



'Water for all': The unlikely confluence of divergent interests (in resisting neoliberalism and promoting human rights) in Mumbai's slums

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ABSTRACT

Despite pressure from international donors and the national government, neoliberal policies have not had a transformational impact on the way water is provided in Mumbai. Some modest reforms were introduced but these have not led to major change. Moreover, in 2022 the city introduced a policy of 'Water for All' to extend water access to slum areas. At first sight this system might seem to be a socially progressive approach to water management, which might be surprising given the right-wing orientation of Shiv Sena, the political party which has been in power since the 1990s. But this paper shows that policy has been shaped by an unlikely alignment of diverse interests. Campaigners have been resisting neoliberal policies and demanding fair water rights for slum dwellers for years. But these demands gained policy traction when they overlapped with the interests of the engineers who manage the complex water system, as well as the political regime. For decades, slum households have been scapegoated and water access was deemed illegal for millions of the city's poorest residents. But the political climate has recently shifted such that it now suits the ruling party to expand water access, although restrictions remain. This paper shows how global paradigms intersect with embedded structures, politics and institutions to create contextually specific outcomes. Drawing on [Brenner and Theodore \(2002\)](#), we argue that the same context that generated Mumbai's form of 'actually existing' neoliberalism has also created a distinctive, 'actually existing', interpretation of the human right to water.

1. Introduction

Mumbai's water system has largely escaped neoliberal reforms. Despite significant pressures from international financial institutions (IFIs), as well as India's national government, to adopt market-oriented policies in water, by and large, these have featured in rhetoric more than practice. As might be expected, these policies faced fierce resistance from rights-based campaign groups in the city ([Björkman, 2015](#); [Anand, 2017](#)). But, as this paper documents, resistance also came from other quarters. The measures were unpopular with the city's politicians who risked losing scope for the manipulation of water resources for political ends. Furthermore, the highly complex water supply system of Mumbai relies on the detailed knowledge of a host of engineers and plumbers who manage the pumps and valve switches across the city to direct water to different neighbourhoods according to an often-changing schedule ([Anand, 2017](#)). Neoliberal policies would struggle to formalise the system which relied on their detailed personal knowledge of the system and of the water users, and so risked undermining an

underlying informal system of social support. Hence, while policy makers were openly supportive of the neoliberal paradigm, in practice, these measures had little transformative impact on the day-to-day operating of the water system.

More recently, politicians in Mumbai have begun to recognise water as a human right. In May 2022, the city government launched a campaign to provide water access in slum areas under the slogan of 'Water for All' (WFA). At a stroke, this remarkable policy turnaround meant that an estimated two million slum-dwellers that had, for decades, been denied water access were suddenly able to apply for water connections ([Wagle, 2022](#); [Contractor and Kannan, 2020](#); [Deekshit and Sumbre, 2022](#)). On one level, this is a significant victory for activists, most notably Pani Haq Simiti (PHS) who have been campaigning for many years for water to be recognised as a human right. But this paper shows how the policy shift also serves a political goal. The right-wing, Hindu nationalist party Shiv Sena, which has dominated the politics of the state of Maharashtra since the 1990s, has been losing popularity. Many have left the party to side with the rival BJP. In interviews we

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were informed that WFA is designed to rapidly boost popularity, especially in the wake of rapidly evolving politics of municipal elections.¹ Furthermore, as we discuss below, implementation has opened up potentially lucrative opportunities for informal deals for the city's water engineers.

This paper explores the way that these superficially progressive policy outcomes have emerged from the unlikely confluence of diverse interest groups. While the policy shift is a win for activist politics, the push for WFA also needs to be seen as the latest pragmatic policy twist in a city where global and national directives intersect with political expediency, working through the complexities of the informal and formal water systems. This case study shows how each of these global paradigms – neoliberal water reform and the human rights agenda – have been modified and rely on an interpretation that aligns with the pre-existing political, institutional and social fault lines (Karunanathan, 2019). Not only is this an example of path-dependent 'actually existing' neoliberalism (Brenner and Theodore, 2002), but also, we argue that the same context has also created a form of 'actually existing' water rights.

The following section outlines conceptual debates regarding water as an economic good as well as a human right and sets this next to the reality of the water system in Mumbai which relies on an immensely complex network of infrastructures and social relations. The paper then explores the ways in which neoliberal policies were formulated and largely rejected in the city, before turning to the effects of a legal campaign to provide water to slums on human rights grounds and the subsequent introduction of WFA. We show that resistance to neoliberalism, and support for a rights-based approach to water is located not just among activists and campaigners but also among the political classes seeking to use water as a means of control as well as the engineers and plumbers who benefit from their role in the water networks. Ultimately the paper shows that rather than an economic good or a human right, water is a political tool and access cannot be separated from wider structural inequalities and patterns of exclusion (Swyngedouw, 2007).

2. Conceptual framing

Increasing water access has been on the global policy agenda for decades (UNDP, 1994). Reform approaches have promoted a technocratic 'good governance' agenda (Zwarteveen and Boelens (2014) under the framework of Integrated Water Resources Management (IWRM). This framing of water ties with the wider 'Washington Consensus', which sees state inefficiencies as a major constraint to effective water governance (Marangos, 2009). As part of these shifting narratives, water became reconceptualised, no longer as a public good but as a commodity and a scarce resource (Ahlers, 2010; Bakker, 2007; McDonald, 2018), recognised as an 'economic good' by the United Nations (see the Dublin Principles, United Nations, 1992).

This shift in understanding of water was associated with a set of policies, framed around a neoliberal ethos. Public water utilities in the global South have faced strong pressure from international donors such as the World Bank to implement water sector reforms to facilitate private sector participation (PSP) (Sangameswaran, 2009). Advocacy for PSP featured not just in policy conditionality attached to lending, but also in training material, policy briefs, and sectoral assessment reports (Ranganathan, 2006; Bakker, 2007; World Bank, 2002).

Public sector institutions are also under pressure to act more like private businesses in terms of financial management. Water utilities are facing greater budgetary discipline, requiring increased attention to revenue and costs. 'Under-pricing' of water is depicted as bad practice that has deprived utilities of funds to provide services (Leflaive and Hjort, 2020) and is seen as regressive because only wealthy households have a water connection (see Bayliss, 2013 for more details and critique). Cost recovery (or at least cost-reflective) pricing is considered

fundamental to good governance both for financial sustainability and to incentivize consumption reduction (Bayliss, 2013; Rusca and Schwartz 2018; Tutusaus and Schwartz, 2020). Sound financial management is also valued to promote creditworthiness in order to access private finance (Bigger and Webber, 2021).

To some degree the notion of water as an economic good faced a significant challenge when in 2010 the UN General Assembly declared that access to safe clean drinking water was a human right. This was a major victory for a campaign groups (Angel and Loftus, 2019; Karunanathan, 2019). But there is debate as to how far this might lead to a divergence from the neoliberal framing of water outlined above (Sultana and Loftus, 2012, p.2; Perreault, 2014). The human rights agenda is limited by an inevitable reliance on the existing constitutional apparatus for its implementation and enforcement. Furthermore, the human rights narrative has been co-opted by corporate and political interests that adopt the narrowest interpretation of the human right to water (HRW) (Wagle, 2022 citing Parmar, 2008; Rajagopal, 2005; Karunanathan, 2019, p.244). Moreover, the rights framework, in common with the neoliberal paradigm, fails to address the structural inequalities that leave millions excluded from formal water systems.

Many countries in the global South were exposed to such pressures of neoliberalisation, privatisation and financialisation and yet the degree to which they have affected water sector policy varies widely (McDonald, 2018; Le Strat, 2014; Horváth, 2016). The privatisation of water featured in reforms across the global South (Bond, 2004; Bakker, 2003, Ranganathan et al., 2009) but implementation has been limited, in part due the political nature of water (Bakker, 2013; Bayliss, 2020). There was wide-spread resistance, particularly in Latin America (Assies, 2003; Schultz, 2008) which subsequently became a global campaign linked to other pressing social issues (Bakker, 2013). PSP was also limited because investors were difficult to attract, put off in part by weak revenue streams from low-income consumers and the political nature of water (Beard and Mitlin, 2021).

Neoliberal policies are implemented differently across locations. Such variegated forms of neoliberalism arise from the ways in which reforms are articulated as a set of policy prescriptions and idealized political and economic relations in diverse geo-institutional landscapes (Harris and Roa-Garcia 2013; Heynen and Robbins, 2005). As Brenner and Theodore (2002) write, 'actually existing neoliberalism' stems from the contextual embeddedness of neoliberal restructuring which is defined by legacies of inherited institutional frameworks and policy regimes. In a similar vein, scholars have called for a shift away from promoting an ideal-type to 'actually existing' heterogeneous infrastructure configurations that incorporate the reality of socio-material connections in the global South (Lawhon et al., 2018). Discussion on alternatives needs to be seen in the context of path dependencies. Policy elites play a role in making or retaining certain policy choices while maintaining the 'politics-as-usual' (Thomas and Grindle, 1990).

In the water sector, neoliberal policies have come under fire for failing to engage with the lived experience of those that lack access. An ideal-type conceptualisation of water governance is far from the everyday experience of water for many (Zwarteveen et al., 2017). In many cities of the global South, the water infrastructure has never operated at sufficient scale to serve the population. The predominant focus on efficiency and the drive for privatisation has failed to improve access and deflects from the state's responsibility to serve low-income households (Beard and Mitlin, 2021). Water systems are tied to pre-existing inequalities, and neoliberal policies risk exacerbating these (Castro, 2005). In many locations, services are heterogenous, spatially uneven and complex operating across a 'splintered' patchwork of arrangements across locations (Van Welie et al., 2018). Water access is tied into the social divisions that determine settlement patterns, engendered by institutions and entitlements, themselves typically shaped by 'powers' resulting from class, gender race as well as political and economic structures (Narain et al., 2023, p.1071; Shah and Narain, 2019; Boelens et al., 2016). Lack of access to water is linked with other

¹ Interview with Paani Haq Samiti

deprivations and is often connected with tenure status (McGranahan, 2015; Van Welie et al., 2018). Governments have been reluctant to supply water to those in informal settlements for fear this would legitimise the claim to the land (Beard and Mitlin, 2021).

Rather than a purely technical activity, it has long been established that the supply of water is political and shaped by power relations (UNDP, 2006; Swyngedouw, 2004) and the wider social institutional and geographic context (Bauer, 2005). As Mawani (2019) documents in relation to water access in Ahmedabad, outcomes are mediated by a range of actors with diverse interests through a series of what she terms “moments of ‘controlling access’” (p.8). She shows that biases are not necessarily institutionalised but that it is the granular decisions made by individual agents at each stage, that creates the system in its entirety. Thus, it is a myriad of institutions and entitlements that enable water access.

This paper explores the gap between policy and practice in Mumbai’s water system. We show how market-oriented reforms to water were resisted by a diverse collection of interests for different reasons. The same set of interests have constructed a contextually-specific interpretation of the HRW agenda to align with the prevailing institutional, political, socio-economic setting (Zwarteveen and Boelens, 2014). Elements of both paradigms have been selectively adapted in Mumbai’s ‘actually existing’ neoliberalism and water rights.

The paper stems from the long-term involvement of one of the authors, Dr Deekshit, a Mumbai resident, in the politics of water in the city. Three substantial rounds of field work were conducted during 2019. Semi-structured qualitative interviews were held with residents of three slums: Geeta Nagar in southern Mumbai, Rafiqnagar and Lullabhai compound on the eastern suburbs of Mumbai and Majas Wadi in Western suburbs of Mumbai covering 25 households. In addition, key informant interviews were held with members of grassroots movements and NGOs, i.e. Paani Haq Samiti (n = 7) Municipal Engineers (n = 5), academics in Mumbai (n = 8), covering 20 interviews. This was supplemented with an extensive literature review to cover academic material as well as formal and informal documents including documents and appeals submitted to the High Court of Mumbai; municipal budget records; reports, pamphlets, and social media posts of non-governmental organisations (NGOs) and social movements; and newspaper articles. The paper also draws on the numerous interactions of Dr Deekshit in his work as an academic and activist in Mumbai’s water, such as his observations in public meetings, his informal discussions with stakeholders, and his decade-long engagement with Paani Haq Samiti. This approach to knowledge generation allows for a longer-term historical perspective on the evolutionary processes that shape the messy complexities that generate the outcomes observed (Mitlin, 2023).

3. Institutional legacies of discriminatory water provisioning in Mumbai

Mumbai is the fourth most populous city in the world, with a population of around 21 million according to the most recent census (2011) and a density of over 30,000 people per square kilometre (second only to Dhaka) (Brodie, 2017). The city is divided. On the one hand it is India’s financial capital, home to significant financial institutions and the corporate headquarters of prominent Indian and global companies. Yet this sits apart from the reality of life in overcrowded slums with congested, polluted roads and an underserved poor population that accounts for almost half the city’s residents (Chattaraj, 2012; Gandy, 2008).

The water system is the responsibility of the municipality. Mumbai has one of the oldest municipal laws in India, specifically enacted to establish the Municipal Council. The governing body is the Municipal Corporation of Greater Mumbai (MCGM) (also known as Brihanmumbai Municipal Corporation (BMC)), a civic body established in 1888. MCGM is responsible for a range of services in Mumbai including city-cleaning, roads, health services and schools. It is one of the richest

civic bodies in India due to revenues from the high population density and large-scale commercial activity as well as substantial grants from the central government until the 1980s.

The water supply is the responsibility of the Department of Hydraulic Engineering (DHE). The water infrastructure in Mumbai is about 150 years old mostly developed under 18th century British colonial rule and subsequently extended to other suburbs as the city expanded in a piecemeal process (Stonebridge, 1927; Anand, 2017). Today, water reaches the city via a series of seven dams located on the highlands of the Sahyadri mountain ranges and 28 service reservoirs located across the city that are naturally elevated in the surrounding hills so that gravity facilitates the distribution system. The DHE mobilises around 3,800 million litres per day and is the world’s seventh largest water system (MCGM, 2019).

There are sufficient resources in terms of water, finance and capacity for all of the city’s residents to have adequate access to safe water. MCGM is one of the richest civic bodies in Asia (Contractor and Kannan, 2020; Jha, 2018) and the water division is staffed by skilled engineers (Anand, 2017). Although the population has expanded considerably, estimates indicate that there would be enough water for everyone if it were shared evenly (Björkman, 2015; Tiwale, 2021; Contractor and Kannan, 2020).

Yet residents are not well served. Even for those with a connection, water supplies are erratic. The system is managed by a complex schedule where water is provided to different zones across the city for a fixed number of hours each day. This water schedule is managed by valve operators or ‘valvemen’ who, each day, switch some eight hundred valves in the water system using cranks and levers to divert the water to specified areas for fixed time periods according to a schedule drawn up by MCGM engineers (Anand, 2017). Frustrated with intermittent supplies and low pressure, many circumvent the system enlisting the help of valvemen and plumbers directly in a sometimes semi-official but haphazard system.

Many do not have a formal water connection. Until recently, millions of slum households were excluded from the water system due to the provisions of the 1888 Act that established MCGM. The Act has provisions to disallow municipal household water connections for residents of informal settlements and to empower municipal authorities to evict households living in slums (Deekshit and Sumbre, 2022; Wagle, 2022). In slum areas, water was traditionally provided via a standpost on ‘humanitarian grounds’ which was linked to a process of ‘notification’. As part of 1971 legislation, public authorities were required to ‘notify’ settlers about proposed interventions, and a distinction evolved between the status of ‘notified’ and ‘non notified’ slums. In those that are ‘non-notified’, households are not entitled to certain public services including water or security of land tenure. They can be arbitrarily evicted and are not eligible for compensation when their homes are bulldozed (Graham et al., 2013; Björkman, 2014; Anand, 2017). There are, then, considerable benefits to living in a slum that is notified rather than one that is not.

Since elections in 1985, politics in the state of Maharashtra has been dominated by Shiv Sena, a right-wing political party founded in 1966 by Bal Thackeray with a mass appeal of reclaiming the rights of native Marathi communities, and an anti-migrant agenda. The nativist politics were merged with *Hindutva* (the religious cultural identity of Hindu) to mobilise Marathi people against ‘invaders’ (immigrants from north and south of India as well as Muslim communities) and polarise the electoral politics. On gaining control over municipal governance Shiv Sena actively used their formal municipal authority over the water supply to informally prioritise water supplies to political supporters² (Contractor, 2012; Bansal, 2015).

The rules for notification and setting of slum boundaries are fluid. Shiv Sena’s regime manipulated the rationales for notifying slum areas.

² Interview with Paani Haq Samiti.

This was ostensibly to deter new entrants and to prevent conferring legitimacy of tenure. Often, the notifying of slums is a political process and those that were Marathi or Hindu could get notified more quickly and saw more improvements than those in slums pockets dominated by non-Marathi and Muslim populations (Anand, 2017; Deekshit and Sumbre, 2022). Discriminatory practices were legitimised by narratives that portrayed poor migrants and Muslims as a source of crime and disorder and to blame for the unemployment of Maharashtrais. In water, slum dwellers were blamed for water shortages faced by Mumbai's middle-class residents (Graham et al., 2013, p.122).

The cut-off date for 'notified' status has been subject to change. Currently, households that settled after 2010 or that are located on land owned by central (rather than municipal) government (such as land owned by the national railways, ports or forest department) are classified as non-notified, even though some were established decades ago. Even within the boundaries of notified slums, non-notified dwellings exist such as where new households have been added, either beside existing hutments or as an additional floor to the notified hutments. These spaces, then, contain great diversity in terms of legality that are difficult to know and to govern (Anand, 2017).

Nearly half of Mumbai's slums are non-notified (Subbaraman and Murthy, 2015) and therefore excluded from formal water access. This amounts to around two million citizens (Contractor and Kannan, 2020). People are forced to rely on complex informal and illegal systems in which many major functionaries of the formal system are informally involved, either directly or indirectly. These informal systems are far from adequate and they are expensive. The effects of water deprivation in non-notified slums are devastating and strongly gendered (see for example studies cited by Contractor and Kannan, 2020).

Informal water systems can be classified into five distinct categories (Fig. 1).

- Piped extensions from a house with a formal connection. This would be carried out by plumbers who may not have formal training. However, equally the licenced plumbers (authorised by MCGM to physically connect households to the municipal piped network) also create informal connections. Such extensions apply a motorised pump to deal with weak pressure.
- Buying municipal water from jerrycan sellers.
- Buying from informal vendors either with water-tankers or other smaller vehicles that source water from the municipal supply or buy groundwater from boreholes of the farmers surrounding villages in Mumbai. The water sourced from the municipal piped network is illegally extracted via motorised pumps which depletes supplies from the formal system (Chowdhury, 2016).
- Groundwater from self-made dug-wells. This water is highly saline and so is not used for drinking or cooking. Safe drinking water is sourced from bottled water or water packaged in polythene bags. These wells are collectively organised, financed and managed by groups of by slum-dwellers in a form of common property resource regime (Joshi and Wagle, 2019). The wells and bore-holes are dug without permission from the state.
- Borewells (operated by a motor or by hand) provided by local political representatives using their own funds or mobilizing funds from donors.

This close nexus between valve men, local politicians, community leaders and informal vendors is vital to meet the water needs of non-notified slum dwellers. The illegality is ignored and local politicians are in some cases involved in the informal water operations as their businesses, while others especially council members support the informal water market which provides opportunities for their political workers and campaigners (Subbaraman et al., 2013). Alongside the physical infrastructure, water access relies on complex social arrangements, even for non-slum households (Björkman, 2015; Anand, 2017). In line with observations by Narain et al., (2023, p.14), both formal and

informal, piped and non-piped water overlap via "complex constellations of actors".

4. Selectivity in adopting neoliberal water policies in Mumbai

The boundaries between formal and informal are blurred such that the system has become 'informally formalised' (or formally informalised) (to paraphrase Misra, 2014). These complex pre-existing political, socio-economic and institutional structures have a major impact on the way that neoliberal water policies unfold (Brenner and Theodore, 2002; Thomas and Grindle, 1990). From the 1970s, the municipal government of Mumbai came under significant pressure, initially from the World Bank and subsequently from the central government, to adopt neoliberal policies in the water sector. Expectations of these reforms were high, promoted by consultants, donors and the government. As they gathered momentum, these reforms were intended to create a 24x7 system (water supplied at the household tap continuously, for 24 h a day, seven days a week) and linked to a vision of the remaking Mumbai as a world class city (Anand, 2020; McKinsey, 2003).

A series of World Bank loans between 1973 and 1997 amounting to lending of almost US\$440 m set out measures intended to instil financial discipline and institutional reform in MCGM. The loans strongly encouraged and pushed the municipal government to impose new tax regimes so as to increase the water revenue base in order to be able to pay back the loans (see below on the water benefit tax). It is, however, worth noting that the existing MCGM system was considered to be doing reasonably well at the time (World Bank, 1973, p.16; World Bank, 1986, p.4).

Subsequently, pressure for neoliberal water reforms came from the national government in 2005 through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) intended to boost urban development in 63 cities with substantial grants for infrastructure. Disbursement of central government funds also had conditions attached at the state (sub-national) and city level. These broadly focused on, (i) cost recovery and financial sustainability of urban utilities, (ii) structural-legal-procedural reforms for bringing in PSP in service delivery, (iii) rationalisation of tariff and staff-sizes of urban utilities, (iv) relaxing land regulations and (v) protective measures for poor households (Deekshit, 2015). The JNNURM adopted a 'performance-based disbursement' approach for releasing funds to local bodies, based on a progress card of implementation of the reforms. Water became the principal sector to receive funding under JNNURM. The central government facilitated the establishment of special public-private partnership (PPP) units at the level of sub-national governments, launched training programs for public officials, and mobilised 'project development funds' to craft 'viable' investment proposals in the water sector. In 2015 JNNURM was replaced with the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) which operated along similar lines. This 'second wave' of reforms in municipal governance, broadly focusing on cost-recovery in infrastructural services, had a strong neoliberal base and prompted the "incurion of private sector principles into a traditional public sector ethos" (Ranganathan, 2013 quoting Laïla Smith (2004, p. 375)).

The MCGM was a major beneficiary of the JNNURM scheme (MCGM, 2011). Grants released by the central government were used to complete the Bombay Water Supply Project – IV, which included the controversial Middle Vaitarana Dam, contributing additional capacity of 455 million litres per day (Dandekar and Thakkar, 2014). According to one retired MCGM engineer, MCGM access to JNNURM funds led to a push for PPPs in urban infrastructure, including water supply (Mahalingam, 2010).³

Yet, these measures were widely espoused with little reference to the political, socio economic and geographical context within which they would be implemented. This section shows how elements of this policy

³ Personal communication with MCGM Engineer.

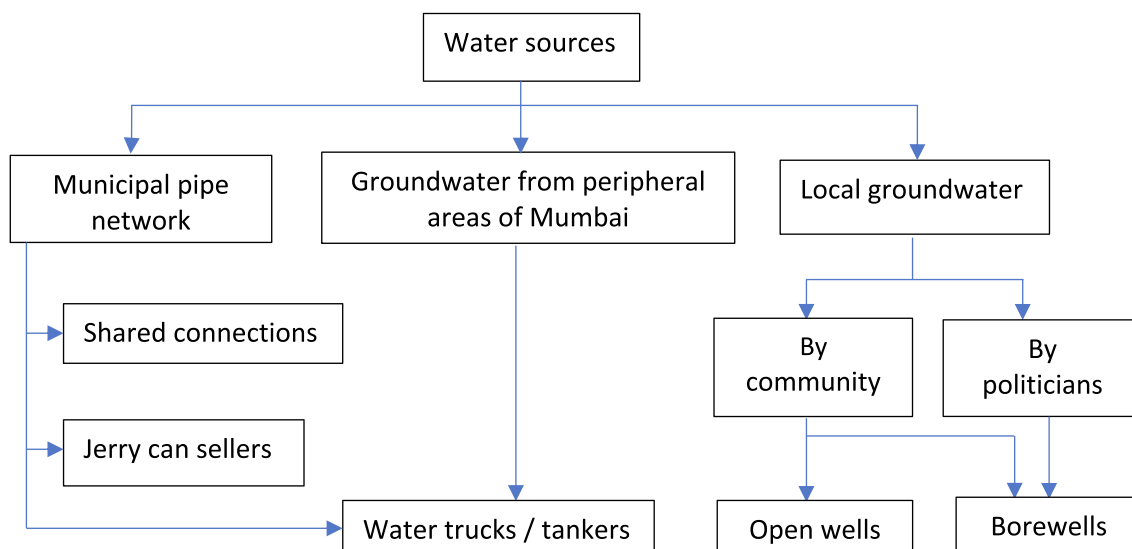


Fig. 1. Informal Water System in Mumbai.

paradigm have been adopted selectively while much of the neoliberal ethos has failed to take root in Mumbai's water. Core elements of the orthodox water policy paradigm such as privatisation, commercialisation, cost recovery pricing and water metering exist only on the fringes of the water system, effecting little significant change in the way the water system is managed.

4.1. Privatisation and prepayment meters rejected

One of the more momentous turns in the limited neoliberalising of Mumbai's water came in 2007. MCGM appointed consultants, Castalia, to design a pilot phase for the Water Distribution Improvement Project in Mumbai city's K-East ward, intended to plug leakages, introduce 100 % metering and provide 24x7 supply to all users, including providing water via prepayment meters in slum areas (Bawa, 2016), under the proposed Integrated Slum Water Improvement Program. Prepayment meters were attractive to the municipal authorities because they avoided the issuing of a paper water bill which might be used by slum residents as a claim for legal housing tenure. As Anand (2017) documents, the water bill provides much more than water but rather represents recognition by the state and a formalisation of citizenship.

Under World Bank terms, three public consultations were organised in 2007 for Castalia to present their final report which was rumoured to contain plans for privatisation. While invited stakeholders were selected because they were expected to be supportive of the policies (Bawa, 2016), there was strong resistance from civil society. A group of local activists organized under PHS mobilised a strong media campaign against pre-paid meters and privatisation. As Björkman (2015, p.49) writes, "by the time Castalia released its report, Mumbai's globally connected anti-privatisation activists were prepared for battle".

In addition to PHS's struggle, the pre-paid meter proposal was also quietly opposed by the city's water engineers who operated the complex valve-switching system where a large share of normal meters was not functioning and which would not be able to sustain a system of expensive prepaid meters (Anand, 2020). As Anand (2017) documents, some city officials were sympathetic to the water needs of slum dwellers and the informal interventions that allowed the engineers to ensure that water reached migrant communities that were legally barred from water access would not be possible in a privatised system with strict monitoring of leakage and per capita consumption (Bawa, 2016).

Alongside these visible, explicit forms of resistance, behind the scenes, opposition also came from the major political parties, especially Shiv Sena which internally opposed Castalia's proposal as the party

would lose control over nativist politics by offering blanket connections with pre-paid meters (Deekshit and Sumbre, 2022). A number of other groups also stood to lose from the measures proposed including licenced plumbers, local politicians, and informal vendors. Tensions were high during the consultation meetings and eventually, plans for privatisation and prepaid meters were quietly shelved, with MCGM explaining that the policies were not adopted on the grounds that any attempt to formalize water supply to slums could be termed illegal in a court of law. But this techno-legal explanation obscured the underlying politics at work. For public officials, Castalia's proposal was an unwelcome proposition that would lead to them losing political control of the water system. Thus, selective prioritisation of the provisions of the MCGM Act could successfully be utilised to create a narrative that MCGM is constrained by the law (Deekshit and Sumbre, 2022).

Further pressure for privatisation from JNNURM and AMRUT led in 2014 to a five-year contract between MCGM and French company, Suez Environnement for a range of projects to improve water distribution in Mumbai. However, for three years, Suez was prevented from starting the project due to lack of data and cooperation and five years after the project began it was wound up (Construction World, 2021; Singh, 2021). Suez was, however awarded a contract in 2015 as part of MCGM's Mumbai Sewage Disposal Project, funded by the central government through the AMRUT, scheme, for a Euro42m wastewater project at Colaba (Suez n.d.; Grafe, 2020) followed by a much larger Euro700m wastewater treatment plant at Worli in 2022 (Suez, 2022). These 'design-build-operate' (DBO) contracts which run for 15 and 20 years respectively are a much more manageable form of private sector engagement. While contractual details are not made public, typically under such DBO structures, the private sector's responsibilities are clearly ring-fenced with little financial risk and a secure revenue flow from the state contracting party (Bayliss, 2020). Suez is excluded from everyday interactions with the complex and highly divided society of Mumbai. Thus, privatisation is only possible at the margins of the water system and is likely to have little effect on the day-to-day operations. The physical, social and political complexities are such that more substantial private sector engagement is unlikely. As one retired engineer told us 'Mumbai's water supply can never be understood by the private sector operators and only MCGM hydraulic department can optimise it although gradually'.⁴

⁴ Personal communication with retired chief hydraulic engineers, MCGM.

4.2. Cost-recovery tariffs

One of the early reforms initiated under international pressure through World Bank conditionalities in the 1980s was tariff reforms with a rationale for cost-recovery in water pricing so that people pay for what they consume. But this relies on a level of infrastructure and organisational sophistication that has not been possible to deploy and maintain in Indian conditions. Also, it neglects the informal social relations that sustain water systems in practice in Mumbai. The MCGM did undertake a metering drive, but an early evaluation revealed that while 75% of the connections were metered, 80% of meters did not function. Domestic tariffs were far below the full financial cost and favoured domestic over commercial and industrial consumers. More than 30% of customers reported paying nothing for water (World Bank, 1996). MCGM continues to replace defunct meters but still many connections are not metered.⁵

Despite having a formal policy of metered connections and consumption-based tariffs, some three decades after reforms began, water revenue comes mainly from charges based on rough proxies rather than actual consumption.

There are three elements to water tariffs in Mumbai:

- i) Water charges based on the volume of water consumed for metered connections.

The majority of Mumbai's water connections are officially metered. Metered connections are more common in the apartments and high-rise buildings of upper- and middle-class households. Domestic water connections in lower middle-class neighbourhoods and slums are not usually metered. There is a cross subsidy across types of user. Tariffs for domestic consumers are very low, from as little as Rs.4.45 (US\$0.056/m³), but these vary across residency categories. This lowest rate applies in notified slums, chawls,⁶ old villages,⁷ tribal habitats and slum communities that purchase water in bulk quantities to distribute via their own internal system at the neighbourhood level. Social institutions such as hospitals, schools and prisons are also charged at a lower rate of \$0.074/m³. This tariff also applies to domestic connections that do not qualify for the lower rate. However, domestic use has been capped with an Increasing Block Tariff (IBT) in place. Consumption blocks over 150 litres per capita per day (lpcpd) are charged at higher rates on a sliding scale. The highest rate is for consumption above 250 lpcpd, which is charged at a rate of US\$0.30/m³. Industrial consumers are charged a higher price, up to Rs.123.00 (US\$1.54) per m³. The highest charges are reserved for industries that sell water products such as bottling plants, and manufacturers of cold-drinks and purified water. For other industries, tariffs range from US\$0.55 to US\$1.12 per m³. Sewerage charges are 70% of water charges (MCGM, 2015).

However, such a consumption-based tariff system relies on effective metering and only around half of the city's 330,000 meters are functional. Many of the functional meters do not give a reliable reading (Björkman, 2015, p.45). In practice, many bills are based on estimates. In a meeting with MCGM in January 2019, we were informed that if meters are not functioning, the bill is based on consumption in the previous period, or when the meter was last working if it broke in the last six months. If the meter has been broken for longer, the bill is based on an assumed consumption and this varies depending on location. In slums, household consumption is estimated to be 225 lpcpd, based on an assumed consumption of 45 litres per person and five people per

⁵ Metering has long been subject to resistance in Mumbai due to lack of trust regarding their accuracy. Meters are often tampered with, break or are stolen. The municipal corporation has had more success in metering the connections of middle and upper classes who subscribe to the idea of metering and protect their meters.

⁶ Large buildings divided into tenements usually for migrant labourers.

⁷ Old traditional fishing settlements that predate the modern city.

household. In chawls household consumption is assumed to be higher at 90 lpcpd and in flats its 135 lpcpd as these will have flushing toilets and maybe other water appliances.

- ii) Water tax and sewerage 'tax', which is linked with the property value for unmetered connections. Unmetered connections receive bills based on a percentage of property values, so a higher tariff is charged to consumers in wealthy areas and to industrial connections, and lower to domestic connections in poorer or lower middle-class areas. The tariff also depends on the size of the connection hardware (diameter of the pipe, for example, a size of ½ inches or ¾ inches) if the connection is not metered.
- iii) Water and sewerage benefit 'tax' also based on property value. These charges were introduced to raise funds for capital expenditure and extending the piped networks. The water benefit tax is based on the capital value of the property and the rate depends on the category of user, with commercial properties charged a higher rate (MCGM, 2015).

Fig. 2 shows data from MCGM's water budget estimates, based on the revenues received from the various types of water tariffs. The figures indicate that the largest share of revenue comes from the water benefit tax which has risen both in value and overall share for over the past nine years. Revenue from water charges has also increased but the share is smaller.

Since 2014, 60% of water revenue has been from charges based on property values (Fig. 2). The remaining 40% is based on consumption charges but, as mentioned above, in many cases these too will be estimates due to inaccurate or broken meters. Despite decades of external pressures, water revenue management in Mumbai continues to operate in a realm of assumptions and judgements rather than the scientific measurement and metrics promised by the neoliberal paradigm. While not based on consumption, the water benefit tax contributes the highest share of water revenue. This slice of revenue is important for MCGM to retain creditworthiness for borrowing and thus allows MCGM to show commitment to cost-recovery pricing.

Effective revenue management also calls for sanctions for non-payment and MCGM has an official policy of disconnecting those that fail to pay their water bill. While there are media reports of water disconnection (Acharya, 2022a), in interviews we were told that connections are not cut or at least, this seems to happen on a discretionary basis rather than following policy. The MCGM time and again announces short-term measures such as the waiving of penalties and persuades defaulters to pay the outstanding bills. According to one engineer interviewed, disconnections for non-payment of water bills would not be possible across all defaulters as 'there would be anarchy'. Moreover, press reports indicate that there are high profile public offices that owe money for their water services including the residence of the Chief Minister of the Shiv Sena and other government ministers (Pinto, 2019) as well as Mumbai Police (Upadhyay, 2019). In addition, the water department itself has liabilities owed to public financial intermediaries such as the Life Insurance Corporation and Housing and Urban Development Corporation (HUDCO).⁸ Non-payment of bills is tolerated across government offices. Thus, water revenues continue to operate outside formal structures despite efforts to promote the standard neoliberal approach to financial management.

Overall, then, neoliberal water reforms have had little transformational impact on the financing of the water system in Mumbai, despite attempts to shift the policy framing over the past three decades. The institutional legacies of water management, including the informal system of water access in non-notified slums and non-compliance to

⁸ Personal communication with staff of utility companies, a consultant with Asian Development Bank, Mumbai academics, and a retired engineer, MCGM.

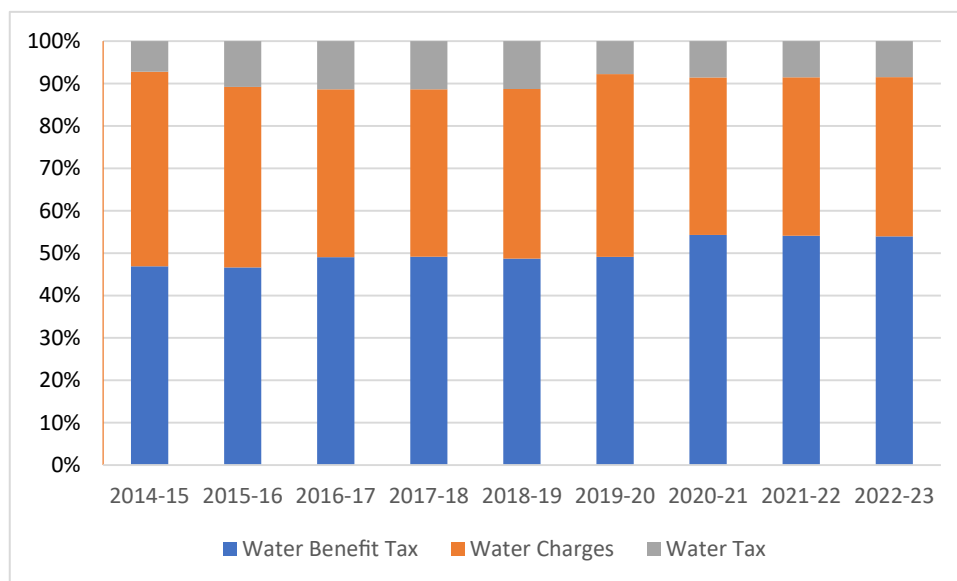


Fig. 2. Contribution of different tariff types to Mumbai's water budget (actual and anticipated, 2014-to-23) (US\$m).

metering by lower middle-class households and notified slums have substantially shaped attempts to neoliberalise Mumbai's water management. There is a sense that officials want to be seen to be following orthodox policy in order to comply with central government and global institutions, but the approach to implementation in practice is highly selective. For example, financial sustainability and cost recovery pricing is achieved by the property-based water benefit tax rather than cost-reflective pricing. Some other neoliberal-type principles were adopted such as the ring-fencing of water revenue from the rest of MCGM's finances and some tariff reforms such as the increasing block tariff and metering, but this is in policy more than practice. Some private sector involvement is found in parts of the sewage treatment system, where revenue streams from MCGM are secure and without the need for Suez to deal directly with water users. This is a way to respond to the pressures for PSP while everyday water management remains under the municipal authorities.

Part of the rationale for neoliberal water policies is to reduce the scope for political intervention and to formalise haphazard and discretionary decision-making into a supposedly neutral, technical structure. But the prevailing complex system offers many benefits for the system operators and political leaders which would be weakened by the regularisation of the water system. Political elites benefit from control of the water supply. Their alignment of interests with civil society activists is not so much due to progressive politics as a preference to maintain political control, with the scope for discretionary intervention over the water system.

Neoliberal reforms have been resisted elsewhere in India. Attempts to establish PSP in water started in the early 2000s in Delhi, Mumbai, Bangalore, Pune, and Selaulim, Hyderabad, and Tiruppur (Deekshit and Wagle, 2019). A PSP contract was awarded in Tiruppur, while in Delhi and Bangalore proposals faced opposition from civil society groups with a position that, by and large, echoed with appeals for democratization of decision-making processes and claims of human right to water (Ranganathan, 2013; Bywater, 2013). The attempts to seek PSP in Pune and Hyderabad also failed due to the possibility of a tremendous increase in tariff for municipal governments as well as citizens.

But Mumbai's resistance is slightly different from that of other metropolitan cities in India. The water movement has built up gradually through a combination of diverse actors and forces (van den Bergeet al., 2022). As in Delhi and Bangalore, Mumbai's civil society groups mobilised the voices of protests against privatization. However, the origin of the movement was rooted in the legal provisions that denied water to the

slum dwellers, and the privatisation protests were only a small part of this. PHS had already started working with slum-dwellers in Mumbai for a variety of basic services, and gradually sought support and ensured active involvement of academics, NGOs, and media supporters in the process. This subsequently provided opportunities for PHS to engage with global anti-privatisation movements. Moreover, Castalia's proposal to privatise water supply was not at a city scale, but specifically targeted the slums. The anti-privatisation struggle provided PHS with a larger narrative of 'water dispossession', cultural discrimination, and political exclusion and a direct link to a global rights-based campaign for water.

5. HRW and the new water for all policy of MCGM

In April 2022, Shiv Sena unexpectedly announced a new policy of 'Water for All'. This immediately overturned the denial of water rights to those in non-notified slums (although some restrictions remain, see below). The origins of this major policy shift date back to the early 2010 s. Activists and campaign groups such as PHS have long protested at the treatment of those in non-notified slum areas that are denied access to water. Numbers are difficult to know with certainty but one study by PHS found that 70% of settlements, around two million people, had been denied formal water access, requiring them to resort to illegal means, often leading to intense deprivation (Deekshit and Sumbre, 2022). However, MCGM has for years refused the demands of campaigners, citing legal obstacles but also reflecting hostility to slum dwellers outlined above (see Anand, 2017; Björkman, 2015; Subbaraman and Murthy, 2015, Wagle, 2022; Deekshit and Sumbre, 2022).

Following years of street protests, it became clear that large-scale demonstrations were ineffective and could be antagonistic, so in 2011 PHS adopted a different approach. They took legal action, filing a Public Interest Litigation (PIL) against MCGM and the State of Maharashtra in the Bombay High Court. The PIL questioned the discretionary logic of the notification cut-off date policy, addressed misconceptions about informal settlers and argued that water is a fundamental (constitutional) right of Indian citizens by referring to past judgements of the Supreme Court of India and Indian Constitution. The specific arguments by PHS were that:

- The right to water and the right to housing could be separated.
- To deny a right to water is to deny right to life which is guaranteed in the Constitution of India (this argument had already been upheld by the Supreme Court).

- Many public sector employees live in non-notified slums.
- There are 53,000 buildings in Mumbai that are illegal but not in slums and they are getting water, so access cannot be denied on the basis of illegality (PIL, 2014).

The first two arguments were instrumental in addressing what were previously considered “intractable legal barriers to water access” in non-notified slums (Subbaraman and Murthy, 2015, p.816.). In a landmark ruling 2014, the High Court of Bombay ruled that India’s constitutional right to life implied the right to water (as well as food, shelter, education and medical care). The court dictated that MCGM should formulate a policy to provide water for residential purposes to the occupants of informal settlements formed after 1 Jan 2000 (i.e. those that were classified as ‘non-notified’) (PIL, 2014).

The court ruling represented a major political milestone. But it came with restrictions. Notably, residents of so-called illegal slums which have emerged since the start of 2000 could not claim a right to drinking water ‘on par with a right of a law-abiding citizen who is occupying lawfully constructed premises’ (PIL, 2014, p.21). This meant that access could be in the form of a truck or other arrangement rather than a piped connection; residents in non-notified slums could be charged a higher price; and the ruling was at pains to delink water from housing. It emphasises that the slums constructed after 1 January 2000 are unauthorised, unprotected from demolition and that the supply of water does not confer legality, which effectively accentuates the illegality of the tenements, thus weakening tenure security (Wagle, 2022). The court ruling also endorsed the use of prepaid water meters so that water access would only be provided on the basis of advance payment. These had been resisted before in the city (see above) and contrary to a rights-based framing, the prepaid meter provides conditional access, based on the responsabilisation of the individual to organise behaviours in a way that meets the demands of the meters (Baron et al., 2019). Thus, rather than a universal and inalienable right to water, the ruling effectively provides legitimacy to the notion of a differential in fundamental rights for slum households (Koonan, 2015; Deekshit and Sumbre, 2022).

MCGM drew up a new water policy in 2017 in response to the court ruling (MCGM, 2017). While the court ruling led to a significant shift in rhetoric surrounding slum access to water, little changed in practice for several reasons. First, there were extensive restrictions and many slum dwellers were excluded, such as those living on pavements or on private land. In addition, slum dwellers were required to obtain a no-objection certificate (NOC) from the landowner, which may be private individuals or public departments, before approaching the civic body for water supply. For the many slum dwellers living on land owned by numerous and often central government departments such as the railways, port authorities, lands under coastal regulatory zones (mostly seashores), forest lands, salt-pan authority lands, obtaining such documentation is virtually impossible (Venkatraman, 2015). Several appeals and submissions to the central authorities for NOCs have not been successful (Deekshit and Sumbre, 2022). Second, implementation of the new policy was incredibly slow. PHS works with households to manage the bureaucracy and information-gathering required to apply for a water connection. But out of 1200 water applications filed by PHS on behalf of over 6000 families between 2017 and March 2020, 785 were accepted for processing and only 96 were successful, granting water to 400 families, just 7% of those that had applied for legal water connections (Contractor and Kannan, 2020).

Third, some policies put forward by the court ruling were already in place, such as the supply of water via tankers. But typically, trucked water is charged at a higher price than the water network charges. Moreover, the quantity of water provided by trucks is insufficient to fulfil domestic water requirements and often the decision to deliver water by trucks is at the discretion of MCGM. Truck-supplied water is far from adequate to meet human rights.

Finally, policy implementation was impeded by the existing socio-political relations around water access. PHS found that many slum

residents were deterred from applying for water connections by the informal but powerful water vendors. The vendors were also supported implicitly by local politicians and municipal officials who were involved in the nexus of informal water sale which would be threatened by the roll out of formal water connections.

The court ruling was, thus, a fragile victory for human rights and far from the spirit of transformational social justice. But, as the court ruling was in part reliant on the progressive political leaning of the presiding judge. PHS opted not to appeal against the extensive limitations in implementation in part because of the risk that another judge would be less sympathetic (Wagle, 2022). And despite the limitations, there were significant positive outcomes such as a shift in narratives, the erosion of the stigma of slum dwelling and the confidence boost for slum residents. The verdict provided “broader legitimacy and moral sanctity to the claims for formal water access by unprotected slumdwellers” (Wagle, 2022, p.4). The ruling was important for the next step in water access for slum households.

In 2022, the government introduced the policy of WFA which removes most of the legal barriers to supplying water to households in slum areas. The policy offers standpost connections to groups of 15 or more slum-dwellers and these will be connected to the main water supply. Still some restrictions apply. Applicants will have to provide proof of residency, and implementation is largely limited to land under municipal ownership. Residents on land owned privately or by other government departments are required to obtain a NOC but PHS reported in interviews that these have not been provided (except from one government department) on the grounds that there is no legal precedence for this. The standpost connections are subject to cut-off in the event of non-payment of water charges and/or poor maintenance of the taps, meters, and pipes (MCGM, 2022). The division between water access and housing tenure outlined in the PIL is reiterated as the WFA policy maintains the ‘responsibility’ of MCGM to demolish the slums, although it provides water access ‘in some form’ as per the directions of the 2014 ruling of the High Court of Bombay and with slightly higher charges to all hutments informally erected after 01.01.2000 (MCGM, 2022). This approach has echoes of the neoliberal pricing policy of charging more to those who cost more to supply, demonstrating the constant recalibration of neoliberal principles by the municipal officials and selectivity in choosing from the neoliberal textbook, in Mumbai’s ‘actually existing neoliberalism’.

Despite the restrictions, the WFA represents a remarkable turnaround in the political narrative after years of hostility from Shiv Sena to migrant communities in slum areas. The policy has been spearheaded by Aaditya Thackeray, grandson of the founder of Shiv Sena and President of the party’s youth wing. Shiv Sena only operates in Maharashtra state and they have seen a sharp decline in their majority in recent years. Increased support is vital for political survival against the national BJP party. According to interviews with activists and journalists, WFA is an attempt to boost political support even though the party remains committed to its Marathi and Hindu centred focus.

The rollout has been speeded up by the involvement of informal actors. To secure a water connection, households are required to go through a detailed application process to prove eligibility, requiring substantial documentation. PHS has been supporting applicants with this process but, as stated above, progress has been slow. However, WFA has opened the space for applications supported by licensed plumbers. According to senior PHS officials, in one slum, Ambujwadi, by the end of 2022, 1600 group water connections had been awarded since the April court order, out of which only 200 can be credited to the efforts made by PHS. The remaining 1400 connections were from applications submitted by licenced plumbers. PHS report that applications from licenced plumbers progress faster due to informal payments that oil the wheels of the system. PHS have found that any small gap in the detail of the PHS supported applications (which do not involve payments of bribes) leads to it being rejected, while some grossly incomplete applications from licenced plumbers are approved.

The WFA policy invokes the rhetoric of human rights (see for example Acharya, 2022b) but implementation relies on the uneasy coalition of interests that led to the rejection of neoliberalism. The translation from PHS advocacy to policy implementation reflects the underlying power relations and vested interests that have long dominated water politics in Mumbai. Increased water access in slum areas results from the alignment of the combined interests of the political leadership as well as those responsible for the day-to-day system management, alongside activists. Often it is the informal water vendors, linked to politicians as well as hydraulic engineers, which manage the everyday water supply and govern the connections on the ground. These relationships involving various kinds of informal exchanges including unauthorised monetary exchanges have been mobilised in support of the WFA programme. Thus, the implementation of the rights-based approach, in common with neoliberal policies, only operate within the bounds of existing social relations and the nexus between local political workers, licenced plumbers, and municipal engineers.

6. Conclusion

Water reforms in Mumbai are shaped by the political, institutional, geographical and socio-economic context within which they are implemented, and water systems are manipulated to suit powerful interests (Shah and Narain, 2019; Boelens et al., 2016; Zwartveen and Boelens, 2014). The lack of water access in urban slums is not due to the absence of water, capacity or finance but wider socio-political imperatives (Swyngedouw, 2007). Global paradigms have been moderated to fit with the prevailing context such that Mumbai has adopted its own version of path-dependent, ‘actually existing’ neoliberalism and ‘actually existing’ human rights to water.

The case study demonstrates Brenner and Theodore’s “blatant disjuncture” between the ideology of neoliberalism and its everyday political operations and societal effects (2002, p.352). With hindsight, when the full context is taken into account, the glossy vision of a 24x7 citywide water supply offered by the World Bank and consultants seems almost delusional. Instead, there is a peripheral, tokenistic form of neoliberalism with PSP on the margins and a veneer of cost recovery pricing, while in practice revenue is mainly based on property value and assumptions about consumption.

The HRW rhetoric adopted in the PIL court ruling provided a verdict which meant that legally abiding citizens had human rights of a higher standard than citizens that cannot abide by legal provisions for acquiring a house. So-called illegal residents are charged a higher price and face bureaucratic barriers to securing a connection. Households remain at risk of eviction. While the WFA policy has led to an increase in those connected to the water supply, in practice the process continues to be largely discretionary, reliant on social relations and informal payments. Despite the limitations, many households now have connections thanks to the new policy, but this is not the same as the inalienable universal human rights advocated by the United Nations.

Policy making is not a linear process of decision-making and implementation but is complex, circular, and multi-dimensional (Thomas and Grindle, 1990). There is a gap between policy and practice operated by a complex set of agents that have a role in shaping water distributions. Water systems stem from institutions and entitlements rather than policy (Shah and Narain, 2019). Grassroots campaigners, in line with water rights and anti-privatisation activists globally, have for years been promoting equity and social justice in the water system. These interests coincided with those of politicians who, for different reasons, were opposed to privatisation. And the institutional and physical idiosyncrasies of the Mumbai water system rendered it highly unsuitable for privatisation and widescale metering.

The case of Mumbai demonstrates that the absence of privatisation and financialisation in the water sector is not necessarily down to progressive politics so much as political interests, and the same is evident for increasing water in slum areas. Both resistance to neoliberal policies

and the adoption of water as a human right reflect a similar alignment of interests of activists with those of politicians, water engineers and informal water providers. The ways in which transformative change is resisted can be complex and often subtle.

This case study offers insights for water rights activists. First, the legal challenge was more successful than street protests, and the PIL ruling in Mumbai highlights that it is possible to decouple water rights from housing tenure. Notwithstanding the limitations in implementation, the PIL ruling was instrumental in shifting the dial on the Human Rights agenda, highlighting the importance of local actors in shifting legal norms (Karunanathan, 2019). Second, water rights campaigners need to take heed of the underlying cultural, institutional and political context (Zwartveen and Boelens, 2014, p.155). It is the embedded relations that have shaped the specific interpretation of water rights in Mumbai. As Angel and Loftus (2019) note, rather than a success or failure, this highlights the possibilities in the geographically grounded struggle in Mumbai. Third, paradigm shifts are more likely to lead to changes in practice insofar as they suit political ends. The case of Mumbai indicates that effective policy change relies on an alignment with elite interests.

Finally, the status quo is maintained for many reasons. The supply of water in Mumbai is embedded in a system that has deep historical roots and idiosyncrasies that are far removed from a traditional water system in the global North (Lawhon et al., 2018). It is these ‘messy realities’ that shape the flows of water and power (Beard and Mitlin, 2021). The system is run according to an immensely complex set of social and physical infrastructures via experienced engineers and plumbers as well as political agents. Many of these benefit from the current operations. This cannot simply be replaced or overruled by an externally imposed set of rules.

The experience of Mumbai shows that water systems cannot be understood in terms of broad paradigms but rather need to be considered in terms of the politics, power relations and associated narratives. The case study demonstrates that standard policy packages mutate when “released into the wild” (Peck and Theodore, 2010, p.173). The local political economy of the water system, operating through myriad combinations of formal and informal spaces shape the actually existing practices of water access. The historical, path-dependent character of power relations embedded in the larger political economy of water has compelled policy-makers to create a unique blend of progressive taxation policy with the (neoliberal) cost-recovery pricing. On the other hand, the same has compelled courts to adopt an interpretation of the ‘rights’ of slum population to water without compromising the pre-existing legal provisions that deny and facilitate water access. Nevertheless, despite extensive obstacles in implementation, the legal action by PHS was instrumental in causing a shift in pre-existing power relations and elevated the voices of the most marginalised. While the nature of the WFA rollout looks set to continue to be based around the power relations and vested interests that have long dominated water politics, the boundaries of what is considered possible have changed considerably.

Credit authorship contribution statement

Kate Bayliss: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Pranjal Deekshit:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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