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NAVIGATING THE DIGITAL FRONTIER: TACKLING INEQUALITY IN THE FABRIC OF SMART CITIES

Introduction

Today's cities stand as the primary engines of economic development, concentrating more than half of the world's population and contributing over 80% of global GDP (UN, 2022). As they continue to grow and evolve, they grapple with multifaceted challenges that encompass various dimensions of life. These challenges span social issues, such as ensuring equitable access to education, healthcare and housing, as well as environmental concerns related to pollution and ecosystem degradation. Furthermore, cities must address administrative challenges associated with citizen participation and the overall quality of life (Kirimtat et al., 2020; Zheng et al., 2020). Additionally, the emergence of the COVID-19 pandemic has cast a unique spotlight on the inherent strengths and vulnerabilities of cities. While it has underscored the importance of adaptability and resilience in urban planning and governance, it has also accelerated trends in digital transformation, remote work, healthcare delivery and sustainable mobility. The pandemic has prompted cities to reevaluate their priorities, with a newfound emphasis on public health, community engagement and digital inclusion.

In light of these complexities, the smart city concept, despite the critiques from urban scholars, has gained global traction as a model for urban development. Its essence lies in leveraging digital technologies to enhance various urban processes, including those related to governance, transportation and environmental sustainability (Ylipulli & Hämäläinen, 2023). However, the integration of innovative tools and technologies in smart city initiatives have sparked both enthusiasm and concern, illustrating the dichotomy of smart cities. While they are celebrated for their potential to revolutionise urban living they are also criticised for fostering utopian or dystopian visions depending on their implementation and impact.

This paper seeks to explore the multifaceted phenomenon of digital exclusion and inequality within the context of smart cities. This focus acknowledges the dual nature of technology as both a potential equalizer and a divider, especially as cities worldwide embrace digital transformations. Furthermore, it critiques the predominant technocentric focus of smart city strategies, arguing that

such approaches inadequately address pressing urban inequalities like sprawl, poverty, unemployment and housing affordability. Therefore, it will critically analyse how various smart city projects interact with existing digital divides among urban populations, aiming to offer a suite of strategies and policy recommendations designed to ensure that smart city initiatives serve as catalysts for digital inclusion. The paper intends to contribute to a more nuanced understanding of the complex interplay between smart city initiatives and digital divides, ultimately providing a roadmap for leveraging urban technological advancements to achieve more inclusive, equitable and connected societies.

The Smart City

The 1990s witnessed a remarkable period marked by technological advancements and the deep-seated integration of Information and Communication Technology (ICT) into urban services. This epoch gave rise to the concept of the digital city, which envisioned a comprehensive, internet-based representation of myriad city functions, designed to be accessible to all, irrespective of their technical expertise (Couclelis, 2004). The latest concept at the forefront of discussions about the future of cities is the "smart city" (SC), representing an evolution of urban development practices informed by earlier models.

The literature reveals a wide array of definitions and models pertaining to smart cities, with many conceptualisations being recent developments within an evolving landscape (Chourabi et al., 2012; Nam & Pardo, 2011a) or lacking comprehensive documentation, often focusing on specific areas of application (Lombardi et al., 2012). Additionally, the labels 'smart' and 'intelligent' frequently accompany digital city-related applications, serving more as marketing terms (Hollands, 2008) and trending policy concepts (Kourtit & Nijkamp, 2012, 2013) rather than grounded, actionable strategies due to a void in systematic evaluation methods (Angelidou, 2015). Smart cities represent a forward-looking vision for urban futures, embodying aspirations more than concrete realities (Wolfram, 2012). They encapsulate a city's ambitions towards future self-reinvention through the adoption of technology and innovation (Komninos et al., 2013). Nevertheless, transitioning to a smart city is not straightforward; it necessitates careful strategic planning, sustained investment, the allocation of necessary resources and active coordination among all involved parties within a clearly established framework (Nam & Pardo, 2011b).

A great part of definitions of smart cities are technology-centric, emphasising the role of ICTs in enabling cities to operate more intelligently and efficiently. This perspective is straightforward and revolves around the idea that technology can empower cities to work "smart" across various urban systems (Chourabi et al., 2012; Neirotti et al., 2014), which can be further segmented into technological domains (e.g., smart mobility, smart energy) and socio-economic aspects (e.g., smart population, smart economy). Another segment of the literature takes a more expansive view by highlighting the interplay between technology and human capital development. In this broader perspective, a smart city is not solely defined by its adoption of information and communication technology (ICT), but also by its capacity to empower citizens to innovate, participate in societal development and collectively address common challenges for the greater good. This human-centric approach underscores the idea that the "smartness" of a city is intrinsically linked to the active engagement and agency of its residents in shaping their urban environment.

Technology-driven smart cities

The interdisciplinary and critical scholarship has been crucial in uncovering the complexities of techno-urban development, offering insights into the real-world experiences of cities navigating the smart city agenda. Such studies frequently point out the oversight of social and environmental considerations in smart city projects, unless these aspects directly contribute to economic outcomes (Cardullo & Kitchin, 2019; Cugurullo, 2021). However, the inevitable continuation of urban development alongside technological advancements highlights the importance of exploring alternative, more inclusive approaches to smart cities.

Research has explored the influence of ICT infrastructure on the quality of life from the viewpoint of individual capabilities (Sen, 2001), revealing that individuals with digital access are generally more satisfied with their lives (Nevado-Pena et al., 2019). Technology access facilitates the spread of information, leading to improvements in health and education (Ganju et al., 2016). Additionally, ICT enhances subjective well-being by offering more chances for socialising, maintaining relationships with family and friends (Campisi et al., 2015), and boosting civic engagement through easier communication with local authorities and organisations (Hasan et al., 2021). The deployment of ICT in city life also improves experiences with services like bike-sharing, car-sharing and online transactions (Castellacci & Tveito, 2018), thereby enhancing the pleasure derived from life. However, it's important to acknowledge the adverse impacts of ICT, such as the

decrease in face-to-face interactions and social involvement, a phenomenon described as the "internet paradox" (Kraut et al., 1998; Wang & Zhou, 2023).

While the smart city paradigm imposes a new form of social discipline, it shapes citizens' daily lives according to the dictates of smart technology, rather than their own needs and preferences (Zhang et al., 2020). That is why, a major concern with smart cities is the unequal access to smart technologies and services, which can exacerbate existing social inequalities (Nevado-Pena et al., 2019). Differences in knowledge, ability and resources to use ICT devices mean that certain social groups may be marginalised in an increasingly smart society (Vanolo, 2014). Although smart systems aim to create a connected urban network facilitating access to jobs and social opportunities, those who are less "smart" or lack the necessary digital literacy are left with reduced life chances (Helsper, 2021). This phenomenon aligns with the digital divide theory, highlighting the uneven distribution in access to, use of and impact of ICT.

Among the critical themes emerging from this body of research is digital equality (Lutz, 2019), recognised as a pivotal element in the pursuit of just and sustainable smart cities. Digital equality encompasses not only equitable access to the internet and technological devices but also encompasses a comprehensive range of digital skills and the benefits derived from technology use. Hatuka et al. (2020) emphasise the pressing challenges of digitalisation within the smart city context, including the security of personal data, the digital literacy gap among different social groups and the scarcity of equal opportunities for citizens to influence significant decisions. Caragliu and Bo (2021) identified four factors that contribute to enhancing existing divides: uneven diffusion of information and communication technologies, unequal access to digital infrastructure, unequal access to education and skills and unequal access to economic resources.

The interplay between socio-digital inequality and the evolution of smart cities offers another critical lens through which to examine the broader impacts of technological advancements on various segments of society (Ylipulli & Hämäläinen, 2023). Socio-digital inequality refers to the unequal distribution of digital resources and capabilities across different groups within society, influenced by socio-economic status, gender, race and ethnicity, age and education. While initially, digital inequality studies focused on the digital divide—unequal access to the internet and computers starting in the 1990s, by the mid-2000s, especially in Western societies, the focus shifted

from mere access to technology to differentiated use, highlighting the importance of digital literacy and internet skills (DiMaggio et al., 2004). Thus, this form of inequality is not just about the digital divide—the gap between those who have access to digital technologies and those who do not—but extends to the quality and efficacy of that access, including digital literacy and the ability to use technology in meaningful ways.

Future discussions must delve deeper into the mechanisms by which smart cities can reconcile the promise of technological innovation with the imperative of social equity. This entails a rigorous examination of digital equality, emphasising not just equitable access to technology but also the cultivation of digital literacy and ensuring that all societal segments can leverage technology for meaningful benefits. Critical themes such as the security of personal data, the digital literacy gap and the democratisation of urban technology decision-making processes demand further exploration. Addressing these challenges requires a concerted effort from policymakers, urban planners and technology developers to prioritise human-centric and environmentally sustainable practices in the smart city paradigm, fostering an urban future where technology acts as a bridge rather than a barrier to societal inclusion and equality.

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