After the hype: the uncertain future of Smart Cities

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Abstract: The promising vision of Smart Cities has been the driver for many projects, plans, and funding schemes across the globe within the last decade. While making cities 'smarter' has always involved some form of digital innovation in urban spaces, the term has remained open to interpretation. Having spent several years researching Smart City plans and their actual (non-)implementation, we propose that the concept of Smart Cities does not seem useful in practice, as comprehensive urban administration systems are not being established. We present observations to illustrate that we may rather be entering a 'post-Smart City era' as the crucial aspects of both 'smart' and 'city' have become blurred. Finally, we provide some perspectives as to what this new era might entail.

Keywords: Smart City, Smart Region, urban innovation, perspective, autonomy, centralisation

1. Introduction

In recent years, the concept of **Smart Cities** has permeated discourses about urban development, driven by the promise of integrating digital technologies to enhance urban management and quality of life. However, the practical utility of this concept remains under scrutiny. This article critiques the Smart City paradigm by examining its implementation and effectiveness, proposing that we may be entering a **post-Smart City era**. The necessity of rethinking the notion of a Smart City arises from the observation that the term has been widely misused, often serving as a veneer for projects that focus on technological advancement and enable greater surveillance and control rather than genuine social improvement. Our critique highlights a research gap in the existing literature on Smart Cities, which has predominantly adopted a realist epistemology focused on technological solutions without adequately addressing the **socio-political dimensions of urban digital transformation**.

Two years of dedicated collaborative research on Smart Cities have significantly enriched the foundation of this contribution, providing insights and empirical data that inform our current analysis. Our interdisciplinary collaboration and prior experience have allowed us to identify persistent trends and evolving challenges within the Smart City paradigm, offering new perspectives on what seems to work and what does not. Our ongoing investigations have revealed not only the technological potential of Smart Cities but also their socio-political complexities, guiding us to question and refine the assumptions underlying their development. Engaging in a continuous dialogue with Smart City practitioners, we began collecting data in the form of field trips and expert interviews, which helped us reconsider and expand our methodological approach. As cooperation and co-creation are already common practices of Smart City professionals, we tried to include elements of action research and living lab research into our portfolio. This background has been instrumental in shaping our approach to evaluating the impact of Smart Cities, ensuring that our analysis is grounded in a nuanced understanding of both their achievements and shortcomings. Through this informed lens, we aim to present a balanced and critically engaged discussion that contributes to the discourse on urban digital transformation.

This paper provides a critical examination of the Smart City concept, questioning its practical utility and suggesting that we may be entering a post-Smart City era. The primary research question we seek to address is: What are the practical realities and future trajectories of Smart Cities, and why might it be necessary to reconsider the conceptual framework underlying the Smart City paradigm? Ontologically, this research challenges the traditional notion of a 'city' as a bounded urban space by considering broader regional dynamics and decentralised urban-rural linkages. Epistemologically, it adopts a critical stance that questions the underlying assumptions of the Smart City narrative, emphasising the need to integrate social sciences to understand the complex reality of urban digital ecosystems. This perspective has the potential to influence future research and practices in urban planning and technological policymaking, marking a critical step towards reimagining our approach to Smart Cities. We conclude our reflections by designing three speculative scenarios that might shape the future beyond the Smart City discourse: (a) the evolution of Smart Cities into Smart Regions, (b) the transformation into AI Cities, and (c) the potential decline and obsolescence of Smart Cities.

2. Smart Cities: a history

Since the 1990s, the term Smart City has become relatively popular when discussing the relationship and dynamics between technology and urbanism (Sharifi et al., 2021). In various scientific and political contexts, Smart Cities were established as a concept describing how cities may use digital technologies to become smarter, better, and more functional organisms, for example, in terms of economy, mobility, or renewable energy. These sectors of digitalisation acted as a technological backdrop for specific narratives that supported the emergence of initiatives for city development, gratefully adapted by local administration officials as well as international companies and service providers who have driven the process over the last two decades (Bieber & Bihr, 2016).

In their overview, Rapp and Moebert (2023) outline four phases of Smart City development, drawing on technological trends and research literature. A more precise specification of the distinctive phases lists 'telematics' as the signature keyword of the 1980s describing the first steps of networked computing, followed by 'early digitalisation' efforts during the 1990s and 2000s with growing online communication on a global scale. A considerable leap forward was constituted by the rise of highly visible digital infrastructures, such as sensors and cameras, which contributed to the traffic and mobility narrative of Smart City development in the 2010s. Another boost resulted from broad discussions concerning the Sustainable Development Goals (SDGs), particularly discourses on climate and urbanisation, and closely connected to various energy narratives. An underlying current since the early 2000s has been the ubiquitous datafication of urban spaces (Bieber & Bihr, 2016; Hashem et al., 2016), driven by the proliferation of multiple devices and processes that produce, trace, and store huge troves of data, thus creating an Internet of Things (IoT). This development was most recently followed by the rise of urban artificial intelligence (AI) triggered by the advent of large language models and 'transformer'-architectures (Frechen et al., 2023; Weber & Ziemer, 2023).

Recently, there has been a shift towards alternative perspectives of the Smart City, with scholars from interdisciplinary backgrounds advocating for smart system interventions that are more attuned to users' needs, preferences, and comprehension, reflecting 'bottom-up' expressions of smartness (Hendawy & Da Silva, 2023). Simultaneously, concerns about issues in Smart Cities like sustainability, decision-making, security, privacy, and data operations (Sharifi et al., 2021) have been raised since the mid-2010s. This

orientation toward the socio-political dimensions of urban planning and Smart City development has shifted away from more descriptive, technology-based approaches, gradually paving the way for a different set of studies focusing on specific stakeholders, their positions, arguments, controversies, and conflicts.

3. Smart Cities: ideal concept vs reality

Although 'Smart City' has become an often-heard phrase, defining this term remains somewhat difficult. The most basic concept of a Smart City could be derived from the two parts of its name: 'Smart' implies a comprehensive, intelligent, and efficient implementation of digital and technological innovations to improve the city in one way or another, be it from a citizen's or administration's point of view, or both. 'City', on the other hand, evidently refers to the idea that such implementations take place in a potentially large, closely interconnected urban space. Over the past few years, we and many other scholars have extensively discussed Smart Cities from various perspectives and across disciplines, sometimes also in a genuinely interdisciplinary setting (Augusto, 2021); we now posit that both of the aforementioned basic elements ('Smart' and 'City') are challenged in practice – continuously and without a clear path for a solution.

Regarding smartness, we earlier highlighted a fundamental flaw that is found in both the scholarly discourse and the practical implementation of Smart Cities – namely, the tendency for discussions to occur within distinct disciplinary or infrastructural silos (Frechen et al., 2023, Kitchin, 2015). This challenge is also associated with big data in Smart Cities, which tends to remain a sector-centred 'mess' (Frechen et al., 2023, p. 48). Distinct Smart City narratives and corresponding sectors (Aoun, 2013) have resulted in a loosely coupled array of silos, each containing substantial amounts of data and insufficiently connected to each other (Weber & Ziemer, 2023). We also found that notions of Smart Cities are frequently put into practice through a series of fragmented initiatives rather than cohesive, integrated strategies aimed at effectively managing both the city and its infrastructure (see also Attaran et al., 2022). For instance, many cities have initially expressed a commitment to solutions in the smart mobility sector (e.g., HafenCity/Hamburg, Kalasatama/Helsinki), while other cities have focused on smart climate considerations (e.g., Bo01/Malmö, Masdar City/Abu Dhabi). As a result, the prevailing trend in smart solutions con-

tinues to focus on one sector-specific narrative without adequately considering the interconnectedness, or lack thereof, among various other sectors. This fragmented approach in dealing with Smart Cities lacks the essential holistic and cooperative perspective necessary for the effective design and implementation of Smart Cities in the real world (Weber & Ziemer, 2023). Therefore, we have advocated for a departure from mono-disciplinary approaches and for the dismantling of silos at the urban data level, favouring instead the cultivation of innovative urban development through interdisciplinary collaboration (Frechen et al., 2023). Considering this scattered and chaotic landscape in terms of planning and data management, practical applications of the Smart City concept seem to be less smart (and less comprehensive) than the term may imply (see also Gonella, 2019).

Parallel to this, we have also noted the transition from city-centric thinking to a more comprehensive regional perspective (Goldmann & Baum, 2023). In adopting technologies developed by powerful platform and technology providers or partner cities, networks of Smart Cities take shape, easily transgressing traditional city limits. For instance, one resulting phenomenon we observe is smart urban-rural areas, where a larger Smart City spills over into the surrounding area and existing ideas and concepts are extended beyond the actual city limits into the surrounding rural areas (Matern et al., 2020). In contrast to these 'extensions of the city', we also see developments on a hyperlocal scale, where thoroughly planned and technology-heavy 'smart districts' within existing city structures are already in an experimental mode, while the overall effects for the 'host cities' remain unclear (Radulova-Stahmer, 2023, p. 177). This phenomenon is also illustrated by loosely organised smart energy communities that aim to establish self-sufficient units within small portions of the city, trying to break away from traditional infrastructures and administrative jurisdiction (Meleti & Delitheou, 2020). Thus, the traditional concept of a Smart City as one specific urban space seems to have been overtaken by a more complex intertwined phenomenon, which we further discuss in the following section.

In sum, on the one hand, we see *non-smart cities* (sector-specific data mess, infrastructure silos) and, on the other hand, *smart non-cities* (regions, urban-rural areas). In other words, we find a difference between the Smart City as a concept and the phenomenon in reality. This difference is reflected in research about digitalisation, smartification, and urbanism. Here, we aim to push the conversations around Smart Cities toward a more intercon-

nected and holistic understanding of the existing sector-specific governance structures.

4. (Technical) decentralisation vs (administrative) centralisation?

Based on the issues presented above, there is a need for a more comprehensive dialogue that delves into the interactions between the fragmented sectors of Smart Cities and evaluates their impact on urban development. Furthermore, we argue that there has been a struggle between centralised city administrations and the increasing demand for decentralisation, supported by the advanced usage of devices and data in various urban contexts. This tension between centralisation and decentralisation can be interpreted as a reflection of the question of what drives Smart City development: administration, citizens, or technology?

As discussions about centralisation and decentralisation in the context of Smart Cities are often linked to questions about sector-specific challenges, this also applies to questions about the centre and the periphery. While the term Smart City emphasises the importance of a single city and its administration, there is another trend focusing more on Smart Territories or Smart Regions, thus signalling a shift from centralisation towards decentralisation (Matern et al., 2020). The basic idea is that cities are no longer seen as isolated entities (Amin & Thrift, 2002); instead, they are now considered within larger geographical contexts (Matern et al., 2020, p. 2061).

Even if this may sound quite simple, the implementation is not yet convincing. For example, Greco and Cresta (2017) look at the development of Smart City projects in Italy, criticising that many initiatives only focus on specific projects and not on the development of Smart Regions. In contrast, the authors would like to see a process that '[extends] the benefits and new opportunities for development [...] to the peri-urban and infra-urban territories that are physically and functionally in the area of gravitation of the main urban pole' (Greco & Cresta, 2017, p. 283). This would not only allow the regions around a city to benefit from digital progress but would also create a complex system in which the territorial advantages of small cities are utilised to benefit the region as a whole. Matern et al. (2020) emphasise that most of the work on Smart Regions only concentrates on the economic perspective for the purpose of growth and innovation. Instead, they propose a more integrated understanding of Smart Regions

as 'urban-rural areas that are spatially reframed by digital technologies' (Matern et al., 2020, p. 2064; see also Radulova-Stahmer, 2023).

While political initiatives, such as those seen in Europe, have pushed more towards a Smart Region approach (European Commission, 2024; FMFA, 2024), other initiatives have focused on singular, robust Smart City centres, such as the New Administrative Capital in Egypt (Hendawy et al., in press) or Masdar City in the United Arab Emirates. In summary, the developments of centralisation and decentralisation in the Smart City sector are occurring simultaneously at a global level.

In addition to this more spatial notion of 'centre' and 'periphery', the terms 'centralisation' and 'decentralisation' are not only intricately connected concepts but are also consistently characterised by inherent conflict due to their contrasting approach to authority and decision-making (Page & Goldsmith, 1985). Centralisation refers to the concentration of decision-making and management functions within a singular central authority or system, thereby consolidating control and oversight (Çiner, 2022). Pooling resources and data in a centralised manner empowers cities to exploit economies of scale, diminish redundant efforts, and bolster their ability to adapt to shifting challenges and emergencies. Within urban management, centralisation entails consolidating diverse functions and operations, such as traffic regulation, waste management, and emergency services, into an integrated platform or structure. Alternatively, decentralisation entails shifting authority, duties, and decision-making from a central body to lower tiers of governance. This empowers local stakeholders to craft decisions that suit their specific needs, priorities, and circumstances, allowing diverse communities, entities, organisations, or sectors to tackle their localised issues.

It is often assumed that in democratic societies, administrative structures and decision-making processes tend to be decentralised, with power distributed across multiple levels of government and agencies. In contrast, administrative structures in autocratic regimes may exhibit centralised control, with decision-making authority concentrated within a small group or individual leader. As we observe the fragmented Smart City developments, the decentralisation of infrastructure can be perceived as being heavily tied to citizens wanting more autonomy from the original city. However, the question remains: would decentralisation via digital technologies in Smart Cities denote more autonomy for citizens? Therefore, to think about a feasible and realistic implementation of Smart Cities, one must balance efficiency and autonomy in the face of decentralisation trends. Originally, the

concept of digital technologies (and the internet) was often intended to promote decentralisation and autonomy (see Benkler, 2006; Hafner & Lyon, 1998; Shirky, 2008; Turner, 2006). Yet, it has been demonstrated that they can be either misused to exert greater control or can contribute to increased control through the dominance of large digital monopolies (Lovink, 2022; Morozov, 2011; Zuboff, 2018). While this stark contrast between diverging theoretical perspectives might fuel future discussions about the level of (de-)centralisation in Smart Cities, it also bears the potential to destroy the conceptual framework.

5. The benefit of the Smart City hype

Although we provocatively question Smart City as a useful conceptual envelope, we must note that while the concept may not be entirely realistic, it definitely can serve as a catalyst for transformative activities within urban landscapes. As mentioned earlier, we must differentiate between Smart City as a concept and Smart City as a phenomenon. Despite the potential challenges associated with actually implementing the building blocks of Smart Cities, the popularity of the term has brought several benefits. For instance, we have seen that the label of a Smart City and the vision to create them has not only incentivised municipalities to take action but has also sparked a redirection of initiatives and activities in the vast field of urban innovation. As a conceptual trend, Smart Cities have raised awareness about the importance of leveraging technology to improve urban living conditions (Bieber & Bihr, 2016). This raised level of awareness has encouraged innovation and investments in related technologies and infrastructure. Additionally, the Smart City hype has fostered collaboration among various stakeholders, including government agencies, businesses, and citizens, leading to the development of partnerships and initiatives aimed at addressing urban challenges. Furthermore, the attention garnered by Smart Cities has attracted talent and expertise to the field, driving research and development efforts aimed at finding solutions to complex urban issues. Overall, while the practicality of the Smart City concept may be questioned, the hype surrounding it has spurred positive advancements and discussions in urban development. From a scientific point of view, the many – sometimes productive, sometimes erratic – activities in Smart City-oriented research have led to manifold perspectives on a diverse field. Although there will be no coherent scientific community structured by well-built and specialised

academic institutions any time soon, many contacts and discussions across a broad set of disciplines have originated during this process. In this regard, the complexity of the topic and the dynamics of technological progress and innovations contribute to a slow but steady alignment across disciplinary boundaries.

6. (How) will the concept of Smart Cities survive?

Currently, we are at a point where the Smart City concept is fading into various other perspectives. Within this process, the future of the Smart City remains uncertain, reminding us of the importance of the central factors: the development of technology, the political response, and the role of the public. But still, one could ask for alternative scenarios. Instead of a conclusion, we will sketch out three possible futures of digitally enhanced cities:

1) Smart Cities could turn into Smart Regions: Smart City cooperations could turn out to be effective as Smart Regions that overcome the traditional city. Such regions are 'spatially reframed by digital technologies and the respective social practices in a variety of fields (citizenship, governance, economy, environment, mobility, infrastructure) on a discursive, implemental and regulative level' (Matern et al., 2020, p. 2064). It is difficult to predict how this development would come into effect as various technological, environmental, demographical, and political factors blend into each other. To a certain extent, this process would echo the rise of ever-growing 'Megacities' as a popular model of global civilisation. On the other hand, the process might question the duality between 'centre' and 'periphery' that is often translated into the rivalry between 'city' and 'region'. A possible convergence is an intriguing outlook from both an empirical and conceptual perspective.
2) Smart Cities could develop into AI Cities: The discussion and narratives on Smart Cities might be absorbed by or integrated into the next wave of digitisation, that is, AI. The amount of digital data in urban environments collected from various IoT devices, as well as from sensors and cameras, is continuously increasing. Thus, AI tools could routinely be used to process and analyse these enormous troves of information and might also contribute to overcoming the segregated data silos derived from traditional Smart City-development projects. Narratives of 'Urban AI' would then function as a key ingredient in new

paths of urban development, offering AI-driven features and functions such as e-mobility, smart grid, urban climate monitoring, engineering, and more. As Popelka et al. (2023) note, the specific nature of AI Cities as hybrid settings characterises this field of research:

> Digital urban AI systems have intrinsic linkages with physical urban systems, be it through the implementation of autonomous robotics that operate in urban space or through the infrastructure of the urban sensor systems that feed data to many urban AI platforms or by virtue of the fact that the results of urban AI platforms play out in urban space, affecting residents, as well as the built and natural environment. (p. 14)

This could keep the current debates and projects of Smart Cities alive, just with a new spin.

3) The Death of Smart Cities: After commercial investments have ceased and funding periods have ended (and failed to be renewed), these once popular initiatives could slowly dry out and die. Staff would be laid off or transferred to other units, software would not be updated, data silos would become outdated, and these spaces would turn into 'digital lost places'. As most of the research focusing on Smart Cities projects a certain yet unspecified future, there is not much literature about a possible decline or termination of such projects. Nevertheless, a more cultural studies-based perspective could help explore this possible development. Mattern (2021) specifies a broad landscape of 'urban media' in which Smart Cities can be integrated at a certain stage of development. Additionally, a 'failed' Smart City could be understood as a new form of 'digital ruin', a term applied by Garcia and Miller (2021, p. 163) to online environments like 'Second Life' or the digital landscapes of computer games.

All three scenarios suggest that researching the evolution and potential futures of the Smart City concept, particularly in the context of transitioning to a post-Smart City era, will require a multifaceted methodological approach. At this point, while assuming possible futures of the Smart City, we recommend using scenario analysis as an instrument to further explore the transformation into Smart Regions, the development of AI Cities, and the potential decline of Smart Cities. Constructing detailed narratives about the future based on current trends, emerging technologies, and potential policy decisions – for example, by organising a Delphi study with a diverse

set of experts – would help understand different trajectories based on technological, economic, and socio-political variables.

In this article, we have cautiously followed the shifting landscape of Smart Cities. As a closing note, we would like to highlight the need to move beyond siloed discussions and fragmented Smart City solutions (replicating siloed urban administration structures). Instead, a more interconnected, interdisciplinary, and wider-scale approach to urban development should be embraced – while accepting that Smart Cities will always be a work in progress.

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