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The Fight for the Poor

The year was 2010. The Dhaka Water Supply and Sewerage Authority (DWASA) had been working on a partnership with the Asian Development Bank (ADB) and several other international development agencies to develop a transformative reform—the Dhaka Water Supply Sector Development Program (DWSSDP)—which aimed to turn around the urban water services sector of Bangladesh. This was one of the biggest reform programs for Bangladesh's public utilities sector, and if successfully implemented, would

create the momentum for more follow-up programs in the future, and thus making it a model for the turnaround efforts of other public utilities in the South Asia region and beyond. The stakes were high—all partner organizations were committed to making the project successful. DWASA and ADB dedicated their top experts to participate in the design process of the turnaround program. Everyone was highly motivated as the program promised to deliver clean water to millions of Bangladeshis, creating broad positive societal and economic impacts.

One of the experts leading the design phase was Akbar Rahman, ADB's urban development specialist. His experience spanned multiple complex innovative projects for urban infrastructure and economic corridor development. As he was examining the proposed program map in the project room, he noticed that large areas of Dhaka city were not included. Upon inquiry, his counterpart from DWASA explained that these areas were illegal settlements and slum neighborhoods, which could not be included in the program. His heart sank. He recalled his childhood growing up in a poor neighborhood; he knew the daily struggles of people who did not have access to reliable clean water supply. These neighborhoods in Dhaka felt like his own, and he felt the urge to advocate for them, to explore the options instead of accepting the assumption that they must be excluded from the program. Furthermore, ADB is committed to promoting inclusive growth and poverty reduction, providing broader access for all members of society to infrastructure and economic opportunities.[1]

Rahman was determined to devise a program design that is inclusive and for-the-poor. After thorough research, field trips, and consultations with key stakeholders including DWASA's Chief Executive Sanjib Hossain, he quickly realized the complexity and challenges he must solve in this fight for the poor. Rahman and his team eventually laid out three main policy options for consideration: (i) prioritize low-risk areas first before finding ways to incorporate the slums into the program; (ii) let the private sector take over public utility services for the slums; and (iii) fully incorporate the slums into the turnaround program, starting with pilot projects to access viability.

Bangladesh and Dhaka City

Bangladesh, a South Asian nation, is one of the most densely populated countries in the world with a total population of more than 163 million people living in a total land area of 130,170 square kilometers (50,259 square miles).[2] The country is surrounded by India to the west, north, and east, and shares a portion of its border with Myanmar to the southeast and the Bay of Bengal to the south. The country's economic development was hindered by many challenges, including environmental challenges such as frequent natural disasters, flooding caused by annual monsoons, adverse effects of climate change, and social challenges including the lack of skills and knowledge, inadequate infrastructure, uneven ownership of productive assets, corruption, low level of

[1] World Population Review. Dhaka Population 1950–2021. https://worldpopulationreview.com/world-cities/dhaka-population (accessed 27 February 2021).

[2] The World Bank. Population, Total – Bangladesh. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=BD; and The World Bank. Land Area (Sq Km) – Bangladesh. https://data.worldbank.org/indicator/AG.LND.TOTL.K2?locations=BD (both accessed 27 February 2021).

urbanization, and overpopulation. As a result, for many decades, the country struggled with severe absolute poverty. Nevertheless, since the early 2000s, Bangladesh's economy has been improving rapidly, its per capita income increased from $418 in 2000 to $781 in 2010 (the year of the case) and $1,855 in 2019; with an average gross domestic product (GDP) annual growth of 4.5%.[3] Economic development and poverty reduction have been two of the most important priorities for the Government of Bangladesh.

Dhaka is Bangladesh's capital and the largest city; and the country's economic, political, and cultural hub. It is the sixth most densely populated city in the world, with more than 14.7 million residents in Dhaka Metropolitan Area as of 2010 and 21.7 million residents as of 2021.[4] Even though Dhaka has higher economic growth and lower poverty rate than the nation's average level, the city struggles with a large number of low-income residents and slum neighborhoods. The annual population growth rate in Dhaka since the 2000s averages 3.5%, and the total population is projected to be 31.2 million residents in 2035. The United Nations estimated that Dhaka city had more than 5,000 slums with more than 4 million slum dwellers in 2010, which accounted for 27.2% of the city's population. Most of the slum dwellers lived on less than $2 a day. Annual flooding, acute poverty, overcrowding, poor housing, lack of sanitary drainage and sewage system, and waterborne diseases are some of the many problems that plague these settlements.

A Water Crisis

Bangladesh has one of the largest river networks comprising about 700 rivers including tributaries and a total length of 24,140 km.[5] Dhaka is located in the central region of Bangladesh, which is surrounded by three large rivers, the Padma (Ganges), the Brahmaputra, and the Meghna. Dhaka is situated on the Brahmaputra River Delta, also known as the Ganges Delta, at an elevation of 5 to 13 meters above sea level. These rivers bring nutritious sediments to the Delta, forming fertile soil for many crops. But they are also the reason why the country is prone to flooding. Flooding normally occurs during the monsoon season from June to September, due to convectional rainfall in combination with relief rainfall and meltwater from the Himalayas. Rivers around Dhaka city are also polluted by industrial activities, municipal sewage, solid waste, fecal contamination, agrochemicals, river encroachment, and urban waste (Appendix A).

Providing reliable clean water to the growing population has always been one of the major challenges of the city. Dhaka's public water supply was criticized to be limited, unsanitary, and often unavailable. Residents often had to find a way to obtain groundwater by themselves. More than 26% of households in Dhaka, mostly in slum neighborhoods, had no sanitary toilets and 70%

[3] The World Bank. Population, Total – Bangladesh. The World Bank. Bangladesh GDP per Capita in Current US$, 1960–2019. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=BD&name_desc=false; and The World Bank. Bangladesh GDP growth (Annual %), 1961–2019. https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=BD (both accessed 27 February 2021).

[4] World Population Review. Dhaka Population 1950–2021. https://worldpopulationreview.com/world-cities/dhaka-population (accessed 27 February 2021).

[5] Banglapedia – National Encyclopedia of Bangladesh. River. https://en.banglapedia.org/index.php/River (accessed 27 February 2021).

had no sewerage. Waterborne diseases, such as cholera and acute dysentery, were the top causes for infant and child mortality. The negative effect on public health also impacted the population's productivity, especially that of women as they had to spend many hours and a lot of effort fetching, storing, treating water, and caring for family members with waterborne diseases.

Dhaka obtained 80% of its water supply from groundwater but was quickly exhausting this resource. Many suction pumps were installed for underground tanks, which reduced or choked off pressure elsewhere, resulting in backwashing, stagnation, and contamination of the entire groundwater system. Aquifers—underground layers of water-bearing permeable rock, sand, or gravel—could take up to half a century to recover from overuse, and Dhaka was on the verge of using them all up. By the year 2000, the city had already exceeded its limit of upper aquifer wells, and lower aquifers could only take 50 more tube wells. Meanwhile, between 40 and 60 tube wells were drying up yearly (ADB 2007). The water table was falling by 2–3 meters annually. Dhaka city as well as the country of Bangladesh were deep in a water crisis.

In 2005, the Bangladesh government listed water supply and sanitation among the seven top priorities in its National Poverty Reduction Strategy, which was in alignment with the United Nations Millennium Development Goals, aiming to halve the number of people without access to safe drinking water and better sanitation by 2015. However, the Bangladesh government quickly realized that the plan was overly ambitious as it lacked specific strategies and funding allocation, with no clear timeline, institutional reforms, legal instruments, or the necessary policy directives.

DWASA and a Challenging Mission

The Dhaka Water Supply and Sanitation Authority was the primary authority responsible for operating and maintaining water supply service, sewerage services, and stormwater drainage service in Dhaka city (Appendix B). It was estimated that DWASA supplied water to 90% or 7.7 million residents living in the DWASA service area (the remaining 10% relied on private wells). Prior to the reform, DWASA had six core problems that were shared by many other public water utility services in developing countries:

First, DWASA struggled to meet growing demand for safe clean drinking water. As both upper and lower aquifers were drying up, DWASA needed to move away from relying on groundwater, instead starting to utilize surface water. However, treating surface water to acceptable quality was much more technically complex and expensive than using groundwater (Appendix C, D, and E, for water demand, supply, and projections).

Second, the existing network of water distribution is of low quality, which led to a high rate of water loss. In a 2006 pilot program in the Manikdi area, it was shown that the water connection system to households was rapidly deteriorating and leaking. Water loss under very low pressure accounted for more than 50%. The system also could not support the high pressure necessary to reliably deliver treated water. Water loss was not only caused by leaks but also due to the inaccurate or absent water meters. Only 59% of household connections had water meters installed to measure

consumption and for those that did, the meters were inaccurate or inaccessible, making it almost impossible to manage the actual water usage from the network.

Third, the water supply was unreliable and often contaminated. Even when the groundwater pumped into the water supply network was of acceptable quality, the water quality deteriorated as it ran through the pipes. The pipes and connection nodes were rusty and leaky. The low or negative pressure created by the suction pumps caused backflows and extensive contamination in the network. For surface water, DWASA did not yet have the pretreatment facilities needed. Intermittent power supply and the lack of backup generators meant that water supply was often cut off.

Fourth, the slum neighborhoods were largely left out of the water supply network. In 2007, an estimated 1.3 million people or 15% of the population living in the DWASA service area lived in slums. A portion of these residents used unauthorized water connections while the rest did not even have access to water services. Without any intervention, the number of slum settlers without access to water services was forecast to exceed 4 million by the year 2025 (see Appendix F for existing network and Appendix G for slum definitions).

Fifth, DWASA's operations were financially unsustainable. DWASA experienced huge revenue loss due to water loss, which is also called nonrevenue water (NRW). Water loss accounted for 40% to 50% of total water supply due to undetected or unresolved leaks, defective or obsolete meters, or lack of meters, in combination with the rampant use of suction pumps and illegal connections. Surveys showed that up to 90% of slum dwellers were using DWASA-supplied water through illegal channels. NRW meant that DWASA did not have the revenue for many necessary operations including maintenance, network rehabilitation, and expansion of the supply network. The water tariffs were much less than the cost of providing water. Internal accounting and management systems were outdated, inefficient, and often not transparent. DWASA estimated that only half of the water supplied were billed for, and only 62% of water billed was collected. That meant only about one-third of the water in the network was ever paid for (Sharma and Alipalo 2017).

Sixth, DWASA's management system required improvement on its efficiency and effectiveness. DWASA, as a public agency, was highly politicized. DWASA operated within the provision of the Water Supply and Sewerage Authority Act of 1996, which stated that DWASA could manage its facilities and operate with a high degree of autonomy. However, it was mandated that the managing director position must be appointed by the Bangladesh government. Furthermore, as the government financed and acted as a surety for finance, DWASA's major decisions must obtain governmental approval prior to being executed, which hindered DWASA's ability to act expeditiously or independently. This explained why DWASA was unable to adjust tariffs to recover its operational costs and why the managing director position was vacant for an unusually extended period of time. The turnover rate among senior executives was high. Labor unions wielded strong pressure on management, frequently blocking them from making key hiring and firing decisions or from taking disciplinary actions. As a result, motivation and morale were low, and staff lacked the incentive to get trained and improve their capability and skills. Furthermore, there was virtually no opportunity for customers to interact, provide feedback, or give suggestions to DWASA staff

and management. Customer satisfaction was never measured nor was it among the management's priorities.

Past Development Partnerships

Over the past few decades, DWASA has had several development partnerships funded by various international development organizations. The World Bank, Japan International Cooperation Agency (JICA), and the Department for International Development of the United Kingdom (DFID) jointly supported the Government of Bangladesh and provided approximately 80% of development assistance in terms of financing amount. The World Bank had been supporting DWASA and was its primary lender since 1973 with back-to-back loans amounting to $147 million. However, the World Bank withdrew its funding in 2001 due to various concerns over procurement inconsistency, slow progress, and institutional and management inefficiencies. As a result, DWASA suffered a huge reputation loss. In 2005, the World Bank returned to support several other projects in waste management, stormwater drainage, environmental and water resource management, and institutional reform. The World Bank also financed an in-depth analysis of the challenges of providing water services to low-income communities in slum neighborhoods. Several other development agencies that previously supported projects by DWASA were the Danish International Development Agency (DANIDA), the Swedish International Development Cooperation Agency (SIDA), Japan's JICA, and the UK's DFID. Nevertheless, due to the core issues and reputation loss, DWASA was listed as a high-risk investment for development partners who might consider investing.

Turning Problem into Opportunity

By 2006, Dhaka's water crisis was worsening rapidly—the groundwater table was dropping fast, sinkholes were appearing in many locations throughout the city, and the price of water was peaking due to the increasing cost of using electricity to pump water or buy from private vendors. Child and infant mortality likely due to waterborne diseases was rising to an alarming level. Even the wealthier communities were being affected by the water crisis.

Sanjib Hossain was appointed as DWASA's chief executive officer in 2009, bringing with him a wealth of experience, technical knowledge, a well-connected network, and an ambitious vision to transform DWASA to be the best public water utility in the South Asia region. This transformation plan required a substantial amount of financial support as well as technical guidance from international development partners.

The Asian Development Bank (ADB) is a regional development bank established in 1966 and headquartered in Manila, Philippines. ADB is known for its work in eradicating extreme poverty in Asia and the Pacific by providing loans, technical assistance, grants, and equity investments to promote social and economic development. To maximize the impact of the assistance, ADB also provides advisory support, facilitates policy dialogues, and other services depending on the need

of its members and partners. At the time, ADB had not invested in DWASA since 1996. However, given the gravity of the situation, ADB management felt the need to step in and help Dhaka tackle the water crisis, improve public health and its citizens' overall well-being. ADB leadership saw an opportunity to package the investment with institutional, operational, and managerial reforms. ADB reached out to other development agencies, discussed a potential partnership, and received favorable responses from the UK's DFID, Denmark's DANIDA, Japan Bank for International Cooperation (JBIC), Korea International Cooperation Agency (KOICA), the Government of Italy, and the World Bank. As the turnaround program was complex and had many different components, it was essential for the development agencies to collaborate closely and arrive at an agreement on commitment and an investment road map. After careful deliberation, a financing agreement of $212.7 million was signed in 2007 by the development partners and the Bangladesh government. ADB, as the main financing partner, took the lead in investing in water supply improvement projects while the World Bank focused on sewerage and drainage with a $100 million loan, partnering with DFID in scaling service models for various communities. DANIDA provided $130 million for a new surface water treatment plant. An urban water supply project in Chittagong was supported jointly by JBIC, KOICA, the Government of Italy, and the World Bank.

Learning from previous development projects in Bangladesh, ADB designed the program based on four key lessons:

- Use performance-based funding to keep the executing agency accountable and to keep the projects on schedule. Disbursements were conditioned upon the achievement of specific performance milestones using clear key performance indicators such as the reduction in the NRW rate. The $50 million program loan to be disbursed over two tranches to cover sector reforms and policy reforms, the $150 million project loan to cover infrastructure rehabilitation and construction, and the $2.5 million technical assistant grant were all structured based on performance milestones.
- Prioritize the financial performance and autonomy of local water supply divisions (with more details in the embedded policy conditions).
- Minimize delays by offering fewer contracts and lesser procurement—the project loan required only six major performance-based contracts, enhancing administrative efficiency.
- Involve local communities through extensive consultations to gather stronger support and commitment and to facilitate smoother implementation.

In order to hedge against structural risk, the program loan was embedded with policy conditions mandating a structural reform. The policy-based loan intended to enable the entire water supply system, including DWASA and local water utility divisions, to operate more effectively and sustainably. The three main areas of reform include the following:

1. Strengthen local water governance and institutional framework.
    - Decentralize and enable local water utility divisions to have more autonomy over operation and maintenance, billing and collection, and tariff setting.
    - Recommend the most appropriate form of water utility regulation, clarifying the functions, roles, and responsibilities of the regulator.
    - Train local water utility staff and build their capacity with sufficient budget and planning.

2. Improve the financial sustainability of local water utilities.
    - Allow local divisions to keep and use water billing revenues for maintenance and improvement, conditional upon transparent bookkeeping and maintenance of inventory and assets.
3. Strengthen DWASA governance, organizational structure, and financial management capacity.
    - Structure a medium-term human resources development strategy, including a staff recruitment and retention plan, capacity building, and projection of salary increments.
    - Define the responsibilities and commitments of the board and the managing director.
    - Strategize the 5-year business plan and operational manual (2009–2013).
    - Establish an anti-corruption committee with sufficient staff, direct line of reporting to the DWASA managing director, and enable follow-up investigations to incident reports.
    - Improve customer service satisfaction by setting up help desks and phone hotlines to resolve consumer concerns and requests.
    - Publish DWASA annual financial statements and audit reports prepared by credible auditors on the DWASA website starting from fiscal year 2010.

ADB also built upon the synergies between policy reforms and infrastructure development by combining the policy-based loan with project loans to provide funding for infrastructure investments using an instrument called the Sector Development Program. This was to ensure that infrastructure projects were implemented on time, on schedule, and on target while leveraging the policy reforms. Below were the major interventions to improve overall water supply service in Dhaka.

a) Rehabilitation of the existing network, including secondary and tertiary network, service connections and existing tanks, and procurement of digital water meters.
b) Rehabilitation of infrastructure including zonal offices, head office, training and laboratory, and expansion of the network to areas within the DWASA service areas.
c) Primary transmission lines to distribute water from the Saidabad Water Treatment Plant to be constructed under item d.
d) 500-million-liters-per-day Saidabad Water Treatment Plant at Khilkhet including intake structure at Lakhya River and raw water transmission main.
e) Additional generators for power backup to the existing functioning private deep tube wells and the additional deep tube wells extracting water from deeper aquifers.
f) Saidabad phase 2, including pre-treatment for both existing Saidabad 1 and the new Saidabad Water Treatment Plant.

All components were part of an integral program, but each was to be financed by a different mechanism to reduce overall cost to the Government of Bangladesh. Components A, B, and C were financed under ADB's project loan as a part of the Sector Development Program. The future investment project prepared by component C was planned to be financed by a separate ADB investment project. Component D was financed by the Bangladesh government, and component E by DANIDA's mixed credit facility.

District Metered Areas Approach and Trenchless Technology

The district metered area (DMA) approach is one of the most promising methods to improve water supply qualitatively and quantitatively. Instead of supplying water to an entire region, breaking down the region into manageable zones, or DMAs, and installing water meters accordingly will enable water utilities to monitor water supply and consumption for each of these zones. Creating such closed hydrologic systems helps to break megacities like Dhaka down into more serviceable zones. Local water utilities will be able to independently monitor and ensure the quality, consistency, and pressure of water supply in each zone. This approach also allows water utilities to pinpoint and measure water leakage, illegal connections, and overall NRW rate. Another advantage of this approach is that the problems in each DMA will be contained and addressed while not affecting the rest of the water supply network (Appendix H).

Given the size of Dhaka city and the quickly declining state of the existing network, DWASA believed that this zonal approach would help to improve the situation. However, this would work only if all the illegal connections within one DMA were regularized and formally incorporated into the main network. This was an argument for why connecting the poor was not only an ideal but also a requirement for the technical viability of the system. If the illegal connections were not addressed and the poor continued to tap into the network in the wrong place, this could affect pressure and disrupt the whole DMA zone. Legalizing and connecting the poor would ensure all connections were done appropriately and safely. Several other challenges with the DMA approach included rehabilitating the existing utilities network while avoiding water supply disruptions to consumers during the project, obtaining road-cutting permits from city authorities, dealing with police interference, and strategizing public messaging to change outdated mindsets, and establishing confidence in the new system. To create DMAs for the Dhaka service area, DWASA had to restore primary and secondary networks, including lining and replacing pipes as needed, replacing old spaghetti connections with new tertiary distribution network, installing functional meters for household connections, installing valves and water meters for each zone, regularly measuring NRW, and ensuring NRW stays below 15% in each DMA.

The rehabilitation of a massive underground utilities network in a megacity like Dhaka was no easy task. The proposed solution for this challenge was trenchless technology, an alternative for the traditional open excavation method. Trenchless technology is a method of construction in civil engineering that allows for the installation or rehabilitation of existing underground infrastructure without the need for open trenches, thus minimizing disruption to surface traffic, business, housing or natural vegetations. This technology is especially suitable for densely populated and densely built megacities like Dhaka. Horizontal directional drilling (HDD) is a subtype of trenchless technology most suitable for water pipes, which are typically smaller in diameter and commonly used by water utilities. This method helped to alleviate the issue of expensive relocation compensation for affected areas, minimize reconstruction along sidewalks and easements for businesses and residences, and minimize environmental and noise pollution. In order to ensure and monitor the

quality of water supply, DWASA also planned to construct and revamp chlorination facilities at each supply point, including groundwater pumping stations. Each facility was to be equipped with good lightning, temperature controls, and the necessary lab equipment for water testing done by microbiologists and chemists.

In order to test the suitability and effectiveness of the proposed technical solutions, ADB approved a separate technical assistance grant for a pilot project in Manikdi in 2006 (Appendix I). The Manikdi neighborhood had one of the highest rates of NRW in Dhaka, up to 58% due to leakage and theft. The pilot project ran between March 2006 and December 2007, installed 215 new connections, and rehabilitated 440 service connections in the network using the DMA approach and HDD trenchless technology. The technical assessments confirmed the major sources of NRW, and the project successfully lowered NRW rate from 53% in March 2006 to 14% in January 2007. Other encouraging improvements included higher water pressure, sufficient amount of water meters, and the ease of meter reading. The length of distribution network pipes increased from 2.5 kilometers to 4.6 kilometers, spaghetti connections decreased from 418 to zero. Most importantly, the residents in the pilot area had access to water 24 hours daily instead of an average 4.8 hours daily prior to the pilot project. The pilot also provided important information for future project design such as the actual household demand for water, tariff collection issues, technical issues around leak management, and social mobilization strategies. Overall, the pilot at Manikdi was a success and a key steppingstone to using the DMA approach as well as the HDD trenchless technology for Dhaka. Furthermore, Manikdi was also one of the low-income communities, and demonstrated the technical and financial viability of extending the program to other low-income communities. Nonetheless, the initial success of the small pilot in Manikdi in 2006 was encouraging but was not persuasive enough for bigger slum neighborhoods to be included in the major turnaround program being designed in 2010. Rahman knew he needed convincing and effective implantation strategies to guarantee future success.

Advocating for the Poor and Navigating Stakeholders' Complexity

As Rahman set out on his quest to advocate for the low-income neighborhoods, he knew he had to gather as much support as possible from all the stakeholders involved. He spoke to key stakeholders in DWASA and the local government, he organized visits to the slum neighborhoods as project design missions, he examined the current conditions, and analyzed the various factors affecting the project. In addition, he leveraged not only the strong working partnership between DWASA and ADB, but also the newly adopted resolution by the United Nations' General Assembly (UNGA) in July 2010 recognizing access to clean water and sanitation as a fundamental human right (UN General Assembly 2010). The low-income residents in slum neighborhoods have this fundamental right as all other residents elsewhere. Furthermore, if DWASA chose to carry out the Dhaka Water Supply Sector Development Program (DWSSDP) and improved water supply systems only for the wealthier neighborhoods, the exclusion of slum residences could make slum dwellers rationalize water thefts through illegal suction pumps as acceptable means to correct social injustice and

inequality. The proliferation of water thefts had already created multiple technical and financial issues, which would worsen if the slum dwellers continued to be left behind. As a consequence, the DWASA water supply network would be weakened as a whole. These were the arguments that Rahman used to advocate for the inclusion of the low-income neighborhoods to the turnaround program.

Nevertheless, he was met with such a great deal of pushback that at one point it seemed like an impossible mission. DWASA engineers presented him with the multitude of technical challenges of trying to connect the slums. When he started a policy dialogue with the Bangladesh government, he was met with more reluctance and resistance. Government officials were not supportive because many of these neighborhoods are illegal settlements. They reasoned that providing them with basic urban infrastructure could be perceived as granting legality to these settlements. In addition, good public services could encourage further encroachment on state lands and private lands. Furthermore, one of the biggest concerns was the financial viability of the project—connecting the slum areas was seen as a guarantee for financial loss. The widely accepted assumption at the time was that slum dwellers could not afford connection costs and water tariffs. However, the belief that slum dwellers were much more likely to default on water bills was never challenged nor verified. Nevertheless, during various public forum debates, these concerns were brought up repeatedly, showing how deeply ingrained was the mindset that connecting the poor was fundamentally non-beneficial to the overall economy and public welfare.

Fortunately, Rahman had one key stakeholder on his side, DWASA's Chief Executive Sanjib Hossain. Upon being appointed in 2009, Hossain's vision was to transform DWASA to become the best public water utility in the South Asia region. He pushed for a reform agenda in three major aspects: first, the improvement in the agency's capacity, efficiency, and financial sustainability; second, environmental sustainability; and third, the provision of reliable and clean water to all the people in Dhaka, including the low-income population. Hossain's third agenda aligned with Rahman's mission, making Hossain one of Rahman's most important allies in this quest. As it turned out during their first meetings, he was right. They agreed that it was important for them to find ways to include the poor neighborhoods. Hossain, who had a wealth of experience working in the public sector and many years working with government agencies, was well-recognized and well-connected among the key government officials who needed to be persuaded. He suggested that they could leverage the favorable policy momentum including the 2004 Water Supply and Sanitation Sector Development Framework, the 2004 National Policy for Arsenic Mitigation, and the 2005 National Poverty Reduction Strategy (Government of Bangladesh, IMF, and the World Bank 2015). These strategies prioritized the need to provide safe water and appropriate sanitation to all Bangladeshis, which also aligned with the 2010 UNGA resolution.

However, the challenges did not stop with obtaining government approval. Rahman's team also had to convince the local mustangs, also called water mafias, to cooperate. This was perhaps one of the most difficult tasks, yet of utmost importance if the project was to succeed. Upon the establishment of slum neighborhoods, the lack of public utilities connections left a vacuum in supply and thus a market opportunity for mustangs to benefit from slum dwellers. They obtained water from other neighborhoods and resold to low-income households at a high margin, up to 15 or even 20 times

DWASA's rate (Sharma and Alipalo 2017). The possibility of official water connections to these neighborhoods, therefore, angered them as it threatened their businesses. Convincing them would require providing them with solid incentives to change their business models and their mindset, with a local community-based approach.

Another key stakeholder group that Rahman had to convince was the general public. On the one hand, the slum dwellers were skeptical whether the water utilities connections would ever become a reality. On the other hand, wealthier communities nearby were resisting the effort due to a deeply ingrained discriminatory mindset against the low-income neighborhoods. Some of the residents blocked the entrance to slum communities, preventing the DWASA team from accessing and carrying out technical assessments. Rahman and his team had to spend many hours speaking to the residents to understand their concerns, and many more hours brainstorming effective strategies to convince them.

Nongovernment Organizations and Community-Based Organizations

Rahman and Hossain believed that the key to slum neighborhoods is the nongovernment organizations who were already working with these communities. They could be playing the vital role of breaking the ice between DWASA and the communities, warming up the relationship which was complicated due to the water issues that the slum dwellers had been experiencing daily. For example, Korail is Dhaka's largest slum, established over 25 years ago, with more than 50,000 households, 125,000 people who have no legal land ownership or legal access to basic utilities. Korail only had 14 legal connections to DWASA's network but all were controlled by mustangs who were selling water from 65 illegal connections at 15 to 20 times the DWASA's rate. Slum dwellers felt excluded from the water supply system, punished by the inflated water price and waterborne diseases, which explained why they did not have favorable opinions about DWASA and other government authorities. Nongovernment organizations (NGOs) could step in to help establish the initial trust and confidence between slum communities and DWASA, to present DWASA's reform plans and to organize community-based organizations (CBOs). Instead of getting individual connections to each household which represented an insurmountable challenge for overpopulated slum neighborhoods, a small community of 15 to 25 households could jointly apply for legal water connections via the local CBO. The local CBOs, which consisted of volunteer officers or slum residents, could help to maintain the connection, distribute the monthly bill as well as oversee collection and payment process. During one of the design missions, Rahman had the chance to meet and discuss this potential with one of the main NGOs operating for many years in Korail, Dushtha Shasthya Kendra. The NGO's officers were receptive of the idea and expressed their willingness to help raise community awareness and gather community support.

Raising awareness of the public about water usage was another important component, in which the NGOs and CBOs could assist. The communities needed to be informed of the project plan and progress, how the project would impact their daily life and schedules, whether there would be a change in the water tariff, how to facilitate meter reading, the negative impact of suction pumps,

how to handle the new billing system, and how to use water economically. The project team and DWASA team had to work closely with the NGOs and CBOs to provide them with relevant information, education materials, communication strategies, and join them during these meetings. However, some DWASA officers already expressed concerns about having to go to Korail due to the strained relationship and negative perceptions held by the residents there.

The resistance did not only come from the residents, but also from the surrounding neighborhoods. Shattola is another of Dhaka's slums suffering from the water crisis, with powerful mustangs monopolizing the water supply. The possibility of connecting Shattola's drain to the main drainage system worried the wealthier communities nearby who had outdated prejudice and believed that the connection would negatively impact the quality of the water supply and drainage system of their residences. The conflict escalated to the point that those residents organized a protest, preventing DWASA's engineering and design team from going to Shattola.

Even of bigger concern were local mustangs. They directly benefited from the lack of formal legal water supply to the slums; some mustangs even had personal connections to certain political parties. They were certainly upset to hear about the possibility that DWASA might want to extend legal connections to Shattola and take away their profitable income source. When DWASA officers went on a design mission to Shattola, they were met with threats and at times were even held at gunpoint by these water mafias.

Time to Decide

Rahman and his team had to make the critical decision on which policy option to advocate. On the one hand, they needed to keep in mind the big picture—they had to ensure the success of the main program. Any misstep that jeopardized the DWSSDP would threaten the continuation of the partnership between DWASA and ADB, as well as other international development partners. On the other hand, they felt strongly that the low-income neighborhoods must not be left behind or excluded from the public sector reform, as this could have long-term consequences on the residents' overall well-being and the neighborhoods' economic and social development.

Three policy options were laid out to be evaluated and considered. The first was to focus on the design and implementation of the program in the low-risk areas before considering the slum neighborhoods. The program was important and of high stakes to all organizations involved—DWASA, ADB, and several other funding partner organizations. The successful implementation of the program during the initial period was extremely important for the funding partners to continue providing funds for the subsequent projects. The management board of DWASA favored this approach, taking into consideration the scale and duration of the program, and the credibility of DWASA to the external partners, to the Bangladesh government, and to the public. With this approach, the possibility of connecting the poor was not entirely ruled out. However, Rahman was concerned that if the design of the program was created without keeping the poor in mind, with the poor being treated as an afterthought, the subsequent effort to connect them would be manyfold more challenging. On the contrary, if the design was created deliberately from the start, not just pro-poor but also for-the-poor, the subsequent implementation, monitoring, and evaluation

would be much smoother and much less likely to be pushed aside due to political pressure or social backlash. Furthermore, the delay in connecting the slum neighborhoods while the whole system was undergoing reform would worsen discontent among low-income population, exacerbating the water theft issue as well as other water-related problems in low-income neighborhoods.

The second option was to engage the private sector's participation. Many have called for the privatization of public utility services, especially when it came to servicing more complex areas like the slum neighborhoods. DWASA could potentially call for a private contract in which private companies could bid to service water for low-income neighborhoods. The involvement of the private sector has several advantages. First, this enabled DWASA to focus on the main turnaround program without being distracted by political or public resistance about connecting slum neighborhoods and to untangle itself from the decade-long debate. Second, the private contractors could start proposing and implementing solutions for water services for slum neighborhoods at the same time as the DWSSDP was being implemented in other areas. This could prevent the low-income population from feeling left behind and excluded. Third, DWASA could use the opportunity to test the concept of private sector participation before deciding whether this could be the right direction and to scale it up in the future. However, this option also had potential downsides. Private sector participation might complicate DWASA's relationship with labor unions. Historically, the active participation of private companies had created conflicts between the labor unions and DWASA management. Furthermore, there could be confusion in the division of responsibilities, which could lead to conflicts of interest or overlapping works and bottlenecks. This was the main issue in the previous agreements between DWASA and outsourced private companies for billing and revenue collection. Most importantly, Hossain expressed his concerns for this option. He believed that DWASA needed to take on the challenge in order to learn from the experience themselves. He believed that the private sector could be involved in some functions such as metering, billing, and revenue collection. However, the main responsibility of connecting the slum neighborhoods should still be DWASA's responsibility.

The third and last option was to carry out pilot projects at one or two slum areas, to evaluate and prove the viability of the design and approach first before scaling up to other low-income neighborhoods. Hossain suggested to Rahman that they could leverage Bangladesh's public policy adopted in 2007 (Sharma and Alipalo 2017), which stated that utility services connections to slum settlements without land ownership was illegal but connections for CBOs were allowed. This meant they could explore engaging NGOs, who were already operating in these neighborhoods. Pitching the water connections to slum neighborhoods as community-based, community-managed projects with NGOs was much more likely to get government approval. Pilot projects could be designed with a clear scope and budget so that the financial commitment for both DWASA and ADB would not affect the budget for the main turnaround program. The pilot projects could be designed such that they would not interfere with the overall progress of the DWSSDP and at the same time allow DWASA to learn from the experience and adjust its approach accordingly for future implementation. Furthermore, they could leverage the latest engineering advancements that were included in the DWSSDP, including the zonal approach DMAs and trenchless technology, in order to mitigate some of the challenges in connecting slum areas. These technologies have been proven effective and suitable in the 2006 pilot project in Manikdi neighborhood. After several project design missions, Rahman and his team identified two slum neighborhoods, Korail and Shattola, as

potential pilot sites. However, to ensure the success of the pilot projects, the design team needed to come up with effective strategies to mitigate potential political resistance, to change the public mindset on connecting the poor to the main utility system, to convince stakeholders including the local water mafias, and to ensure the pilot projects would not create additional technical challenge or financial burden on the DWSSDP and the development partnership.

It was 8 o'clock in the evening and Rahman was still in his office pondering the difficult questions: Which strategy was the right move for the project? How could they ensure that the poor have 24-hour access to reliable clean water supply without exposing DWASA and the partnership to political targeting, public backlash, or additional technical and financial challenges?

Would it be better if DWASA focused their effort and attention on the main DWSSDP in lower-risk areas and left the low-income areas to the private sector who might have more experience and expertise working in these challenging neighborhoods? Or would the entire water supply network benefit more if DWASA was to directly execute, learn, and subsequently scale these projects to all the slum areas?

Must they push for the pilot projects in Korail and Shattola now when DWSSDP needed to achieve certain initial success before risking any potential setbacks? Or should they focus on lower-risk areas first before initiating projects in higher-risk areas?

How could they best manage the stakeholders involved including DWASA's existing customers, the low-income neighborhood residents, the Bangladesh government, the investment partners, DWASA's staff and management, the NGOs and CBOs, the local mustangs, etc.? Which stakeholders could they leverage? Which stakeholders must they gain support from, and how?

How could they measure their success? Which key performance indicators should they use, from both technical and societal standpoints? What lessons could they learn from this experience that could be applied to future scale-up projects? What lessons could other water utilities in the developing world learn from DWASA's turnaround program?

As the program design deadline was approaching, Rahman must pick a policy recommendation for his proposal even though he did not have all the answers yet.

Appendix A: Dhaka's Water Crisis before the Turnaround Program

- Water pollution

- River encroachment

- Industrial wastewater and sewage discharge into rivers

Industrial wastewater and discharge in Turag river

Sewage discharge in Balu river

Waste materials dumping in Turag river

Sewage discharge in Bongshi river

Source: ADB and AIM (2016).

Appendix B: Dhaka Water Supply and Sewerage Authority Key Milestones up to 2010

- **1963:** The Dhaka Water Supply and Sewerage Authority (DWASA) was created under the Ministry of Local Government, Rural Development and Cooperatives with the main mission to provide water supply and sewerage services in the metropolitan area of Dhaka.
- **1996:** The Dhaka Water Supply and Sewerage Authority Act was amended to grant more autonomy to DWASA, reducing the government's interference.
- **1998:** The National Policy for Safe Water Supply and Sanitation passed by the Parliament.
- **2004:** The Water Supply and Sanitation Sector Development Framework and National Policy for Arsenic Mitigation passed by the Parliament.
- **2005:** The National Poverty Reduction Strategy listed clean water supply and sanitation as one of the Bangladesh government's seven top priorities.
- **2006:** The Water and Sanitation Sector's Sector Development Program was approved
- **2006:** The Manikdi pilot demonstrated the effectiveness of the district metered area approach and the viability of connecting low-income neighborhoods to the water supply network.
- **2007:** Development partners together with the Bangladesh government signed the partnership framework for funding, technical assistance, and policy reforms.
- **2008:** The ADB-financed Dhaka Water Supply Sector Development Program was initiated.
- **2010:** DWASA initiated the design of the turnaround program.

Appendix C: Key Statistics

Population of Dhaka City and Demand and Supply of Water

Year	Population (million approximately)	Demand of Water (million liters)	Supply of Water (million liters)	Storage (million liters)	No. of Deep Tube Wells
1963	0.85	150	130	20	30
1970	1.46	260	180	80	47
1980	3.03	550	300	250	87
1990	5.56	1,000	510	490	216
1996	7.55	1,300	810	490	216
1997	8.0	1,350	870	480	225
1998	8.5	1,400	930	470	237
1999	9.0	1,440	1,070	370	277
2000	9.5	1,500	1,130	370	308
2001	10.0	1,600	1,220	380	336
2002	10.5	1,680	1,300	380	379
2003	11.025	1,760	1,360	400	391
2004	11.567	1,850	1,400	450	402
2005	12.15	1,940	1,460	480	418
2006	12.65	1,900	1,540	480	441
2007	13.15	1,980	1,660	320	465
2008	13.65	2,050	1,760	290	490
2009	14.15	2,120	1,880	240	519
2010	14.50	2,180	1,990	190	560
2011	15.0	2,240	2,150	90	599
2012	15.0	2,240	2,180	60	615
2013	15.0	2,250	2,420		644

Source: ADB and AIM (2016).

Appendix D: Water Demand Projections (Best Case Scenario)

			2010	2015	2020	2025
Population in DWASA area			10,290,000	12,320,000	14,610,000	17,190,000
Served by DWASA (90%)			9,270,000	11,090,000	13,150,000	15,470,000
Slum population (15%)			1,540,000	1,850,000	2,190,000	2,580,000
Served by DWASA excluding slums			7,730,000	9,240,000	10,960,000	12,890,000
Water Demand						
- Residential	l/c/d		140	130	120	110
- Slum	l/c/d		35	40	45	50
- Commercial/ Industrial	%		12%	15%	17%	20%
Total	Ml/d		1,290	1,480	1,680	1,880
Unaccounted for Water	%		35%	25%	25%	25%
Total Water Demand	Ml/d		1,980	1,970	2,240	2,510
Water Availability						
Ground Water	Ml/d		1,250	1,175	1,175	1,175
Saidabad SWTP I	Ml/d	225	225	225	225	225
Saidabad SWTP II	Ml/d	225	225	225	225	225
SWTP III (Khilkhet)	Ml/d	500		500	500	500
SWTP IV (Padma)	Ml/d	500				500
Total			1,700	2,125	2,125	2,625
Deficit/Surplus			(280)	155	(115)	115

DWASA = Dhaka Water Supply and Sewerage Authority, l/c/d = liters per capita per day, Ml/d = million liters per day, SWTP = surface water treatment plant.

Source: ADB and AIM (2016).

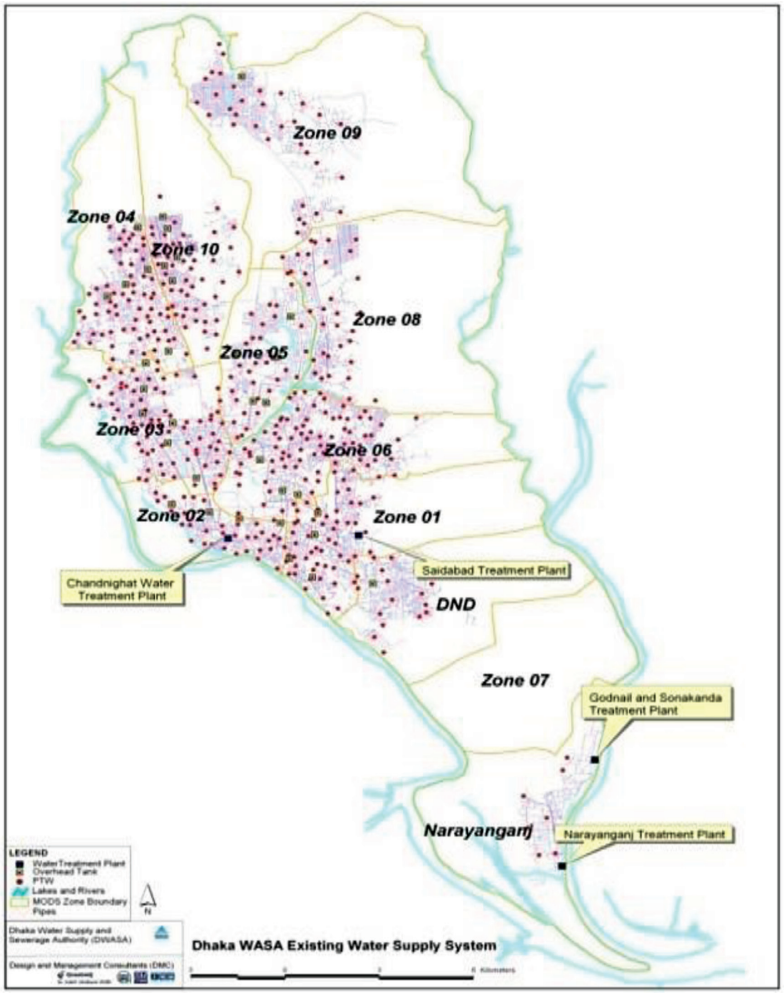
Appendix E: Water Demand Projections (Worst Case Scenario)

			2010	2015	2020	2025
Population in DWASA area			10,290,000	12,320,000	14,610,000	17,190,000
Served by DWASA (90%)			9,270,000	11,090,000	13,150,000	15,470,000
Slum population (15%)			1,540,000	1,850,000	2,190,000	2,580,000
Served by DWASA excluding slums			7,730,000	9,240,000	10,960,000	12,890,000
Water Demand						
- Residential	l/c/d		150	150	150	150
- Slum	l/c/d		35	40	45	50
- Commercial/ Industrial	%		12%	15%	17%	20%
Total	Ml/d		1,360	1,680	2,040	2,480
Unaccounted for Water	%		40%	40%	40%	40%
Total Water Demand	Ml/d		2,270	2,800	3,400	4,130
Water Availability						
Ground Water	Ml/d		1,250	1,175	1,175	1,175
Saidabad SWTP I	Ml/d	225	225	225	225	225
Saidabad SWTP II	Ml/d	225	225	225	225	225
SWTP III (Khilkhet)	Ml/d	500		500	500	500
SWTP IV (Padma)	Ml/d	500		500	500	500
SWTP V (Saidabad)	Ml/d	500			500	500
SWTP VI (TBD)	Ml/d	500			500	500
SWTP VII (TBD)	Ml/d	500				500
Total			1,700	2,625	3,625	4,125
Deficit/Surplus			(570)	(175)	225	(5)

DWASA = Dhaka Water Supply and Sewerage Authority, l/c/d = liters per capita per day, Ml/d = million liters per day, SWTP = surface water treatment plant.

Source: ADB and AIM (2016).

Appendix F: Water Supply Network in Dhaka City Before the Turnaround



Source: Sharma and Alipalo (2017).

Appendix G: Dhaka Slums

Basic Information on Dhaka City Slums

	1986 (BBS)	1997 (BBS)		2005 (DTCB)
	Dhaka Metropolitan Area	Dhaka City	Dhaka Mega City	
Number of slums	N/A	1,396	1,579	2,001
Number of households	121,328	178,527	204,390 (4.9)	284,823 (4.2)
Slum population	575,604	724,891	829,866 (3.4)	1,304,381(4.1)
% of total population	16.4	12.7	14.4	14.9
Average household size	4.74	4.06	4.06	4.06

BBS = *Bangladesh Bureau of Statistics*, DTCB = *Dhaka Transport Coordination Board*, N/A = not applicable.

Sources: ADB and AIM (2016); BBS (1988); BBS (1999); Dhaka Transport Coordination Board (1985); and Centre for Urban Studies (2005).

Slum Definitions

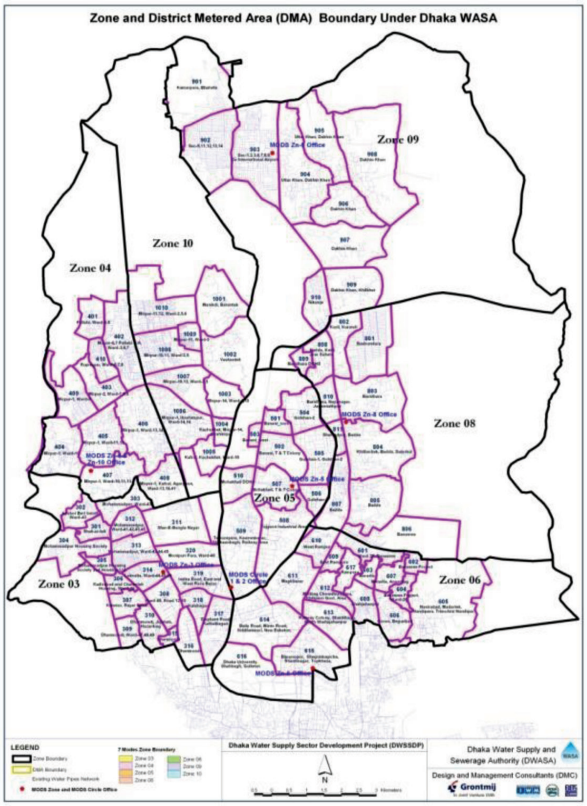
(i) "A slum is a cluster of housing units which grow unsystematically in government owned or private vacant land. The walls and roofs of such houses are generally made of straw leaves, gunny bags, polythene paper, bamboo etc. A tin shed house or even a building may be added, if it is situated within the purview and environment of a slum. The physical and hygienic conditions of such houses are far below those of a common urban residential area. Generally, this segment of people is distressed and forced to live in such unhygienic conditions due to economic reasons" (BBS 1988).

(ii) "A slum is a cluster of compact settlements of 5 or more households which generally grow very unsystematically and haphazardly in an unhealthy condition and atmosphere on government and private vacant land. Slums also exist in the owner-based household premises" (BBS 1999).

(iii) "Slums are defined as settlements with a minimum of 10 households or a mess unit with a minimum of 25 members and predominantly very poor housing; very high population density and room crowding; very poor environmental services, especially water and sanitation; very low socio-economic status; lack of security of tenure" (Centre for Urban Studies 2005).

Sources: ADB and AIM (2016); BBS (1988); BBS (1999); Dhaka Transport Coordination Board (1985); and Centre for Urban Studies (2005).

Appendix H: District Metered Areas



Benefits:

- Up-to-date water supply information
- Minimized non-revenue water
- Easier detection of leaks and illegal connections
- Energy-efficient system
- Higher water pressure
- Improved water quality
- Greater customer satisfaction
- Enhanced financial sustainability

Primary Criteria

- All connections and sources are formalized and metered
- Hydraulic isolation
- DMAs of appropriate size, not too big or too small
- At least one reliable water source
- At least one external connection for emergencies

Secondary Criteria

- Well-defined roads
- Administrative boundaries
- Suitable land use and housing patterns
- Suitable future developments

Source: Sharma and Alipalo (2017).

Appendix I: Manikdi Pilot Project Key Features and Outcomes

- Technical assistance project in partnership with ADB
- Network rehabilitated with high-density polyethylene pipes
- Water meters installed in homes of all consumers
- Continuous supply of water to all households through a pressurized system
- Suction pumps were no longer in use
- Replaced illegal connections with official DWASA connections
- Rate of NRW dropped from approximately 53% before the pilot to 8% after the pilot
- Billing rate after the pilot project: 100%
- Collection rate after the pilot project: 100%

Source: Sharma and Alipalo (2017).

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Study Questions

1. Would it be better if DWASA focused their effort and attention on the main DWSSDP in lower-risk areas and left the low-income areas to the private sector who might have more experience and expertise working in these challenging neighborhoods? Or would the entire water supply network benefit more if DWASA was to directly execute, learn, and subsequently scale these projects to all the slum areas?
2. Must they push for the pilot projects in Korail and Shattola now when DWSSDP needed to achieve certain initial success before risking any potential setbacks? Or should they focus on lower-risk areas first before initiating projects in higher-risk areas?
3. How could they best manage the stakeholders involved including DWASA's existing customers, the low-income neighborhood residents, the Bangladesh government, the investment partners, DWASA's staff and management, the NGOs and CBOs, the local mustangs, etc.? Which stakeholders could they leverage? Which stakeholders must they gain their trust and support, and how?
4. How could they measure their success? Which key performance indicators should they use, from both technical and societal standpoints? What lessons could they learn from this experience in order to apply for future scale-up projects? What lessons could other water utilities in the developing world learn from DWASA's turnaround program?

Note: In this publication, "$" refers to United States dollars.

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