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WATER SCARCITY RESPONSE: EFFICIENT USE OF WATER – CHALLENGES AND POLICY INTERVENTIONS IN UZBEKISTAN

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1. Introduction.

Uzbekistan is facing growing water crisis due to climate change, on the one side, and increased water demands, on the other side. Increased heat, melting glaciers, and low rainfall amplify add on to water stress. What is more, Afghanistan is constructing the Qush-Tepa canal on the Amu Darya basin, which will more likely decrease water availability by further 30% in the next 5 years. Recent estimates have forecasted that by 2030 water supply in the country will fall 7 billion cubic meters short, which is 25% of its supply, making Uzbekistan rank as one of 33 countries that will be highly impacted by water scarcity in 2040. Despite these alarming trends, **water use efficiency** remains low, hence it is crucial that water reform is urgently adopted in order to secure both natural ecosystems as well as economy development.

Background

Uzbekistan's primary water sources-the Amudarya and Syrdarya Rivers-are part of the Aral Sea basin, where average annual flows total 116 billion m^3, with only 22% formed inside the country. Additionally, changes in glacial melt and reduced snowfall have cut per capita water supply by 53% in three decades. Recurrent droughts, extreme temperatures, and dust storms further strain water availability, affecting farmers, industries, and households.

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Water is at the core of Uzbekistan's economy, mainly in agriculture that consumes up to 90 percent of available water. About 45 percent of employment is in farming, with about 25 percent of GDP relying on irrigated farming. The depletion of water resources threatens livelihood and food security.

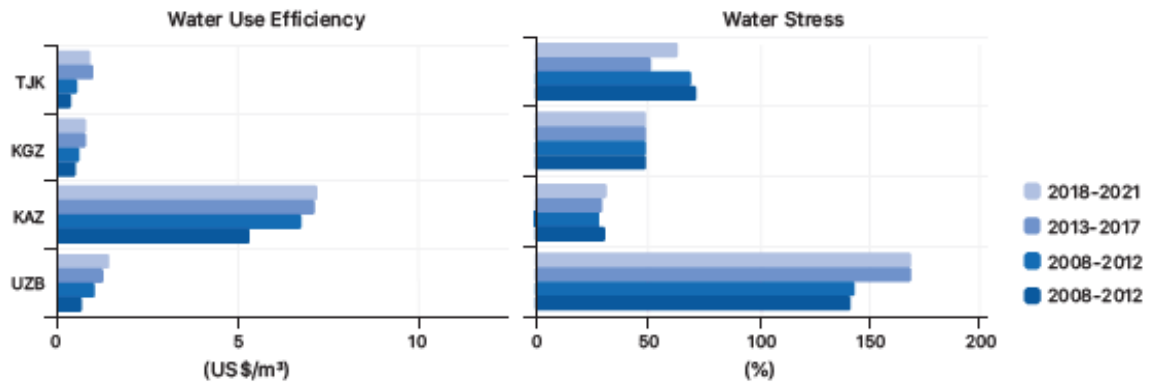
Low water use efficiency

Despite acute water shortage as well as water deficiency forecasted, water utilization remains inefficient. Excessive withdrawal, traditional methods of irrigation, as well as outdated infrastructure, contribute towards high losses as well as poor output. Comparative data suggest that Uzbekistan utilizes much more water on a per-capita basis compared to a majority of those with similar, not to mention more critical, water challenges. The water-use efficiency in Uzbekistan is as little as $1.34 a cubic metre–far below some neighboring countries' $4–5/m³ level–implying that much space is available towards improving allocation as well as efficiency. Such inefficient utilization is seen in poor water-use efficiency measures. Therefore, a comprehensive deep understanding of infrastructural, financial as well as institutional causes is necessary in determining trends in water use.

2. Methodology

This research employs a qualitative analytical approach combining secondary data review, policy analysis, and comparative evaluation to assess the challenges and policy responses to water scarcity in Uzbekistan. The methodology is designed to identify the underlying causes of inefficient water use and evaluate the effectiveness of existing interventions.

Figure 1 Water Use Efficiency and Water Stress Source: AQUASTAT, 2023



2.1 Research Design

The study follows a descriptive and analytical research design, focusing on understanding structural inefficiencies in water management and exploring evidence-based solutions. By examining Uzbekistan's water governance

framework, infrastructure conditions, and economic policies, the research aims to highlight the multidimensional nature of the country's water scarcity problem.

2.2 Data Analysis

Data were analyzed through a thematic framework organized around three primary constraint categories:

1. Technical (infrastructure and agricultural practices)
2. Financial (tariffs, investments, and cost recovery)
3. Institutional (governance structure, capacity, and enforcement)

Each theme was examined using a root cause analysis approach to identify systemic inefficiencies. Comparative analysis was also conducted with neighboring Central Asian states to contextualize Uzbekistan's performance in terms of water-use efficiency and infrastructure investment.

2.3 Policy Evaluation Framework

Government interventions were assessed using a policy effectiveness lens, evaluating each response along three dimensions:

- Relevance – alignment of interventions with identified root causes
- Efficiency – resource allocation, cost recovery, and implementation mechanisms
- Sustainability – long-term institutional and environmental impact

This framework helped in formulating the study's policy recommendations, ensuring they are both evidence-based and practical within Uzbekistan's economic context.

3. Root cause analysis

A careful assessment of the factors behind inefficient water supply highlights ineffective farming practices, high water losses from old, poorly serviced infrastructure, inadequate investment in infrastructure upgrading, and cost-recovery tariffs that are not sufficient.

3.1. Technical constraints

3.1.1. Aging infrastructure

Uzbekistan's water infrastructure, i.e., canals, conduits, as also networks of pipelines–is predominantly from Soviet-times and far outlived its working period. This aging network is a cause of massive water losses; 36% of 39 billions cubic meters water that is utilized in 2022 alone went down through earth canals as also ditches. Among 60,200 km water pipelines as also pipes in the nation, much is in a condition that urgently demands upgrading: 32% of distribution pipes are in a state of deterioration.

Wastewater treatment and reuse is also poorly developed–the majority of municipal wastewater is not treated for secondary use in irrigation or industrial

production, a key means of improving overall water-use efficiency. In addition, metering and monitoring are also poor in much of the country, outdated monitoring devices and a lack of tiered billing leave little room in terms of consumer incentives to conserve water.

Poor operation and maintenance is another key contributor to inefficiency. Older 1980s-era pumps frequently are operated at a constant speed because newer controls are not available, resulting in over-pressurization (and hence additional leakage) as well as energy waste. Simultaneously, utilities have constrained capacity as well as resources, resulting in slower leak repairs as well as postponed network upgrading. Preventive maintenance is replaced with expensive ad hoc repairs that are 3 times more expensive than planned maintenance. Operating on a regular basis in a state of emergency preempts water and sanitation businesses from having effective short- as well as long-term operational planning. All these contribute towards putting Uzbekistan's water network in a state of inefficiency with a pressing requirement towards upgrading with more advanced technologies as well as improved management.

Uzbekistan also has a series of reservoirs and dams. According to FAO, the country's storage capacity is at 0.6 thousand m³ per person, lower than countries like Georgia and Azerbaijan. Kazakhstan, Kyrgyzstan, and Tajikistan have even higher per capita storage, ranging from 3 thousand to over 4 thousand m³. Dams are a critical water infrastructure component that is essential in order to meet growing demands on water, food, energy, as well as flood prevention. In May 2020, a failure at Sarboda Dam in Uzbekistan impacted around 100,000 in both Uzbekistan as well as in Kazakhstan. Given that Sarboda was a relatively new dam, such failure highlighted a cause of growing concern over Uzbekistan's other hydraulic structures' safety as well as sustainability.

3.1.2. Agricultural practices.

Agriculture in Uzbekistan is one of the most inefficient in terms of water consumption in the world (90% of freshwater withdrawals in the country). In the world, this figure is on average 65%. Water consumption per hectare in agriculture is twice higher than in a number of countries.

Approximately 80% of the country's agricultural production depends on inefficient flood **irrigation systems. This leads to suboptimal performance of the agricultural sector–the lower TFP for Uzbekistan compared to other Central Asian countries.**

Switching from flood to drip irrigation can cut water usage by over 50% while boosting yields of 20%. Specifically, drip irrigation achieved a 56% water savings

and a 22% cotton yield increase compared to furrow irrigation in trials. Drip and sprinkler systems deliver water directly to roots, reducing evaporation and runoff.

Despite the clear benefits, adoption of water-saving irrigation technologies in Uzbekistan is still limited, being introduced in only 23% of the irrigated areas. Farmers stuck with familiar practices (flood irrigation) due to cost, risk aversion, and lack of knowledge, these have been. Land leveling are underutilized, which is key technology being promoted to save water. Smoothing fields reduces water pooling and runoff, allowing more uniform, efficient irrigation.

A major driver of water inefficiency in Uzbekistan is its historical focus on water-intensive crops, especially cotton. While cotton area has been on a downward trend in recent years as part of a national food and water security strategy, cotton still remains water-intensive given irrigation patterns.

3.2. Financial constraints

Tariffs for water supply in Uzbekistan remain below cost-recovery levels and are among the lowest in developing countries. JSC O'zsuvta'minot uses a uniform tariff approach based on service costs, household incomes, and inflation. Of 4,052 thousand connections, households make up 3,959 thousand (97.7%), budget organizations 13.3 thousand (0.3%), and enterprises 79.7 thousand (2%). Tariffs average about $0.13 per m^3–half of neighboring Kazakhstan's $0.21 and well below Eastern Europe's $0.5–$1.5. Veolia Energy Tashkent reports households currently cover only 18% of the base tariff. In many cases, low tariffs indicate that the income earned is inadequate to pay the expenses of water delivery, including the costs of treatment, distribution, and the repairs and upkeep of infrastructure.

Despite 2019's Resolution No. 309 aiming to move tariffs toward cost recovery, they remain inadequate. In 2023, some regions nearly doubled water and sewerage prices, yet full cost recovery is still not achieved. The government plans gradual tariff hikes to balance fiscal needs with public acceptance. This financing gap is enormous: recent analyses estimate an annual shortfall of about $826 million in Uzbekistan's water supply and sanitation funding. In other words, each year the country is investing hundreds of millions less than what is needed to properly operate, maintain, and expand its water services – a direct consequence of tariffs and fees being set too low for cost recovery.

Underinvestment in modernizing Uzbekistan's irrigation infrastructure remains a significant concern. Although the expenditure spent on operations and maintenance (O&M) per cubic meter and per hectare when measured against other countries is comparatively lower, most of these costs stem from electricity use, not the modernization of infrastructure. This high reliance on electrically powered lift irrigation arises from Uzbekistan's terrain and hydrogeological conditions, leading

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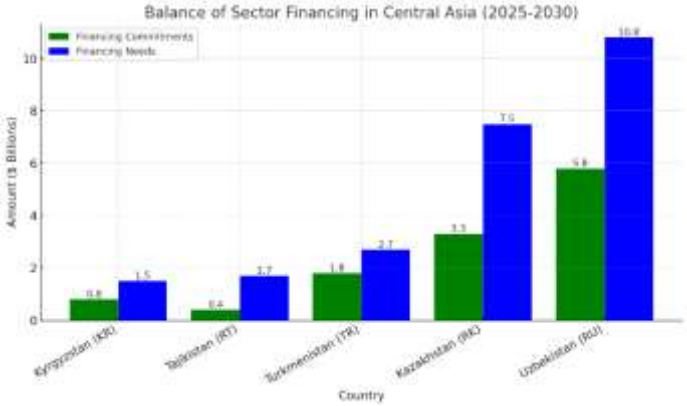
to elevated O&M expenditures and lower economic efficiency in provinces that depend primarily on lift irrigation, as opposed to those using gravity-fed systems. Chronic underfunding of repairs and upkeep has intensified wear and tear, shortened the functional lifespan of infrastructure, and amplified the demand for major capital investments.

Even though public spending has increased substantially in recent years, it still lags behind the levels required for replacing assets, performing routine maintenance, and expanding the system. Budget shortfalls in O&M result in declining performance–aged pipes, pumps, and canals often receive deferred maintenance, leading to frequent breakdowns, disruptions in service, and substantial water losses. To address these escalating challenges between 2025 and 2030, the water sector will need an additional annual investment of $5 billion.



3.3. Institutional constraints

To some extent, water resources may not efficiently be handled by government bodies. For instance, Ministry of Agriculture (favoring water-intensive crops) and Ministry of Water Resources (for water conserving) create institutional fragmentation that leads to ineffective allocation of resources, and slow decision-making.

Throughout the region, planned versus actual payments as well as payments per unit for irrigation services are inadequate, undermining water user bodies by constraining resources available for personnel, operation, as well as infrastructure development. This is exacerbated by a critical lack of competent managers, engineers, planners, and technical personnel in the provinces. Inadequate remunerations and work conditions create high turnover that erodes training as well as development capacities.

With no overall strategy towards reclamation of land as well as poor funding undermining water management bodies as well as Water Consumer Associations (WCAs), resulting in reduced reclamation activities, rising water tables, as well as increased salinity in cultivated fields. Furthermore, outdated infrastructure makes

these more difficult by cutting down on irrigation efficiency as well as performance.

4. Government Response & Policy Recommendations

Uzbekistan is implementing extensive economic reform in a bid to attain sustainable development. The measures are far-reaching and involve infrastructure development, simplification, environmental sustainability, as well as social development. Some of these are improving water management, improving technologies in irrigation, energy efficiency, as well as rural development.

Irrigation for Agriculture

Between 2022–2025, 1.3 million ha has been equipped with modern irrigation (sprinklers, drippers), conserving around 2 billion m^3 in 2023 alone. Substantial subsidies (1.465 trillion soums) have encouraged adoption of water-saving technologies; 2 million ha are planned as target equipped by 2025. But adoption is slow with smallholders.

Recommendations: 1) Increase training and extension services, as well as maintenance on new technologies; 2) Introduce more water-efficient, high-value crops with targeted incentives.

Aging Infrastructure

Renovation of infrastructure accelerated with concrete canal lining (5 thousand km in 2024), water infrastructure projects in Karakalpakstan and in Bukhara, universal metering by 2030. Nonetheless, massive renovation costs, limited budgets for Operation and Maintenance, as well as inadequate technical competence persist.

Recommendations: 1) Enact stringent annual objectives on canal lining, pipeline replacement, metering; 2) Implement asset management solutions and modern leak-detection technologies; 3) Secure ongoing funding as well as operational/maintenance capacity in order not to let infrastructure deteriorate in the future.

Financial constraints

Reforms in 2023 increased water/sewerage tariffs in a few regions by nearly doubling; a new tariff on irrigation also took effect. Yet, the tariff measure falls short of cost recovery; affordability measures are weak; collection/enforcement are poor.

Recommendations: 1) Gradually move towards cost-recovery tariffs with tiering in order to protect poor users; 2) Develop PPPs as well as water funds/bonds specifically designed to finance big infrastructure; 3) Streamline collection/billing and target subsidies towards poor households..

Institutional Weaknesses

Some recent developments include a new Code on Water (still in preparation), reorganization in public administration in 2023, more training activities, and a

move towards digital water accounting. Slow implementation, weak local level capacity, and uneven application of new regulations are, however, some persistent challenges.

Recommendations: 1) Complete the Water Code with firm power, accountability, and enforcing authority.; 2) Expand training as well as incentives in order to retain experienced water agency personnel.

5. Conclusion

Uzbekistan faces water problem not just from external (trans-boundary administration, climatic shift), but also from domestic (inefficient water utilization, outdated infrastructure) aspects. The government reform strategies from raised tariffs to enhanced application of water-efficient irrigation are a demonstration of enhanced awareness as also political will towards resolving water crisis. Yet, the measures are not sufficient, in closing the overall funding gap each year, stemming losses in outdated infrastructure, as also stimulating mass private sector participation.

Achieving efficient water use will involve persistent, collective effort on a variety of factors:

- Upgrading infrastructure to reduce distribution losses
- Adopting water-saving agricultural practices and crops
- Implementing cost-reflective pricing gradually
- Building productive personnel and enhancing institutional structures

By following these directions towards a more long-term strategy, Uzbekistan can transition towards a mitigation of water scarcity risks, and move forward for more resilient economic growth.

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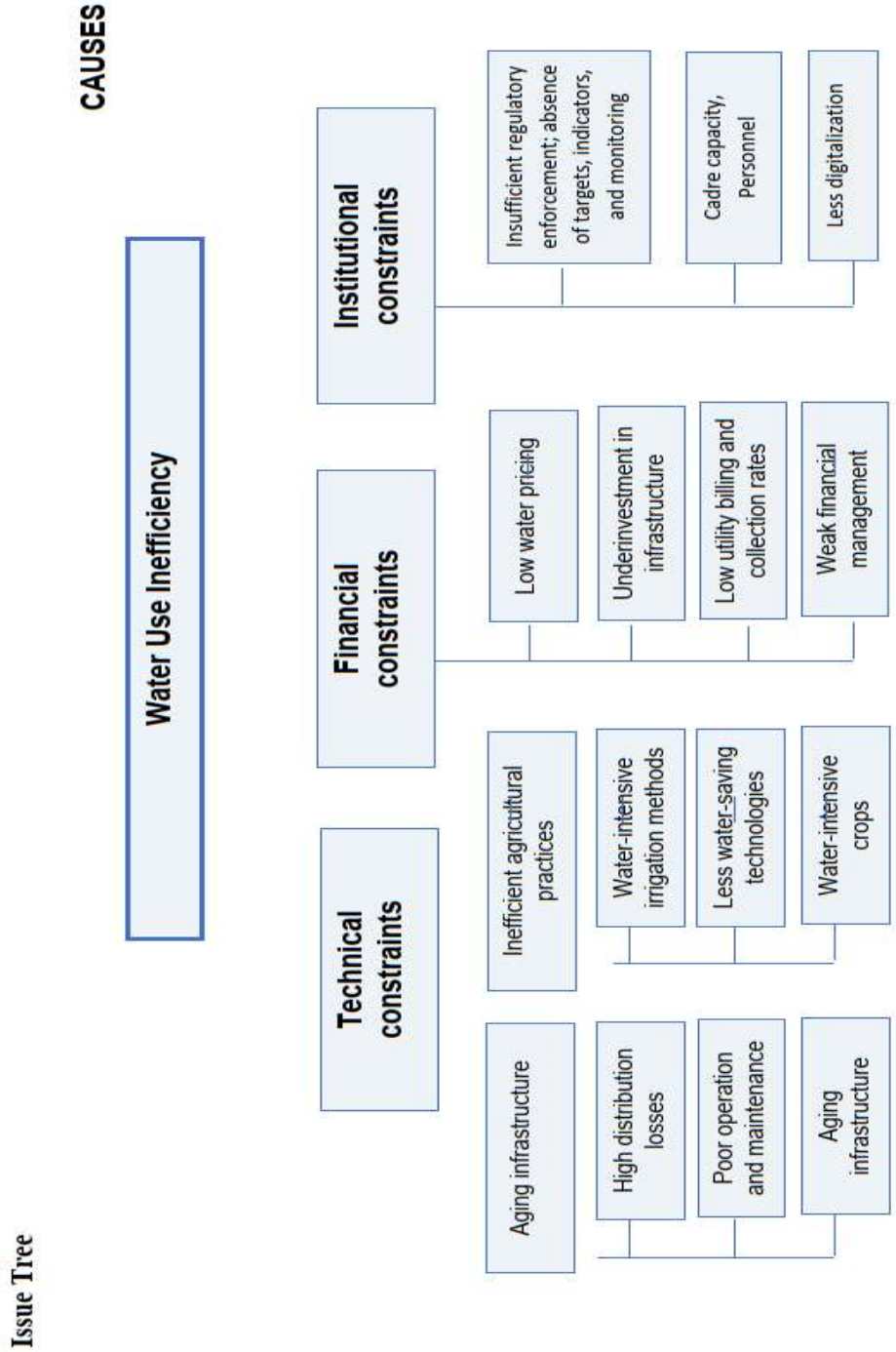

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