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Public Provision To Private Dependence: Declining Trust In Municipal Water And The Rise Of Costly Commercial Alternatives In Karachi

Dr. Sahar Afshan[1], Tazeen Saleem[2], Mehak Ather[3], Mahzaib Noor Ansari[4], Dr. Anantha Raj A. Arokiasamy*[5]

[1]Senior Assistant Professor, Head of the Department Humanities and Social Sciences Bahria University Karachi Campus 13 National Stadium Rd, Karsaz Faisal Cantonment, Karachi, Pakistan Email: saharafshan.bukc@bahria.edu.pk, https://orcid.org/0000-0002-7222-1123

[2]Bahria University, Karachi Campus 13 National Stadium Rd, Karsaz Faisal Cantonment, Karachi, Pakistan, tazeensaleem.bukc@bahria.edu.pk, 0009-0009-0466-0640

[3]Alumni, BS Social Sciences, Department of Humanities and Social Sciences, Bahria University Address: 13 National Stadium Rd, Karsaz Faisal Cantonment, Karachi, Pakistan Email: maheck.patel@gmail.com

[4]Alumni, BS Social Sciences, Department of Humanities and Social Sciences, Bahria University Address: 13 National Stadium Rd, Karsaz Faisal Cantonment, Karachi, Pakistan Email: mahzaibansari21@gmail.com

[5]Imman Yameen Ghandhi Alumni, BS Social Sciences. Department of Humanities and Social Sciences, Bahria University 13 National Stadium Rd, Karsaz Faisal Cantonment, Karachi, Pakistan immanghandhi@gmail.com

[6]Associate Professor Faculty of Business and Communications, INTI International University Address: Persiaran Perdana BBN Putra Nilai, 71800 Nilai, Negeri Sembilan anantharaj.asamy@newinti.edu.my, https://orcid.org/0000-0001-9784-6448

Abstract

This study investigates how institutional failure and declining public trust in Karachi's municipal water systems have compelled households to rely on costly commercial alternatives, transforming water from a public right into a commodity. Amid rapid urbanization and infrastructure decay, the city receives less than half of its daily water requirement, while widespread contamination has undermined public confidence. Using a mixed-methods exploratory design, the research combines household surveys, expert interviews, and microbiological testing of RO water across three socioeconomically distinct neighborhoods—DHA Phase 2 Extension, Federal B Area Block 15, and Korangi Sector 6C—to assess water access, affordability, quality perceptions, and coping strategies. Findings reveal that reliance on bottled and reverse osmosis (RO) water is a structural necessity rather than a preference, with low-income households spending up to 20% of their monthly income and affluent households up to PKR 20,000. Despite high costs, residents express deep skepticism about water safety, citing unhygienic vendor practices and limited regulatory oversight. While RO samples tested microbiologically safe, elevated Total Plate Counts in some cases and the lack of chemical analysis highlight persistent concerns over long-term health risks. These findings underscore how Karachi's water insecurity reflects broader patterns across the Global South, where neoliberal reforms, intermittent supply, and weak regulation have transformed water from a public right into a commodified, transactional good and disproportionately burdened marginalized communities. The study concludes that Karachi's crisis stems from systemic institutional failure rather than physical scarcity, and that restoring water equity requires urgent infrastructure renewal, robust regulatory oversight, and participatory, community-led governance reforms. While geographically limited and lacking chemical testing, the research highlights the urgent need for broader, long-term studies to inform rights-based policy interventions aligned with Sustainable Development Goal 6 and to rebuild public trust in municipal water systems.

Keywords: *Municipal Water, Clean Water and Sanitation, Water Supply, Pollutant Removal.*

1. INTRODUCTION

The global water crisis represents a critical development challenge, intersecting with public health, sustainability, and urban equity (Biswas et al., 2025). While 74% of the global population has basic drinking water services, over 2 billion people still lack safely managed water, a gap projected to widen with continued urbanization, climate change, and weak governance (Bose et al., 2024, WHO et al., 2022). Pakistan, facing geographic vulnerabilities and poor water governance, suffers acutely: over 60% of illnesses stem from unsafe water, and only 36% of urban households have piped access, with usage declining 40% between 2007 and 2020 (Maqbool, 2024).

Karachi, Pakistan's largest metropolis, vividly illustrates the deepening urban water crisis. With a

population exceeding 20 million (Ayub, 2023), the city needs approximately 1,100 million gallons of water per day but receives less than half that amount due to systemic issues such as extensive leakages, illegal connections, and sewage infiltration (WWF, 2019; Ahmed, 2025; Muhammad Toheed, 2025; Shahid & Ali, 2024). As a result, more than 90% of municipal water samples are chemically or microbiologically contaminated (Kumar et al., 2022). These failures have forced residents to increasingly depend on costly and unregulated alternatives: around 25% of households obtain water from tanker trucks, while 34% rely on small vendors or bottled water, options that can cost up to 29 times more than municipal rates (Farooqi, 2024; Khan & Arshad, 2022; Beard & Mitlin, 2021). Low-income families may spend as much as 20% of their monthly income just on drinking water, deepening cycles of inequality and precarity (Khan & Arshad, 2022). These market-based alternatives, while filling critical gaps, remain poorly regulated and frequently unsafe, reproducing urban inequities and exposing already vulnerable communities to further health and financial risks (Beard & Mitlin, 2021).

Karachi's water crisis exemplifies a broader global transformation in which water is shifting from a public good to a commodified, market-governed necessity. While existing research has primarily focused on technical and infrastructure-based solutions (Shahid & Ali, 2024; Khan & Arshad, 2022; WWF, 2019), it has insufficiently examined how eroded trust in municipal systems, perceptions of water safety, and household-level socioeconomic constraints shape water-related decision-making. This study addresses that gap through the lens of social ecology by Murray Bookchin (1998), which critiques how hierarchical, profit-driven systems commodify essential resources and reinforce urban inequalities. It explores how governance failures, environmental degradation, and infrastructural decay compel households – especially in marginalized communities – to depend on costly and often unsafe commercial alternatives. Using a mixed-methods approach – the research highlights the differentiated burdens across socioeconomic groups and argues that water commodification in Karachi not only reflects institutional breakdown but actively reproduces spatial and economic inequality. The study calls for equitable, community-centered reforms to reframe water as a universal public good.

2. LITERATURE REVIEW

Karachi's water crisis exemplifies a broader transformation in Global South megacities, where water insecurity is shaped not only by physical scarcity but also by deep structural inequalities, infrastructural decay, and institutional fragmentation. Aging infrastructure, misgovernance, and neoliberal shifts have collectively redefined water from public goods into a commodified, market-governed resource, mirroring challenges across other rapidly urbanizing cities (Beard & Mitlin, 2021). This review synthesizes key debates across five interrelated themes: infrastructure and water sources, access and quality, institutional governance, commodification and inequality, and emerging research gaps.

2.1 Urban Water Infrastructure and Primary Sources

Karachi's water supply is anchored in the Indus River and Hub Dam. Of the 646 MGD drawn from the Indus, 35% is lost to theft and leakage, while the Hub adds 100 MGD—together supplying only 41% of the city's daily 1,100 MGD demand. Expansion has stagnated since the K-III project in 2005; the delayed K-IV project, expected to inject 650 MGD, remains incomplete (Ahmed, 2025, Muhammad Toheed, 2025). The crisis is further compounded by distributional inefficiencies and inequitable access. In many low-income settlements, residents lack piped access and rely instead on informal tanker systems or non-potable groundwater, underscoring infrastructural neglect and spatial inequality (Khan, 2025, Farooqi, 2024, Janjua et al., 2021).

2.2 Water Quality and Accessibility

Access is further compromised by contamination. Over 93% of piped water fails to meet WHO safety standards, often containing fecal coliforms and heavy metals. Cross- contamination from adjacent sewer lines is common, especially in high-density, low-income areas (Alamgir et al., 2021). Karachi's filtration capacity is severely limited: only three of nine plants function, and just 55 of 151.5 MGD of wastewater is treated, contributing to widespread health risks (WWF, 2019, Ali, 2025).

2.3 Institutional Governance and Systemic Breakdown

The Karachi Water and Sewerage Corporation (KWSC), formerly KWSB, embodies decades of governance failure (Ahmed, 2025). Persistently underfunded, politically influenced, and weakly regulated (World Bank, 2018), KWSB historically reached only 60% of households with supply often limited to under four hours per day (Asim & Lohano, Heman D, 2015), losing public legitimacy amid widespread perceptions of corruption and inefficiency. Reform attempts in billing, illegal hydrant control, and private

connection regulation have shown limited success, while the proliferation of tanker mafias and illegal groundwater extraction highlights a broader institutional vacuum (Muhammad Toheed, 2025). Despite policy optimism, the transition to KWSC still raises concerns about its implementation capacity and accountability (Ahmed, 2025).

2.4 The Political Economy of Water: Commodification and Inequality

As public provision fails, water in Karachi is increasingly commodified, reflecting a deeper political-economic shift where state withdrawal and infrastructure decay have enabled market-based access to a vital resource (Raza & Junaid, 2025). Households across income groups now rely on bottled water and RO systems, yet low-income families spend up to 20% of their monthly income for inferior quality water, while high-income areas enjoy near- universal piped coverage (Khan & Arshad, 2022). Bottled water prices surged by 150% in 2023, pushing the poorest to pay more for less in an unregulated sector valued at over $327 million (Farooqi, 2024). Only 71% of low-income households are connected to piped supply, with many reporting sewage contamination, and disparities range from just 15 minutes of weekly supply in Malir to over 2,500 minutes in affluent Gulshan-e-Iqbal and disparities range from just 15 minutes of weekly supply in Malir to over 2,500 minutes in affluent Gulshan-e-Iqbal and disparities range from just 15 minutes of weekly supply in Malir to over 2,500 minutes in affluent Gulshan-e-Iqbal (Khalil et al., 2023). This uneven, profit-driven system reinforces urban stratification and water precarity, shifting water from a universal public good to a contested commodity embedded in class and governance failures.

3. RESEARCH GAPS

Despite extensive literature on water contamination, supply failures, and infrastructural decay, few studies have explored household-level behavior, perceived risk, and trust in relation to market-based water reliance (Khalil et al., 2023). This research addresses that gap by applying a social ecology lens to examine how neoliberal governance, environmental degradation, and institutional collapse interact to actively produce and sustain urban water inequality in Karachi, highlighting the socio-economic consequences of shifting from public provision to privatized dependence.

4. METHODOLOGY

This study employed a mixed-methods exploratory design with an inductive reasoning framework to investigate Karachi's urban water crisis across dimensions of access, affordability, quality, and trust. The research combined household surveys, expert interviews, and microbiological water quality testing to provide a holistic understanding of water-related behaviors and inequalities. A case-study approach was adopted to capture the socioeconomic diversity of Karachi's water landscape by selecting three neighborhoods: DHA Phase 2 Extension (high-income), Federal B Area Block 15 (middle-income), and Korangi Sector 6C (low-income). Each site represents distinct infrastructural and governance challenges—from DHA's dependence on bottled and RO water due to infrequent municipal supply and sewage infiltration, to Federal B's moderate infrastructure strained by aging pipelines and industrial effluents, and Korangi's severe exclusion from piped networks, with 29% of households lacking connections and facing high reliance on costly alternatives. Purposive sampling guided site selection, while convenient sampling ensured balanced representation across income groups. A total of 75 household heads (25 per site), responsible for managing water procurement, were surveyed to assess disparities in access, affordability, and trust in public supply systems.

Table 1. Distribution of household surveys and water samples by case study area

Area	Socioeconomic Profile	Household Surveys	RO Water Samples Collected
DHA Phase 2 Extension	High-Income	25	4
Federal B Area Block 15	Middle-Income	25	3
Korangi Sector 6C	Low-Income	25	3

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Figure 2. Map of RO plants present in DHA Phase II Ext *Figure 1. Map of RO plants present in Federal B Area Block 15*

Qualitative data were gathered through semi- structured interviews with key informants: the Dean of Architecture at NED University, the Director of Hisaar Panjwani, and a former Director of the Karachi Water and Sewerage Corporation. These interviews contextualized household-level findings within broader governance failures.

Figure 3. Map of RO plants present in Korangi Sector 6C

Ten water samples were collected from reverse osmosis (RO) plants commonly used by respondents – four from DHA, three from Federal B, and three from Korangi. Samples were analyzed using WHO-compliant microbiological protocols to detect pathogens including E. coli, Salmonella, Vibrio, Staphylococcus aureus, and Total Plate Count (TPC). Chemical parameters were not assessed due to budgetary constraints. Quantitative data were analyzed using descriptive statistics and pivot tables in Microsoft Excel. Qualitative responses were coded thematically to explore patterns of water insecurity and coping strategies. Limitations include the study's small geographic scope, limited temporal range, and lack of chemical water testing. These constraints underscore the need for broader, longitudinal studies to inform equitable and sustainable water governance in Karachi.

5. RESULTS AND DISCUSSION

5.1 Household Water Costs, Inequality, and Systemic Distrust

Across Karachi's socioeconomically diverse neighborhoods—DHA Phase 2 Extension, Federal B Area Block 15, and Korangi Sector 6C—households reported substantial financial burdens related to drinking water access, reflecting entrenched class-based disparities and a broader transition from public provision to commodified dependence. In Korangi, where no piped municipal supply exists, families spent PKR 2,000–4,000 monthly on RO water— amounting to 10–20% of household income—with some forced to borrow funds to meet water needs. In Federal B Area, monthly water expenses ranged from PKR 2,500–10,000, with bottled water rationed for children while adults relied on cheaper RO sources. Even in affluent DHA, residents spent PKR 15,000–20,000 per month on bottled water, treating it as a default utility rather than a guaranteed public right.

These patterns illustrate structural compulsion, not consumer choice, driven by institutional neglect and systemic governance failures. A senior professor and Dean of Architecture and Planning at NED University contextualized this transition, explaining how Karachi's water system evolved from a centralized municipal network to a fragmented storage-based model that fails to meet the demands of densified urban zones. His insights linked infrastructure neglect, unregulated high-rise construction, and neighborhood-level disparities—such as Korangi's exposure to industrial effluents and DHA's distribution inefficiencies—to broader structural inequalities. Public distrust in the Karachi Water and Sewerage Corporation (KWSC) was widespread; households across all three sites reported sewage mixing, turbidity, salinity, and visible contamination in piped water. In Federal B Area, boiling tap water has given way to filtered sources, and DHA residents rely solely on bottled water despite lacking verification mechanisms. A former KWSC director attributed this crisis to poor pressure management and inconsistent motor use, which create backflow and cross-contamination risks. Collectively, these experiences underscore how systemic failures—not consumer preference—have driven Karachi's residents toward costly, unregulated alternatives, echoing global concerns that bottled water growth threatens the universal human right to safe, affordable drinking water and undermines Sustainable Development Goal 6.

5.2 RO Water Microbiological Quality

Microbiological testing of ten RO water samples collected from Korangi, DHA Phase 2 Extension, and Federal B Area confirmed the absence of major pathogens, with all samples testing negative for E. coli, Salmonella, Vibrio, and Staphylococcus aureus, and most Total Plate Count (TPC) readings reported as Too Less to Count (TLTC). However, three samples - K2, D4, and F3 – showed TPC levels exceeding 2000 CFU/g, far above the acceptable RO standard of 500 CFU/g, suggesting potential post-treatment contamination or poor handling practices. Due to budget constraints, no chemical testing was conducted, leaving unanswered concerns about long-term exposure to contaminants unresolved. These gaps highlight the urgent need for comprehensive monitoring of both microbiological and chemical safety to protect public health in Karachi's commercialized and fragmented water landscape.

Supporting these concerns, PCRWR's 2024 report found that 19 of 185 bottled water brands failed to meet safety standards, with PSQCA detecting high levels of sodium, TDS, and arsenic, reinforcing public mistrust in commercial alternatives and highlighting urgent regulatory gaps.

Table 2. Distribution of household surveys and water samples by area

S.No	Area	Sample Codes	TPC cuf/g	XLD	EMB	TCBS	MSA
1	Korangi	K1	TLTC	ND	ND	ND	TLTC
2	**Korangi**	K2	2200	ND	ND	ND	TLTC
3	Korangi	K3	TLTC	ND	ND	ND	TLTC
4	DHA Phase II Ext	D1	TLTC	ND	ND	ND	TLTC
5	DHA Phase II Ext	D2	TLTC	ND	ND	ND	TLTC
6	DHA Phase II Ext	D3	TLTC	ND	ND	ND	TLTC
7	**DHA Phase II Ext**	D4	2300	ND	ND	ND	TLTC
8	Federal B Area	F1	TLTC	ND	ND	ND	TLTC
9	Federal B Area	F2	TLTC	ND	ND	ND	TLTC
10	**Federal B Area**	F3	2100	ND	ND	ND	Less than 1000

*TLTC (Too Less to Count) and ND (Not Detected)

6. DISCUSSION

These findings affirm that Karachi's water crisis stems not from absolute scarcity, but from institutional collapse, unequal distribution, and the commodification of basic human rights. The widespread shift to commercial alternatives reflects not consumer preference, but an adaptation to prolonged governance failure—one that imposes significant social, economic, and psychological burdens. In line with social ecology theory, this transformation illustrates how profit-driven systems reconfigure public resources into stratified market commodities, reinforcing urban inequality. Expert insights further highlight how infrastructure neglect and the failure to adapt to urban densification have fostered dependency on informal and decentralized water systems, exacerbating household vulnerability and citywide precarity.

This study's novelty lies in its triangulation of household expenditure data, qualitative narratives, expert insights, and microbiological testing to demonstrate that reliance on bottled and RO water in Karachi is

not driven by consumer preference but is a structural compulsion rooted in institutional collapse and governance failure. While most RO samples met microbiological safety thresholds, the absence of chemical testing, combined with poor regulatory oversight and unhygienic practices, continues to fuel widespread public anxiety. These findings align with global research, including (Beard & Mitlin, 2021) comparative analysis of 15 cities across the Global South, which shows how intermittent municipals sometimes limited to under 17 hours per week—forces low-income households to spend over 15% of their income on alternative water sources. This far exceeds the internationally recommended affordability threshold of 3–5%. Karachi's case is even more extreme, with its poorest residents allocating up to 20% of monthly income to water. This mirrors patterns observed in Nairobi, Dhaka, Mumbai, and Lagos, where commodification and ineffective oversight entrench inequalities and dismantle the human right to water (Beard & Mitlin, 2021). In Karachi, near-total public mistrust, pricing opacity, and systemic inequities reflect how profit-driven systems reconfigure essential resources into market-governed, exclusionary goods.

Overall, the collapse of Karachi's water governance has created a multidimensional crisis, where the urban poor disproportionately shoulder the financial, psychological, and dignity- related burdens of an unequal system. Uneven affordability, compromised quality, and limited access underscore the need for a paradigm shift—one that prioritizes regulatory reform, public trust, and infrastructure renewal. Advancing a rights-based, community-responsive framework is essential to ensure equitable and sustainable access to drinking water, in line with Sustainable Development Goal 6.

7. CONCLUSION

This study investigated how declining trust in Karachi's municipal water systems, driven by contamination, institutional decay, and infrastructural failures, has reshaped household water consumption, forcing residents toward costly and often unsafe commercial alternatives. Using household surveys, expert interviews, and microbiological testing across three diverse neighborhoods, it revealed how unequal water access, and the commodification of a basic right deepen urban inequalities and harm residents' health and dignity.

Findings show Karachi's water crisis is rooted less in absolute scarcity than in profound governance failure, transforming water from public good into a market commodity. Households across income groups reported high expenditures — with Korangi families spending up to 20% of income and DHA residents paying PKR 20,000 monthly — yet skepticism about water quality remained strong, given limited safety guarantees. These patterns mirror conditions in other Global South cities where weak regulation, affordability crises, and intermittent supply force the poor into exploitative markets.

Practically, this underscores the urgent need to reestablish water as a public good through infrastructure investment, stronger regulation, and participatory, community-centered governance to rebuild trust. Theoretically, the study contributes to urban water justice debates by showing how commodification redefines water from a right to an exclusionary, conditional service. Limitations include the study's geographic scope and the lack of chemical testing, pointing to the need for larger-scale, longitudinal, and more comprehensive research. Ultimately, unless Karachi and similar cities adopt equitable, rights-based water frameworks, cycles of inequality and health insecurity will persist, undermining progress toward Sustainable Development Goal 6 and urban justice.

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