BUILDINGS & CITIES

Social justice implications of smart urban technologies: an intersectional approach

SPECIAL COLLECTION: DATA POLITICS IN THE BUILT ENVIRONMENT

RESEARCH

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ubiquity press

ABSTRACT

Techno-optimistic visions around smart buildings, homes, cities, grids, healthcare, *etc.* have become ubiquitous over the past decade. Using variations of machine learning and artificial intelligence, smart urbanism (SU) envisions an efficient, digital society. However, research shows that smart technologies reinscribe inequalities by prioritising the interests of the free market, technology-centric governance and data monetisation. Although there has been a growing concern over the injustices SU perpetuates, there is a lack of systematic engagement with power systems such as capitalism or heterosexism that underpin SU visions. A novel framework is presented that situates intersectional justice at the heart of SU. A mapping of 70 cases of 'trouble' with the promises of SU is used to address three core research questions: What are the 'troubles' with SU? To what extent are they intersectional? What can intersectionality add to the development of a just SU? The analysis shows how SU politics play out in relation to how users are understood and engaged, how different actors institutionalise SU and how dominant power systems are challenged. The presented strategy contributes to understanding not just the data politics in urban spaces, but also how they can be renegotiated and re-evaluated to solve multiple and interconnected urban crises without compromising on social justice.

PRACTICE RELEVANCE

Citizen-led initiatives against SU should commit to intersectionality's radical core to dismantle power structures to ensure local smart urban projects do not entrench global business-as-usual neoliberal agendas. Intersectional thinking can create spaces for deliberative dialogues between civil society groups and build alliances across groups that seek to challenge the hegemony of exclusionary urban policies. *Urban planners and local governments*, which are at the forefront of SU applications, should decentre technologies and rather focus efforts on working out how smart technologies can work in conjunction with other kinds of urban interventions, such as social, economic and environmental policy

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KEYWORDS:

cities; data politics; Internet of Things; intersectionality; smart city; smart technology; smart urbanism; social justice

TO CITE THIS ARTICLE:

Sharma, N. K., Hargreaves, T., & Pallett, H. (2023). Social justice implications of smart urban technologies: an intersectional approach. *Buildings and Cities*, 4(1), pp. 315–333. DOI: https://doi.org/10.5334/bc.290

changes, collaborative planning, community development, *etc.* to herald more just urban futures. *Designers of smart urban technologies* should apply intersectional approaches to further challenge '*Homo economicus*' (rational, White, technophilic, able-bodied) as the primary user type and to replace it with diverse user archetypes that express humanity, justice and generosity.

DOI: 10.5334/bc.290

1. INTRODUCTION

Urban spaces are key sites of intersecting global crises (Joss *et al.* 2019), such as the racialisation of borders, crises of care, climate and environmental change, and increased social inequalities (Michalec *et al.* 2019). In recent decades, 'smart urbanism' (SU) has captured the imagination of many policymakers and industry players because it promises a panacea for these critical interconnected problems. As a result, urban spaces are seeing unprecedented 'smartification' (Karvonen *et al.* 2019) with the global market for smart urban technologies forecast to double from US$116 billion to US$241 billion between 2020 and 2025 (Statista 2022). SU is defined in the present paper as the visions of high-tech urban development and digital citizenship that are emerging at the intersection of urban planning and new digital technologies—promoted by international organisations, the corporate sector, and national and local governments. In this respect, Luque-Ayala's (2019) definition is built on to highlight that digital technology is the primary driver of change in SU. SU serves to recast cities as programmable data flows and offers economic, transportation, healthcare and environment solutions, whilst also promising to expand public participation within local democratic processes (Cardullo & Kitchin 2019; Luque-Ayala 2019; Shelton & Lodato 2019). The digital technologies and related infrastructures that are materialising these visions (*e.g.* digital welfare schemes, automated vehicles, urban sensors, smart meters, smart buildings) are what is referred to here as 'smart urban technologies'.

Despite their potential, critical urban scholars have shown that whilst SU narratives present them as a public good, in practice they routinely serve to reinscribe inequalities by prioritising the interests of the free market, technology-centric forms of governance and data monetisation (Kitchin 2021; Krivý 2018). Over the last few years, growing attention has been paid to justice concerns in this transition, with critics highlighting how the sociotechnical assemblages of smart technologies are embedded within and serve to advance rather than challenge the legacies of capitalist exploitation, sexism, racism, ableism and classism (Cardullo & Kitchin 2019; Datta 2015; Eubanks 2017; Goulden 2021; Strengers & Kennedy 2020). Nonetheless, despite growing recognition of the injustices, to the present authors' knowledge, there has not yet been a comprehensive and systematic analysis of the different ways that justice concerns surface in the various promises of SU (Rosol & Blue 2022). Critical smart urban scholarship has made some progress here, but emphasises reformist measures around improving inclusivity in technical and procedural design, without engaging with systems of power such as capitalism or heterosexism that underpin smart urban deployments. Without such an engagement, it can be argued that there is unlikely to be a fundamental shift in the injustices inherent to contemporary visions of SU (Kitchin 2021).

This paper applies an intersectional approach to develop a more transformative perspective to just SU. Drawing on the works of intersectional and feminist STS theorists (Haraway 1991; Kennedy 2005; Strengers 2022; Wajcman 2007) and scholars of intersectional social justice (Ishkanian & Peña Saavedra 2019; Lutz 2014; Williams 2021), the present paper develops for the first time a framework that situates intersectional justice at the heart of SU. This is done through a systematic mapping of 70 cases of 'trouble' (opposition, alternatives and glitches with SU) with the utopian promises of SU drawn from both academic and non-academic sources. Across the cases, three core research questions are addressed:

- What can an intersectional framework add to the development of a just SU?
- What are the 'troubles' with smart urban technologies?
- To what extent are the 'troubles' with smart urban technologies understood as intersectional?

Through this threefold framework, a more complex understanding of the social relations of power can be developed which can help align strategies for SU with ongoing intersectional struggles for gender, climate, racial justice, *etc.* The analysis will show how these politics play out in specific urban settings in relation to how users are understood and engaged, how different institutions embed smart urban technologies in ways that maintain social stratification, and how dominant systems of power—such as around racism, sexism, classism—are (or are not) challenged in the quest for smart urban futures.

The paper is structured as follows. The next section explores the social justice implications of smart urban technologies before introducing intersectionality and outlining how it is applied here to SU. Section 3 summarises the methods. Section 4 details the findings. Section 5 draws out key implications for future research and practice in relation to intersectionality in SU.

2. SMART URBANISM, SOCIAL JUSTICE AND INTERSECTIONALITY

Since the emergence of cybernetic interventions in urban planning in the 1980s (Söderström *et al.* 2014), several terms around 'smart'—intelligent, wired, innovative, digital, *etc.*—have emerged (Hollands 2008). Hollands argues that the terms themselves are often conflated and borrow one another's assumptions, but that whichever term is used, proponents of such digital transformations share the belief that the ubiquitous presence of connected technologies in urban environments, households and personal devices will optimise patterns of consumption, and assert the centrality of big data in attempts to improve urban governance (Krivý 2018).

Smart urban technologies can provide automated, personalised services and present a range of benefits for their users from healthcare and entertainment to nutrition and energy management. With the smartification of urban spaces, there is a simultaneous smartification of public and private infrastructure and the emergence of new synergies between government and industry. According to Sadowski (2020: 12), the emergence of 'smart' as a term across public and private sectors is a coordinated push towards societies being transformed into an interconnected 'system of systems' where individuals are recast as data points for achieving better control. This vision of smart cities as a 'smart entity' depicted in Figure 1 brings out how smart technologies populate different scales and spaces, while embodying the emerging regime of data capitalism (West 2019).

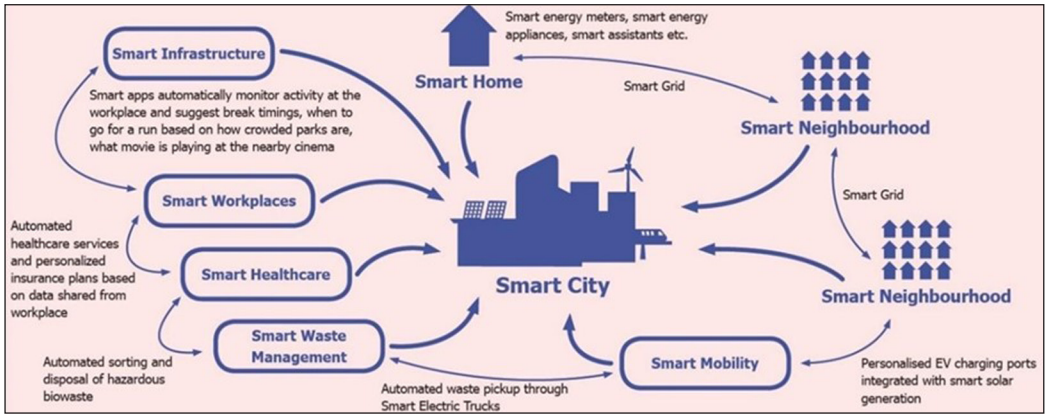

Figure 1: A technosolutionist vision of the smart city as a 'smart entity' with integrated smart systems.

Source: Aaron Kopp.

2.1 SOCIAL JUSTICE IMPLICATIONS OF SMART URBAN TECHNOLOGIES

Despite the growing appeal of SU, it has been under scrutiny for issues such as its focus on technosolutionism, expert-driven bottom-up models of citizen participation, and issues of privacy and security (Nilssen 2019). Krivý (2018) highlights that the elusiveness around exact definitions

of SU is part of its strategic appeal because it enables utopian discourses to be manipulated by key institutions to suit their momentary agendas. Vanolo (2014) argues that visions of SU have constructed a new hegemonic urban identity or 'smartmentality' that functions as a disciplinary mechanism pressurising municipalities to pursue 'smartness'. Cities that do not adopt this technologically advanced narrative, and follow different development paths instead, are implicitly reframed as backward (Vanolo 2014).

Krivý (2018) highlights how this hegemonic epistemology is influencing urban planning, reinforcing incumbent geopolitical power dynamics, directing investment flows and modifying everyday life. The linear, data-intensive models of SU have been shown to be incompatible with the unpredictable, informal character of the urban (Karvonen *et al.* 2019), and critiques have demonstrated how the entrepreneurialisation of the urban reproduces social inequalities (Datta 2015). However, only relatively few critiques of SU have engaged directly and systematically with social justice (Rosol & Blue 2022: 13) and this paper agrees with Krivý (2018) that these have often been 'auxiliary', *i.e.* they address particular symptoms of injustice in SU whilst often leaving the foundational causes and contradictions unexamined. What is needed, therefore, are critiques that actively resist and challenge the fundamental beliefs of SU by repoliticising its discourse and focusing squarely on diverse social justice concerns and outcomes (Kitchin 2015). It is argued here that intersectionality offers an important way forward in developing this more transformative approach to justice that can help to identify and tackle the root causes of inequalities.

2.2 INTERSECTIONALITY AND TRANSFORMATIVE SOCIAL JUSTICE

The term 'intersectionality' was first coined by Kimberlé Crenshaw, who argued that social justice analyses must grapple with the inequalities created by gender and race interacting together to uniquely shape Black women's experiences (Crenshaw 1989). Intersectionality refers to the intersections of and interactions between gender, race and other social categories in individual lives, social practices, institutional arrangements and cultural ideologies, and the outcomes of these interactions in terms of power (Davis 2008). Crucially, intersectionality draws attention to how different systems of oppression compound and co-produce each other to create unequal power dynamics. In this sense, it should not be thought of as merely collecting oppressions and simply adding up analyses linked to gender, race, class, *etc.*, which is a common misconception (Lutz 2014). Instead, it seeks to understand the dynamics of interaction between different oppressions showing how different oppressions shape and impact one another. Since its inception, intersectionality has been developed as a theory and praxis and has been widely used in critical feminist scholarship (Kennedy 2005; De Vita *et al.* 2016).

Intersectionality should be considered an orientation (Lutz 2014) that enables thinking about contingency and connectedness in social and political phenomena and a refusal to reduce phenomena to single causes. As Williams (2021) writes in her intersectional analysis of social policy, it offers social scientists a kind of transformative thinking that can help visualise and practice in the present what could bring reparative change for the future. She argues that this transformative thinking should be developed by taking inspiration from prefigurative practices in global feminist, anti-racist and environmental struggles which seek to foreground the aspirations, experiences and needs of diverse individuals. By seeking to bring different social justice struggles together, and recognising both their similarities and specificities, intersectionality thus seeks to create space to foster alliances and solidarities between different social justice struggles and cultivate deep deliberative dialogue required for transformative change. Intersectional practice requires reflexivity to acknowledge how inequalities transform under different social settings and to be prepared for 'uncomfortable conversations' (Ishkanian & Peña Saavedra 2019: 996).

2.3 AN INTERSECTIONAL FRAMEWORK FOR JUST SMART URBANISM

In developing an intersectional framework, this paper brings together existing work on intersectionality with insights from feminist science and technology studies (STS). Specifically, two crucial insights are drawn from the existing literature on intersectionality: (1) its transformative focus on examining (and seeking to dismantle) intersecting power-systems such as racism, sexism

DOI: 10.5334/bc.290

and colonialism (Overstreet *et al.* 2020), which has often been missing from critical SU scholarship; and (2) its focus on the diverse and situated experiences of different users which contrasts with the general, universal, unspecified and undifferentiated figures typically imagined as the users of smart urban technologies (Shelton & Lodato 2019). A third focus, from STS work on smart technologies, explores how, through the co-production of technology and society, sociotechnical processes also serve to construct and institutionalise unequal social categories and relations to create intersecting axes of inequality (*e.g.* Benjamin 2019).

Various critical approaches have been used to question neoliberal and capitalist-driven agendas in smart city initiatives, develop more transformative visions and add new layers of arguments to critical scholarship. For example, Sheikh *et al.* (2023) discuss expanding inclusivity beyond diverse human subjects to include non-human and more-than-human subjectivities in digital urban transformations. Yang (2020) uses a genealogical approach to critique the privilege accorded to current smart city applications, arguing that critical scholarship must address historical and cultural aspects of the smart city. West (2019) examines the terminology behind data capitalism and highlights how it enables an asymmetric redistribution of power with an aim to place accountability on big tech firms driving the smart city transition.

While most critical SU scholarship has focused on critiquing the actions of state and corporate actors and their digital systems, a smaller body of literature explores alternatives to the current technocapitalist model. Lynch (2020) examines grassroots initiatives in Barcelona, challenging techno-utopian imaginaries and promoting decentralised control and decision-making. Lynch also recognises the need to address gender and racialised inequalities in a harmonious way. March (2018) brings in degrowth perspectives and argues for critical scrutiny and appropriation of technologies to enable alternative urban transitions focused on socio-environmental justice. Although these critical stances in the SU literature share commonalities with the present proposed framework, the fresh perspectives that intersectionality could add are elaborated below. These have also informed the development of the framework.

First, due to intersectionality's commitment to going beyond tinkering within the same frame, and unwavering focus on dismantling power systems, intersectionality can help re-evaluate and shift values; reconceptualise entrenched, unquestioned logics received through capitalism, patriarchy, heterosexism, ableism, *etc.*, and embrace the complex subjectivities of the many different types of users. Second, intersectionality's focus on critical self-reflection and interrogation can help scholars question the legitimacy of the claims SU proponents make towards sustainability, citizens, justice and decoloniality, exposing cases where this is being done to mask pro-market, colonial, state-driven agendas. Third, intersectionality brings in the perspective of 'asking the other question'—practitioners examining an issue for racism must ask themselves 'Where is the patriarchy in this?' (Matsuda 1990: 1189). It is insufficient for a holistic critique of SU to engage with just one form of subjectivity such as race or gender, but rather how they co-constitute each other. Intersectionality thus focuses on 'racialised gender' and 'gendered racism' rather than just merely race or gender, or for that matter race and gender. Fourth, intersectionality's origins in Black feminist reformist thought can repoliticise the SU discourse by calling into question the roles of actors in institutionalising inequalities and injustices—challenging SU narratives that hide behind the ubiquity of digital technologies to render banal the intrusive and anti-democratic nature of some applications of smart technologies (Ferreira *et al.* 2022). Finally, the intersectional framework proposed herein addresses Kitchin's (2015) critique that critical urban scholars rarely undertake applied research aimed at informing new SU initiatives, preferring to critique instead. The presented framework not only can help critique 'actually existing' smart city developments in hindsight, but also can be helpful in interrogating the users, institutions and power-systems embedded within ongoing and future SU applications.

In the rest of this section, this framework is outlined for 'doing' intersectionality (Kennedy 2005; De Vita *et al.* 2016; Lutz 2014; Overstreet *et al.* 2020) in the context of SU. Three intersectional approaches are proposed based on users, institutions and power systems (Figure 2). Intersectionality could be pursued through any one of these approaches in isolation, and can help generate new interventions, problem definitions and recommendations for developing a more nuanced understanding of the social justice implications of smart urban technologies.

2.3.1 User-focused approach

This approach is oriented towards the diversity of individual practices and experiences that challenge the dominant imaginaries of smart technology development such as the 'resource man' (Strengers 2014) and '*Homo economicus*' (Williams 2021)—White, rational, able, autonomous men. Even in considering diverse experiences, there is a risk that current analyses of smart technologies fragment people's experiences, and there is a need to adopt approaches:

> that facilitate exploration of the relationship between all these aspects of lived experience and the social and technological structures within which those experiences take place.
>
> (Kennedy 2005: 473)

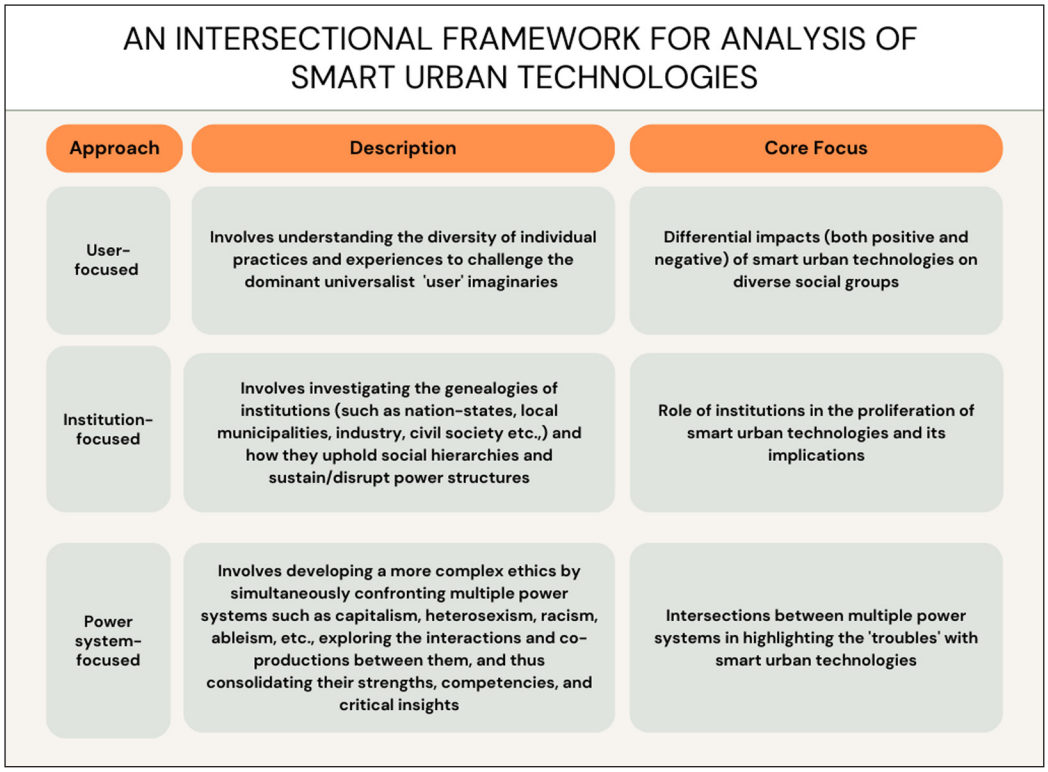

Figure 2: Summary of the intersectional framework.

Through in-depth engagement with diverse groups of individuals, intersectionality helps practitioners reflect on the intersecting and dynamic axes of gender, race, class, and understand how they are interconnected and reconstitute individual identities, preferences and practices. Therefore, it can help identify omissions and serve to counteract and deconstruct universalist approaches. By reflecting on the diversity of individual experiences, this approach provides an understanding of inequalities as interlinked, shifting and multifaceted, constituting both penalties and privileges (Kennedy 2005; Overstreet *et al.* 2020). It can help better understand the differential impacts of SU on diverse populations—highlighting the exclusionary nature of contingent methods of technology development.

This approach also creates the possibility of a deep dialogue across lived experiences of different groups with similar technologies, offering a process through which a situated-yet-global ethics can be formed to judge practices, policies and social institutions (Williams 2021). Furthermore, paying attention to the different ways that users appropriate and reconfigure technologies could inform the kinds of data they collect, making way for more just care and welfare while also providing crucial insights into the links between ethnicity, gender, sexuality, income, *etc.* which can further inform social policy on vulnerability.

2.3.2 Institution-focused approach

This approach involves investigations of the genealogies of institutions (such as nation-states, local municipalities, industry, civil society, *etc.*) and how they create and uphold social hierarchies and sustain/disrupt power structures. This approach expands understandings of smart technologies as not just the dynamic outcomes of the alignment of current technical, economic and sociopolitical forces, but also as historical forces and in 'unmasking' how smart technologies are deliberately institutionalised and by whom.

It achieves this by developing historical perspectives on the ways that powerful institutions have contributed to processes of injustice such as disembedding, dispossessing, dehumanising, colonising and commodifying people (Williams 2021). Therefore, it forces analyses to dwell on the institutionalisation of racism, sexism, classism, and other forms of discrimination and spark reflections on how they are embedded in institutions and propagate transgenerational trauma experienced by vulnerable groups such as those affected by genocide, slavery and colonialism.

It could thus help provide accountability in the context of rapid proliferation of SU in increasingly neoliberal settings, characterised by a blending together of roles, responsibilities, and power of private and public institutions. Its focus on institutionalisation foregrounds past processes which are emulated in the present and how they might create irreversibility or path dependencies for smart technology users. It is transformative because it presents an opportunity to acknowledge and repair history and pursue reparative justice (see Rosol & Blue 2022 for a definition). Constructing technologies for the benefit of non-elite groups requires empowering those who are excluded not just in design discussions, but also to structural positions that allow them genuine influence—this approach thus calls for structural interventions and can help unmask tokenistic inclusions presented in the form of legitimate participatory methods.

2.3.3 Power system-focused approach

Third, and finally, a power system-focused approach to intersectionality involves developing a more complex ethics for smart urban transitions by going beyond a focus on single axes of oppression one at a time, towards simultaneously confronting multiple power systems such as capitalism, heterosexism, racism, ableism, *etc.*, exploring the interactions and co-productions between them, and thus consolidating their strengths, competencies and critical insights. Social movements and critical social science theories provide thought-provoking ideas that can be turned into insights and action. For example, work on decoloniality engages with the unsettling of social relations of power upon which modern societies and their knowledge are built, and creates a new narrative based on submerged knowledge of colonised others. It thus inculcates 'border thinking' by recentring epistemologies towards those marginalised by coloniality and this in turn makes them become the producers of morality and ethics while those outside/farther away from the borders, *i.e.* in the centres of power, have the responsibility to listen (Dunford 2017). Anti-racist schools of thought bring reparative justice to the fore, centring discussions on White privilege and the relevance of imperialist histories (Benjamin 2019). And, inspired by the LGBTQIA+ movement, queer theory transgresses sexual boundaries and blurs the foundations of identities and understands how queerness simultaneously evades and challenges heteronormative power structures (Gambino 2020). Thus, different struggles expose different mechanisms of injustice, such as privatisation, extractivism, exploitation, omissions, *etc.*, and therefore a combination of their insights can make demands for justice more holistic.

This approach attempts to systematically bring these perspectives into conversation with one another and to reflect on their commonalities, strengths and insights. As Rosol & Blue (2022) highlight, remedies to address one dimension of injustice in urban digital transformations must necessarily extend to others, and therefore solutions offered by one critical perspective on SU must inform others too. A similar approach has been applied by Williams (2021), who argues that this process of harmonising critiques, or developing an intersectional multifocal framework, can provide new and transformative perspectives. Importantly, Williams cautions that this must not be done in a simple 'additive' way. Rather, commonalities should be identified in ways that that do not lose sight of specificities of difference. As laid down by intersectional Black feminist scholars,

the power struggles of Black women are simultaneously similar to and different from those of Indigenous women, with variations across different diaspora around the world (Overstreet *et al.* 2020). A power system focused approach to intersectionality must therefore acknowledge this complexity. An ideal application of this framework would therefore recognise the specificities of these struggles and respect the significance of their analyses of power asymmetries. This approach should strike a balance between becoming too specific and therefore siloed and becoming too universal and therefore abstract (Kennedy 2005).

In the subsequent sections these three approaches are used to explore the extent to which current work on smart urban technologies—from both academic and non-academic sources—is being pursued in an intersectional manner.

3. METHODS

This paper's methodology explores whether and how social justice concerns are being addressed in approaches to SU, and the extent to which such concerns are understood as intersectional. In seeking to explore the social justice implications, the paper began by searching for global instances of tension, opposition, contestation and resistance to SU, which is framed as 'troubles', drawing inspiration from Donna Haraway's *Staying with the Trouble* (Haraway 2016). Haraway argues that the 'troubles' of global crises humanity faces are not vague, abstract or universal, but are specific and situated, and that attempts to escape from the 'troubles' are a 'techno-fantasy'. These closely resemble the promises of smart utopian (Sadowski 2020) visions that offer techno-solutions to intersecting urban crises.

'Staying with the trouble' involves an acknowledgement of the complexities of wicked problems, and a critical reflection on cultivating ethical 'response-abilities'. The present analysis takes this literally and 'troubles' are identified as cases of resistance, opposition, errors, conflicts and confrontation to smart visions which disrupt the techno-optimistic status-quos around SU. These troubles emerge globally in many different forms, engaging with real-world contexts onto which smart utopias do not neatly translate. Thus, cases of trouble in the academic and grey literature are systematically mapped. A 'case' is defined as an instance of SU being 'troubled' and/or causing 'troubles' in a 'situated' manner, *i.e.* in a specific geography or towards a certain demographic (excluding low-income households). The cases are then analysed in order to understand to what extent they engage with aspects of intersectional social justice.

Using the approach to systematic mapping employed by Pallett *et al.* (2019), academic and non-academic online sources to identify cases were searched. First, a list of synonyms for 'smart' ($n = 7$), 'urban' ($n = 8$) and 'trouble' ($n = 21$) was developed. Appendix B in the supplemental data online gives the full list and search terms used; Appendix A online lists the case studies; Appendix C online has further detailed information about the case studies. Searches were conducted manually and carried out on Scopus and Google (a new cache clean browser was installed) between September and November 2022. During the final filtration stage of the mapping, the selected cases were classified into one of the three broad categories of troubles described in Table 1.

Table 1: Three categories of 'trouble' with smart urban technologies.

WHAT ARE THEY?	DESCRIPTION
Errors, glitches, dissonance	Cases that provide evidence of errors or glitches post-implementation of smart urban technologies, or that identify dissonance between the claims being made for smart urban technologies and their actual impacts in certain contexts or for specific groups
Alternate visions	Cases that present alternative approaches to or visions of smart urban technologies which seeks to expand or reform the rhetoric around smart technologies, or that present alternative smart futures which promote more democratic, emancipatory or just outcomes
Opposition and resistance	Cases that evidence instances of resistance, conflict or protests against smart urban technologies

Scopus was searched exhaustively (Figure 3 shows the steps), and 44 cases of trouble were selected for further analysis. Google searches were conducted to complement these results. The first 1500 search results were screened by their titles until the results became irrelevant, *e.g.* when the results led to webpages that described fixes to common 'errors' with smart technologies by providing user manuals. Thus, 26 additional cases were identified, and the search yielded academic and grey literature, media reports, websites, and op-eds. Smart urban scholarship should prioritise diverse geographies and demographics beyond canonical examples (Kitchin 2015). This additional principle guided the selection of the final corpus, resulting in the inclusion of some academic papers through the Google search as well (*e.g.* case 64; Appendix A in the supplemental data online has the full list of cases). The final corpus of 70 cases was then read in-depth and analysed first for general characteristics, such as the socio-material aspect being critiqued (technology, urban policy, *etc.*), geography, *etc.*, and then using this framework (Figure 2) for doing intersectionality. This will be elaborated further in the next section.

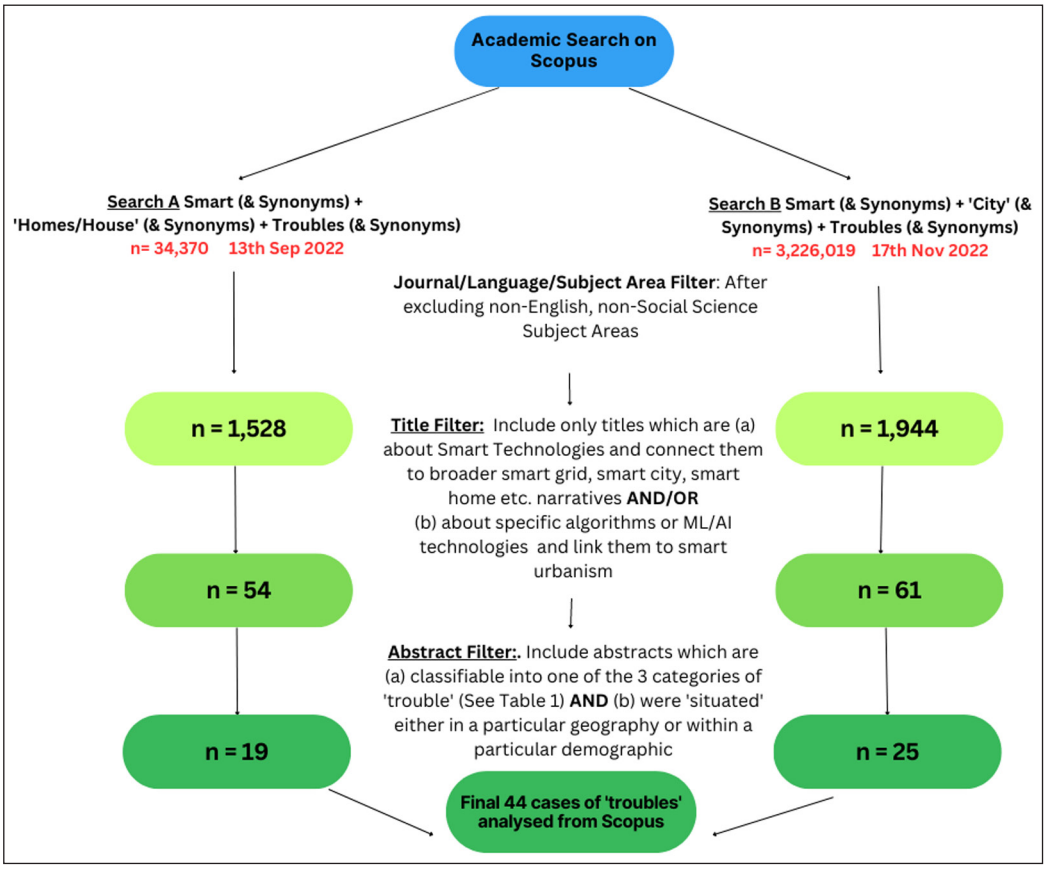

Figure 3: Screening and selection process for the 44 cases of 'trouble' from Scopus.

It is important to acknowledge that the final corpus of 70 cases provides only a partial account of the 'troubles' with SU both due to the limitations of the literature itself and the sheer diversity of the different approaches in which they can be framed. The intent was not to provide a comprehensive overview but rather to develop a diverse, contemporary and substantial evidence base to ground the present intersectional analysis. The chosen methodology could have resulted in some relevant cases being excluded, due to both the algorithmic processes of the search engines as well as manual error.

4. RESULTS

4.1 OVERVIEW

Of the 70 cases of trouble, 44 were academic publications identified via Scopus (63%), seven were academic publications identified via Google (10%) (a total of 51 academic sources), and 19 were web-based articles, media reports and op-eds via Google (27%). As Figure 4 shows, diverse

geographical settings are represented, although the majority (46) were from the Global North (66%). This could partially be attributed to the English-language setting of the searches, even though it shows a bias in the dominant literature on SU critiques. Figure 5 shows that the cases examined various socio-material aspects of SU. The majority of cases (30%) focused on whole-city initiatives, while a small percentage (7%) directly addressed surveillance related to specific smart technologies. Smart home technologies were the focus of 31% of cases, and 16% focused on smart energy technologies (such as smart meters). Three cases (4%) critiqued research agendas or digitalisation of urban spaces in a more general sense, rather than directly addressing smart urban technologies or projects.

As Figure 6 indicates, errors, glitches or dissonance were the most common types of trouble found in the corpus, accounting for 34 of 70 cases. For example, case 35 discussed ethnographic research on a smart neighborhood initiative in Singapore, which revealed that residents often did not receive or understand basic information about the initiative, leading to little knowledge about what was happening or how they were supposed to be involved. These cases showed how residents' everyday lives often undermined or frustrated the idealised and universal outlook of the smart city programme in predictable ways, such as being unavailable at crucial times.

The least common type of trouble was alternatives to smart technologies or cases proposing alternative scenarios for their use (15 of 70). Case 67, for instance, described the efforts of web platform 'Thingful' to combat big tech's top-down policies and promote engaged, rather than just smart, urban spaces. Thingful enables urban residents to access and use valuable urban data by mapping public and private datasets and making the data available for free according to the principle of open knowledge, thus offering an alternative vision to free apps such as Google Maps, which monetise the data.

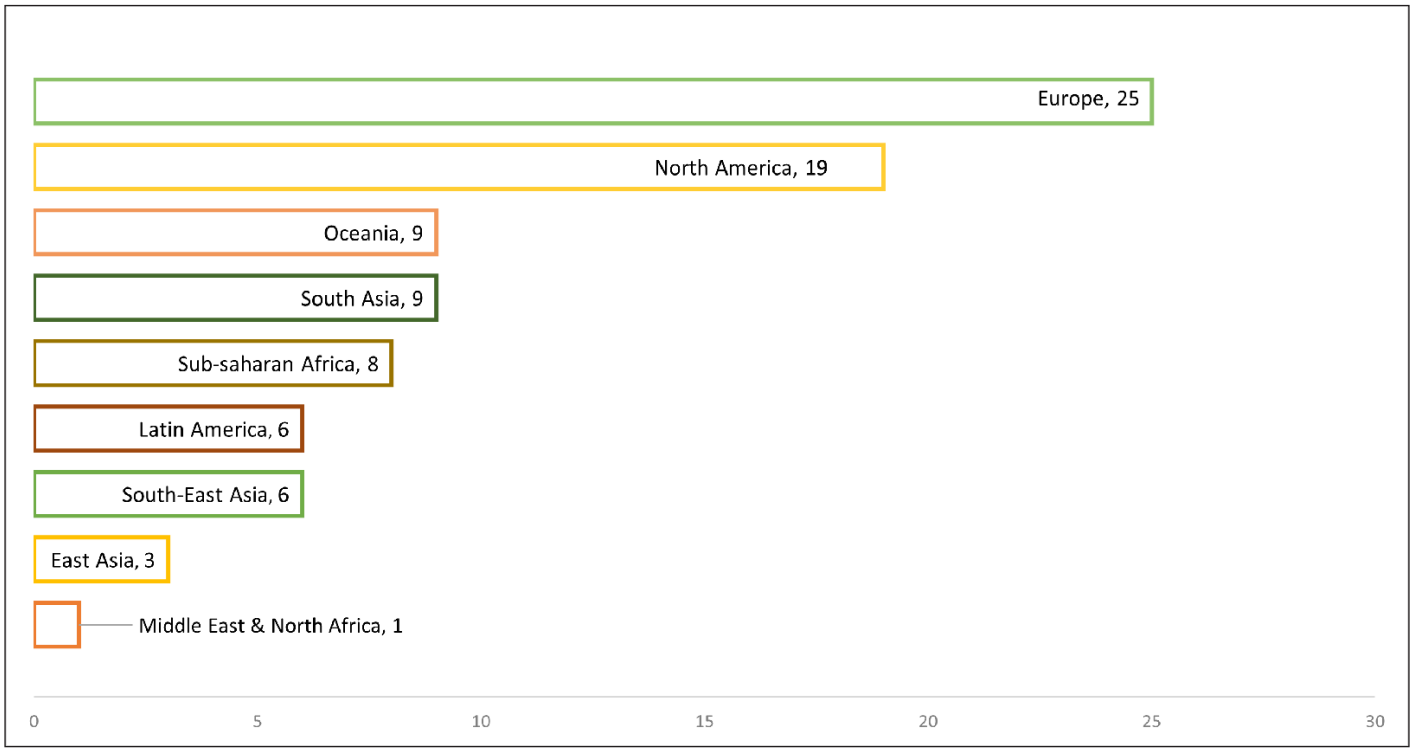

Figure 4: Geographical distribution of cases by world region.

Note: Six cases represented 'troubles' in more than one world region, one (case 48) in all world regions and one (case 11) had no specific geographical focus.

The third type of trouble related to existing empirical evidence of conflict and struggles against SU and represented 21 of the 70 cases. Examples include cases 24 and 59 that show different forms of trouble with the Google subsidiary Sidewalk Labs (SL) in the widely discussed Waterfront Toronto project. Case 24 focused on citizen-led initiatives that raised serious concerns around SL's involvement, while case 59 is an interview with a former privacy officer of SL who resigned in protest against surveillance issues due to the project.

Notably, trouble centred on forms of conflict, protests and direct action dominated the search results from non-academic sources such as media reports (13 of 19), but was the least common type of trouble among the academic sources (7 of 51) highlighting the need for academic research to engage more with confrontations with smart technologies which stem from grassroots initiatives and engage more directly with social justice.

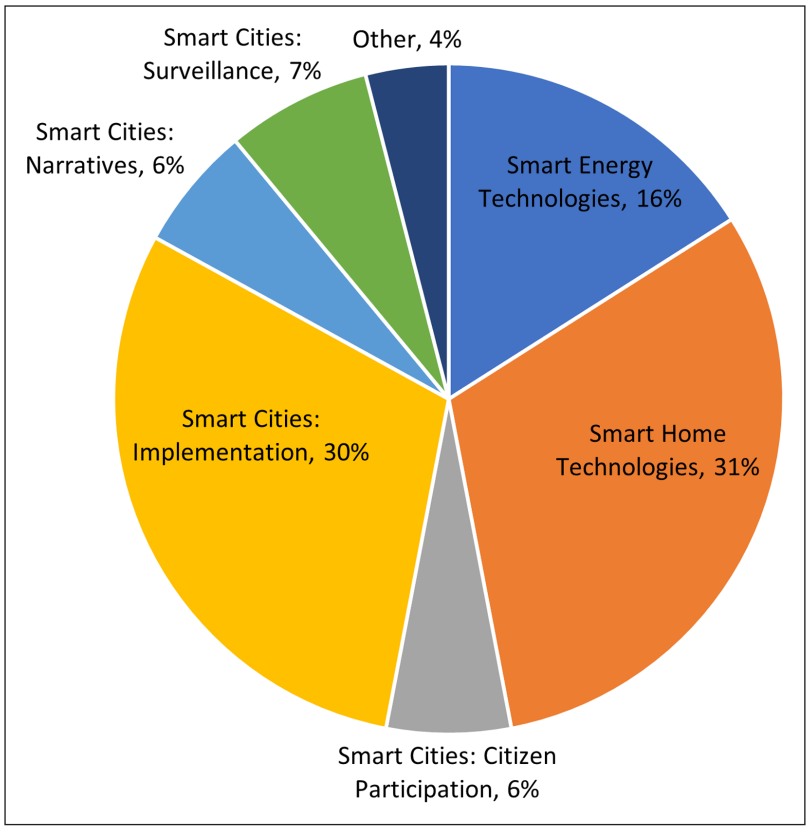

Figure 5: Distribution of technology/project focus across the cases (n = 70).

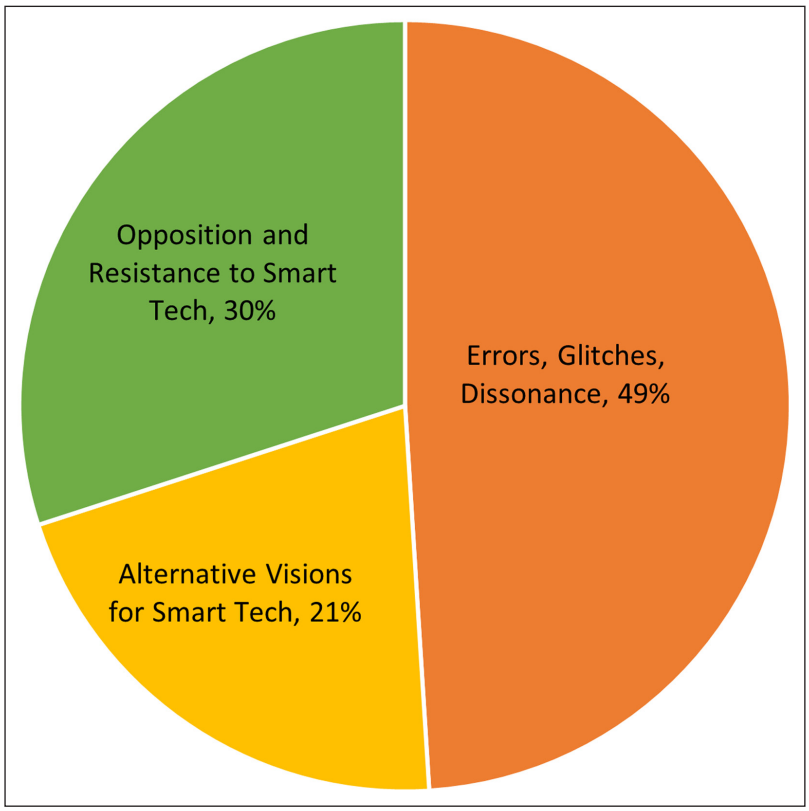

Figure 6: Distribution of different types of 'trouble' (n = 70).

Having described the overall nature of the results, the next three subsections explore the presence of the intersectional approaches across the cases. It is notable that only one of the 70 cases explicitly used the term 'intersectionality'. The three approaches to intersectionality (Figure 2) were absent from 16 cases (of 70) which simply identified technical glitches or suggested novel methodologies, but without explicit focus on users, institutions or power-systems. Of the remaining 54 cases in which these approaches were present, only 39 (of 70) explicitly mentioned 'justice' or 'inclusion' or 'equity'. Whilst justice is an important and growing concern in this area, it has not yet been given the attention it deserves in relation to SU. Crucially, these three approaches were not mutually exclusive. Of the 54 cases that employed the intersectional approaches in some form, two employed all three, 11 only two and 41 only one.

4.2 USER-FOCUSED APPROACH

This was the most prevalent in the corpus, present in 42 of the 54 cases of trouble. This shows that the most common way in which concerns relating to intersectionality are currently being addressed is through cases that highlight that diverse groups of people experience the benefits and risks of smart technologies in differentiated ways. For example, case 45 concerns efforts by smart city initiatives in Portland, Oregon, to tackle the emergent issue of traffic deaths occurring in disadvantaged groups. The local municipality addressed this by using a common data framework to formulate incremental safety measures for some areas of the city, which accounted for differences in demographics between Portland's neighbourhoods and aimed to pursue a strategy for reparative justice by equalising resource distribution according to need. Similarly, case 16 shows the key role played by the tech-savvy middle class in the governance of rapidly urbanising Bengaluru, India. In efforts to improve and modernise governance, these middle-class citizens developed participatory models that ultimately served to further marginalise the urban poor, migrant labourers, *etc*., and ignore their needs and desires in the future smart city because they relied upon and required access to digital technologies which were far from universal. Case 36 focuses on what is referred to as the 'cheap smart home' in Australia. The cheap smart home refers to situations—often in households with multiple occupants—in which housemates use a range of 'smart' technologies and platforms out of necessity, *e.g.* in order to find flatmates, coordinate bill payment or schedule household tasks. This case highlights how dominant smart home narratives tend to foreground nuclear families with heterosexual couples, tech-savvy singles, affluent professionals and owner–occupiers, rather than catering to more diverse household configurations.

Cases that adopted a user-focused approach stress that race, gender, class and income are all social indicators that need to be kept in mind while imagining democratic smart citizenship models, as current models tend to exclude citizens without digital expertise. Case 7, for example, shows how even when smart city initiatives explicitly seek to be participatory, they can often fail to consider already existing forms of social exclusion and how they can hinder access and participation to certain disadvantaged groups. In this case, based in Atlanta, Georgia, ethnographic research shows how in roundtable discussions on smart initiatives, discussion about smart citizenship rarely acknowledges citizen-centric needs or perspectives and remains expert-driven. Importantly, however, the user focus is not always on struggles, nor is it always framed in exclusionary ways, *e.g.* case 37 demonstrates how artificial intelligence (AI) technologies in smart homes can be used to enhance safety and security for vulnerable inhabitants such as people of colour or LGBTQI+ groups who are more likely to be subjected to domestic abuse, mental health issues and suicidal tendencies by automatically notifying emergency services when the residents are under threat/distress.

4.3 INSTITUTION-FOCUSED APPROACH

This was the second most prevalent approach, present in 22 of the 54 cases. The common denominator in all these cases was that SU transitions are far from smooth and that, despite the universalising desires of SU proponents, initiatives are heterogenous in time and space and are always and unavoidably conditioned by existing urban trajectories and local contexts (Lee *et al.* 2022).

These cases were successful in embedding the role of institutions—particularly corporations such as IBM—in purposefully building the discourse around smart utopias. In case 13, for example, IBM's push towards SU is situated within the company's wider history. In the late 1990s, its annual losses reached US$8 billion and its strategic direction turned towards lucrative sources of income. Given the emergence of digital technologies, the company moved to cement its position as the global company at the forefront of these technologies, and therefore it promoted the SU discourse which has since captured the imaginaries of several global cities. Thus, this approach helps draw out accountability on firms such as IBM when it comes to injustices which arise from embedding neoliberal logics and systems thinking to cities in ways that simplify and misrepresent the complexity and diversity of their inhabitants.

In contrast to the often universalising tendences of large firms such as IBM, case 10 exemplifies how smart technologies can be institutionalised in ways that are more attentive to local needs and concerns. Drawing on the example of Milton Keynes, UK, case 10 describes how local authorities can selectively foreground specific elements from the urban constellation and background others while curating their own version of the 'global' smart city. This case shows how, far from accepting smart city imaginaries as a whole, cities are selectively receptive or resistant to various smart urban futures and therefore these processes of local curation are profoundly political.

Another notable example is case 14, which explores smart city implementation in Cape Town in relation to its historical importance for South Africa as the site where White supremacy and Apartheid played out and continue to do so even today. This case highlights the ambivalent feelings citizens and local government authorities expressed towards smart city data-gathering efforts in Cape Town, because whilst there was recognition that new forms of data collection were necessary in pursuit of the modernising smart city project, there were simultaneous concerns associated with the local histories of racial discrimination enabled by the public authority's data-collection practices in the Apartheid era. This case thus emphasises the distinct 'data cultures' that emerge in different socio-historical contexts and the importance of paying attention to local histories and data politics in the institutionalisation of smart technologies.

4.4 POWER SYSTEM-FOCUSED APPROACH

Before considering the examples of cases that confront multiple power systems, the most common power systems are explored in the 54 cases with intersectional approaches in the corpus (Figure 7). Nine of the 54 cases (13%) did not mention any power systems, and simply detailed the issues with smart urban technologies in general terms, without directing their critique at specific power systems. For example, case 62 highlights the increasing bias in AI voice assistants with their incremental uptake in society, calling for a careful examination of how machine-learning algorithms are designed to train these assistants. Notably, heterosexism, ableism, ethnocentrism and other power systems were not discussed in the corpus. The remaining 45 cases engaged with one or more power systems, but only four of these cases explored the intersections between them and will be described at the end of this section.

The most commonly addressed power system—across both the academic and the web-based cases—was the broader context of neoliberalism that surrounds SU. In 29 cases (42%), the reasons for 'trouble' were attributed to the dominance of neoliberal urbanism (*e.g.* cases 7 and 13). Further, it was also cautioned that these technologies are often intertwined with narratives that obfuscate their true benefits, in the guise of advanced technology-based urban entrepreneurialism, and deliberately play down negative effects in favour of positives (*e.g.* cases 3 and 53). This corporatisation of governance also occurs in a top-down technosolutionist manner, universalising users and simplifying vulnerabilities, and thus new political tensions between centres of power and peripheries emerge (cases 17 and 58). Neoliberal attitudes towards smart citizenship were also criticised as they force citizens to be digitally literate and universalise visions of citizenship (case 7).

Closely associated with neoliberal critiques were critiques of capitalism, especially the profit-making, market expansion motives of multinational corporations that were present in 17 cases (24%). The 'smartification' motives of the corporations not only resulted in the governance issues

discussed above, but also their interest in the creation of new data markets were often shown to render privacy and consumer choice subservient to their business models. Further, several cases showed that the focus on data ownership and monetisation frequently leads to increased surveillance at the cost of digital and civil rights (*e.g.* cases 23, 24 and 33).

Whilst critiques of neoliberal and capitalist power systems were the most dominant, eight cases (9%) focused on colonialism and how its legacies continue to influence SU in post-colonial states, which readily accept capitalist agendas directed at them through technology companies based in the Global North in order to project a 'globalised' and 'high-tech' image without much attention to their own local needs and contexts (case 44). Relatively fewer cases explored how smart urban technologies reinforce gender norms (sexism, three cases, *e.g.* cases 8 and 69) or at how they exclude racially diverse populations or use consumer data to track down 'illegal' migrants (racism, four cases, *e.g.* cases 42 and 70).

Whilst most cases therefore addressed single power systems in isolation, four cases explicitly explored the intersections between them. Case 8, for example, draws on both feminist and anti-capitalist critiques in exploring the feminisation of smart home devices. It highlights how voice assistants are deliberately feminised by big tech companies in order to soften and mask their real intentions around monetising user data, increasing user dependence on smart technologies, and obfuscating the social, economic and environmental impacts of these technologies. In the process, the case highlights the risks of feminised voice assistants in reinforcing sexist ideas around women and their roles in society.

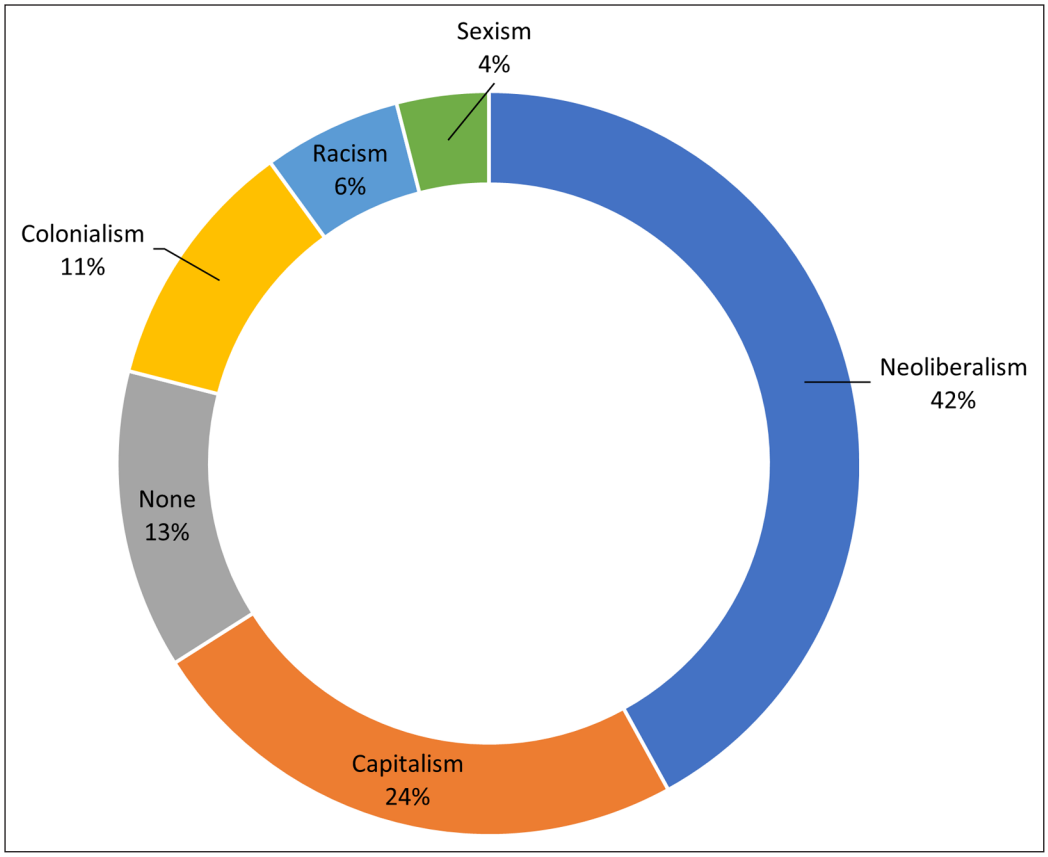

Figure 7: Distribution of power systems addressed in the corpus (n = 54).

Case 11 presents an alternative agenda for digital justice in the age of SU, and in doing so highlights the importance of using multiple critiques to inform discourses on inclusion and justice, but also draws upon anti-capitalist, anti-neoliberal and decolonial critiques in framing the arguments that underpin such an agenda. Case 38 employs both anti-capitalist and decolonial approaches to show how in-home entertainment management platforms developed by big tech firms in smart homes function as 'colonisers' of the home that erase alternative family structures, capitalising on family relations for profit maximisation. In doing so, decolonial theories are drawn upon and it is shown

how these waves of data capitalism are a form of data colonialism in the sense that try to erase cultural heterogeneity and impose a single reality. Case 44 couples decolonial feminist theories with anti-capitalist critiques to explore smart urban discourses in Santiago, Chile. It highlights how the discourses of salvation and superiority embedded in smart city visions draw attention away from the realities and challenges of everyday urban life.

5. DISCUSSION AND CONCLUSIONS

A total of 70 cases of trouble in relation to smart urbanism (SU) were analysed, representing a wide array of critiques, power struggles, geographies and technologies. A novel, threefold framework was developed for identifying and exploring intersectional approaches in the SU discourse: power system, institution and user-focused. The most significant finding is that intersectional justice concerns are addressed only marginally in these cases. Only one of the 70 cases explicitly mentioned the term 'intersectionality', 16 did not employ any of the intersectional approaches identified in the framework, and 31 cases did not address social justice concerns directly. In those cases that explored justice, the most prevalent focus was on the diverse experiences of different user groups in smart urban settings. Fewer cases explored the institutionalisation of SU visions and how these processes can entrench or challenge inequality. The least common focus, apparent in only four of the 70 cases, was to employ and combine critiques of multiple power systems simultaneously in order to develop a complex and intersectional analysis.

There were also notable gaps and biases in the present corpus that future research should address. These include an anticipated bias towards cases from the Global North, the absence of any cases that focused explicitly on ableism, and very few which focused on LGBTQIA+ user groups. A significant shortage of academic studies was observed: few engage directly with confrontations and protests around SU led by grassroots initiatives.

The analysis suggests that the most common approach to addressing justice concerns in SU to date—namely the user-focused approach—is also potentially the least transformative. Focusing just on diverse user experiences, whilst valuable, tends to result in recommendations around improving inclusion that can leave wider systems of inequality unchallenged. By contrast, approaches that explicitly focus on such system transformation—such as cases that employ an institution-focused or power systems-focused approach—were much less common. A combination of these approaches to analyse smart urban transitions can harness the full potential of intersectionality as a radical, transformative tool for social justice.

There is a pressing need for more research on intersectional social justice in relation to SU and four ways are suggested in which this agenda could be further developed:

- The user-focused approach should not only be expanded to include demographics currently excluded, but also should develop a more nuanced understanding of the intersections between social categories such as race and gender. Such an analysis would be mindful of the ways in which differences within these categories influence experiences of smart technologies as this could inform emancipatory designs. Caution is warranted: this should not lead to the specificities of social categories, simply being tagged onto the universalising visions of algorithms, but rather to a more fundamental reconstruction of human-centred smart visions (Kong 2022).
- Whilst a small but growing body of work is exploring the roles that different institutions play in entrenching or potentially challenging inequality in the development of SU, future work should engage in a critical reflection of the social hierarchies that are embedded within these institutions and how they have propagated or been complacent to racism, ableism, heterosexism, capitalism, *etc.*
- Critical research on SU should explore interactions between different power systems and how they combine to create intersectional inequalities. Existing approaches draw on feminist, anti-capitalist, anti-racist or decolonial critiques, but rarely acknowledge key

arguments from each other's rhetoric and do not draw on each other's struggle with respect to the regulations they challenge or demand, the types of smart technology they resist or the alternatives they propose.

- This paper has demonstrated the extent to which intersectional justice concerns are currently being addressed in SU critiques. A crucial next step would be to examine why the applications of intersectional approaches remain marginal and how they can be applied to 'actually existing' smart urban projects. Therefore, in-depth case studies are called for. These should apply the core insights of intersectionality to understand how 'troubles' against SU play out on the ground, the challenges different actors and institutions face in developing intersectional approaches and solutions, and how intersectionality can bring about more just smart urban transitions in specific settings. Such studies could focus on deducing possible sites of interventions for remedial justice and use them to guide priorities in sites of smart technology implementation.

The radical ethics demanded by intersectional thinking are difficult to realise as they could become constrained by a multitude of economic, social, political, and cultural forms of local urban organisation and ideologies. Nonetheless, the presented strategy of looking at 'troubles' with SU and cross-examining it using an intersectional lens contributes to understanding not just the data politics in urban spaces, but also how they can be renegotiated and re-evaluated to solve multiple and interconnected urban crises without compromising on social justice.

This novel framework also has three practical implications:

- *Citizen-led initiatives* against SU should commit to intersectionality's radical core to dismantle power structures to ensure local smart urban projects do not entrench global business-as-usual neoliberal agendas.
- *Urban planners and local governments*, which are at the forefront of SU applications, should decentre technologies and their social networks from these visions and rather focus efforts on centring intersectional social justice that seeks to reconfigure structural relations. This would involve working out how smart technologies can work *in conjunction* with other kinds of urban interventions, such as social, economic and environmental policy changes, collaborative planning, community development, *etc.* (Kitchin 2021) to herald more just urban futures. SU projects should ensure stakeholders are collaboratively involved, prioritise alternative information flows and trigger collective governance (Carr & Hesse 2020).
- *Designers of smart urban technologies* should apply intersectional approaches to further challenge '*Homo economicus*' (rational, White, technophilic, able-bodied male) as the primary user type and to replace that with diverse user archetypes that embody what it takes to make equal, thriving societies that express humanity, justice and generosity, thereby moving from user-centred design towards design justice (Costanza-Chock 2018).

ACKNOWLEDGEMENTS

The authors thank the anonymous reviewers for their valuable time and effort in providing feedback on earlier versions of this paper.

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COMPETING INTERESTS

The authors can confirm that there are no competing interests to report.

FUNDING

This research received funding from the European Union's Horizon 2020 Research and Innovation programme under the Marie Skłodowska-Curie grant agreement number 955422.

SUPPLEMENTAL DATA

Two files containing supplemental data for this article can be accessed at: https://doi.org/10.5334/bc.290.s1.

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TO CITE THIS ARTICLE:
Sharma, N. K., Hargreaves, T., & Pallett, H. (2023). Social justice implications of smart urban technologies: an intersectional approach. *Buildings and Cities*, 4(1), pp. 315–333. DOI: https://doi.org/10.5334/bc.290

Submitted: 01 February 2023
Accepted: 17 May 2023
Published: 15 June 2023

Buildings and Cities is a peer-reviewed open access journal published by Ubiquity Press.