

Decoding Delhi's water governance through multi-level governance approach

Savitri Kumari ^{id}* and Rabidyuti Biswas ^{id}

Department of Physical Planning, School of Planning and Architecture, Delhi, India
*Corresponding author. E-mail: savitri.choti@gmail.com; savitri232phd@spa.ac.in

^{id} SK, 0000-0001-9186-4426; RB, 0000-0002-9867-1026

ABSTRACT

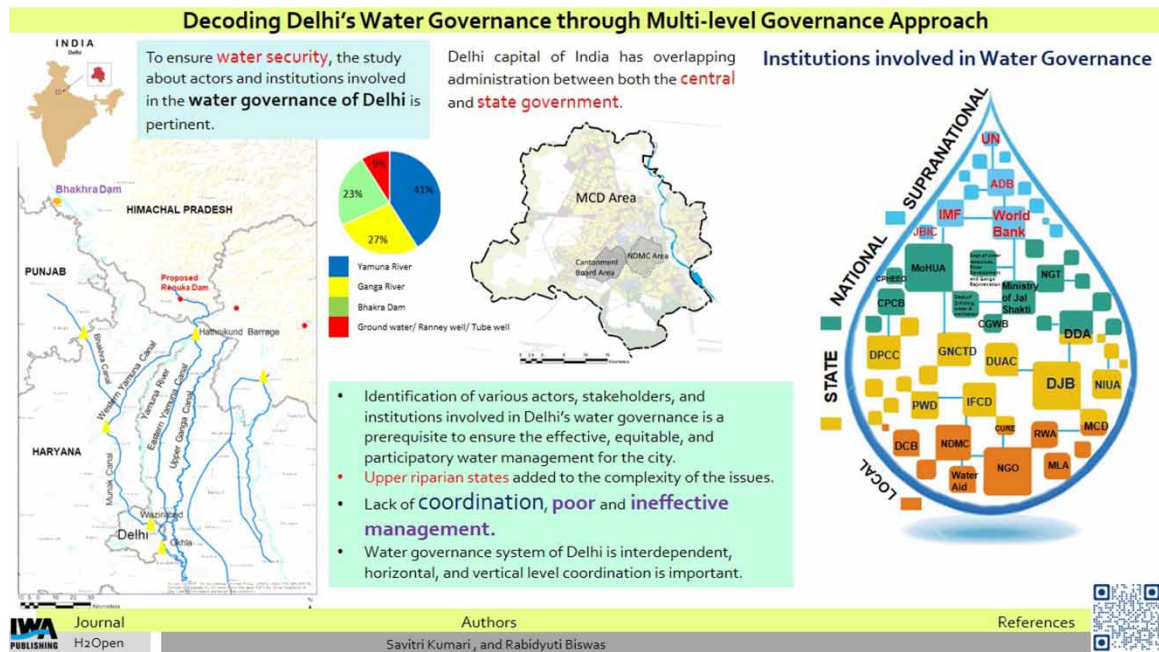
This article explores the intertwined, multi-level, and varied scale of public institutions, local level organizations, and various actors involved in rendering water supply services to the residents of Delhi. To ensure water security in the national capital, the study of actors and institutions involved in the water governance of Delhi is pertinent. Delhi, being the capital of the country, has overlapping administration between both the central and state government. Various ministries and departments which vary in hierarchy and power are working for the day-to-day functioning of the megacity. This phenomenon also applies to the water governance of Delhi, making it byzantine and complex in nature. In this context, a multi-level governance approach has been used for exploring the water governance of Delhi. Identification of various actors, stakeholders, and institutions involved in Delhi's water governance is a prerequisite to ensure effective, equitable, and participatory water management for the city.

Key words: complex, coordination, Delhi Jal Board, multi-level governance, water governance

HIGHLIGHT

- This article explores the intertwined, multi-level, and varied scale of public institutions, local level organizations, and various actors involved in rendering water supply services to residents of Delhi, India.

GRAPHICAL ABSTRACT



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1. INTRODUCTION

India is a developing country that is going through fast urbanization. This rapid urbanization has a negative influence on the environment, particularly the water environment. Access to clean drinking water is a significant governance concern in many cities. Water governance in India is currently facing severe issues due to a variety of factors, including poor institutional performance, overlap in tasks, confusing rules, and lack of water-related knowledge among urban local bodies at the ground level (Cronin *et al.* 2016). Various studies highlight the governance challenges that are being faced by the cities now. The studies to evaluate water governance based on three dimensions of water law, policies and administration aspects in eight Indian cities show improvement in governance after the announcement of the Sustainable Development Goals (SDGs) (Ahmed & Araral 2019). According to Aartsen *et al.* (2018), the assessment of Ahmedabad city using the City Blueprint Approach, the main obstacles to effective water governance are lack of stakeholder involvement, lack of ongoing learning, and lack of implementing capacities. Challenges limited data sharing between the service providers and the citizens, thereby the water literacy of the people in Kozhikode city, is found to be poor, and there is also spatial inequity in service delivery. (Navaneeth *et al.* 2021).

Delhi, with an estimated population of 20 million, is witnessing a rapid pace of urbanization. People from all over the country are migrating to Delhi in search of jobs, education, health, and a better standard of living. In these circumstances, access to safe water for drinking and other domestic purposes continues to be a problem in many areas of Delhi due to the large population residing in the informal and unauthorized settlements where it is difficult to provide formal supply of water through the present institutional arrangement. Skewed, unreliable, and intermittent availability of water in planned and unplanned settlements has caused social injustice and inequitable distribution of water in Delhi (Kumar *et al.* 2021). About 20% of Delhi's population receives 92% of the city's water, while the remaining 80% receives only 8% of the available supply of water (Ahmed & Araral 2019).

It has been said that the water crisis is caused due to mismanagement of water and essentially because of inefficient governance (World Water Development Report 2003). So efficient governance is essential for the long-term management of water resources (Jiménez *et al.* 2020). Water governance is quite a complex concept and scholars, organizations and institutions define it according to their own areas of expertise. Initial thought about water governance was based on the centralized systems that emphasized the role of governments in water management. In the present context, the term water governance is used more broadly to describe it as political, social, economic, and administrative systems to manage water resources, and the delivery of water services, at different levels of society (Global Water Partnership 2002). The United Nations Development Programme Water Governance Facility, 2013, on the other hand, provides a more understandable and concrete definition. It argues that water governance should address principles of equity and efficiency in water resource and services allocation and distribution, water administration based on catchments, the need for integrated water management approaches, and the need to balance water use between socio-economic activities and ecosystems (Facility 2013). For this paper, the important water governance definition is considered as a set of administrative systems, with a focus on formal institutions like laws, official policies, and informal institutions like power relations and practices with organizational structures of water providing institutions (OECD 2011). Also, water governance involves a range of actors from different sectors, scales, and domains with various and often conflicting views, values, and interests who participate in the decision-making process of the water resource along with specific roles and responsibilities assigned to every one of them (Teisman *et al.* 2009). However, the water governance in Delhi can be characterized by several formal and informal actors and institutions at different levels of their jurisdiction.

In this paper, we have explored the complex, multi-level, and contemporary approaches and mechanisms to water governance in the National Capital Territory (NCT) of Delhi. It begins with a summary of key water governance definitions identified by various scholars, organizations, and institutions. The article further explores the concept of Multi-level Governance (MLG) in the European context and its application in the water sector and in Delhi's context. The article then proceeds to analyse Delhi's present water governance practices. As Delhi is a state, a city, and the capital of India, its water governance is polycentric within the state. This paper examines the water governance of Delhi based on the role and functions of different levels of institutions, their jurisdictions, and responsibility for water provision like supranational, national, regional, state, and local. It is argued that water governance in Delhi is characterized by a high degree of fragmentation.

2. EXPLORING THE THEORY OF MLG

MLG has its origin in the neo functionalist theory that was developed to analyse the process of European integration (Haas 1958). It was argued that national governments were losing control of the process in an increasingly complex web of interdependence in which supranational and non-state actors were becoming more important. MLG brought the observation that, in the wake of the single market programme, subnational authorities were also becoming important players in European Union policymaking, particularly in the sphere of structural policy (now generally known as cohesion policy). To refer to developments in structural policy MLG was first used by Gary Marks in 1993. MLG, in its earliest forms, was defined as ‘constant negotiation between nested governments at various territorial tiers and supranational, national, regional, and local governments are entwined in territorially encompassing policy networks’ (Marks 1993). However, despite these intergovernmental relationships, it emphasizes the importance of supranational level and subnational level institutions.

Complex interconnectedness and tangled hierarchies are features of multi-level governance (Edelenbos & Teisman 2013). Traditionally for mutual adjustment to occur, two or more parties must come to a realization that to achieve their objectives, they must rely on the resources of other parties and that they cannot compel them to do so. While highlighting the value of mutual adjustment, MLG must also consider people’s demand for hierarchy and control (Edelenbos & Teisman 2013). Institutions, programmes, and processes may develop between levels to establish new spheres of authority (Adger *et al.* 2005). This will make it difficult to build and design institutions.

A variety of national tasks were decentralized to local levels because the national level was not as appropriate as it had been in the beginning, and supranational networks like the EU arose. The idea of localization, which combines globalization and the value of the local, suggests a deep-seated scepticism. Coordination and collaboration occur when lower level organizing units follow the guidelines established by higher-level individuals and institutions.

There are two types of MLG as distinguished by Marks & Hooghe (2004). The Federalist theory is echoed by MLG type 1, which limits the distribution of power to a small number of non-overlapping jurisdictional borders at a small number of levels. According to this perspective, authority is comparatively constant, and analysis concentrates on individual governments rather than shared policies. MLG type 2 presents governance as ‘a complex, fluid, patchwork of innumerable, overlapping jurisdictions’ (Marks & Hooghe 2004).

It is clear from MLG that actors behave ‘at best as *primus inter pares* in the network, which challenge the idea of each level of being immediate holders of sovereign authority in a single hierarchical command structure’ (Edelenbos & Teisman 2013). Less hierarchical, centralized, and directive behaviour results from state engagement. The process of joint programme decision-making and implementation benefits from the information, resources, legitimacy, and organizational capabilities provided by regional and local actors.

2.1. Contextual examples of MLG application

‘Multilevel Governance implies the concept of levels, the term refers to different levels (supranational, national, regional, and local) depending on the jurisdiction and/or corresponding spatial scale’ (Kersbergen & Waarden 2004). MLG denotes ‘*the existence of centres of decision-making or governing authorities at various levels (vertical) or layers (horizontal, i.e., arrangements that may not necessarily stand in a hierarchical order but have a certain level of independence and interdependence between institutions within the same level of governance)*’ (Jiménez *et al.* 2020). These governance systems can take various forms, and the terms are often used in the same sentence. Within this, the terms ‘nested governance’ and ‘polycentric governance’ are often used in academic literature. ‘Nested systems, or those having functional links between levels or layers, are those in which important governance functions are organized into many reinforcing tiers of governance but are not necessarily independent of one another’ (Jiménez *et al.* 2020), whereas ‘*Polycentric systems are those where decision centres are present in different layers and are independent of each other, with a certain degree of power and financial autonomy (which may not be the case in a hierarchical structure), such as in municipalities. This attribute is closely linked to decentralization and its different modalities*’. For example, at a city level, if the power and control related to water management are distributed among multiple administrative units, or different municipal authorities within a metropolitan area, then that is a polycentric system (Jiménez *et al.* 2020).

Local governments (municipalities) are the main subnational authority in-charge of creating and/or executing policies for drinking water supply and wastewater services, according to the OECD surveyed cities in 2016 (Romano & Akhmouch 2019). Sanitation and water supply may be handled by metropolitan authorities. For

instance, the metropolitan region of Barcelona, which is made up of 36 municipalities, encourages integrated administration of the city's water supply and sewage system. Additionally, there are a number of vertical and horizontal coordination mechanisms to improve water security. For example, the Metropolitan Glasgow Strategic Drainage Partnership (MGSDP) in Glasgow, United Kingdom, is a partnership between local governments, the Scottish Environment Protection Agency (SEPA), Scottish Water, Scottish Enterprise, Clyde Gateway, and Scottish Canals. Its duties also encompass reducing flooding and improving water quality. In order to administer water services in an integrated manner, the authorities of the optimum territorial areas in Italy (Ambiti Territoriali Ottimali, ATO) provide local stakeholder participation. The benefit of the coordination mechanisms is that they bring together various agencies and stakeholders for an organized effort toward increased water security and cogent water management while minimizing overlaps and duplications. The achievement of anticipated results is dependent on both internal and external factors, including political will. Thus, cities must collaborate with both lower and higher levels of government and set up effective systems for involvement in order to solve the complexity of water concerns.

3. COMPLEX GOVERNANCE SYSTEM OF DELHI

Delhi is quite unique in terms of its administration; it exemplifies a classic example of Byzantine governance where multi-levels of governments are involved in the day-to-day functioning of the city. Being the nation's capital, it hosts various central government and international institutions which gives a global identity to the city. As per Article 239AA of the Indian constitution, Delhi received the status of a state in year 1991 under the 69th Constitutional Amendment Act and the Government of National Capital Territory of Delhi (GNCTD) was formed (Ministry of Law & Justice 2018). As a result, Delhi is a union territory along with its own Legislative Assembly and Council of Ministers, its assembly has power to make law on subjects stated in 'State List' of the Indian constitution except Land and Police (as shown in Figure 1; Central Water Commission, n.d.). This dual nature of the city makes its governance quite complex, thus Delhi has a multi-level government, i.e., central, state, and local.

The Delhi Municipal Corporation Act of 1957 opened new dimensions of urban local governance in Delhi at a local level. As per the act, provision for the constitution of Corporation was made, the urban area of Delhi was divided into 80 smaller units named as Wards and provision was made for the election of a public representative, i.e., ward councillor from each ward by local people (North Delhi Municipal Corporation 2020). Later, in the year 2011, the Municipal Corporation of Delhi (MCD) was the single municipal body serving 94 percent of the area of Delhi (as shown in Table 1) and providing basic civic services to 98% of the total population. The Delhi Municipal Corporation (Amendment) Act 2011 was introduced and as per the 14th schedule of the act, the corporation was restructured and divided into three new municipal corporations which are South Delhi Municipal Corporation, North Delhi Municipal Corporation, and East Delhi Municipal Corporation (Department of Law, Justice & Legislative Affairs 2014). Other than these municipal corporations, there are two more urban local bodies in Delhi which look after the provision of services and utilities to Delhi's resident like the three municipal corporations: New Delhi Municipal Council (NDMC), and Delhi Cantonment Board (DCB).

3.1. MLG and its application in Delhi

In the previous sections, we have illustrated the complex nature of the governance mechanisms in Delhi, and the same is true for the governance of water where multiple levels of governance are involved. The governance of

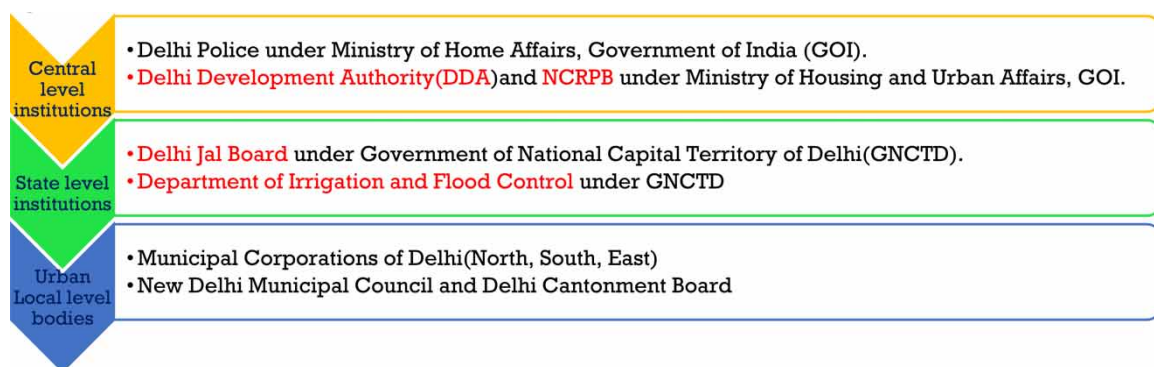


Figure 1 | Multi-scale institutions involved in governance of Delhi. Source: Compiled by authors, 2022.

Table 1 | Geographical area of local bodies in national capital territory of Delhi (NCT)

Jurisdiction	Total area in sq. km (2021)	Percent	Population (lakhs)
Municipal Corporations of Delhi	1,397.3	94	164.20
New Delhi Municipal Council	42.7	3	2.58
Delhi Cantonment Board	43.0	3	1.10
Total NCTD AREA	1,483	100	167.88

Source: Master Plan of Delhi, 2021.

water in Delhi involves multi-level institutions for governing water resources. Water is a local resource with implications of high magnitude which can be recorded at a global scale due to its hydrological cycle. From recent studies in the field of climate change, it has been established that it affects water in a complex manner. In the wake of this, various global level institutions have released policies, guidelines, floated infrastructure projects, etc. in guiding national, regional, and local level governments in deciding judicious and sustainable use of water.

3.2. Reliance on neighbouring states for raw water

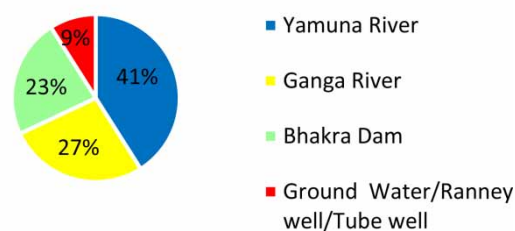
The National Capital Territory of Delhi (NCT) is one of India's fastest-growing cities and sprawls across the west bank of the river Yamuna. The State of Haryana borders it on three sides, and Uttar Pradesh borders it on the east across the river Yamuna. The city, being located in a semi-arid zone, depends to a great extent on raw waters from the Ganga basin, Yamuna sub basin, and Indus basin, in addition to its own internal aquifers and its groundwater resources (as shown in Table 2) (Planning Department GNCTD 2020). The River Yamuna is the only river to pass through Delhi's administrative boundaries. Delhi's groundwater resources are a significant additional raw water source. However, the percentage of groundwater used in Delhi's total water supply is only 10%. As a result, Delhi is significantly dependent on its neighbouring states to provide 90 percent of its daily water needs (as shown in Figure 2). In the residential areas, piped water supply network is present. The Delhi Jal Board (DJB) supplies piped water and at the same time, it also provides water by water-tankers and water vending machines.

Delhi receives water from neighbouring states through a canal in the form of raw water as per the Yamuna water sharing agreement of May 1994 between the States of Haryana, Uttar Pradesh, Uttarakhand, Himachal Pradesh, and Delhi (Planning Department GNCTD 2019). This agreement was about the sharing of water in upper

Table 2 | Sources of water for Delhi Jal board, 2020

S. No.	Resources	Quantity in MGD	Percent
1.	Yamuna River	389	41
2.	Ganga River	253	27
3.	Bhakra Dam	221	23
4.	Ground Water/Ranney well/Tube well	90	9
	Total	953	100

Source: Economic Survey of Delhi, 2020.

Figure 2 | Water resources for Delhi Jal Board**Figure 2** | Sources of water supply from various river basins for Delhi. Source: Economic Survey of Delhi, 2020.

Yamuna, i.e., from Yamunotri Glacier (origin point of river Yamuna) to the Okhla barrage (as shown in Figure 3) and also the involvement of various states governments and their departments from the beneficiary states, for example, Haryana Irrigation and Water Resource Development, Uttar Pradesh Irrigation, and Uttar Pradesh Jal Nigam. Upper Yamuna River Board, a subordinate office of the Union Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India was constituted under the framework of the agreement to look after the functioning and implementation of related projects (Upper Yamuna River Board 2020). Table 3 shows the share of Delhi's water as per the agreement.

4. DECODING DELHI'S WATER GOVERNANCE AT VARIOUS LEVELS

Delhi's water governance is quite complex and intertwined as compared to other cities of India because of its nature and administrative set-up. At the supranational level the United Nations, World Bank, Japan Bank for International Cooperation (JBIC), and Asian Development Bank (ADB) are involved in funding the water

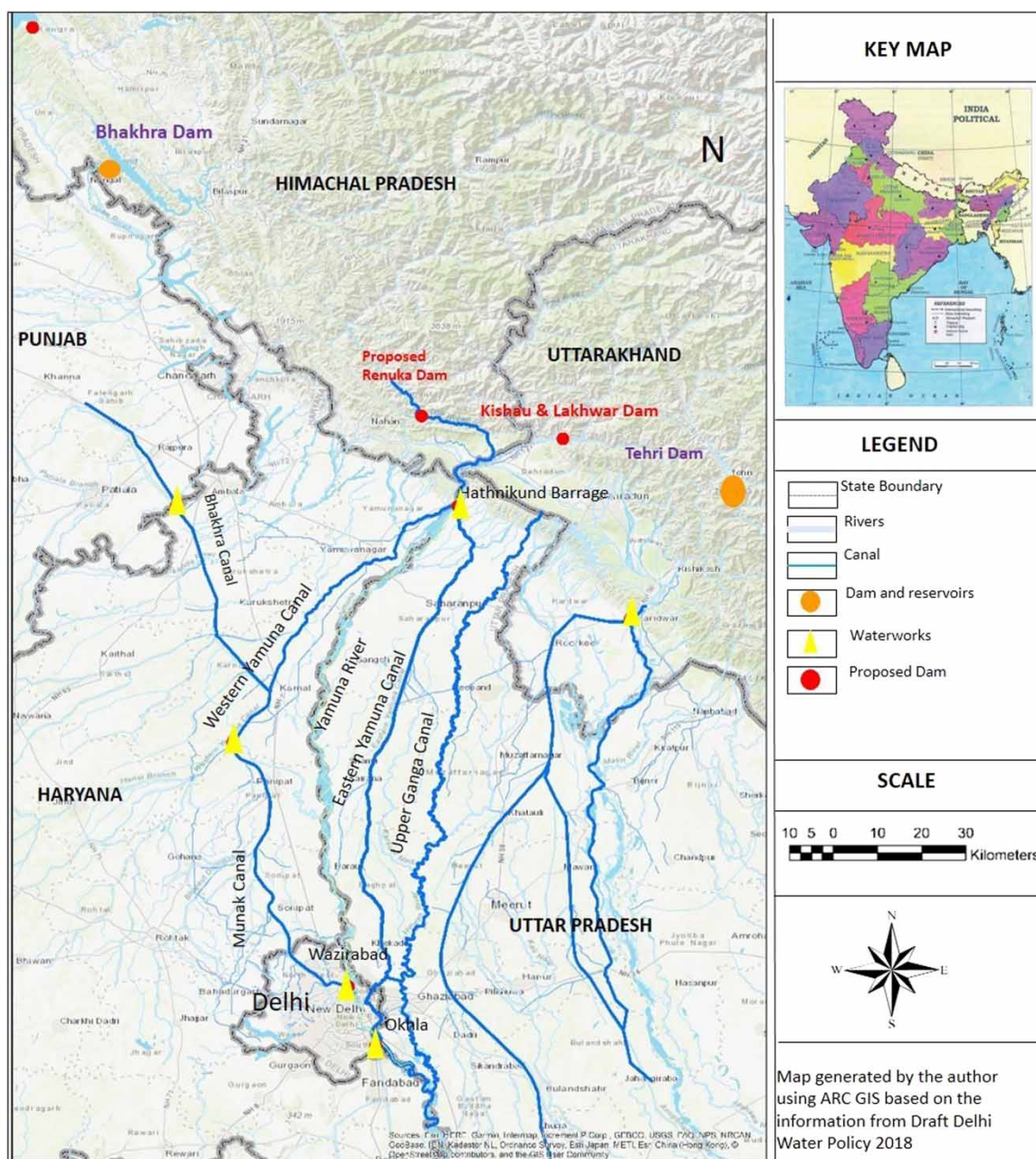


Figure 3 | Sources of water supply for NCT Delhi, 2018. Source: Draft Water Policy Delhi, 2018.

Table 3 | Approved allocation of water from Yamuna river to NCT Delhi

Sl. No.	States	Allocation (BCM)			Total (BCM)
		July to October	November to February	March to June	
1	Haryana	4.11	0.69	0.94	5.73
2	Uttar Pradesh	3.22	0.34	0.47	4.03
3	Rajasthan	0.96	0.07	0.09	1.12
4	Himachal Pradesh	0.19	0.11	0.08	0.04
5	Delhi	0.58	0.07	0.08	0.72

Source: Economic Survey of Delhi, 2020–2021.

Note: BCM is Billion Cubic Metre.

sector projects, thus affecting India's national water discourse. At the national level, central government level institutions such as the Ministry of Jal Shakti, Central Ground Water Commission, National Green Tribunal, Central Public Health and Environmental Engineering Organisation (CPHEEO), Delhi Development Authority (DDA), etc. are involved in the water governance of Delhi at a macro level in the form of policy making, guidelines, etc. (as shown in Figure 4). As the water governance system of Delhi is interdependent, horizontal, and vertical level coordination becomes important.

4.1. Supra national level

The global discourse on water and sanitation is led by the intergovernmental institutions such as the United Nations and its various arms. Similarly, global funding agencies such as the World Bank, International Monetary Fund (IMF), ADB and donor countries also influence the water narrative in the counties of the global south. The

JURISDICTION	POLICY MAKING	PLANNING AND MANAGEMENT	SERVICE DELIVERY/ IMPLEMENTATION
SUPRA NATIONAL	United Nation, World Bank, Japan Bank for International Cooperation (JBIC) and ADB funded projects (privatization of water)		
NATIONAL	Parliament of India and Judiciary (Supreme court or Constitutional court)	Ministries Ministry of Jal Shakti Ministry of Housing and Urban Affairs Departments- Department of Drinking Water and Sanitation, Regulatory Authority- National Green Tribunal(NGT)* Central Ground Water Board Central Pollution Control Board	
STATE	GNCTD*, Delhi Jal Board (DJB), INTACH, NIUA,	PWD- Public Works Department, Regulatory Authority- National Green Tribunal(NGT)* Central Ground Water Board Delhi Pollution Control Committee	Delhi Jal Board Delhi Urban Arts Commission(DUAC), Municipal Corporation of Delhi (North, South and East), New Delhi Municipal Council and Delhi Cantonment Board
LOCAL		Delhi Jal Board	Resident Welfare Associations (RWAs), NGOs-CURE, Water Aid
		Delhi Jal Board	


 No Authority is present

Figure 4 | Institutions involved in Delhi's water governance. Note: Yamuna Water Sharing Agreement May, 1994 between Haryana, Himachal Pradesh, Uttar Pradesh and Rajasthan. Delhi Jal Board provides bulk water supply to New Delhi Municipal Council and Delhi Cantonment Board. 95% of total area of Delhi is within the jurisdiction of DJB. GNCTD* – Government of National Capital Territory of Delhi; INTACH – Indian National Trust for Art and Cultural Heritage; NGT – National Green Tribunal – it is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues. NIUA – National Institute of Urban Affairs advances inter-disciplinary research, capacity building, knowledge management and policy making on issues relevant to cities across India. Source: Compiled by authors, 2022.

global missions on water and sanitation in the past had impacted the project, policies, and priorities of the governments in developing countries. The recent global mission of Sustainable Development Goal-6 has influenced and impacted the actions of Indian governments as well because India is one of the signatories of this mission. The Indian government's flagship projects such as Swachh Bharat Mission and Jal Jeevan Mission are aimed at the 100% coverage of sanitation and water supply in every household in the country. In the past, the World Bank has funded various mega projects in India for the construction of dams, irrigation, and canals. During the 1990s when India enacted Liberalization Privatization and Globalization reform in the country, the World Bank promoted the narrative of Private Sector Participation (PSP) based on the principles of neo-liberalism in the water sector through various publications, seminars, and projects. As a result of the pro-privatization efforts, India's National Water Policy-2002 promoted PSP in water sector projects in an unprecedented manner. Delhi's water utility privatization attempts of early 2000 are a clear attempt to impose the supranational policies. The building of the Sonia Vihar water treatment plant was carried out by the global water Ondeo Degremont, a Suez subsidiary, in 2002. This was one of the first significant projects in Delhi's water sector history where a foreign private consultant was involved in the building along with the operation and administration of infrastructure connected to water delivery. Another action to promote PSP in Delhi's water sector was carried out through the preparation of the draft Delhi Water and Wastewater Reforms Bill, 2003.

4.2. National level

The management and development of water resources is the responsibility of individual states under the Indian constitution (Pandit & Biswas 2019). Thus, water governance in India is decentralized at the state level. While the central government provides funds for the state governments to carry out national-level projects, the states are also responsible for implementing and monitoring these projects. The states have different institutions for developing and managing water resources, such as regulatory authorities, water departments, irrigation departments, and public works departments (Bhatt & Bhatt 2017). Since water is a state subject, the upper riparian states could play a major role in allocating water to neighbouring states. This is quite evident in the case of Haryana and Delhi along with other states, leading to interstate water disputes in India such as the Kaveri Water Dispute between the states of Karnataka and Tamil Nadu.

In the current situation, the National Capital Territory of Delhi (NCT) relies heavily on reservoirs located at large distances (as shown in Figure 3) on the interstate rivers of the Ganges and Indus basins because it lacks sufficient natural water resources of its own in the form of rivers.

At the regional level, the water resources are managed by the Upper Yamuna River Board having the function of regulation and supply of water from all storages and barrages, maintenance of a minimum flow, framing of rules and regulations for water accounting and determination of the shares of water for each state, ensuring delivery of supplies to all the concerned states and coordination of activities relating to and giving of appropriate directions. The National Capital Region's (NCR's) groundwater resources are being depleted, which could lead to increased reliance on water resources from outside the area. This is a crucial part of water management in the NCR. Pollution in many areas also has an impact on water quality. The high concentration of ammonia in the River Yamuna is a direct result of upstream activities. Panipat, a district in Haryana, is 85 km upstream of Delhi, which boasts more than 2,000 textile dyeing units. These units use formaldehyde, volatile organic compounds (VOC), and other chemicals like ammonia in different quantities. Most of these units are operating illegally and they are not connected to the common effluent treatment plants (CETP). As a result, they directly discharge ammonia into the River Yamuna through drains. The River Yamuna has less water during the pre-monsoon, which causes the ammonia content to surge. DD-6 drain from Sonipat and DD-8 drain, X-Regulator from Rohtak, Haryana, discharge ammonia into the river in a similar manner thus causing water pollution. The water level at Wazirabad Pond dropped to 670 feet from the usual level of 674.5 feet on April 13, 2021, according to Raghav Chadha, vice chairman of DJB, who spoke at a press conference (Aam Aadmi Party, 2021). This had an impact on the operation of the three Water Treatment Plants. As a result, the areas of north, central, south, and west Delhi that receive water from these WTPs are under water supply stress. In his news conference, the vice chairman also claimed that the Haryana government was to blame and accused them of disobeying the Supreme Court's orders.

In order to manage the diverse issues in the water sector, the Central Ground Water Authority (CGWA), which was established by the Supreme Court on orders to regulate groundwater, was given the status of a licencing organization (Thakkar & Harsha 2019). The 700 cusec of water from Haryana comes to Delhi via the 102 km

long Munak Canal. Sonia Vihar, Okhla, and other WTPs in Delhi receive raw water from this canal. During the Jaat Reservation movement in 2016, protesters destroyed the canal to cut off the water supply to Delhi, thus affecting its water security.

4.3. State level

State level institutions like Delhi Jal Board (DJB), Irrigation and Flood Control Department, Delhi State Industrial and Infrastructure Development Corporation Ltd, Public Works Department, Delhi Pollution Control Committee, etc., also have their stake in terms of decision making related to Delhi’s water resources and formulation, execution and monitoring of water-related schemes and projects (as shown in Figure 5). Delhi Development Authority formulates water-related building byelaws, plans water supply systems, and disposal, and maintaining the lakes and wetlands in the NCT of Delhi. The GNCTD is mainly in charge of funding, cost recovery, and management of all water-related operations in the NCT of Delhi because water is a state subject. The GNCTD borrows money from financial institutions and private corporate sectors in addition to its own revenues, or a portion of proceeds from centrally collected revenue, to finance water development programmes. The GNCTD launched several water development programmes for the NCT of Delhi, including free lifeline water up to 20 kL.

DJB was constituted under an act passed by the Legislative Assembly of Delhi in 1998. The [Delhi Jal Board Act, 1998](#) delegates power to DJB, defines its roles and responsibilities, and outlays its organizational structure. The act directs DJB in the responsibility of water supply and sewerage for all areas inhabited within the jurisdiction of NCT Delhi. In this manner, DJB is expected to render its services to unauthorized areas, JJ clusters, resettlement colonies, and planned areas. Unfortunately, the act has a caveat which prohibits DJB from providing its services in residential areas constructed in contravention of any law. Due to this ambiguity around 1,650 unauthorized colonies were earlier lacking in water supply and sanitation but after their regularization in 2019, their situation is supposed to improve. Another major function of DJB as per the act is to ensure proper regulation and management of ground water in consultation with CGWA.

DJB as an organization is led by a Chairperson who is the Chief Minister (CM) of Delhi. Below the Chairperson is the Chief Executive Officer (CEO), who is an IAS officer responsible for complete administration and day-to-day functioning of DJB which are as follows: Administration, Finance, Water Supply, and Drainage (as shown in Figure 6). The fact that the CEO of the DJB, an Indian Administrative Service (IAS) officer, receives instructions from the state’s CM’s office is one of the fundamental inconsistencies that complicate the agency’s system for managing urban water resources. Due to Delhi’s unique hybrid city-state status, state officials can ultimately

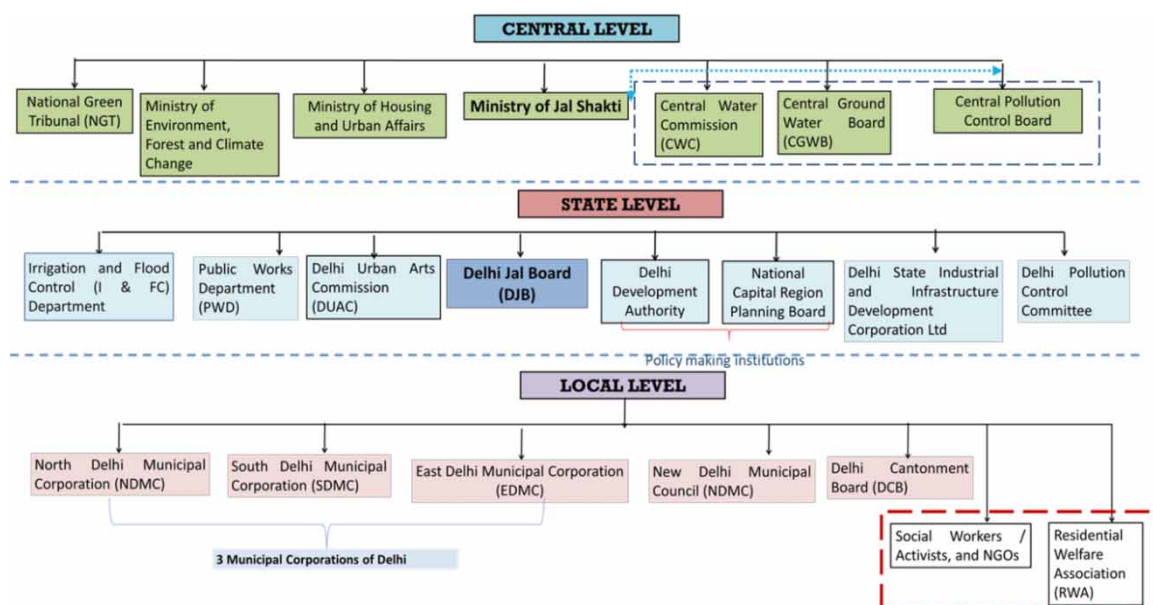


Figure 5 | Organizations involved in water governance of Delhi. *Source:* Compiled by authors, 2022.

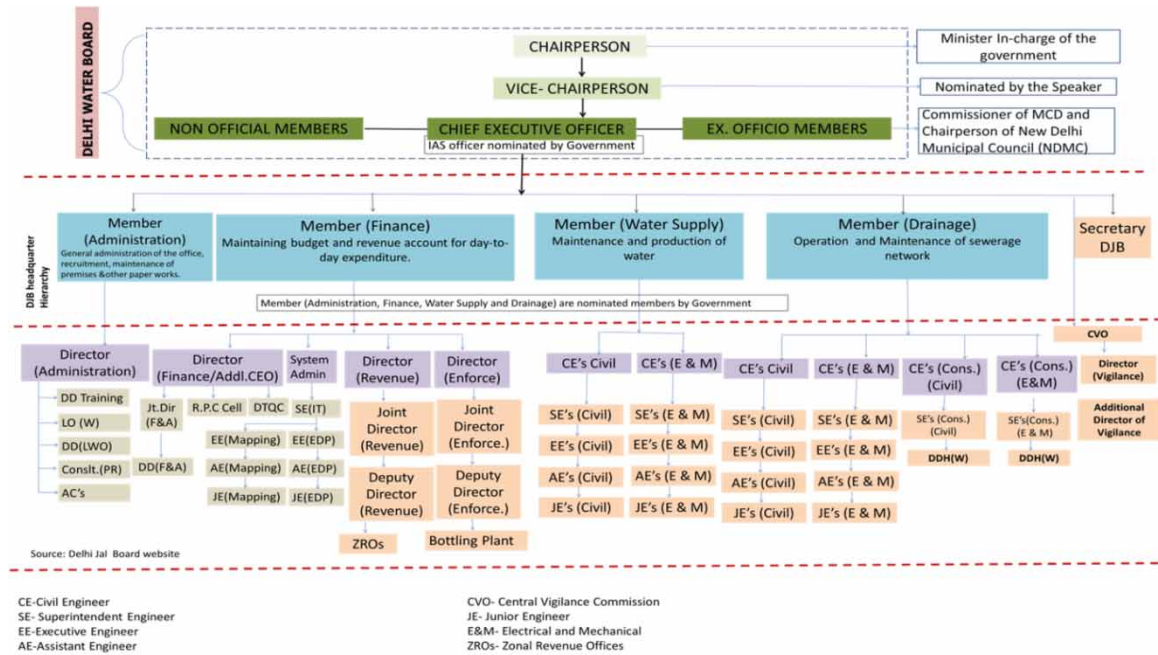
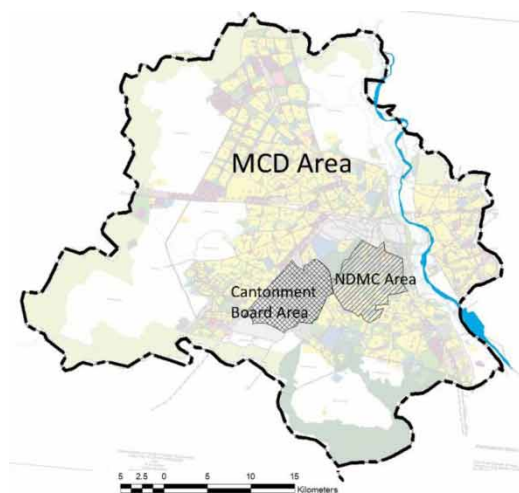


Figure 6 | Organizational structure of Delhi Jal Board. *Source:* <http://www.delhijalboard.nic.in/sites/default/files/Org%2Bchart%2BCng.JPG>.

supervise the city’s water agency, dictating and directing water-related policy, sometimes with little input from DJB authorities (Truelove 2018).

4.4. Local level

The third level of hierarchy includes the urban local bodies, i.e., MCD (East, South, and North), whereas the central part is governed by the NDMC and the cantonment area is being served by the Delhi Cantonment Board Committee (as shown in Figure 7). At present, DJB is the main institution for Delhi’s water supply and sanitation. It is responsible for the treatment of raw water supplied from various sources and the distribution of water for areas under MCD’s jurisdiction which accounts for 95% of Delhi’s geographical area. MCD’s role is in enforcing water-related byelaws such as rainwater harvesting structures, waste water recycling plants at household and community levels, and dispensing several water consumption and disposal activities in the respective areas.



Source: Delhi Jal Board Act, 1998

Geographical area	FUNCTIONS		
	Capital Works (CW)	Operation & Maintenance (O&M)	Revenue Function (RF)
MCD			
New Delhi Municipal Council		Bulk Supply only	Bulk payment from NDMC to DJB
Delhi Cantonment Board		Bulk Supply only	Bulk payment from Cantonment to DJB

Services provided by DJB

Figure 7 | Spatial representation of DJB for water services in NCT Delhi. *Source:* Delhi Jal Board Act, 1998.

For the remaining 5% of areas, which comprises NDMC and DCB, DJB supplies only bulk water and respective bodies distribute it on their own. All Delhi's wastewater treatment is carried out by DJB, including the NDMC and DCB areas. At the same level, various ground level bodies like Residential Welfare Associations (RWA), NGOs, and civil societies also make up part of Delhi's water governance system (as shown in Figure 5).

The 1998 DJB Act, which says that the DJB has no formal obligation to supply water to any building constructed in contravention of any law (The Delhi Jal Board Act, 1998, section 9.1.A) is responsible for the legal denial of water rights to significant portions of the population. While many homes throughout the city violate building codes (for example, with illegally extended walls, balconies, and rooftop structures), the state water agency has only applied section 9.1.A of the DJB Act to homes that are part of informal settlements that are against city land-use classifications. The majority of city people in contemporary Delhi are not served by the centralized water system (Sheikh *et al.* 2015). Through the Master Plan and the DJB 1998 Act, which was implemented by the state's agency known as the Delhi Jal Board (DJB) and Delhi Development Authority (DDA), unplanned neighbourhoods which house more than half of the population have remained cut off from centralized water connections (Truelove 2020). The routine water procurement negotiations, which occasionally involve local politicians and the Delhi Jal (water) Board and other times the so-called water mafia, neighbours, employers, and nearby residential areas, are highly situated and have an uneven social structure and infrastructure impact on colonies as a whole (Truelove 2016). For the areas not covered by the piped water supply distribution system, DJB provides water through a tanker service. However, as per Service Level Benchmarks (SLBs) by the Ministry of Housing and Urban Affairs (MoHUA), water supplied through tankers, stand posts, or tube wells is not considered as coverage of water. According to SDG-6 water supplied through an un-piped supply is considered as unsafe for drinking purpose. The municipal authorities in Delhi have a differential water supply policy for the different types of settlements in Delhi. However, even that is not uniform because the situation is further complicated by the intervention of political actors such as the local MLA in certain areas.

5. DISCUSSION AND CONCLUSIONS

We can draw the conclusion that the water governance system of Delhi is diverse and interdependent in nature, convergence, and coordination at both horizontal and vertical level is of utmost importance. For judicious use of Delhi's water resources and achieving sustainable development, a sound and healthy governance system is required.

Firstly, we deduced from our explanation that boundary-crossing interactions are most important for water governance. Governance is about multi-level interaction because there is no ideal scale for carrying out water management measures. There is no ideal way to divide functions. Many of the issues with water management must be resolved in conjunction with or in addition to other areas of policy.

Secondly, the National Capital Territory of Delhi's current water supply issues can be directly attributed to the absence of coordination, poor and ineffective management techniques, and the lack of any serious effort to develop and implement a workable plan. Population growth throughout time has also added to the complexity of the issues. There is little coordination and convergence between the DJB and DDA, the city planning agency.

Thirdly, in order to improve urban water governance, there is a critical need for multi-level integration of planning processes (horizontally and vertically within the governmental levels) and policies (top-down and bottom-up). This entails combining the size of analysis and action as well as all sectors at all levels (administrative, in central and local government, inter-ministerial, across organizations) (national, regional, local, and at the organization level).

Fourthly, to improve our understanding, we strongly advocate the need to look beyond the mechanisms for accessing water at the local level to wider processes of governance, in order to understand how MLG is embedded and reinforced. This includes understanding how resources, actors, scales, and jurisdictions shape how to apply a multi-level approach for distributing water to the residents.

Overall, the study's findings show that as the water governance system of Delhi is interdependent, horizontal and vertical level coordination becomes important. NCT Delhi has a polycentric system of governance as power and control related to water resource management is distributed among multiple administrative units. In addition, this paper draws from the work of Truelove (2018) on infrastructural absence, which found the ambiguous water supply sustains uneven geographies of coverage for inhabitants across social categories to varying degrees, driving localized everyday water politics.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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First received 13 September 2022; accepted in revised form 11 November 2022. Available online 5 December 2022