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Hybridity in Practice: Responding to Water Insecurity in São Paulo, Dhaka and Cairo

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ABSTRACT: This paper examines everyday practices of self-construction and connection, negotiation, and self-disconnection of, and from, formal and informal water infrastructure and services in three global cities – São Paulo, Dhaka, and Cairo. While each city has distinct histories and geographies, we show via detailed qualitative fieldwork in six low- and high-income neighbourhoods how residents face ongoing struggles to access quality, affordable, and sustainable water supply. We make two key contributions to the existing debate on urban water insecurity. First, we highlight that while residents continue to pursue water formalisation as a pathway towards neighbourhood regularisation and broader citizenship entitlements, they do not abandon the hybrid systems of infrastructure and provisioning they use to access water. Instead, these hybrid material, social, and political practices of self-connection and contestation of water services are the cornerstone of negotiating water in/security in everyday urban life for both high- and low-income groups. Second, we focus beyond the formalisation of water supply to highlight how residents maintain, repair, and/or disconnect from water infrastructure and services. We introduce the underexplored practice of 'self-disconnection' as a way in which residents respond to water insecurity in state or community systems, challenging notions of a linear, singular network ideal. The paper concludes by synthesising the diverse ways in which residents respond to water insecurity in their daily lives, across three distinct geographical contexts.

KEYWORDS: Water insecurity, hybrid infrastructures, formalisation, land tenure, urban political ecology

INTRODUCTION

Despite being declared a human right in 2010, 785 million people globally still lack basic drinking water services, and around two billion people use 'unimproved' drinking water sources contaminated with faeces (WHO, 2019). Whilst global access is improving, serious concerns over the sustainability, affordability, and quality of water infrastructure and services remain, especially in densely populated urban areas across the so-called 'Global South' (Farmer, 2017; Mitlin et al., 2019; Beard and Mitlin, 2021). Extensive water scholarship spanning urban political ecology (UPE), geography, and development studies has helped to shift understandings of water in/security beyond physical infrastructure provision or a linear single network ideal – often promoted by international organisations and implemented by national governments – to the grounded realities of pluralised networks, artefacts, access, and repairs that urban residents turn to for sustained water supply (Jaglin, 2002; 2014; Ahlers et al., 2014; Lawhon et al., 2018).

Water insecurity, in this sense, is inherently relational, multi-dimensional, and political (Jepson et al., 2017; Empinotti et al., 2021).

Hybrid arrangements are recognised in water scholarship as the global *modus operandi* for how low-income citizens access and maintain water services in the case of absent or unreliable formal water systems (Furlong, 2014; Jaglin, 2014; Lawhon et al., 2018). Scholarship on infrastructure access in the Global South defines hybridity as one of the ways in which formal and informal supplies and practices blur in residents' everyday lives as they negotiate to gain and maintain access to water (Furlong, 2015; Coutard and Rutherford, 2015). One of these processes is when policymakers and urban residents continue to seek water formalisation via the installation of legal, metered, or billed infrastructure and services as a path towards universal access, standardising infrastructure and neighbourhood regularisation (the legal recognition of land and housing tenure by the state) (Denaldi and Ferrara, 2018; Hylton and Charles, 2018). However, existing scholarship has also been critical of the impact that formalisation through billing, metering, and diverse forms of managing 'formal' infrastructure has had on citizens' everyday lives (Sultana, 2020; Cawood and Rabby, 2021). This is especially the case in low-income 'unrecognised' neighbourhoods, where it is often assumed that formalisation of access to water would eliminate the need for hybrid infrastructure systems (Ahlers et al., 2014). UPE scholarship has shown, rather, how formal access can be a *continuation of non-linear struggles* for safe, affordable, and quality potable water (Jaglin, 2014; Coutard and Rutherford, 2015; Ramakrishna et al., 2021). However, few studies to date have focused explicitly on how residents respond to water insecurity via everyday practices of self-construction and connection, negotiation, and *self-disconnection* of, and from, formal and informal water infrastructure and services in different geographical, politico-legal, and socio-economic contexts. There is a conceptual need to understand the key drivers that contribute to these continued timelines of connection and disconnection as a means to increase water security.

This paper addresses these knowledge gaps by focusing on the intersection of water formalisation, land tenure regularisation, and hybrid water infrastructure and supply arrangements in six neighbourhoods across three global cities – São Paulo (Brazil), Dhaka (Bangladesh), and Cairo (Egypt). We make two key contributions to existing debates. First, we highlight that although residents continue to pursue water formalisation and neighbourhood regularisation for a variety of reasons, hybridity of infrastructural systems and citizens' access to a multitude of choices remains a cornerstone of household and community water systems due to the structural barriers associated with formalisation, including the economic rationale of cost recovery and standardised revenue collection. The afterlives of formalisation in low- and high-income neighbourhoods (which, in addition to improved services, can also be characterised by broken, dilapidated infrastructure and unpaid labour) operate across a range of connection and disconnection timelines that do not end with billing and registration, but extend in non-linear and uneven pathways towards water in/security. The selection and analysis of water practices in both high and low-income areas contributes directly to existing scholarship on the contested relationship between formalisation of water supply and neighbourhood regularisation (Ranganathan, 2014; Anand, 2017; Hylton and Charles, 2018; Sultana, 2020), and the realisation that formalisation or 'legal' water access does not guarantee water provision or land tenure security for the city's low and high income groups, but can be characterised by uneven and often retreating values of both state and community infrastructure (Ahlers et al., 2014).

Second, we contribute to the literature on hybridity of provision and maintenance (Ahlers et al., 2014; Kooy, 2014; Lawhon et al., 2018; Harris, 2019), by bringing forth the fluidity of access and repair in shaping state-society relations and capturing and reinforcing precarity for urban residents (Sultana, 2020). We focus on what happens after water formalisation to highlight how citizens may switch between individual (household), community, and (often highly corporatised) state systems to access, maintain, and repair water infrastructure and services, perpetuating hybrid infrastructure and supply arrangements. We put

forward the practice of 'self-disconnection'¹ as one of the ways in which low- and high-income residents respond to water (and financial) insecurity. Disconnection in this instance becomes part of residents' hybrid practices and a non-linear form of access following infrastructural break-down, intermittency in supply, or unaffordable billing arrangements. These choices, though constrained, appear at odds with the pursuit of formalisation, and have received less attention in the literature on the afterlives of formal infrastructure access (De Cross-Corzo, 2020; Ramakrishnan et al., 2021). We build on this literature by calling for deeper acknowledgement of the key drivers of, and enabling resources for system connection and disconnection among residents in low- and high-income neighbourhoods to unpack the contested relations between water, urban citizenship, and political economy.

The paper is organised into five sections. Following this introduction, Section Two outlines the key bodies of urban water insecurity and UPE literature we engage with and existing knowledge gaps around disconnection and hybrid water regimes. Section Three outlines the methodology and introduces the six neighbourhoods (across three global cities) that were studied. While each city has distinct histories and geographies, we demonstrate how residents face ongoing struggles to obtain and maintain potable water in a shared context of neo-liberal reform, as well as land tenure, financial, political and environmental stress and uncertainty. Section Four outlines how residents have responded to water insecurity in each case, while Section Five discusses overarching findings. We conclude with a reflection on the ways in which future research and practice can better capture the diversity of water infrastructures and user preferences to improve urban water security for all.

WATER INSECURITY AND HYBRID INFRASTRUCTURAL SYSTEMS

Self-construction, formalisation, and regularisation

With the advent of modernity and attempted standardisation of infrastructure systems, water distribution has been gradually concentrated in the hands of state and private providers, creating the illusion of a monopoly over urban waters (Graham and Marvin, 2001; Gandy, 2014; Kooy, 2014). In an overarching definition, Jaglin (2014: 434) argues that we must recognise the "vitality and multiplicity of actual service delivery systems which contribute to the functioning of cities – informal, formal, self-help, legal, illegal" rather than only the failures of so-called 'formal' provisioning often highlighted in policy literature. For residents of low-income neighbourhoods, one of the main pathways toward everyday provision has been to use 'self-construction' and connection practices to secure housing, infrastructure, and basic services. Developmental and urban scholarship has identified how groups come together to build housing and infrastructure by using community organisation, pooling local funds, and utilising formal systems and structures in different ways. Scholarship has labelled these practices as 'self-help' (Turner, 1976; Rakodi, 1989), 'self-supply' in the case of rural sectors (Sutton and Butterworth, 2021), 'community or citizen-led development' (Satterthwaite et al., 2005; Satterthwaite and Mitlin, 2014), and 'auto-construction' (Lemanski, 2020), documenting the ways in which residents exercise their right to the city outside of formal recognition by the state. We rely on the term 'self-connection' to indicate how communities adapt to lack of reliable water supply in multiple ways, such as by constructing their own community systems and tapping into formal state systems, in order to connect to supplies they have been excluded from. For instance, within informal neighbourhoods on the periphery of growing cities like São Paulo, self-construction of water infrastructure and self-connection to formal water lines are often the only means of obtaining potable water (Cohen, 2016; Empinotti et al., 2019; Ferrara et al., 2019).

¹ This term emerged from the *Urban Water Security in Brazil: From Infrastructure to Social Action* workshop in São Paulo, and is based on conceptual framing and fieldwork in Wahby (2019).

Whilst regarded as 'illegal' by water companies and government agencies, 'alternative' self-connections² to public water mains or private wells are often the only viable option for households who cannot afford billing and maintenance or are simply living 'off grid' in peripheral areas. However, these connections can also be used – as in the case of Dhaka – by local leaders and political patrons to exert and maintain social, political, and economic power over residents (especially tenants) at the neighbourhood level, via charging high bills or additional connection fees (Hackenbroch and Hossain, 2012; Cawood and Rabby, 2021a).

Despite these complexities, self-construction and connection has become an important avenue for residents to secure access to water infrastructure and services in global cities. While these practices are akin to survival strategies practised outside the gaze of the state (though usually with its knowledge [Deboulet, 2009; Davis, 2017]), residents of self-constructed areas using self-constructed infrastructures also make claims to be officially recognised by the state. The pursuit of legal rights and equal citizenship have been at the core of citizens' contested relationships with the state (Lemanski, 2020), with lengthy negotiations and contestations to achieve the regularisation of housing and land tenure for 'unrecognised' neighbourhoods (Hylton and Charles, 2018). Another strategy residents have used to gain recognition is to pursue 'infrastructural citizenship' (Lemanski, 2020), where they strive to acquire some type of formal supply of utilities – particularly water and electricity – in their neighbourhoods. By being recognised 'infrastructurally' by the state's utility institutions, residents would be placed on the supply map, receive metered water, become paying customers, and have documentation proving their residency, which can be used in employment and other official applications (Ranganathan, 2014; Anand, 2017; Baptista, 2019; Sultana, 2020). These measures of formalisation for residents can then mean a stronger case for final regularisation of their tenure status and removal of the stigma around their supposed 'illegality'.

In this paper, however, we demonstrate that formalisation of water supply – although it can and does bring numerous benefits like cheaper water supply, better water quality, or perceived improvements in land tenure security – does not necessarily lead to improved services or consolidate broader claims to land, housing, or other citizenship entitlements, as other scholars have previously noted (Graham et al., 2015; Satterthwaite, 2016; Boayke-Ansah et al., 2016). Rather, some residents and neighbourhoods resort back to 'alternative' water supply mechanisms, including private vendors, water tankers, self-dug wells, or community-managed water points. In fact, while the state still plays a strong regulatory role in theory, neoliberal water reforms³ premised on revenue collection instead of quality and affordable water access (Jaglin, 2002; Farmer, 2017; Mitlin et al., 2019; Beard and Mitlin, 2021), and the fragmentation and underfunding of state agencies, means that hybrid infrastructure and supply arrangements – involving an array of state and non-state actors and institutions – persist in practice (Bakker, 2007; Jepson et al., 2017).

These practices have been well documented across different urban contexts. For instance, Dar es Salaam, Tanzania, has seen the 'spaghetisation' of water supplies, which emerge from multiple sources, including private trucks, wells, and canisters (Monstadt and Schramm, 2017). On the other hand, in Tijuana, Mexico, 'artefacts' like barrels, cisterns, and buckets are considered tools of power when authorities cut off illegal connections and reintroduce water supply as a way of ordering and disciplining city residents (Meehan, 2014). This literature is useful in addressing how informal and heterogeneous infrastructural practices continue in the presence of formalisation. A parallel thread of scholarship on the practices of elites also helps us to move beyond the idea that formalisation and regularisation are a binary

² The term 'alternative connection' instead of illegal or irregular connection is used so that self-connection to the state water supply system cannot be used to criminalise poor residents, who live in precarious conditions and without affordable and appropriate solutions for water access.

³ Whilst we acknowledge that the scale, nature, and depth of privatisation varies between and within the countries (and utilities) of focus, we highlight a common trend in corporatisation of the water sector, with emphasis placed on profit and cost-recovery via the expansion of paying customers (and surveillance practices), outsourcing, and tariff hikes.

set of categories and instead pushes us to think of the non-linear ways in which infrastructure and supply are formed and continue to be maintained across different neighbourhoods (Misra, 2014; Bjorkman, 2018). This critical approach brought forward by Roy's (2009) intervention on how India plans its cities allows us to think about how illegal water practices in elite, high-income neighbourhoods, such as pumping water and off-grid connections (Misra, 2014), are technically similar to low-income neighbourhoods but are sanctioned and even supported by the state. Bringing these different spatial contexts into dialogue, this paper also reflects on the role of the state and its private partners in maintaining the unevenness of urban water infrastructure systems through selective formalisation, regularisation, and criminalisation.

Hybridity and disconnection as security

The above scholarship has been especially successful in highlighting the multiple ways in which water is accessed and supplied in the pre-formalisation phases of infrastructural timelines. It is now widely recognised that urban water infrastructure and services can be delivered and obtained in a number of ways that scholars have epistemologically tackled under different labels such as heterogeneous 'service delivery configurations' (Jaglin, 2014) and 'hybrid systems' (Ahlers et al., 2014; Kooy, 2014; Schwartz et al., 2015; Harris, 2019). In particular, the concept of hybridity has been used by scholars researching global cities to point to the ways in which water supply is accessed through means of formal, self-constructed, and community-managed modes of governing water supply services (Furlong, 2014; Jaglin, 2014; Coutard and Rutherford, 2015; Wahby, 2021). Hybridity in particular has the conceptual use of breaking down the binary view of legal/illegal or formal/informal supplies and demonstrates the ways in which hybrid arrangements are often deeply intertwined, highly political and unequal (Loftus, 2015), and delineated according to class, race, gender, income, occupancy type, and place of residence (Truelove, 2019; Sultana, 2020). What is considered to be hybrid in these arrangements is not only the physical and material infrastructures of water access – such as official and informal pipelines, wells, and tankers etc. – but also the social, economic, and political networks, capital, and relations, that are continually being shaped in the process of access and maintenance (Kooy, 2014; Meehan, 2014; Harris, 2019). This means that while the state and its private partners strive to establish a single infrastructure network to connect all urban citizens, the reality of dilapidated systems, interrupted supply, and uneven formalisation and recognition of urban citizenship has forced residents to diversify their sources of water access and maintenance even after the installation of formal supplies (Empinotti et al., 2021). For instance, Furlong (2014) has illustrated how hybrid arrangements in networked electricity grids still allow for the co-existence of multiple full and partial, formal and extra-state networks of supply, governance, and maintenance, emphasising their use in everyday life. The focus on everyday lives of both high- and low-income neighbourhoods engaged in these hybrid systems by scholars (Roy, 2009; Misra, 2014) sheds light on the role of continual negotiations with the state and other actors beyond formalisation and the perpetual pursuit of water security.

One line of scholarship on the afterlives of formalisation is urban water literature on infrastructure failure and the associated practices and processes of repair and maintenance that ensure a sustained supply (Graham and Thrift, 2007; Ahlers et al., 2014; Misra, 2014; Alda-Vidal et al., 2018; Silver, 2019). This scholarship has focused on the messy realities of decaying or failing water infrastructure by nuancing definitions of repair and maintenance as the practices to sustain and improve water supply within neighbourhoods (Ramakrishnan et al., 2021). Hybridity literature has also nuanced these contributions to remind us of the ways in which infrastructure is constantly in the making with the inclusion of multiple actors, institutions, and practices (Baptista, 2019). We use this scholarship to recognise the temporal dimension of lack of supply as both systemic or episodic, in moments of shortage (Bhan, 2019), the physical and embodied dilapidation of systems (Björkman, 2015; 2018), and the transformation of power dynamics when infrastructures fail (Barnes, 2017).

In this paper, we contribute to this emerging literature by highlighting how residents in low- and high-income neighbourhoods respond to water insecurity via practices of *self-disconnection* at different temporalities and scales, perpetuating (and utilising) hybrid infrastructural and supply arrangements. By 'self-disconnection', we refer to the poorly documented practice whereby residents *choose or are forced to disconnect from legal or 'formal' water systems* and use a range of alternative sources due to intermittent, unaffordable, individualised, or poor-quality supply. Whilst literature on this practice is limited, some studies have highlighted the ways in which residents attempt different forms of disconnection as a form of resistance. For instance, Von Schnitzler (2016) has spoken to the ways in which the neoliberal transformation of the South African water sector created a new infrastructure cost-recovery rationale that resulted in new forms of agency and practices of citizenship. Residents who were forced into metered supply systems with formalisation rejected these new payment practices, loopholes were found to bypass the new machinery, and meters were removed and thrown at municipal buildings. This case, and our paper, reminds us of the different forms of what we call self-disconnection practices, which can include defaulting on bill payment (or refusal to pay), removal of metering artefacts, protesting delays, or falling back on 'alternative' systems (some of which remain connected to the 'formal' supply) – processes that are not only material (removing a pipe or meter), but also highly symbolic and political.

As we highlight above, our focus on disconnection practices also raises important questions around the relationships between potable water and formalisation (via single-agency provision) and between formalisation, regularisation, and broader citizenship claims (Lemanski, 2020; Sultana, 2020). We do not wish to relegate self-disconnection solely to the terrain of maintenance and repair, but instead to also view it as a relational practice, a contestable path toward pursuing water security, and a political act in response to uneven access, insecure housing and land tenure arrangements, and pricey formalisation. While we recognise the role that front-line bureaucrats (Lipsky, 1980) and utility entities, whether state or private, play in the choice of citizens to remain connected to their newly installed formal arrangements, or to disconnect temporarily or permanently, we emphasize the focus on hybrid practices that citizens adopt in their everyday lives as a means of achieving water security (Empinotti et al., 2021). For instance, Baptista (2019) details the ways in which communities under formalisation conditions and prepaid metering for electricity have continued to use hybrid repairs to maintain their uninterrupted supply in Maputo, Mozambique. She argues that these formal arrangements are in fact 'precarious achievements' and are as patchy as 'informal systems', resulting in the need for communities to find ways of 'everyday maintenance and repair' to fill these gaps. Self-disconnection is one of the practices households and communities use to increase infrastructural security, which releases their bind to formal regulated systems and creates new practices outside the gaze of the state or its private partners, akin to self-construction practices. The emphasis here, as it is across this paper, is on the choices and actions that residents residing in particular neighbourhoods make when responding to water insecurity in their daily lives. In centring our analysis onto residents rather than utilities, Non-Governmental Organisations (NGOs), or donor agencies, we also acknowledge that these choices and actions vary significantly according to who residents are (across intersections of race, gender, class, religion, ability, age), where they live (geographical location, land and housing tenure status), and the resources available to them (material, financial, social, and political). As we will demonstrate, not everyone has the choice or resources to access a single regular supply or hybrid arrangements, leading to asymmetries in access, maintenance, and repair within and between neighbourhoods. We argue that it is these asymmetries, as well as disconnection practices, that require greater attention conceptually, methodologically, and empirically in water insecurity and UPE scholarship moving forward.

RESEARCH CONTEXT AND METHODOLOGY

The cities of São Paulo, Dhaka, and Cairo are used as 'illustrative cases' (Flyvbjerg, 2006) to demonstrate struggles over potable water in cities globally. The authors have been engaged separately in fieldwork (as part of different research projects) in each city over the last seven years. The data used in this paper is drawn from data collected in six neighbourhoods⁴ (Table 1). Though distinct historical and geographical contexts, the use of a similar conceptual (Section 2) and methodological approach (outlined below), including long-term engagement with residents in the six low- and high-income neighbourhoods (in the case of Cairo), provided a common basis for analysis and the identification of overlapping trends. Similarities and differences were identified between the cases and neighbourhoods by the authors in a series of discussions during and after the 'Urban Water Security in Brazil: From Infrastructure to Social Action' international workshop in São Paulo (October 2019). These discussions revealed new conceptual, methodological, and empirical avenues for the authors to examine water in/security in the respective cases. In this sense, comparison was a more grounded and inductive process rather than something that was predetermined with set criteria or 'standards' (i.e. Krehl and Weck, 2020).

Despite carrying out independent research, this approach enabled the authors to re-examine detailed timelines and personalised accounts of struggles for potable water infrastructure and services from the inception of these neighbourhoods to present day – including complex processes and practices of self-construction and connection, negotiation and disconnection of, and from, formal and informal supply arrangements – involving a range of state and non-state intermediaries (from utilities to private vendors and real estate actors to NGOs and Community Based Organisations [CBOs]). The cases illustrate different combinations of how these varied hybrid infrastructure systems are produced and maintained over time and at different scales. In particular, the inclusion of a formal elite district was important as it provided further weight to our argument that formalisation and regularisation do not directly equate to singular, linear, and regular provision and maintenance of water supply. The authors build on Roy's (2005) work to illustrate how informality and hybridisation exist in what is described as formal spaces in order to illustrate the fluid boundaries of formality and informality. While we acknowledge the privileges of elite settlements, the case of al-Tagammo' al-Khames (Cairo) reveals that elite infrastructural entitlements are also not guaranteed despite their regularised status (Wahby, 2021). In all these cases, residents are engaged in an ongoing struggle for affordable, quality, and sustained potable water supply in contexts of land tenure, financial, political, and environmental stress and uncertainty.

The methods deployed across the cases included in-depth interviews (IDIs) and transect walks with community leaders, ethnographic participant observation (sitting at tea stalls, by water points, and in community centres), focus group discussions (FGDs), and participatory mapping exercises with male and female house owners and tenants (Table 2). The authors also conducted a review of secondary data and citywide key informant interviews with NGO, international donor agency, and utility staff to examine wider trends in water provision (including, for example, key policies, programmes, and regulations impacting urban residents).⁵

⁴ We use the term 'neighbourhoods' in the paper, even though the six examples include building occupations and larger settlements, to challenge negative connotations associated with the terms 'slum' or 'squat' and highlight the investments (financially and in-kind) residents make in infrastructure, services, and the social and political life of these areas.

⁵ For further information on these cases (including the different water supply, utility arrangements and methods deployed), see Ferrara et al (2019); Cawood and Rabby (2021; 2021a) and Wahby (2021).

Table 1. Summary of neighbourhoods studied in São Paulo, Dhaka, and Cairo.

Neighbourhood	Number of residents or households (estimate)	Responsible for water supply system	Key changes in water supply	
Gaiivotas occupation, São Paulo	~800 residents, ~200 households (2019)	State Basic Sanitation Company – Sabesp (mostly public with mixed public and private capital)	2005 until 2018: self-connections	After 2018: connected with the state system of Sabesp
São João 588 occupation, São Paulo	~281 residents, 90 households (2018)	Community leaders and residents State Basic Sanitation Company Sabesp (mostly public with mixed public and private capital)	Since 2010 (the start of the occupation of the building): self-connections and demand for formalisation until now	
Jheelbari, Dhaka	660 households, 3000-3500 people (2015)	Community leaders (all house owners) and political patrons	1980-85 until 2013: all self-connections	After 2013: formal DWASA connections sought
Sakti, Dhaka	650 households, 2600-3200 people (2015)	Commercial public-private organisation (DWASA), NGOs, and CBOs	1999 until 2005: self-connection or alternative sources (e.g. wells, local ponds)	After 2005: formal DWASA connections
Ezbet El Haggana, Cairo	~500 households 2500-3000 people (2016)	Community leaders, Greater Cairo Water Company (state-owned)	1970s until 1990: communal taps (taken over by water mafia) and private vendors	After 2013: Installation of formal systems
Al-Tagammo' al-Khames, Cairo	Selected 15-20 districts and gated communities, ~5000 residents (2017)	Greater Cairo Water Company (state-owned)	1990s until 2013: self-construction of community systems and private vendors	Formal systems (governed by municipality, water company, real estate developers)

(Source: Authors)

Table 2. Summary of methods in São Paulo, Dhaka and Cairo fieldwork.

Country case	IDIs (n)	Transect walks (n)	FGDs (n)	Mapping exercises (n)	Participant observation (months)
<i>São Paulo, Brazil</i>					
Gaivotas occupation	2	6	2	4	10
São João 588 occupation	3	3	0	0	2
<i>Dhaka, Bangladesh</i>					
Jheelbari	5	1	1	1	2
Sakti	10	1	3	1	2
<i>Cairo, Egypt</i>					
Ezbet El Haggana	12	2	0	0	3
Al-Tagammo' al-Khames	21	1	0	0	0

Source: Authors

Quotes from residents (and in the case of Dhaka the neighbourhood names) have been anonymised and pseudonyms used to safeguard confidentiality in areas with contested land tenure arrangements. Written or verbal informed consent was obtained from all research participants, with formal ethical approval granted by host institutions. It is also important to note that whilst two authors are country-nationals (conducting research in the cities where they live and work), one is based in a UK university, raising important ethical and logistical questions over language, continued interaction with study participants, and working with potentially vulnerable groups. These challenges were mitigated by working effectively and sustainably with local partners (including NGOs, universities, and research assistants) and participants (including community leaders and associations), building trust, and maintaining linkages over many years via return visits. None of the authors (all of whom are middle-class women) live in the neighbourhoods studied, so care was taken throughout and after fieldwork to ensure that the purpose and potential outcomes of the research were clear from the outset (i.e. that participation is voluntary, and that these studies would not result in any direct intervention, but seek to highlight the daily struggles for potable water). Care was also taken to ensure different participant voices across gender, age, ethnicity, race, ability, and class were captured in fieldwork. For example, by running female- and male-only FGDs or ensuring that community leaders (many of whom are house owners) and short-term tenants could share their experiences via interviews, participatory mapping exercises, and observations. The following section outlines the ways in which residents respond to water insecurity in each of the cities studied.

RESPONDING TO WATER INSECURITY IN SÃO PAULO, DHAKA, AND CAIRO

Occupation and self-connection: Contradictions and struggles for regularisation in São Paulo, Brazil

The São Paulo municipality is home to over 11 million inhabitants and is the hub of the Metropolitan Region of São Paulo (RMSP) (Fundação Seade, 2020). Its territory is characterised by extreme inequalities resulting from an unequal urbanisation process. In this context, access to housing is a structural problem, which is yet to be solved by the state. According to 2016 municipal data, it is estimated that in São Paulo city there were 445,112 households in slums (known as *favelas*) and 385,080 in irregular allotments

(Prefeitura de São Paulo, 2016), in addition to an unknown number of families living in tenements, occupied buildings, and on the street. The emergence of the housing issue caused many neighbourhoods to be created through the occupation or irregular purchase of land, combined with the self-construction of housing, unaccompanied by public infrastructure. The issue of water access is thus directly intertwined with access to housing. In 2016 there were 300,000 households in low-income areas of the RMSP lacking regular water supply service (Sabesp, 2018), which represents over one million inhabitants.

Sabesp is a public sanitation company with mixed capital⁶ that operates 37 of the 39 municipalities of the RMSP. Its contract with the city of São Paulo represents 44.48% of the Company's total revenue (Sabesp, 2019). The company has made profits over the years, ensuring a return to its shareholders. Therefore, the operation of sanitation services is governed by an economic and financial rationale, which is combined with the technological control of the water supply network. The company particularly emphasizes reducing physical losses of water because of its associated financial implications. For Sabesp, self-connections in favelas are calculated as water loss, with irregular land ownership commonly used as a reason public services cannot be installed in these areas (Hylton and Charles, 2018). Uncertain tenure arrangements and low incomes cause residents to seek improvised and alternative avenues for water access. These precarious solutions can persist over time, transforming into chronic water insecurity for many years. Ultimately, the construction of public networks in popular neighbourhoods depends on public investment and political prioritisation.

To illustrate different contexts that relate to self-construction, water insecurity, and land tenure, we discuss two neighbourhoods in São Paulo. The first case is the Gaivotas occupation⁷ in the Grajaú District, a periphery in the southern administrative zone. The occupation began in mid-2005 and suffered the first forced eviction by the municipal authority in 2007 under the justification that it is a water source protection area. However, in 2013, some families without alternative housing solutions returned to the site, and new low-income residents also arrived (Ferrara et al., 2019). Although land ownership remains in dispute and families do not know if the municipality will allow them to remain, the occupation is gradually growing. Residents have also constructed alternative water connections to their homes from the main avenue, where there is public water supply. However, they reported a lack of water for four days in a row because the supply from the local hose was not enough to supply all the connected houses. Sewage is also dumped close to the houses, creating significant risk of water contamination.

In 2018, leaders of the housing movement that work closely with Gaivotas residents held meetings with Sabesp to demand the formal installation of the water supply in the occupation. In 2019, Sabesp began the construction of shelters for hydrometer installation in homes and pipe placement in the streets, without the potential of tenure regularisation by the municipality. This seems to contradict the company's restrictions for the installation of public networks in irregular neighbourhoods; however, the intervention was part of a Sabesp program funded by the World Bank called the Legal Water Program (implemented since 2016), which defined specific sectors for the expansion of water facilities, including part of the southern area of São Paulo. After the installation of formal water connections, a 'social tariff'⁸ was applied for a period of two years. According to the program documentation, "at the end of the period, for each case the situation of family income is verified against the criteria of the social tariff" (Sabesp, 2018). Thus, while the program enables the expansion of water connections in some irregular

⁶ Sabesp shareholding composition: 50.3% of the Government of the state of São Paulo, 34.5% is listed on the São Paulo Stock Exchange and 15.2% on the New York Stock Exchange.

⁷ 'Occupation' of land or buildings (public or private) is the act organised (or not) by groups of low-income families who do not have housing solutions even in public projects or in the so-called 'formal' real estate market.

⁸ A social tariff is a reduced tariff applied to low-income households or to unemployed people, with the maximum consumption of 15m³ of water per month. For the Gaivota occupation's residents, the applied tariff is around 2 USD. In August 2022, new residents arrived to live in the occupation and asked Sabesp for water regularisation. For these residents, Sabesp did not apply the social tariff and they have to pay the full rate without discounts.

neighbourhoods, this access is conditional on the payment of a social tariff, even if residents like those in Gaivotas cannot afford it. In 2020, residents reported that they could not pay the bills, which could possibly lead to the return of alternative (unbilled) connections. But for now, public water connections have improved access to water in the occupation.

The second example, the São João 588 occupation, was created when a social housing movement occupied an abandoned hotel in a centrally connected area of República District. The occupation was carried out with a high degree of community organisation, and residents are still struggling to transform the building into social housing despite eight legal attempts at repossession by the buildings' owners (Ferrara et al., 2019). From the beginning of the occupation, according to residents, water supply was an obstacle to making the building habitable. Collective sinks and water reservoirs were needed, but it was also necessary to buy water for consumption because the quantity of stored water was not sufficient for the whole building. This forced residents to bathe in the homes of friends or in nearby buildings. As repairs advanced, residents with technical knowledge checked the pipelines, performed repairs, and were able to make alternative connections by tapping into the public network. Some residents installed toilets and sinks in their apartments, but showers remained in a collective space on each floor. According to some residents, their future intention is to have this alternative water supply formalised by Sabesp. Their demand for formalisation represents the residents' desire to obtain proof of address, which is critical for various issues of citizenship and everyday tasks like the search for employment. Residents also stressed the need to formalise connections, reiterating that they are willing to pay for the service. Although negotiations with the municipality to convert the building into social housing have advanced, the negotiations with Sabesp for water formalisation remain suspended due to the irregularity of the occupation.

Intermediation, 'illegality', and contested land claims in Dhaka, Bangladesh

Within Dhaka, an estimated 35-40% of the city's 19 million people live in low-income neighbourhoods known as *bostis* (UN, 2018) with limited access to basic services and partial or non-existent land and housing tenure security. In 2007, after decades of neglect, a breakthrough in supply of legal water to *bostis* occurred when the Dhaka Water and Sewerage Authority (DWASA)⁹ changed its Citizen Charter to permit provision of water via CBOs, regardless of land tenure status (Hossain and Ahmed, 2014). It was declared that 'recognised' *bostis* on public and private land would receive subsidised connection fees of Bangladeshi Taka (Tk) 5000,¹⁰ compared to the Tk 25-30,000 paid by 'regular' customers.

Whilst some commentators regarded this as a progressive example of co-production to meet universal coverage (Hossain and Ahmed, 2014), others saw it as a cost-recovery initiative (Cawood, 2017; Cawood and Rabby, 2021a) driven by DWASA's interest in recouping revenue previously lost to illegal connections. Though the reality arguably lies somewhere in between, the provision of legal water via the DWASA model reportedly resulted in lower bills for *bosti* residents (many of whom were paying higher prices for illegal supply) and a strategic stepping stone to demand other legal services (gas, electricity, telecommunications). This model has also had important implications for the reconfiguration of water governance at the neighbourhood level. In the past, water was largely controlled by illegal vendors and *mastans* or 'musclemen'. Now, NGOs and CBOs have become the new intermediaries in water provision and management. However, the extent to which these institutions replace vested interests and intermediation in urban water supply remains disputed (Cawood and Rabby, 2021a). Critical challenges also remain over water quality, quantity, affordability, and sustainability for Dhaka's *bosti* residents in a context of intense land grabbing, rising urban inequality, and groundwater depletion and contamination (Islam et al., 2019; Haque et al., 2020). The following vignettes outline how residents in two

⁹ DWASA is an autonomous and commercial public-private organisation entrusted with the responsibility of providing water supply, sewerage disposal (wastewater), and storm water drainage services in Dhaka.

¹⁰ During fieldwork in April 2015, 1 USD = Tk 77.

neighbourhoods – Jheelbari and Sakti – respond to water insecurity and illustrate the central role a range of intermediaries play in self-connection, negotiation for, and maintenance of, 'formal' supply.

Jheelbari is an 'unrecognised' neighbourhood with a mix of tenants and house owners on disputed land claimed by residents, three private housing societies, and a government bank. The neighbourhood is located in the northwest of the city on low-lying land surrounded by high-rise apartments. It regularly floods during heavy rains, and the narrow lanes can remain waterlogged for weeks, often submerging water pipes connected illegally to DWASA pipes. Community leaders in Jheelbari shared that they obtained water connections by tapping into DWASA lines: "when DWASA put a line in the upper side 10-12 years ago, people of the area tapped the line at midnight to bring connections to the neighbourhood. Someone watched out for police to ensure they weren't caught!" (Interview, Ripon, 2015). In 2013, a group of 7-10 leaders – all male house owners with links to political patrons from the ruling political party – applied to DWASA for 25 legal connections at a cost of Tk 25-30,000 and a deposit of Tk 10,000 per line (in 2015, approx. 320-400 and 125 USD, respectively). The primary incentive for leaders to do this was to solidify land claims: "We thought if we get water, electricity, or gas connections, [and] if we have government approve legal papers of these connections, then we could use this to prove our legitimate claim over the land" (Interview, Mahir, 2015).

Despite the efforts of these leaders, in 2015 only four out of 25 DWASA lines were approved, and none had been installed. One leader, Zahidul, noted that the other connections were "not approved by the government because they [the disputed land owner] opposed it" (Interview, 2015). During fieldwork, it transpired that Jheelbari was not 'recognised' as a bosti by DWASA (even though it clearly met the criteria), meaning leaders had to pay the full non-subsidised cost of Tk 25-30,000 per line as opposed to the subsidised Tk 5000. The high application fees meant that the new lines were only accessible to those who could pay, namely well-connected local leaders who owned multiple houses and businesses. One resident, Hasina, remarked how "we cannot afford the connection fees...They [local leaders] will have a monopoly and sell water to others for a higher price" (Interview, 2015). Formal supply in Jheelbari, even if approved and installed, may therefore do little to reduce bills for residents (whether they're tenants or house owners), who remain reliant on local leaders to obtain and manage water or who continue to seek alternative sources outside of the settlement, including public DWASA pumps, employers/offices, or benevolent residents in surrounding high-rise apartments (where many female residents reported working as domestic help).

The second neighbourhood, Sakti, is also located in the northwest of Dhaka, yet it presents a different story. A 'recognised' neighbourhood on public (government) land with majority house owners, Sakti has an abundance of NGO water and sanitation infrastructure and has had legal DWASA supply since 2005. Despite an increase in access, Sakti faces particular challenges in operation and maintenance, with a number of NGO-installed water facilities in disrepair. Whilst CBOs – created by NGOs in water and sanitation projects – are supposedly responsible for operation, maintenance, and repair of water points and sanitation chambers in Sakti, CBO leaders argued that whilst they could collect money from fellow residents for minor repairs, any major repair work was unaffordable and unfeasible due to the residents' low and insecure incomes. CBOs, like the infrastructure, would also commonly dissolve once NGO projects phased out – a well-known tyranny of NGO project cycles (Cooke and Kothari, 2001). Despite living in a recognised neighbourhood, residents were also fearful of eviction as they didn't have any legal documentation for the land or housing, a further impediment to investing financially (via cost-sharing) or in-kind (via unpaid labour in CBOs) in infrastructure that could be demolished. As one long-term resident, Hasna, remarked: "the army [located nearby] have their eye on this land, they are very powerful" (Interview, 2015).

Frequent disputes over billing, water quality, intermittency, and appropriation of tube wells by influential local leaders (including CBO members), who would re-sell water to tenants, meant that some disgruntled residents stopped using the 'formal' supply and resorted to collecting or buying water elsewhere, such as tube wells in nearby settlements (where they have friends or family), and constructing

or re-opening shallow or deep wells. Well users no longer needed to pay bills (though construction would cost around Tk 20,000) and perceived these sources to be of higher quality and "tastier" than the DWASA-connected tube well water. Other residents went directly to DWASA to obtain a connection, bypassing the CBOs. As one resident explained: "The CBO leaders encouraged residents to pay DWASA Tk 8000 for a legal connection. However, I'm aware it costs only Tk 7500, so the other 500 was for their own pocket, so people went to DWASA directly" (Interview, Mariam, 2015). The reason for the discrepancy between the Tk 5000 declared by a DWASA official and Tk 7500 as told here is not clear and again raises questions about what information is circulated and how much residents actually have to pay, and to whom, for a connection.

Informality, elites and disconnection in Cairo, Egypt

Considered one of the world's megacities, Cairo's growth has been mostly attributed to the rise of informal neighbourhoods, of which there are an estimated 1000 with over 11 million residents (Sims, 2012). In parallel, the national government has invested in 'satellite cities', contributing to the mostly elite suburbanisation of the deserts surrounding Cairo. Greening the desert with gated communities, golf courses, and luxury living has cost the government millions in investments while only housing less than a tenth of the city's population (Sims, 2012). New water infrastructure to these areas has also been criticised for its failure to deliver promises of elite water security and intensified the neglect of infrastructure in poor neighbourhoods (Wahby 2021). One of the ways in which the government seeks to fund its growing water repair expenses is through the formalisation of informal connections in low-income neighbourhoods. Since the early 2000s, the establishment of state-owned regional water companies has corporatised the water sector and focused on cost recovery (USAID, 2013). In an effort to increase the customer base and account for 'lost waters', Prime Minister Nazif's government (2004-2011) installed networks in Cairo's districts regardless of land tenure legality. Water pricing was also used to simultaneously commodify the resource and increase legibility of communities, especially through water meters (Farmer, 2017). Communities were encouraged to buy meters as a means to obtain legal urban citizenship in Cairo's neighbourhoods and as a path towards water security. However, although water seemed guaranteed by the installation of official state piping, it was not guaranteed for long. Two Cairene neighbourhoods, outlined below, show that in spite of class, legality, and geography, communities have had to return to informal norms and rules in order to secure sustainable water supply.

The first neighbourhood, Ezbet El Haggana (Haggana), is one of Cairo's largest informal neighbourhoods, built incrementally on desert land on the north-eastern periphery. Originally ignored by the national government as a squatter area, the neighbourhood steadily grew due to affordable house prices and self-construction of infrastructure. Despite recent state-installed infrastructure, land remains contested and the municipality refuses to regularise tenure for most of Haggana's residents, while the recent military government has used destruction and eviction to make space for bridges and flyovers cutting through the settlement. Whilst in the southernmost district of Haggana, community leaders claimed victory to register with the Greater Cairo Water Company (GCWC),¹¹ their struggle with the state for water supply continues. One of these sites of struggle is an arbitrary system of 'guesstimation' and billing enacted by state water bill collectors once residents register for formalisation (Wahby, 2019). Water workers in Haggana often use approximations based on observations of the size and exterior of a building to estimate water consumption rather than taking actual meter readings. Water workers later compare these estimates with real readings in subsequent months and calculate an average. Residents, already suspicious of the state and its representatives, feel exploited by this system of approximations. One example of billing practices that most outrages residents is receiving water bills even during times

¹¹ GCWC is a fully state-owned utility company responsible for the supply and maintenance of water in the Cairo Governorate. Beginning in 2004, USAID and World Bank programmes corporatised these companies by standardising water tariffs through the Holding Company for Water and Wastewater (HCWW), setting cost recovery targets and reinforcing technical managerialism.

of water cuts. Despite being connected to the formal water system, periods of water shortage have left residents without water, and they are then forced to buy expensive water from private water trucks to meet their daily needs. Nonetheless, water collectors still demand regular payments from residents. One resident commented: "I don't understand how they can give us receipts when we don't even have the meter. We registered for a meter at the local administration office, but we have not picked it up let alone installed it at home!" (Interview, Umm Mohamed, 2015).

Water shortages across Cairo from 2015-2017 were especially challenging. In Haggana's southernmost district, only two years after official state piping was installed in 2013, residents were left stranded without water for several weeks. Their only recourse was to rely on different means of water access and repair previously used during their self-construction days. In the 1990s, community leaders with the support of NGOs and CBOs installed an elaborate system of community networks that tapped into nearby official supply (Bremer and Bhuyian, 2014). These older pipes still produce water while new state pipes run dry. As a result, several households have opted to maintain their community lines in order to diversify their water supplies and have developed into 'community hotspots' that disconnected households can tap into to fill their own water tanks and jerry cans. Other families have begun to negotiate with neighbours to revive their local pipes as they recognise the futility of relying on state supply, and some have refused to pay water bills until sustained supply could be guaranteed.

Only a few kilometres south of Haggana, the second neighbourhood al-Tagammo' al-Khames (Tagammo') in the satellite city New Cairo represents a different case of extra-state practice. Built on state-developed desert land covering 70,000 acres, New Cairo is one of the new towns that aimed to attract elite and middle class residents away from central Cairo. Real estate developers and state entities enticed residents with promises of uninterrupted services and easy living. However, from its inception, these new water systems suffered repeated water cuts and chronic shortages erupting in the summer months (Esterman, 2014). The state has long used the pretext of a tired colonial network to construct a perception of a decaying water network in the centre, but the breakdown of infrastructure in the periphery has meant a return to social networks and informal repair practices (Wahby, 2021). For instance, residents who live in private apartments and villas have resorted to bribing or pressuring officials to send water relief tankers and expedite water repairs. One resident explained, "when we call them [the municipality] ourselves no one answers. The whole of Tagammo' is calling them(...)" (Interview, Soheir, 2017). This is why many residents use a *wasta* or important social connection, such as a retired police or army general, to leverage powers with the municipality. These social networks of patronage and privilege are shared with neighbours and operate within informal norms of bribes, gifts, and favour exchanges. Similarly, residents living in gated communities also resort to informal practices to secure and maintain their water supply as they negotiate with both the state and their real estate developer. When residents experience water shortages, they turn directly to their compound administrator to find answers. Administrators handle negotiations with the state, but residents have started to realise that the social connections of the administrators dictate how fast water starts to flow again. In most cases, developers pull strings to force state authorities to repair damages in order to save on costly operations. Compound administrators also turn to networks of privilege and bribery to gain priority access to faster repairs and water flow. These extra-legal practices are necessary to confront a process of repair that is predicated on the state's arbitrary choices. Regardless of their formal and legal status, elite residents still face an arbitrary state and a waterscape that is splintered by privatisation and hybrid regimes of water supply.

DISCUSSION: HYBRIDITY IN PRACTICE

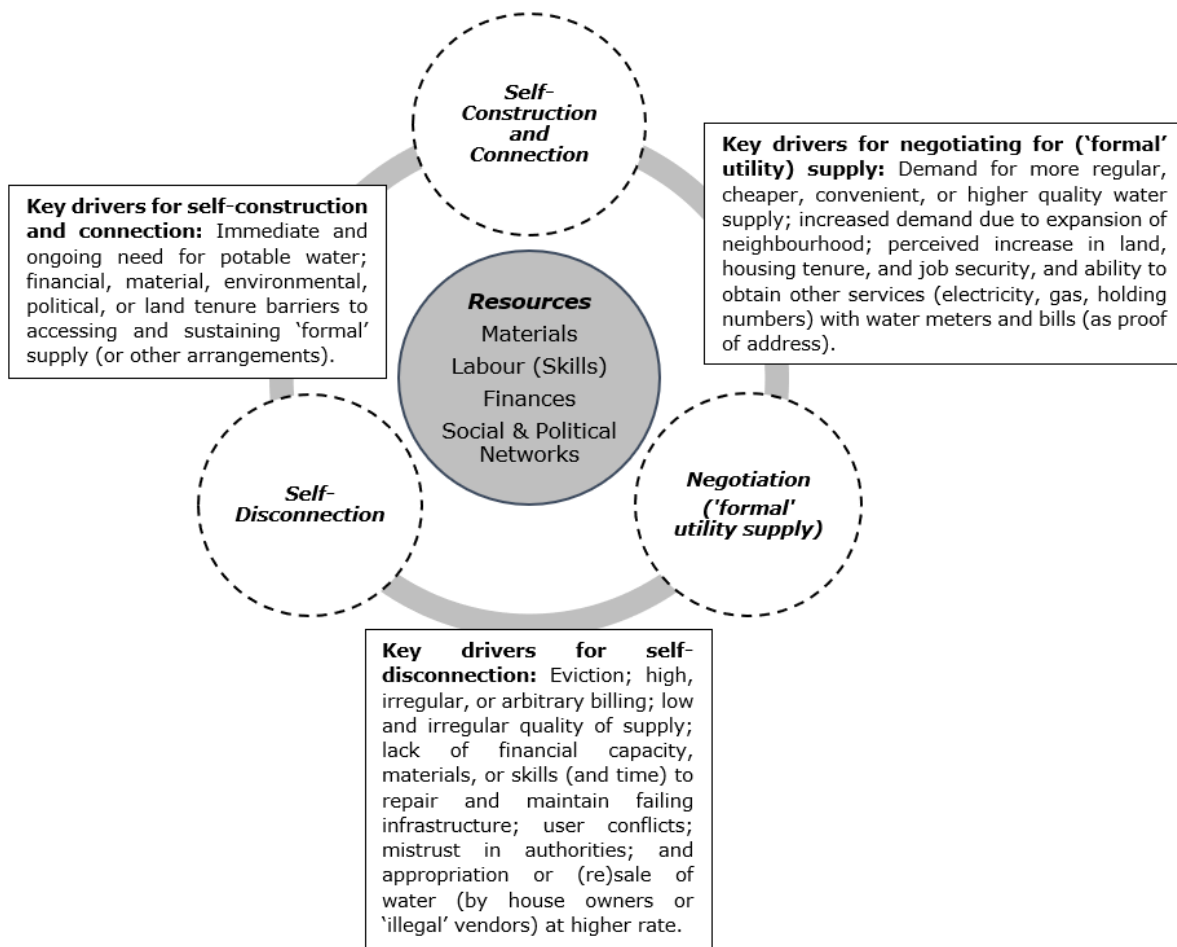
The six neighbourhoods in the three cases outlined above illustrate the various ways in which urban residents respond to water insecurity in their daily lives. In all cases, it is clear that neoliberal water reforms, which are premised on cost-recovery and revenue collection, and demand from residents have

led to the expansion of supply to some formerly unserved areas, including those with contested housing and land tenure arrangements. Within this broader context, residents continue to deploy a range of strategies to obtain and maintain water directly, or via a range of state and non-state intermediaries. In São Paulo, low-income families and social movements occupy buildings and land and self-construct, connect to, and maintain 'alternative' water lines to meet their needs. They struggle to obtain formal Sabesp water to gain broader recognition as urban citizens but also struggle to maintain costly connections after formalisation. In Dhaka, residents also seek formal DWASA supply to stake a claim on the land. However, if you do not live in a 'recognised' neighbourhood, the connection costs remain high, reinforcing a monopoly over water amongst those most able and willing to pay. Legal connections are also not guaranteed, nor do they necessarily result in sustained water supply. In some cases, residents reject formal supply arrangements and return to 'unimproved' sources (such as private wells) due to high or unevenly distributed user costs, intermittency, and dilapidated infrastructure. In Cairo, low- and high-income residents must negotiate with water workers from GCWC to obtain a sustained, uninterrupted supply. However, 'guesstimation' and intermittency leads some residents to disconnect and return to parallel community or private water supply systems or leverage social and political connections to resolve supply issues – something residents in elite gated communities are most able to do.

Across the cases, we see how residents respond to water insecurity via practices of self-construction and connection, negotiation, and *self-disconnection* of, and from, formal and informal supply at different temporalities and scales, drawing upon a range of resources (Figure 1). For example, in the São João 588 occupation (São Paulo) and Sakti (Dhaka), residents use and develop their construction and plumbing skills and utilise local materials and artefacts to construct private wells or connect to, and repair, water lines. In Tagammo' (Cairo) and Jheelbari (Dhaka), well-connected residents utilise social and political networks (including to political patrons) to negotiate for regular supply across the (in)formal spectrum. We not only see asymmetries in access between neighbourhoods (including occupations like São João 588 that cannot access formal water at all because they are not legally recognised) but also within them, as some residents (for example, local leaders and house owners) are better able to connect to different supply arrangements than others (such as tenants or low-income households, who may also be charged higher rates or cannot afford regular bills). Whilst the practices outlined in Figure 1 epitomise and perpetuate hybrid infrastructural and supply arrangements and may lead to greater water security for some, these arrangements are not experienced or accessed equally by all. In addition, not all residents or neighbourhoods will actively seek 'formal' connections (for various reasons), with many still in continuous processes of negotiation with a multitude of private, state, or community providers since the neighbourhood's inception, including so-called 'illegal', informal, or alternative suppliers.

Despite these differences in access, we are still able to discern common drivers for residents (who are able) to switch between different infrastructural systems and supply arrangements at distinct moments in time (such as 2005, 2013, or 2018, Table 1), in parallel, or across multiple timelines. For example, we see these drivers as part of long-term struggles among house owners to pursue land tenure security (as seen in Jheelbari and Gaivotas), or more immediate responses to failing or poorly managed infrastructure (as in Haganna and Sakti). Within water policy literature, there is a common assumption that once formalisation occurs, self-connection will disappear as residents shift to legalised systems of access and repair (Ahlers et al., 2013; Kooy, 2014). However, we find self-connection to be a continuous process that is prolonged by the uneven nature of formalisation and asymmetries in access. Across the three cities, residents engaged in prolonged timelines of self-connection and disconnection, and newly installed systems became part of the hybrid arrangements of access and repair (Jaglin, 2014; Lawhon et al., 2018). The delineation that self-connection represents illegal and abandoned supplies is sharply contested with the blurring of formal and informal binaries. In São Paulo, communities lobby for their alternative supply to be legally recognised by the state despite their illegal status. In addition to formalising access to water, they claim that the bill serves as a stepping-stone toward regularising the occupation (and to employment security), which reminds us of the way residents understand access to citizenship in contexts of

Figure 1. Responding to water insecurity in São Paulo, Dhaka, and Cairo.



Source: Authors

vulnerability. In Cairo, elites use extra-legal tactics (Roy, 2009) and social networks of patronage and privilege to gain exclusive access to expedited water repairs and maintenance, challenging the notion that 'informality' (and hybridity) refers only to low-income residents and neighbourhoods, but is also actively produced and enabled by the state. As highlighted above, the instalment of formal supply does not guarantee secure and uninterrupted water or land and housing tenure regularisation, which remains elusive in all cases. Instead, a plurality of 'illegal', state and private supplies may be more secure (or at least more affordable) sources for some neighbourhoods, even if the quality and quantity of water is not guaranteed.

As formal services are rolled out, new conditions of cost and discipline add an additional layer to heterogeneous practices that create pathways and potential burdens for community-managed infrastructure and services. Although the state – either directly or via its affiliated companies – has provided access with the instalment of public works, sustaining quality and quantity has faltered in all cases. These deficiencies have created a fertile space for hybrid arrangements of both access and repair. Clearly, we must continue to look beyond water formalisation to examine operation, maintenance, repair, failure, and crucially, disconnection of, and from, water infrastructure and services. For example, in Dhaka, when faced with water intermittency and infrastructural failure, residents return to self-constructed wells to extract water. In Cairo, community water hotspots that rely on previous self-

constructed systems became the focal point for water relief when cut-offs occurred. In São Paulo, low and irregular incomes make residents unable to pay even social tariffs, creating debts to the water company and generating new alternative water connections. Thus, although access becomes regulated through water formalisation, repair remains an afterlife that cannot be controlled or rendered legible, causing some residents to disconnect and return to community systems.

While still striving to be recognised by the state as entitled urban citizens, urban residents are acutely conscious of their everyday pressing needs. Disconnection and a search for alternatives becomes logical when residents can no longer afford their regular bills (especially when no water arrives or the quality is very poor), to invest time and energy in lobbying municipalities for recognition, and/or trust local intermediaries who have vested interests in water supply. Disconnection does not mean an end to water formalisation efforts; instead, it could mean the return to self-construction and connection of wells in Dhaka, reliance on networks of social capital in São Paulo, and refusal to install water meters or pay regular bills in Cairo. This diversification of disconnection is akin to the heterogeneous and hybrid ways water is accessed and repaired (Ahlers et al., 2014; Kooy, 2014; Schwartz et al., 2015; Lawhon et al., 2018; Harris 2019). At the same time, disconnection also illustrates the inherent contradictions of formalisation, a process that can, but does not always, lead to improved service outcomes and recognition or redistribution for low-income urban residents, especially those living on the peripheries of growing cities.

CONCLUSION

In this paper we examined the ways in which residents of six low – and high – income neighbourhoods in three global cities – São Paulo (Brazil), Dhaka (Bangladesh), and Cairo (Egypt) – respond to water insecurity in their daily lives. Drawing on detailed qualitative fieldwork in the three cities, we demonstrated how access to sustained, affordable, and quality water supply remains elusive for many urban residents, especially those living in dense, low-income neighbourhoods with insecure land and housing tenure. We provided two key contributions to the existing debates on urban water insecurity spanning UPE, urban geography, and development literature. First, we highlighted that although residents continue to pursue water formalisation as a pathway towards neighbourhood regularisation and broader citizenship entitlements, formalisation does not guarantee security in supply or tenure. Rather, it forms part of the hybrid systems of infrastructure and provisioning that residents use to access water over time. Second, we focused beyond formalisation of water supply to highlight how residents maintain access and repair water infrastructure. We introduced the concept and practice of 'self-disconnection' as a way in which residents respond to water insecurity in formal state or community systems, challenging notions of a linear, singular network ideal.

Though distinct historical and geographical contexts, the use of a similar conceptual and methodological approach, including long-term engagement with residents in the six neighbourhoods, provided a common basis for analysis. It enabled us to build detailed timelines and personalised accounts of struggles for potable water infrastructure and services in each neighbourhood. A clear and worrying trend is the continued corporatisation of water, land, and housing, creating and reinforcing asymmetries in access, maintenance, and repair. Whilst the rollout of formal services by state utilities and private companies to so-called 'illegal' neighbourhoods can improve provision, reduce costs, and lead to fragmented forms of 'infrastructural citizenship' (Lemanski, 2020), the fixation on cost recovery, profit, and revenue collection, as opposed to universal coverage, affordability, quality, and sustainability (vis-a-vis operation and maintenance), means that water insecurity persists in the very structures of prescribed solutions, especially for the most marginalised residents in global cities. These ongoing neoliberal reforms and the underfunding of state services also mean that being recognised as legitimate citizens by 'the state' is even more elusive in increasingly fragmented and unequal governance contexts. In order to better derive improved conditions for urban water security, future multi-country research and reflective practice will need to engage further with asymmetries in access; user preferences for water cost, quality,

and governance; and the currently understudied practices of self-disconnection that remain illustrative of shifting state-society relations. These avenues for engagement are essential to support ongoing struggles for water rights, urban citizenship, and urban water security.

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