T20 POLICY BRIEF

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Task Force 01

FIGHTING INEQUALITIES, POVERTY, AND HUNGER

Ensuring Water Secure Cities: Learnings from Global Best Practices for Mainstreaming Circular Economy in Wastewater Management

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Abstract

Water scarcity has become a global crisis, with about 2.4 billion people living in countries experiencing water stress and 2.2 billion without access to safely managed drinking water services. In cities, the major challenge is providing water security to the rapidly growing population in emerging economies that will be at risk due to exposure to increased occurrence of climate-induced extreme events such as droughts and floods and vulnerability due to the absence of adequate water supply services. The solution lies in strengthening policy interventions and governance responses, managing water demand, and making the water systems more resilient. Wastewater treatment and reuse is a distinct alternative to augment water supply, reducing the pressure on existing freshwater resources and improving the water environment. The existence of wastewater treatment infrastructure is a strong function of economic development, with some of the G20 member countries, such as the USA, Australia, and Germany, having high per capita GDPs, also having high wastewater treatment capacity. There is an opportunity to learn from the experiences of the G20 countries in the global North and South that are at an advanced stage of wastewater treatment and reuse as well as resource recovery. We discuss the importance of governance, finance, technology, capacity building, and data and information, and make recommendations from the learnings for countries yet to consider wastewater as a resource. Further, we discuss the role of partnerships in knowledge sharing and building capacities to strengthen urban wastewater treatment systems and enable reuse.

Keywords: water security, wastewater treatment and reuse, cities, circular economy, water quality

Diagnosis Of the Issue

By 2030, the world will be generating about 470 million cubic metres of municipal wastewater, out of which 44 per cent will be from Asia alone (UNEP 2023). Of the total domestic wastewater generated worldwide in 2022, treatment stands at 58 per cent with large variations reported across regions (WHO and UNICEF 2023). For instance, 86 per cent of domestic wastewater is safely treated in Europe and Northern America, as opposed to 24 per cent in Central and Southern Asia (WHO and UNICEF 2023). Further, the reuse levels are even lower, with only 11 per cent of the total municipal wastewater generated globally being reused, as reported in 2015 (UNEP 2023).

The global water crisis, fuelled by depleting freshwater resources, exponential increase in water demand, and increasing levels of water pollution, is more severe in rapidly growing urban areas, especially in the Global South. As of 2022, 2.2 billion people still lacked access to safely managed drinking water services, with countries in the Global South disproportionately more affected than countries in the Global North (Bassi et al. 2023). Water reuse is a proven approach to contribute towards equitable access to water of the proper quantity and quality if policies concerning water supply and wastewater management are planned coherently (Tortajada 2024). The Council on Energy, Environment and Water (CEEW) analysis suggests that most of the G20 countries with high GDPs have high wastewater treatment capacities (Figure 1). Building such systems is capital-intensive, and their implementation goes together with economic development and growing awareness of environmental and health issues. Thus, a major growth in wastewater treatment capacity is expected in leading emerging economies, including Brazil, India, China, and South Africa (Gupta, Chaturvedi, and Bassi 2023).

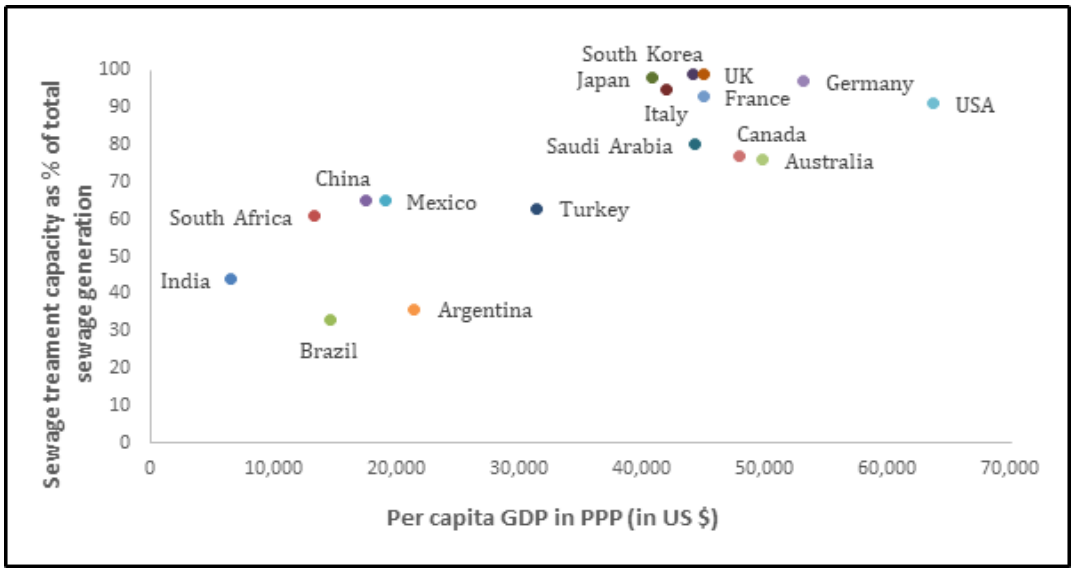

FIGURE 1. Wastewater treatment is a strong function of economic development

Source: Gupta, Chaturvedi, and Bassi 2023

As the Water Dialogue within the G20 Agenda progresses, cross-linking discussions between presidencies, tracks, and working groups that address interdependent challenges are important to formulate coherent policy outcomes. The Environment and Climate Sustainability Working Group under India's Presidency last year acknowledged the need to double global rates of progress to achieve targets under SDG 6 for universalisation of water and sanitation services. The current Brazilian Presidency is taking this forward under the Development Working Group as a key priority area.

This policy brief examines the current policy discourse on wastewater management and provides recommendations to strengthen it using selected global practices, highlighting the cases of Spain, Singapore, and Saudi Arabia. These countries present good examples of how transformative action in approaching wastewater as an important resource can ensure efficient water resources management and reduce demand pressure on freshwater resources.

Importance of G20 in wastewater management

Rising water demand amidst climate change-induced adverse impacts on water resources are common drivers for governments globally, including member countries of G20, who are taking steps to strengthen wastewater treatment and reuse (Bassi, Gupta, and Chaturvedi 2023). Singapore, Spain and Saudi Arabia have introduced well-planned governance tools to foster an enabling environment for the reuse of treated wastewater. Singapore, reclaimed water (NEWater as it is known locally) is a central element in the long-term water security vision of the city-state (Tortajada and Rensburg 2019). Further, Singapore, a global leader in wastewater treatment and reuse, leverages population awareness to establish the reuse of treated water as a national priority (Tortajada and Rensburg 2019). In Spain, the National Plan for Wastewater Treatment, Sanitation, Efficiency, Savings, and Reuse (DSEAR Plan) promotes the circular use of wastewater as a part of river basin management planning. Saudi Arabia has mainstreamed water reuse through a dedicated governance model that support the sector's privatisation and services subsidisation by the government.

G20 is a crucial platform that serves to address complex global challenges by influencing the Sustainable Development Agenda among nations. Circular management of water is a multilateral solution to the challenge posed by the global water crisis. Mutual learning through knowledge sharing between G20 countries and beyond can accelerate the mainstreaming of circularity in wastewater management. Thus, the G20 can play a pivotal role in driving long-term impact towards sustainable water management.

Recommendations

The policy brief makes recommendations for mainstreaming the circular economy in wastewater management in cities globally. The recommendations are categorised under the five accelerators of the UN-Water Global Acceleration Framework for achieving SDG 6, based on learnings derived from selected global cases. The role of partnerships is also highlighted as a key policy recommendation for the G20 nations and beyond.

3.1 Governance models for strengthening wastewater management

The adoption of a national policy framework with clear guidelines and legal provisions for the reuse of treated wastewater is a fundamental enabler (Bassi, Gupta, and Chaturvedi 2023). Learning from Spain, Singapore, and Saudi Arabia demonstrates that a paradigm shift in approaching wastewater as an important resource contributes to efficient water resources management. These nations have made wastewater an integral part of water management-related policies, plans, and regulations. To ensure the effective implementation of their national wastewater regulations, they have entrusted River Basin Organisations with the integrated management of the entire water sector, including water supply, sanitation, sewerage and drainage.

3.2 Sustainable financing options for implementing treated wastewater reuse projects

Developing a market for the reuse of treated wastewater is crucial for ensuring the financial sustainability of reuse projects. Implementing authorities in urban areas can recover the cost of wastewater treatment from revenues generated by selling the treated wastewater and its by-products (such as sludge and biogas) of a prescribed quality to users

such as industries and farmers (Gupta et al. 2024). For instance, local authorities can provide treated wastewater to industries at rates lower than industrial freshwater tariffs that would have been paid otherwise. The residual treated bio-solids that are left as part of treatment process can be sold as fertilisers, as they have high nutritional value (Barbarwar, Gupta, and Parmar 2023). Further, global experiences suggest that mixed funds and public–private partnerships are required for successful integrated water management. Cities in G20 nations must explore and leverage blended finance options such as municipal bonds, public equity, loans from multilateral institutions, sustainable finance bonds, value-captured finance, viability gap funding, etc.

3.3 Technological advancements for optimising resource efficiency

Demand-driven technological advancements and dedicated funds promoting innovation in this sphere play a key role in developing technologies that optimise resource efficiency (Bassi, Gupta, and Chaturvedi 2023). Emerging economies from G20 nations must formulate a clear strategy for research and development, especially focusing on low-cost treatment technologies that are high on energy efficiency. Taking the example of Spain, the nation carried out targeted technological improvements for wastewater treatment in alignment with the directives of the European Commission that define uniform reuse-specific quality standards and benchmarks for treated wastewater. It also evaluates associated risks, implements mitigation measures and promotes stakeholder participation.

3.4 Use of data and information for effective monitoring and evaluation

The lack of updated and reliable data is often a key impediment to the implementation and performance monitoring of policy initiatives. Hence, cities in G20 nations must invest

in the development of a comprehensive information system for urban water and wastewater management hosted on an open-access platform. The city-level data parameters critical for wastewater management can include information level of investment and cost recovery in wastewater management, coverage and collection efficiency of the sewerage network, wastewater treatment capacity installed and level of utilisation, stormwater drainage network coverage, status of water bodies, reuse of treated wastewater, quality of treated wastewater, energy consumption and energy cost of treatment infrastructure, level of GHG emissions from wastewater treatment and discharge, updated city masterplan and sewerage plan, and details of implemented reuse projects (Gupta et al. 2024). A municipal index developed by CEEW assesses the performance of over 500 Indian Urban Local Bodies (ULBs) in wastewater management across these parameters (Figure 2). Such an evaluation can inform ULBs about areas that require improvement, enabling the development of targeted strategies to strengthen their wastewater management (Gupta et al. 2024).

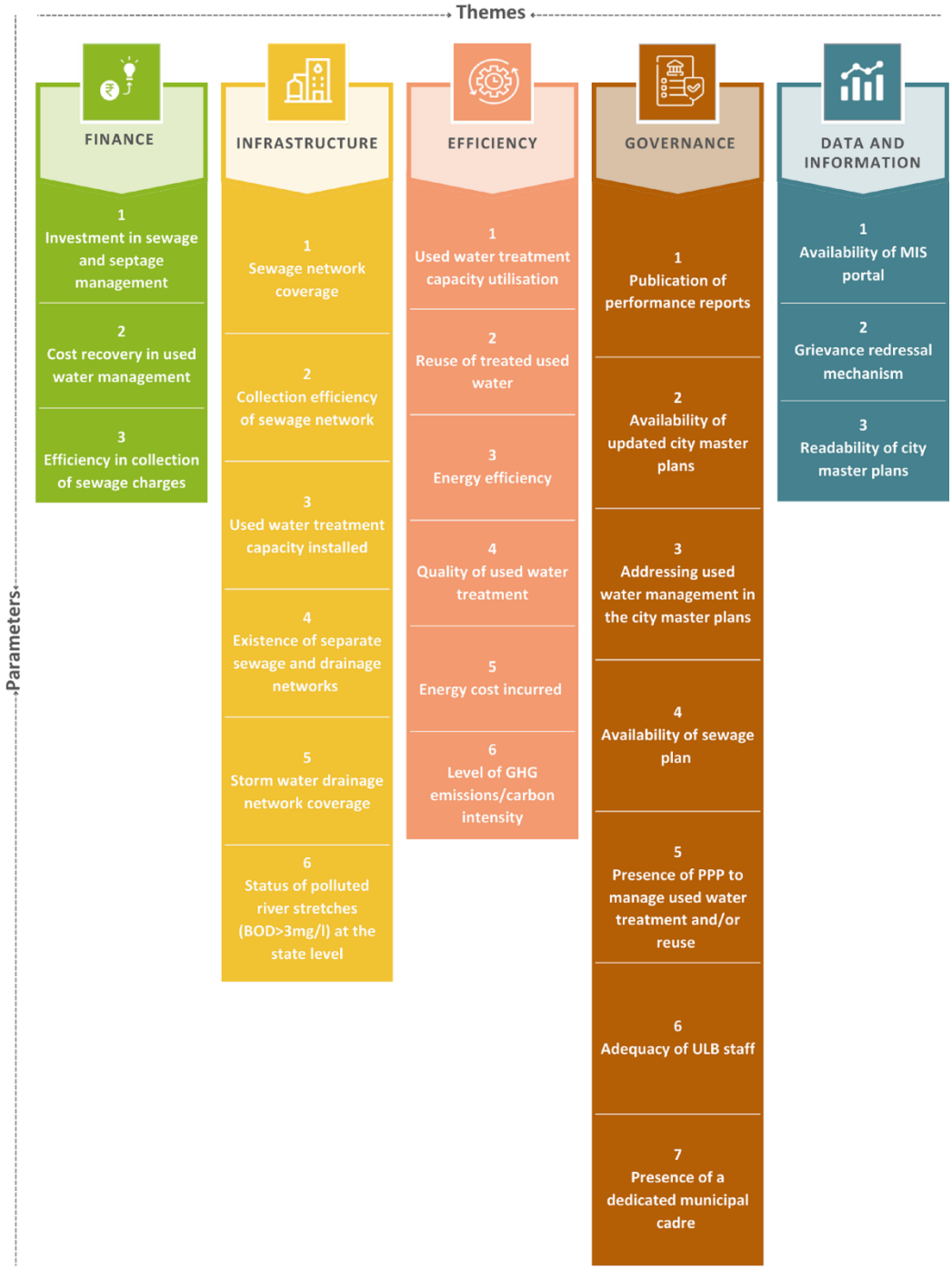

FIGURE 2. Index developed and computed to assess Indian Urban Local Bodies (ULBs) performance on wastewater management

Source: Gupta et al. 2024

3.5 Institutional capacity-building leading to public acceptance

Global experiences suggest that the proactive role of stakeholders and citizens is crucial in driving the shift towards circular wastewater management (Bassi, Gupta, and Chaturvedi 2023). G20 nations can draw inspiration from Singapore, having invested massively in public outreach programmes and designed a comprehensive information, education, and communication programme to gain public trust and acceptance for treated wastewater reuse. Simultaneously, institutional capacity building of city officials needs to be undertaken to enhance their understanding of wastewater treatment technologies, digital monitoring systems, regulatory compliance for treatment and reuse, business models for reuse projects, and project management. This extends to utility operators as well for effective operation and maintenance. Acceptance of reused water can be greatly enhanced if risks are properly identified and addressed. The European Wastewater Reuse Regulation therefore focuses on ensuring the safety of public health and the environment by assessing and managing risks at all stages of the process, from collection to final application. It sets water quality standards, evaluates associated risks, implements mitigation measures, and promotes stakeholder participation and transparency to ensure confidence in these practices.

3.6 Water partnerships between the G20 member nations

The G20 Water Platform, which is the main tool for sharing the outcomes of the G20 Water Dialogues, can be developed as a partnership facilitation portal (refer to the illustration in Figure 3). This can be done by providing details of the policy and legal landscape governing the water sector of each G20 country; the existing partnerships between G20 countries; and organisations that have demonstrated excellence (governments, non-governmental organisations, multilateral organisations, and funders).

This can provide information on the potential areas of investment in the G20 nations, enabling the development of pilots and research, which in turn can boost partnerships for economic growth, jobs, innovation, knowledge generation, and dissemination, all of which lie at the heart of the G20 agenda. The Global River Cities Alliance (GRCA) launched at COP-28 by the Government of India (Press Information Bureau 2023) and has members from 11 countries is an example of such a global water partnership that can enable South-South collaboration.

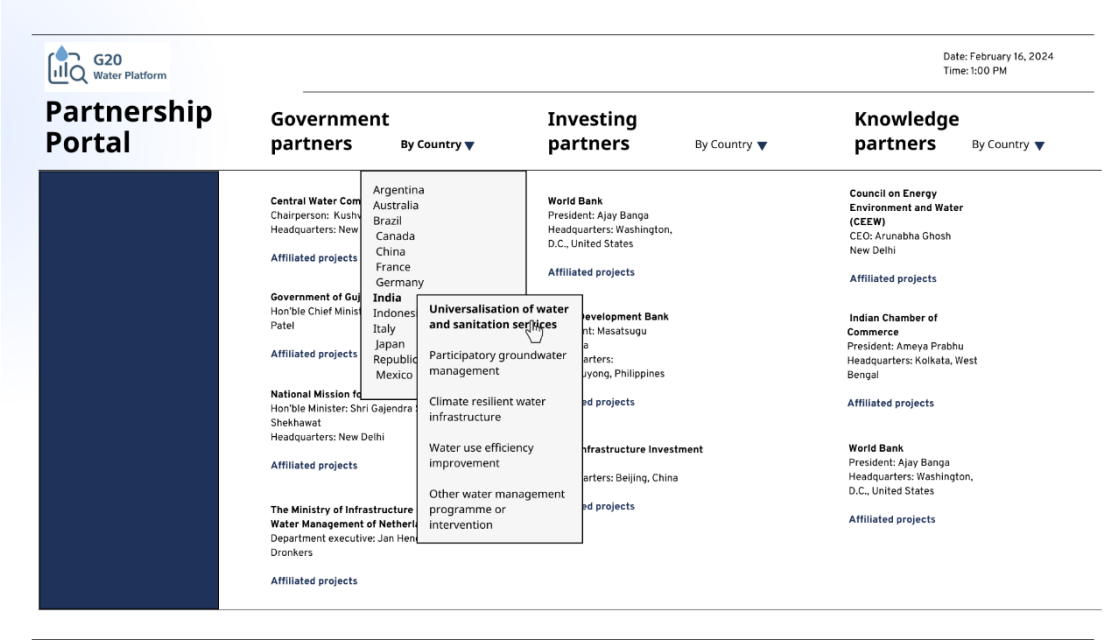

FIGURE 3. An illustration of the suggested G20 portal on water partnerships

Source: Prepared by authors

Scenario Of Outcomes

In this section, selected global cases of Spain, Singapore and the Saudi Arabia are presented in detail in terms of the drivers, barriers and enablers of their wastewater management models. Their approach and outcomes are discussed under the following heads: governance, finance, technology, capacity building, and data and information.

1. Governance

Saudi Arabia's agricultural development in the late 90s substantially increased the water requirements of the state, putting pressure on existing water sources. Thus, the nation’s quest for additional sources of water supply drove the institutionalisation of a dedicated governance model for wastewater management. As a result, Saudi Arabia’s Vision 2030 considered treated wastewater (TWW) as an integral part of national water management strategy. Further, for effective management of water in urban areas, a dedicated agency i.e. National Water Company (NWC) was created to provide water and wastewater services. Likewise, in Singapore, the Public Utilities Board (PUB) is the national water agency for managing water supply, sanitation, sewerage and drainage networks.

2. Finance

The provision for subsidies on freshwater in Saudi Arabia (Mu’azu, Nuhu Dalhat, Abubakar, and Blaisi, Nawaf I 2020) and the absence of a competitive market for treated wastewater in Spain were the major barriers that inhibited the development of financially viable reuse projects. However, both countries adopted context-specific strategies for the financial sustainability of the projects. Saudi Arabia’s NWC was mandated to formulate

a clear business plan for the privatisation of wastewater treatment and reuse infrastructure. Spain's National Investment Plan (NIP) 2019 provided adequate concessions and subsidies for water operators, which enabled private sector participation in wastewater infrastructure. Singapore created the market for TWW by offering reclaimed ultrapure water (NEWater) to the water industry at a lower price than tap water.

3. Technology

Need-based and demand-driven assessments are key drivers for technological advancements in wastewater treatment. Singapore's Smart Nation Initiative, which intends to drive transformation through technology in various sectors, is one such leading example. Regarding water, this initiative comprises automation, artificial intelligence, big data and machine learning for operational resilience, productivity, safety and security. The city-state has invested heavily in research and development of membrane technology to enhance the efficiency and operation of water and wastewater treatment capabilities such as energy and cost-efficient ceramic membrane systems and bio-rector technology. Spain has a long tradition of reuse, with technologies and experience in a wide range of applications, under legally regulated quality standards and conditions. To overcome the current dramatic drought in Catalonia, 1.75 m3/s of recycled water will be discharged into the river Llobregat, upstream of Barcelona's drinking water treatment plant. Guidance values have been set, and monitoring is in place for 102 chemical compounds (micropollutants, pharmaceuticals, and their metabolites) detected at any point in the treatment chain.

4. Data and information

Till 2022, only 45 per cent of the global population had access to data and information for safely managed water services (WHO and UNICEF 2023). The development of comprehensive databases and their effective dissemination is imperative for more efficient water resource management. In this regard, Singapore has created a digital twin for a water reclamation plant. Digitalisation and data are used for water quality monitoring, rainfall prediction, and optimised operation and decision control. Further, there is a unified database enabling effective water resource management. Most importantly, they intend to use their technological advancement as an instrument to achieve broader national objectives of water security by promoting water use efficiency and encouraging water conservation practices.

5. Capacity building through education and awareness

From the time of its independence, Singapore made water security a national priority. The government worked on several fronts simultaneously. It redeveloped a large part of the city and built water, sanitation and wastewater infrastructure, enforced strict land use, produced non-conventional sources of water, and applied numerous water efficiency and conservation measures at the domestic and industrial levels (Tortajada, Joshi, and Biswas 2013). These strategies have been enabled by strong political leadership and public outreach (Gupta, Chaturvedi, and Bassi 2023). In Saudi Arabia, there was initially significant reluctance towards reusing treated wastewater. Public perception and subsidies on freshwater were the major barriers to its adoption (Mu'azu, Nuhu Dalhat, Abubakar, and Blaisi, Nawaf I 2020). However, the reuse of treated wastewater in the country increased gradually through effective public engagement and behavioural nudges that made people realise the multiple benefits of treated wastewater. The use of treated

wastewater for irrigation has led to increased crop production, improved water use efficiency and reduced the requirement for nitrogen fertiliser application by 50 per cent in the country. Such evidence-based benefits have encouraged farmers towards the adoption of treated wastewater reuse.

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