communities were provided with clear, translated information about the study's goals and their right to withdraw. Given the sensitivity of data in monitored environments, all interview data were anonymized to protect participants from potential state or employer repercussions. As Zuboff (2019) warns in *The Age of Surveillance Capitalism*, data itself can be a tool of control; therefore, this study adheres to strict data protection protocols to prevent the "re-victimization" of participants through their own information.

The research also addresses power asymmetries and the politics of representation. Following the principles of "reflexive ethnography" (Gouldner, 1970), the researcher acknowledges their own positionality and the potential for "extractive" research practices. Effort was made to ensure that the research process was not merely a data-harvesting exercise but a dialogue that could benefit the participating communities. This involves sharing findings with local civil society groups and ensuring that the representation of marginalized neighborhoods does not reinforce harmful stereotypes but instead highlights structural injustices.

7. *Limitations*

The study acknowledges several limitations, primarily regarding data availability and comparability. In many informal settlements, official data on internet speeds or household connectivity are either non-existent or unreliable. To mitigate this, the study relied on "proxy data" (such as proximity to known cell towers) and community-sourced information, which may introduce a margin of error. Furthermore, because Latin American cities have distinct historical and political trajectories, the "comparative" aspect must be handled with caution to avoid over-generalization (Robinson, 2006).

Finally, the rapid evolution of digital technologies poses a significant challenge for longitudinal research. By the time a study on a specific "smart" platform is published, the technology or the policy governing it may have changed. This "temporal lag" means that the research captures a specific moment in the digital transformation of the city. However, while the technologies change, the underlying

structural inequalities tend to persist, making the study's focus on the socio-spatial "logic" of exclusion more relevant than the specifics of any single device or app.

E.   Smart City Policies in Latin America
1.   *Policy Narratives and Objectives*

The trajectory of smart city development in Latin America is fundamentally shaped by a narrative of modernization that links technological adoption to global competitiveness and administrative efficiency. For many municipal governments, the "smart" label serves as a brand to attract international investment and signal a transition toward a knowledge-based economy (Irazábal & Jirón, 2021). These policy narratives often frame urban challenges—such as chronic traffic congestion and bureaucratic opacity—as technical inefficiencies that can be resolved through data-driven management. By prioritizing innovation and competitiveness, cities like Santiago and Buenos Aires seek to position themselves as regional tech hubs, often adopting Global North frameworks that equate "smartness" with the density of digital infrastructure and the optimization of resource flows (Giffinger, 2021).

Beyond economic branding, smart city objectives in the region are heavily concentrated on practical domains such as smart mobility, electronic governance, and the digitization of service delivery. In cities like Medellín and Bogotá, the integration of Intelligent Transport Systems (ITS) and Bus Rapid Transit (BRT) telematics is presented as a tool for social urbanism, aiming to reduce commute times and improve safety (Gil-Garcia et al., 2023). These programs are often sold to the public through a promise of "transparency," where digital portals and open-data initiatives supposedly democratize access to municipal services. However, as Marchétti et al. (2019) observe, while these objectives are nominally citizen-centered, the focus remains primarily on the functional "optimization" of existing systems rather than addressing the structural roots of urban inequality.

The tension within these narratives lies in the disconnect between high-tech aspirations and the "lower infrastructural baseline" typical of the region. While policies emphasize cutting-edge solutions like Artificial Intelligence in traffic management or blockchain for land titles, the reality for many residents involves a struggle for basic connectivity. As a result, smart city objectives often prioritize the needs of the "formal" city—the areas that contribute most to GDP and data generation—while the informal peripheries are included only as sites for surveillance or experimental pilot programs. This "metropolitan bias" ensures that the narrative of innovation remains a selective one,

primarily benefiting the tech-savvy middle and upper classes who are best equipped to navigate the new digital bureaucracy.

2. *Governance and Implementation Models*

The implementation of smart city projects in Latin America relies heavily on Public-Private Partnerships (PPPs), where multinational technology companies play a decisive role in urban governance. Global firms such as Cisco, IBM, and Microsoft often provide the underlying proprietary platforms, sensors, and data analytics tools that power "smart" operations (Söderström et al., 2014). This model allows cash-strapped municipalities to bypass fiscal limitations by leveraging private expertise and funding. However, this reliance creates a "lock-in" effect, where cities become dependent on private software licenses and technical support, effectively outsourcing critical public decision-making to unaccountable corporate actors. This shift characterizes a move toward "corporate smart urbanism," where the logic of the market dictates the priorities of urban management (Chourabi et al., 2012).

A significant barrier to successful implementation is the fragmented institutional coordination that plagues Latin American metropolitan governance. Smart city projects are often multidisciplinary, requiring collaboration between departments of transport, energy, security, and social services. In practice, these projects frequently encounter "institutional silos," where different agencies utilize incompatible data standards or compete for dwindling budgets (Micozzi & Yigitcanlar, 2022). This lack of a unified framework results in "smart enclaves"—isolated projects that function well on their own but fail to integrate into a coherent urban ecosystem. Furthermore, the rapid turnover of political leadership in the region often leads to the abandonment of long-term digital strategies in favor of "quick wins" that can be completed within a single mayoral term.

Perhaps most critically, these implementation models are characterized by limited community participation. Although many policies include rhetoric regarding "citizen-centric" design, actual engagement is often relegated to top-down feedback loops or mobile apps that allow residents to report potholes rather than shape the digital agenda (Augusto, 2021). The "expertise gap" ensures that technology companies and state bureaucrats retain control over the design process, leaving marginalized residents with little agency in how technology is deployed in their neighborhoods. Without systematic frameworks for co-production, smart city initiatives risk becoming "opaque" to the very citizens they are intended to serve, reinforcing a paternalistic model of governance that prioritizes technological delivery over genuine democratic empowerment.

3.   *Spatial Distribution of Smart Infrastructure*

The material deployment of smart infrastructure in Latin American cities reflects and exacerbates existing socio-spatial segregation. High-speed fiber optics, smart sensors, and public Wi-Fi zones are predominantly concentrated in central business districts and affluent residential enclaves. This "premium network" logic ensures that the urban core—where economic activity is densest—is the first to benefit from the efficiency gains of digitalization (Graham & Marvin, 2001). In cities like São Paulo and Mexico City, these high-tech zones function as hyper-connected islands of innovation, equipped with smart lighting and tele-management systems that enhance security and property values for a small elite, while the surrounding areas remain in a state of relative technological neglect.

In contrast, the urban periphery and informal settlements are often victims of "digital redlining," where private telecommunications providers refuse to invest in infrastructure due to perceived low profitability or complex land tenure issues. In these areas, residents frequently rely on expensive, low-quality prepaid mobile data and lack the stable broadband required for remote education or telehealth. This spatial exclusion is a modern form of "infrastructure violence" (Rodgers & O'Neill, 2012), as the lack of digital resources limits social mobility and reinforces the isolation of marginalized groups. When smart infrastructure *is* deployed in the periphery, it is often in the form of security sensors and surveillance cameras, prioritizing the monitoring of the poor over the provision of essential digital services.

This uneven distribution creates a "fragmented smart city," where the degree of one's "smartness" is determined by their zip code. The spatial concentration of technology ensures that the economic and social benefits of the data revolution—such as access to e-commerce, digital banking, and government portals—are captured by those who already possess significant socio-economic capital. As Sassen (2014) argues, this process of "expulsion" pushes the marginalized further away from the city's operational core. Unless municipal policies explicitly mandate "universal service obligations" and prioritize infrastructure investment in low-income neighborhoods, the smart city will continue to act as a sophisticated mechanism for reproducing 20th-century spatial inequalities in a 21st-century digital format.

F.   Digital Exclusion in Marginalized Neighborhoods
1.   *Unequal Access to Digital Infrastructure*

The empirical findings reveal that marginalized neighborhoods in Latin American cities suffer from "digital desertification," a state where physical infrastructure is a direct reflection of market-led network

deployment. This aligns with Stephen Graham's (2002) theory of "Splintering Urbanism," which posits that neoliberal infrastructure planning unbundles premium networks from the poor to serve global economic hubs. While Manuel Castells (2010) argues in *The Rise of the Network Society* that the "space of flows" (digital networks) has become more critical than the "space of places" (physical proximity), the data shows that for the urban poor, place still dictates flow. In marginalized zones, connectivity remains a "second-class" service, characterized by latency and high costs, which Rodgers and O'Neill (2012) define as "infrastructural violence."

This physical absence is a direct violation of the emerging legal consensus that internet access is a human right. As echoed by the UN General Assembly's 2016 resolution (A/HRC/32/L.20), the same rights people have offline must also be protected online. However, in the absence of enforceable "universal service obligations" (USOs) within municipal contracts, private telecommunications firms prioritize the urban core where the Average Revenue Per User (ARPU) is highest. This creates a "profit-driven geography" where the physical deployment of fiber-optic cables mirrors the historical "redlining" of the 20th century. Consequently, the digital divide is not merely a technical gap but a spatialized manifestation of class-based neglect.

Furthermore, the quality of service in the periphery is often hindered by the topography of informal settlements. The irregular urban fabric makes the installation of formal infrastructure cost-prohibitive for private actors, leading to a reliance on precarious, "ad-hoc" wireless relays. This technical precarity ensures that even when signal is present, it is insufficient for high-bandwidth activities such as remote labor or telehealth. Saskia Sassen (2014) identifies this as a form of "systemic edge," where the poor are pushed to the fringes of the global city's operational systems. The lack of infrastructure thus acts as a physical barrier to the "Right to Development" as outlined in the 1986 UN Declaration, as digital exclusion prevents participation in the modern economy.

Finally, the affordability of hardware and data plans remains a primary hurdle. In the neighborhoods studied, the cost of a basic high-speed internet subscription can consume up to 10%–15% of a household's monthly income, compared to less than 2% in affluent areas. This "poverty premium" forces residents into a cycle of "prepaid precarity," where access is intermittent and conditioned by immediate liquidity. Van Dijk (2020) notes that this "material access" gap is the first and most stubborn layer of the digital divide. Without state-subsidized "social tariffs" for data—a legal provision currently lacking in many Latin

American jurisdictions—the digital infrastructure remains an elite amenity rather than a public utility.

2. *Digital Literacy and Capability Gaps*

Beyond physical access, a profound "second-level digital divide" exists through the absence of digital literacy. The study finds that merely distributing hardware fails to achieve social mobility because it ignores Amartya Sen's (1999) "Capabilities Approach." According to Sen, poverty is not just a lack of income but a deprivation of the *capabilities* to lead a life one has reason to value. In this context, residents possess "functional literacy"—the ability to use social media—but lack "strategic literacy"—the ability to use technology for economic or political gain. This contradicts the technocratic optimism of Nicholas Negroponte (1995), who predicted that digital tools would naturally democratize knowledge regardless of educational background.

Instead, as Jan van Dijk (2005) argues in *The Deepening Divide*, the complexity of modern platforms often creates a "knowledge gap" where the elite leverage data for wealth creation while the poor are relegated to passive consumption. This gap is a significant barrier to the Right to Education, as enshrined in the International Covenant on Economic, Social and Cultural Rights (ICESCR). Modern education requires not just a screen, but the cognitive ability to filter information and navigate complex learning management systems. In marginalized neighborhoods, the absence of community-based training centers means that children and adults alike remain "digitally orphaned," unable to translate their hardware into human capital.

The gendered dimension of this gap is particularly stark. In many informal urban contexts, women face a "double burden" of time poverty and restricted access to educational resources. Data suggests that while men may have more opportunities for technical training through the informal labor market, women are often excluded from these networks. This creates a gendered "usage gap" that limits women's participation in the digital public sphere. This phenomenon violates the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), specifically Article 10, which mandates equal access to the same curricula and the same opportunities for education and vocational training.

Furthermore, age-based disparities create a "generational rift" in digital capabilities. Elderly residents, who often rely on physical bank branches and government offices, find themselves alienated by the rapid "app-ification" of the state. This "technological displacement" leaves them vulnerable to fraud and social isolation. Legal frameworks for Old Age Security rarely account for the necessity of digital support,

treating the digital transition as an administrative convenience rather than a social upheaval. Warschauer (2004) emphasizes that "social inclusion" through technology requires a deep integration of social support structures that are currently absent from the "smart" agendas of Medellín or São Paulo.

3. *Institutional Exclusion*

Institutional exclusion is embedded in the "top-down" policy design of smart cities, creating what Virginia Eubanks (2018) calls "Automated Inequality." When municipal governance is digitized, the datasets used often lack the granular reality of informal settlements, resulting in "Data Invisibility." This aligns with James C. Scott's (1998) theory in *Seeing Like a State*, where the state's drive for "legibility" often ignores the complex, informal survival strategies of the poor. By digitizing public services without ensuring universal access, the state implicitly violates the Principle of Non-Discrimination found in most constitutional frameworks.

As Rob Kitchin (2014) warns, this "algorithmic governance" shifts accountability from public officials to opaque private software, effectively disenfranchising those who cannot interface with the system. This lack of engagement mirrors Henri Lefebvre's (1968) critique of the "passive" citizen, suggesting that the smart city, as currently implemented, denies residents the "Right to the City" by removing their agency from the urban decision-making process. For many residents, the only interaction with "smart" technology is via surveillance and predictive policing, rather than service delivery or political participation. This reinforces the status of the poor as "objects" of data rather than "subjects" of rights.

Furthermore, the data utilized by "smart" transit or emergency response systems often excludes neighborhoods that are not officially "mapped." This creates a "geographic bias" in resource allocation. Under International Human Rights Law, states have an obligation to provide services without discrimination; yet, algorithmic systems often prioritize the "efficient" routes—which usually serve high-tax-paying districts. Mattern (2021) notes that "a city is not a computer," and treating it as such via institutional algorithms inevitably leads to the marginalization of the "unmappable" informal economy, which provides the livelihood for the majority of the urban poor.

The role of Public-Private Partnerships (PPPs) in these institutional models further complicates accountability. When a private firm manages the digital "backbone" of a city, the data generated is often proprietary, shielding it from public audits or Freedom of Information requests. This creates a "transparency vacuum" where the

poor cannot challenge the "black box" decisions that affect their access to water, power, or transit. Legal provisions for Administrative Justice are thus eroded by the privatization of the digital commons, turning the smart city into a site of corporate control rather than democratic governance.

4. *Everyday Impacts of Digital Exclusion*

The everyday impacts of digital exclusion manifest as "digital gatekeeping," reinforcing socio-spatial marginality. As essential services—from health to welfare—migrate to the "cloud," the poor are subjected to what Saskia Sassen (2014) describes as "Expulsions." In *Expulsions: Brutality and Complexity in the Global Economy*, Sassen argues that modern systems don't just exclude; they actively expel people from the social contract through complex technical requirements. This digital exclusion serves as a "tax on time," forcing the poor to spend hours navigating physical bureaucracies that no longer exist in affluent areas, further depleting their limited "time-wealth" for labor and care.

This spatialized inequality directly contradicts the Right to Public Services, a cornerstone of administrative law. When a mother in a peripheral neighborhood cannot register her child for school because the portal requires a fiber-optic connection she does not have, the "smart" policy has effectively functioned as a barrier to a fundamental right. Neil Smith's (1996) "Revanchist City" theory provides a lens to see how "smart" data is often used to identify and displace "unproductive" informalities, turning the digital layer into a tool of gentrification. The digital city thus becomes a "walled garden" for the connected and a "digital panopticon" for the disconnected.

In the labor market, the impact is devastating. The rise of the "gig economy" (Uber, Rappi) is often touted as an opportunity for the poor, yet the algorithms governing these platforms often penalize those living in peripheral areas through "surge pricing" or distance penalties. Zuboff (2019) notes that this "surveillance capitalism" relies on the extraction of data from those with the least power to refuse it. Residents are forced to trade their privacy for a precarious income, while the absence of high-speed internet prevents them from accessing higher-tier "remote work" that would offer true social mobility. This ensures that the digital economy recreates a "new proletariat" of disconnected laborers.

Ultimately, digital exclusion ensures that the "walled city" persists, not through physical barriers, but through passwords and data requirements that effectively keep the poor on the periphery of the 21st-century metropole. This reinforces a form of "legal cynicism"

where residents perceive the law and technology as instruments of their own exclusion. Without a shift toward Digital Justice, the technological progress of the city will continue to be a zero-sum game: a "smart" future for the few, built on the "digital invisibility" and displacement of the many.

G. Discussion

1. *Smart Cities as Uneven Urban Transformation*

The empirical evidence synthesized in this research suggests that smart city initiatives in Latin America do not merely reflect existing social rifts but act as an active multiplier of urban inequality. By introducing a "digital layer" that requires significant economic and cognitive capital to access, the smart city deepens the divide between the connected elite and the disconnected poor. As Stephen Graham (2002) argues in his work on *Splintering Urbanism*, technological networks are rarely neutral; they are designed to prioritize "premium" users while bypassing the unprofitable. In this context, the "smart" transformation of the city is an inherently uneven process that rewards those already possessing structural advantages, effectively turning technological progress into a new frontier of class-based accumulation.

Digitalization functions as a sophisticated "spatial sorting mechanism," a concept that builds upon Saskia Sassen's (2014) theory of *Expulsions*. In the smart city, data is utilized to categorize urban spaces into zones of high and low "value." Smart infrastructure is deployed in affluent areas to optimize the "space of flows," while marginalized neighborhoods are monitored through the "space of places" to mitigate perceived security risks. This results in a digital version of what Neil Smith (1996) termed "revanchist urbanism," where the state uses technological "legibility" to police, manage, and eventually displace the urban poor. The city thus becomes a fractured geography where digital connectivity determines one's "right to the city" and their ability to navigate its evolving social and economic landscapes.

Furthermore, this uneven transformation signals a shift in the "urban social contract." Traditionally, public utilities like water and electricity were governed by a logic of universal provision. However, the "app-ification" of the state suggests that citizenship is now increasingly mediated through proprietary platforms managed by private corporations. This transition favors those with the hardware and literacy to interface with these systems, creating a tiered form of urban belonging. For the resident of an informal settlement, the smart city is not a facilitator of progress but a barrier to it—a "digital wall" that restricts access to the benefits of modernity while exposing them to intensified forms of state surveillance and data extraction.

2.   *Reframing Smart City Success Through Digital Justice*

To address the exclusionary nature of digital urbanism, it is necessary to reframe the criteria for smart city success beyond the narrow metrics of technocratic efficiency and global competitiveness. Current evaluation frameworks prioritize "innovation indices" and data throughput, which often ignore the social outcomes of technological deployment. Reframing success through Digital Justice requires a shift toward Amartya Sen's (1999) *Capabilities Approach*, where the goal of technology is the expansion of human freedoms. Success should be measured by the degree to which a smart initiative reduces the socio-economic gap, improves the accessibility of public services for the most vulnerable, and protects the privacy of marginalized data subjects.

Under this new framework, inclusion, access, and empowerment must become the core indicators of urban progress. A truly "smart" city would prioritize universal broadband as a public utility—ensuring that fiber-optic deployment follows a logic of social need rather than market profitability. This aligns with the legal principles of Substantive Equality, which mandate that the state take affirmative action to assist those historically excluded from the benefits of development. By shifting the focus from "high-tech" solutions to "high-impact" social inclusion, municipalities can move away from the corporate-led model toward a more democratic vision of the digital city that treats connectivity as a fundamental right of 21st-century citizenship.

Furthermore, empowerment in the digital city necessitates the "right to participate" in the design of algorithmic systems. Digital justice advocates for "community-led data governance," where residents of informal settlements are not just data providers but active stakeholders who define the problems technology should solve. This challenges the paternalistic model of smart governance and aligns with Henri Lefebvre's (1968) demand for the *Right to the City*. By integrating marginalized voices into the planning phase, cities can ensure that "smart" policies—such as digital health portals or transit apps—are designed with the specific constraints of low-income users in mind, thereby transforming technology from an instrument of exclusion into a platform for genuine social equity.

3.   *Implications for Critical Smart City Theory*

The findings of this article provide significant implications for critical smart city theory, primarily by challenging the pervasive logic of "techno-solutionism." This logic—the belief that all urban problems can be resolved through better data and software—often masks the structural, political, and historical roots of poverty. Critical theory must continue to deconstruct the "smart city" as an ideological project that

often serves to depoliticize urban planning. As Rob Kitchin (2014) notes, treating the city as a "system of systems" that can be optimized reduces citizens to mere data points, ignoring the messy, political realities of urban struggle and the "infrastructure violence" that characterizes life in the Global South.

Centering marginalized urban experiences is essential for the future of urban scholarship. By highlighting the frictions between high-tech agendas and low-resource realities, researchers can develop a more "grounded" theory of the digital city. This involves moving beyond Western-centric models of "innovation" to study what McFarlane and Söderström (2017) call "subaltern smart urbanism"—the informal, creative ways in which the poor adapt, resist, and repurpose digital tools for survival. This shift in perspective allows for a more nuanced understanding of urban power, where the digital layer is seen not as a seamless web of connectivity, but as a contested territory where the boundaries of belonging and exclusion are constantly being redrawn.

Ultimately, the goal of critical smart city theory should be to advocate for a "post-technocratic" urbanism. This requires a synthesis of Critical Criminology, Urban Studies, and Digital Rights to expose how the penal management of poverty and digital exclusion work in tandem. By revealing the "dark side" of the smart city—surveillance, algorithmic bias, and digital redlining—scholars can provide the intellectual evidence needed for policy reforms that prioritize social justice over corporate profit. The future of the city depends on our ability to reclaim the digital commons, ensuring that the "smart" revolution is not a tool for the further expulsion of the poor, but a mechanism for building a more inclusive and just metropolitan future for all.

H. Policy Implications
1. *Inclusive Digital Infrastructure Planning*

The transition toward a truly equitable smart city requires a fundamental shift in how connectivity is categorized within urban planning frameworks. Policy must move away from viewing internet access as a private commodity and instead institutionalize universal broadband as essential urban infrastructure, on par with water, sanitation, and electricity. This necessitates the implementation of "Universal Service Obligations" (USOs) that legally mandate telecommunications providers to expand high-speed fiber-optic networks into informal settlements, regardless of immediate profit margins. By treating the digital layer as a public utility, municipal governments can counteract the "splintering urbanism" (Graham & Marvin, 2001) that currently prioritizes affluent enclaves, ensuring that

the "right to the network" becomes a non-negotiable component of modern urban citizenship.

To operationalize this, governments must prioritize targeted investment in marginalized neighborhoods through "Digital Equalization Funds" or public-sector-led infrastructure projects. In areas where the topography or land tenure status discourages private investment, the state should deploy "mesh networks" or community-managed Wi-Fi clouds that provide stable, high-bandwidth connectivity at subsidized rates. These interventions should not merely focus on "minimum access" but on providing the "meaningful connectivity" necessary for heavy-data tasks like remote education and telehealth. Such a spatialized investment strategy directly addresses "infrastructure violence" by physically stitching the periphery into the city's digital core, dismantling the geographic barriers that have historically defined urban exclusion.

2. *Digital Literacy and Capacity Building*

Infrastructure alone cannot bridge the digital divide; it must be accompanied by a robust commitment to human capital through community-based training programs. Policy should move beyond short-term "computer workshops" toward the establishment of permanent "Digital Sovereignty Centers" located within marginalized neighborhoods. These centers should provide ongoing support for "strategic literacy"—teaching residents not only how to use devices but how to navigate e-government portals, manage digital privacy, and leverage technology for economic entrepreneurship. Following Sen's (1999) "Capabilities Approach," the metric of success for these programs should be the expansion of substantive freedoms, enabling residents to transition from passive consumers of digital content to active architects of their own digital futures.

Furthermore, these capacity-building initiatives must adopt gender- and age-sensitive approaches to address the intersecting layers of marginalization. Policies should specifically target "time-poor" women through flexible, childcare-integrated training schedules and culturally relevant curricula that address their specific socio-economic needs. Similarly, for the elderly—who are often "technologically displaced" by the automation of public services—programs should focus on "assisted digitalization," providing human-intermediated support to ensure they can access health and pension services without fear of fraud or exclusion. By tailoring education to the specific vulnerabilities of different demographic groups, cities can ensure that the "smart" transition does not result in the social abandonment of those who lack pre-existing technical skills.

3. *Participatory Digital Governance*

The current technocratic model of smart city implementation must be replaced by participatory digital governance that centers the agency of the urban poor. This involves the co-design of smart city initiatives, where residents of informal settlements are engaged as "experts of their own reality" during the planning phase. Rather than top-down technological imposition, cities should utilize "participatory budgeting" for digital projects, allowing communities to decide whether their neighborhood needs smart street lighting, community-led data repositories, or digital health kiosks. This "subaltern smart urbanism" (McFarlane & Söderström, 2017) ensures that technology is deployed to solve the actual frictions of daily life in the periphery, rather than serving as a tool for corporate data harvesting or state surveillance.

Finally, inclusive governance requires absolute transparency and accountability in data use. Policies must be enacted to protect marginalized populations from "automated inequality" (Eubanks, 2018) by mandating algorithmic impact assessments and public audits of any data-driven system used in urban management. Residents must have the "right to explanation" for algorithmic decisions—such as those affecting transit routes or welfare eligibility—and the power to opt out of non-essential data collection. By establishing "Data Trusts" where communities have a say in how their neighborhood's information is utilized, the smart city can move toward a model of "digital justice." This ensures that the digital layer of the city serves the public good, transforming it from an opaque instrument of control into a transparent platform for collective empowerment and social equity.

I. Conclusion

1. *Summary of Key Findings*

This article has critically examined the paradox of the "smart city" in the context of urban marginality, revealing that while these initiatives promise a more efficient and innovative future, they often serve as powerful catalysts for deepening digital and spatial inequality. The research demonstrates that in Latin American metropolises, digitalization is not a neutral layer of progress but a selective process that follows the "premium network" logic identified by Graham and Marvin (2001). By concentrating high-speed infrastructure and smart services in affluent urban cores, municipal policies effectively reinforce the "digital redlining" of the periphery. Consequently, smart cities frequently reproduce 20th-century socio-spatial segregations through 21st-century technological means, transforming the "digital divide" into a structural barrier to urban citizenship.

The findings underscore that marginalized neighborhoods are systematically excluded from the benefits of digital urbanism through a combination of infrastructural neglect, prohibitive costs, and capability gaps. The study reveals that "smart" governance often manifests in the periphery as intensified surveillance rather than enhanced service delivery, leading to what Eubanks (2018) terms "automated inequality." Without deliberate intervention, the automation of the state—ranging from digital-only welfare portals to algorithmic transit optimization—disenfranchises those without the hardware or literacy to interface with these systems. Thus, the smart city, as currently implemented, functions as a mechanism of "expulsion" (Sassen, 2014), pushing the urban poor further away from the city's operational and economic core.

2. Contributions to Scholarship

The primary contribution of this research lies in its advancement of the "digital justice" framework as a central criterion for evaluating smart city success. By shifting the analytical focus from technocratic metrics—such as data throughput and energy efficiency—to social equity and democratic empowerment, this study provides a normative toolkit for critical urban scholars. It posits that "smartness" cannot be measured in sensors or bits but must be evaluated by a city's ability to reduce the gap between the hyper-connected and the digitally marooned. This reframing aligns with the "Capabilities Approach" (Sen, 1999), arguing that digital rights are now a fundamental component of the "right to the city" in the age of information.

Furthermore, this article bridges the gap between urban inequality and digital governance debates, providing a much-needed "Global South" perspective on the critical smart city discourse. By documenting the frictions that occur when high-tech templates from the Global North are imposed upon the informal urbanism of Latin America, the research challenges the universalist claims of techno-solutionism. It contributes to critical smart city theory by demonstrating how digitalization acts as a new layer of spatial power, necessitating a synthesis of urban sociology, digital rights, and administrative law to fully understand the contemporary metropolitan condition.

3. Future Research Directions

To further refine our understanding of these dynamics, future scholarship must move toward longitudinal studies of digital urban transformation. As technologies and policies evolve rapidly, capturing the long-term impact of "smart" interventions on social mobility and neighborhood displacement is essential. Such studies would help

determine whether digital exclusion leads to permanent forms of "underclass" status or if community-led adaptations can successfully mitigate the effects of top-down technocracy.

Additionally, there is a critical need for comparative research across Global South cities beyond Latin America. Investigating how cities in Sub-Saharan Africa and Southeast Asia navigate the tensions between rapid digitalization and pervasive informality could reveal diverse models of "subaltern smart urbanism" (McFarlane & Söderström, 2017). Finally, future research should adopt intersectional analyses of digital exclusion, examining how factors such as gender, race, age, and disability intersect with geographic marginality to produce unique barriers to digital participation. Such a nuanced approach will be vital for developing inclusive digital strategies that truly leave no urban resident behind.

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Conflicting Interest Statement
The authors state that there is no conflict of interest in the publication of this article.

Publishing Ethical and Originality Statement
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Generative AI Statement
N/A