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Irrigation Water Saving Methods in Central Asian Countries

Author: J. Ishanov, PhD

ABSTRACT

CThe countries of Central Asia – Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan – are inextricably linked by their shared water resources, primarily within the transboundary Amu Darya and Syr Darya basins.

With agriculture accounting for approximately 80% of the region's total water withdrawal, improving water-use efficiency remains a critical challenge for regional stability and development.

However, limited water availability, climate change, and the inherent complexity of water distribution create significant operational challenges. Structural inefficiencies, such as high seepage losses in aging irrigation networks, remain major obstacles to the region's sustainable development.

Consequently, this policy brief focuses on irrigation water saving measures, examining practical approaches to reducing conveyance losses and improving management efficiency across Central Asia.

Scientific-Information Center
of the Interstate Commission for Water Coordination (SIC ICWC)

Karasu-4, B.11A, Tashkent, 100187, Republic of Uzbekistan

sic.icwc-aral.uz cawater-info.net

INTRODUCTION

BGlobally, water scarcity is intensifying annually, driven by the combined pressures of climate change, inefficient utilization, and geographical imbalances in water distribution.

In Central Asia, this shortage is becoming increasingly acute. The convergence of climate change, advancing desertification, and unsustainable water use has placed the region among the most water-stressed areas in the world. Rapid temperature increases, accelerating glacier retreat, and a rising frequency of droughts now pose existential threats to regional water security.

Agriculture accounts for approximately 80% of total water withdrawal in Central Asia. To support this demand, an extensive irrigation infrastructure has been developed, comprising **46,848 km of main canals, over 33,932 km of inter-farm networks, and more than 224,193 km of on-farm distribution lines** [1]. However, total water losses within these systems reach 40% [28], while seepage losses at the field level average up to 35% of total volume. Such significant wastage under-scores that improving water-use efficiency is among the most urgent priorities for the region's water security.

Accordingly, optimizing water management and minimizing conveyance losses in irrigation canals are paramount to sustainable regional development. The rational utilization of Central Asia's water potential would ensure the reliable irrigation of over 10.1 million ha [19], thereby bolstering regional food security.

This paper analyzes the condition of irrigation networks and compares the following water saving approaches:

- Reduction of water losses in irrigation canals and at junction points of different water management levels (including through canal concreting or lining, the use of anti-seepage materials, the restoration of canal sections and conveyance capacity, modernization of pumping stations, transition to more energy-efficient solutions, and use of closed or piped water systems where economically justified).
- Improvement of water measurement and distribution efficiency, through flow measurement, automation of gates, and the SCADA and GIS technologies, sensors, and real-time monitoring systems.
- Application of water-saving technologies, such as drip and sprinkler irrigation and other methods, insofar as they are related to the modernization of irrigation systems and water supply management.

COUNTRY OVERVIEW

IN KAZAKHSTAN, the irrigated crop land area is approximately 2.2 million ha, with the plans aiming to expand it to 2.6 million ha by 2030 [32]. This represents about 21.8% of the total crop area in Central Asia.

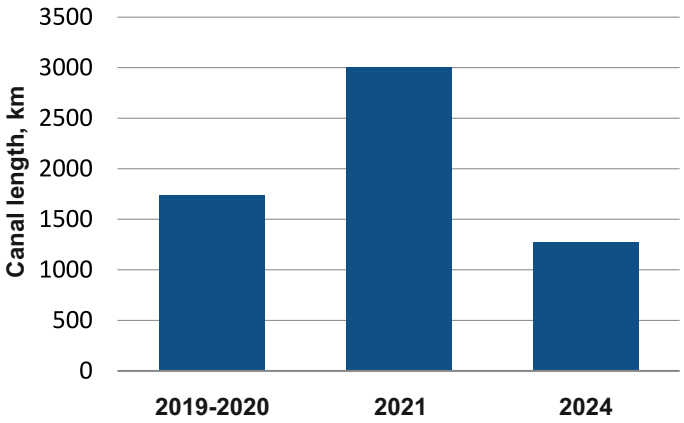
Kazakhstan operates more than 13,000 hydraulic facilities, including reservoirs, dams, and irrigation canals, for regular irrigation of crop land [1].

The total length of the country's irrigation network is approximately 39,637 km [20], of which 55% (11,800 km) is degraded. This results in 40-50% conveyance losses [33] and increased operation costs [28]. To address these challenges, approximately 6,000 km of irrigation canals were rehabilitated and modernized during the period 2020-2024, leading to about 5% reduction in water losses [3]. Continued implementation of these measures is expected to gradually reduce conveyance losses to around 25% by 2030, compared with the current level of 40-50%, and to recover an additional 3-4 km³ of water resources. A graphical representation of the results of irrigation canal rehabilitation completed in the Republic of Kazakhstan during 2020-2024 [14, 26] is given in Figure 1.

In Kazakhstan, total water losses exceed 50% at the field level as these are compounded by losses in inter-farm and on-farm irrigation canals.

Figure 1

Dynamics of irrigation canal rehabilitation

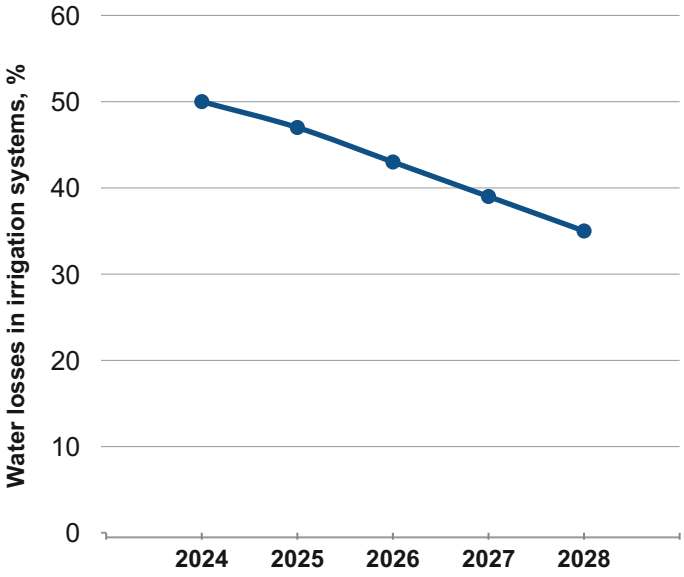


According to the 2024-2028 Integrated Development Plan of the Water Sector of the Republic of Kazakhstan, conveyance losses in irrigation canals are projected to decline to 50% in 2024, 47% in 2025, 43% in 2026, 39% in 2027, and 35% in 2028. A graphical representation of these indicators is given in Figure 2.

One of the key development priorities of the Republic of Kazakhstan is the integration of digital technologies into water accounting, management, and forecasting processes. The launch of the National Water Information System is planned for 2025; this system will enable real-time monitoring of the status of water bodies.

Figure 2

Dynamics of decreasing water losses in irrigation canals in Kazakhstan



According to the Head of State's Order dated April 1, 2024, the "Tasqyn" information system is currently under development to forecast and model water-related emergencies [2]. Furthermore, approximately 5,000 km of irrigation networks nationwide are currently being digitalized [2].

Analysis suggests that measures planned for 2024-2030 are expected to halve water losses in irrigation networks, expand irrigated land by roughly one-third, save approximately 10 km³ of water, and increase crop yields by at least 1.5 times.

IN THE KYRGYZ REPUBLIC, irrigated land covers approximately 1.0 million ha, accounting for 9.9% of the total irrigated area in Central Asia. These lands are primarily dedicated to vegetable and fruit cultivation [28]. Agriculture remains a cornerstone of the national economy, with over half of the population deriving their livelihood from irrigated farming.

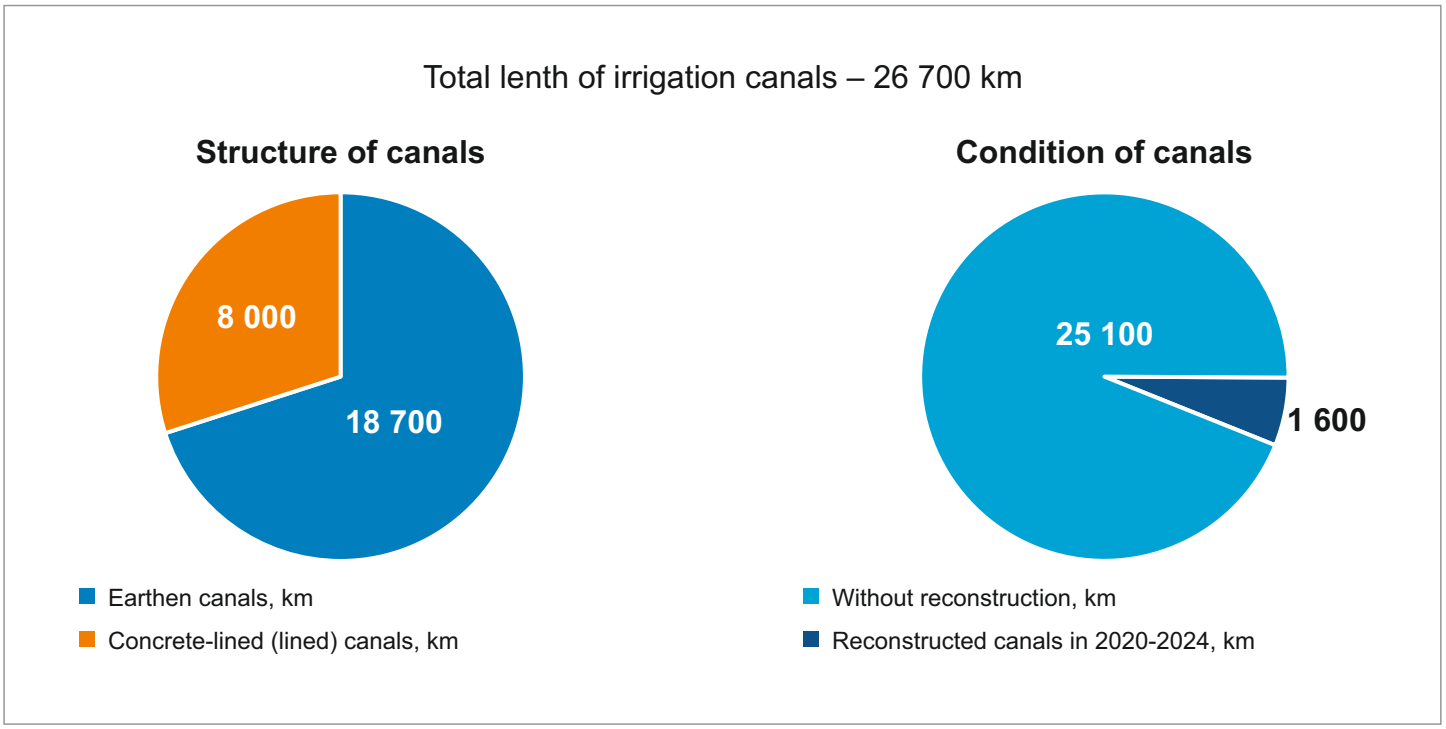
To support these regions, an irrigation network spanning approximately 26,700 km was constructed, largely during the 1970s and 1980s; of this, roughly 8,000 km consists of concrete-lined canals. As part of the state irrigation fund, a signi-ficant portion of these facilities now requires rehabilitation and modernization through modern technologies. Since agriculture accounts for nearly 89% of Kyrgyzstan's water consumption, enhancing irrigation efficiency is vital for both food security and water conservation [5].

The current irrigation system in Kyrgyzstan is comprised mainly of earthen canals, which make up over 70% of the total network. These unlined structures result in significant seepage losses, estimated at 35-40% [4]. To mitigate these losses, lining canals with concrete and utilizing impermeable materials have been identified as priority measures. While the existing 8,000 km of lined canals have improved water conservation, they account for less than 30% of the overall system, highlighting an urgent need to accelerate modernization.

Between 2020 and 2024, approximately 1,600 km of canals were rehabilitated – representing only about 6% of the total network length [10]. Although these interventions addressed the most deteriorated sections, the current pace of rehabilitation is insufficient to achieve sustainable water management.

Figure 3

The total length, structure, and condition of irrigation networks in the Kyrgyz Republic



A graphical representation of these indicators is presented in Figure 3.

To further reduce conveyance losses, Kyrgyzstan has intensified the rehabilitation of 65 existing irrigation canals extending to approximately 1,000 km under the 2024-2035 Irrigation Development Program. This is expected to reduce water losses by an estimated 30-50% [10].

Simultaneously, Kyrgyzstan is introducing innovative solutions within its irrigation networks. The British firm **Concrete Canvas** intends to establish a local production facility for flexible concrete lining materials, designed to stabilize canals, prevent erosion, and mitigate seepage losses.

The government has also prioritized the widespread adoption of digital water management systems, specifically SCADA and GIS. These technologies facilitate real-time monitoring of water conveyance, allowing for the rapid identification of high-seepage zones and the assessment of infrastructure health.

Their integration is a cornerstone of the nation's strategy to modernize the irrigation sector and reduce water losses amid growing pressure on national water resources [8].

Despite implemented measures in the water sector, several systemic challenges continue to constrain efficiency:

1. Approximately 60-70% of irrigation infrastructure was constructed during the 1970s-1980s and is currently in a physically deteriorated and functionally obsolete condition.

2. Water losses due to seepage and evaporation in canal systems reach up to 40%.

3. Financial resources remain insufficient to support comprehensive modernization of irrigation infrastructure.

4. Degree of automation in water metering and distribution remains low.

TAJIKISTAN has approximately 0.8 million ha of irrigated land, accounting for 7.9% of the total irrigated area in Central Asia. Agricultural production is dominated by subtropical crops and horticulture [28]. Agriculture accounts for about 80% of total water withdrawals from the Amu Darya and Syr Darya river systems, underscoring the urgent need to improve water-use efficiency and adopt water-saving irrigation technologies [30].

Approximately 64 km³ of surface water is formed annually in the territory of Tajikistan, including 1.1 km³ in the Syr Darya basin and 62.9 km³ in the Amu Darya basin. Tajikistan contributes more than 60% of total river runoff in Central Asia; however, poor water management and significant deterioration of infrastructure constrain the ability to fully meet domestic water demand [30]. Annual water use by the national economy amounts to 11.5-12.8 km³, representing 18-20% of the water generated within the country. The remaining quantity flows downstream to Uzbekistan, Turkmenistan, and Kazakhstan via transboundary river systems [6]. More than 70% of the population and economic activity depend on agriculture.

The total length of Tajikistan's irrigation network is approximately 33,250 km [23], with around 70% of unlined (earthen) canals. This results in water losses of up to 50% due to seepage and evaporation, reducing crop productivity and exacerbating soil salinization processes [12].

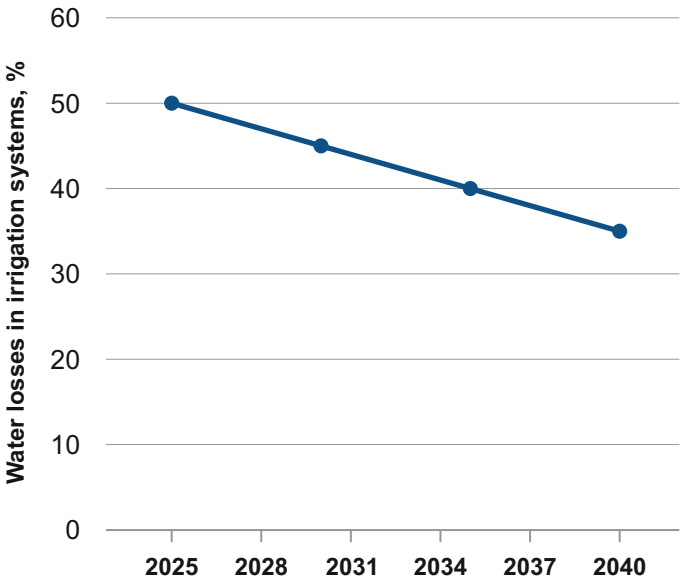
More than 40% of irrigated land relies on pumped water, the highest proportion among Central Asian countries. Approximately 80% of pumping stations are in substandard technical condition. Furthermore, the energy intensity of irrigation water supply averages 0.28 kWh/m³, meaning that irrigation accounts for roughly 20% of total national electricity consumption [20]. The average canal efficiency coefficient is estimated at 0.42 [13], implying that approximately 58% of diverted water is lost during conveyance and field application. These losses primarily stem from seepage (~30%) and surface runoff (~35%), resulting in a low overall water-use efficiency of 0.4-0.6.

In this context, minimizing conveyance losses in open canal systems, adopting water-saving technologies, and modernizing distribution management are essential prerequisites for ensuring water security and sustainable development in Tajikistan. National water policy, as outlined in strategic reforms, prioritizes the reduction of these losses. According to the National Strategy, canal water losses are projected to decrease from the current 50% to 45% by 2030, 40% by 2035, and 35% by 2040 [31]. This trend is illustrated in Figure 4.

The graph illustrates a projected progressive reduction in irrigation water losses from 2025 to

Figure 4

Dynamics of water loss reduction in irrigation canals in the Republic of Tajikistan



2040. This downward trend is anticipated to stem from strengthened water governance, the rehabilitation of irrigation canals, and the widespread adoption of concrete lining. Together, these measures will substantially mitigate conveyance losses, boost operational efficiency, and foster more rational and sustainable management of national water resources.

While comprehensive data on current digitalization levels remain limited, the National Water Strategy of the Republic of Tajikistan through 2040 sets ambitious targets for digital integration. Specifically, the strategy mandates that digital water management systems reach 50% coverage by 2030, 60% by 2035, and 80% by 2040 [31].

The Water Sector Reform Program for 2016-2025 (WSRP) recognizes water as an economic good and provides for the implementation of Integrated Water Resources Management (IWRM) principles. Within this framework:

- The Institute of Water User Associations (IWA) is enhancing the effectiveness of local-level water management.
- Annual funding requirements are estimated at USD75 million for routine operation and maintenance of water infrastructure, with an additional USD50 million allocated for system modernization [32].

Table 1

Project Name	Objective	Key outcomes
SWIM (World Bank)	Strengthening water resource management	Irrigation system efficiency increased by 20%
ADB Panj River Basin	Energy efficiency and irrigation technologies	Water saving of 25-30% achieved; energy inputs decreased by 10-15%
JICA (Japan)	Canal cleaning, and reinforcement	20 km of canals rehabilitated; water losses decreased by 50-70%

To meet these financial needs, additional resources are mobilized through international cooperation and donor-funded projects. The outcomes of this support are summarized in Table 1 [23].

IN TURKMENISTAN, the total agricultural area amounts to approximately 40.6 million ha, of which about 1.8 million ha are irrigated, representing 17.8% of the total irrigated area in Central Asia. The dominant crops are cotton and cereals. Turkmenistan is among the most arid countries in the region, and its water resources are derived primarily from the Amu Darya, Murghab, and Tedzhen rivers. Agriculture plays a central role in the national economy, providing employment for approximately 20-25% of the workforce [29]. However, a significant share of irrigation infrastructure is physically deteriorated, and water losses in canal systems are estimated at 35-40% [32, 23].

A key component of Turkmenistan's irrigation system is the Karakum Canal extending to approximately 1,375 km. Originating upstream of the city of Kerki, the canal annually conveys around 13 km³ of water from the Amu Darya River across the Karakum Desert [13], accounting for up to 45% of the river's total flow [22]. The total length of irrigation canals nationwide is about 42,700 km, of which an estimated 12,000-14,000 km are in unsatisfactory condition [29]. In response, approximately 4,000-5,000 km of canals have been rehabilitated in recent years under state development programs [7], primarily the Karakum Canal, as well as the irrigation networks of the Murghab and Tedzhen oases and other major conveyance systems [30].

Through the consistent implementation of these measures from 2025 to 2040, irrigation water losses in Turkmenistan are projected to halve, decreasing from the current 40-50% to approximately 20-25%. Simultaneously, the broad-scale adoption of modern irrigation technologies is expected to enhance agricultural water-use efficiency by 35-40% [16].

Alongside canal lining with impermeable materials, the introduction of an automated water flow measurement and monitoring system along the Karakum Canal marks a major modernization milestone. This project was a collaborative effort between the State Committee for Water Management of Turkmenistan and the United States Agency for International Development (USAID).

Installed by the Bosphorus Youth Center in partnership with the Garagumderýasy Suwhojalyk Association, the system facilitates more precise planning and oversight of agricultural water distribution. Real-time data acquisition allows water users and farmers to track actual consumption, optimize irrigation schedules, and calculate crop-specific water requirements accurately [16].

With approximately 4.3 million ha of irrigated land, **UZBEKISTAN** ranks first in Central Asia, accounting for 42.57% of the region's total agricultural area [29]. The country faces intensifying water scarcity; roughly 90% of available resour-

ces are allocated to agriculture, with the remaining 10% distributed among the municipal, industrial, and other economic sectors. Transboundary rivers – the Amu Darya and the Syr Darya – supply 80-85% of Uzbekistan's water, while the remaining 15-20% is sourced internally.

To mitigate these challenges, Presidential Decree No.6024 (2020) enacted the Water Management Development Concept for 2020-2030. Under this framework, average annual water withdrawals are at 51-53 billion m³, approximately 20% below the established annual limit. In this context, the Concept mandates the implementation of water-saving technologies across 2 million ha of agricultural land by 2030 and aims to improve the irrigation canal efficiency coefficient from 0.63 to 0.73 [17].

However, external factors also affect rational water use. In particular, the construction of the Qosh-Tepa Canal in Afghanistan – spanning approximately 280 km with a design capacity of 200 m³/s [9] – could significantly alter water availability and allocation within the Amu Darya basin. In light of this, during the 2023 meeting of the International Fund for Saving the Aral Sea (IFAS), President Shavkat Mirziyoyev proposed incorporating Afghanistan into regional consultations on the matter [26].

Against this backdrop, the adoption of water-saving technologies and the mitigation of seepage losses have become increasingly critical. The national Water Management Concept identifies the reduction of infrastructure-related water loss as a top priority for sustainable resource management.

Detailed analytical assessments reveal that Uzbekistan's total irrigation network spans approximately 183,600 km, of which 39% (roughly 71,600 km) is concrete-lined [21, 26]. According to the Ministry of Water Management, 3,813.3 km of canals and 741.4 km of flume networks were rehabilitated between 2018 and 2024. An additional 544.1 km of canals and 21 km of flume networks are slated for reconstruction in 2025. These annual figures are illustrated in Figure 5.

Figure 5

Dynamics of construction and rehabilitation of irrigation canals and flume networks in Uzbekistan

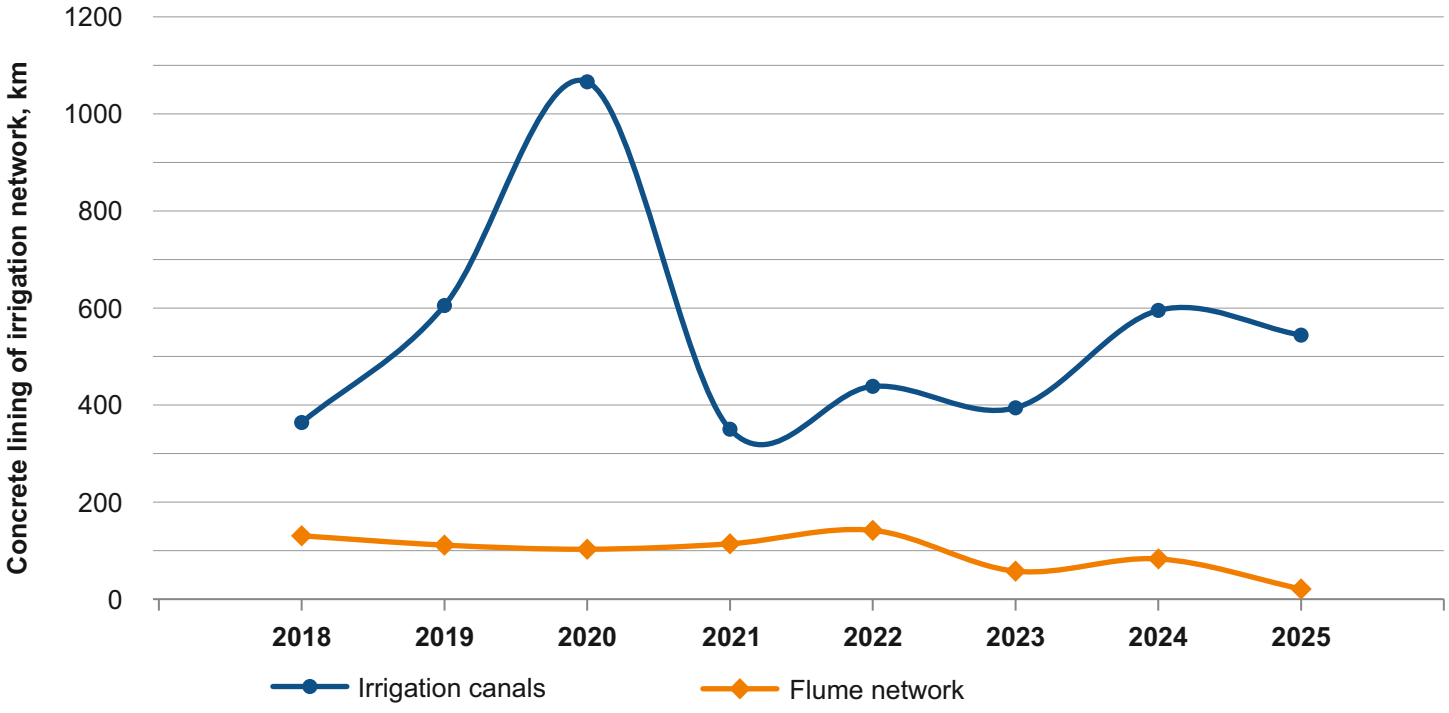


Figure 5 illustrates significant annual variability in irrigation canal works. Concreting peaked in 2020 at approximately 1,066 km, followed by a sharp decline to 350 km in 2021. Work volumes gradually recovered to 595 km by 2024, with a slight projected decrease to 544 km for 2025. In contrast, the flume network shows more stable but lower annual volumes, generally ranging

from 60 to 140 km. While rehabilitation peaked at 141.8 km in 2022, a decline to approximately 21 km is anticipated for 2025.

Overall, these data reveal uneven rates of modernization, with a clear strategic focus on lining major canals to mitigate conveyance losses. Notably, the President of Uzbekistan declared 2024 the "Year of Accelerated Canal Concreting," during which 1,500 km of on-farm and inter-farm canals were lined. For 2025, UZS800 billion has been allocated to line an additional 2,000 km [25].

Digital integration has also accelerated, with the deployment of SCADA, GIS, and "Smart Water" platforms enabling real-time distribution tracking. Under the national digitalization program, 12,992 Smart Water devices have been installed to date. These measures minimize human error, enhance transparency in water allocation, and allow farmers to forecast availability more accurately.

Amidst escalating scarcity, water-saving technologies have become a top priority. Between 2020 and 2024, investments totaling UZS60 trillion and USD622 million helped increase the share of agricultural land using these technologies from 4% to 50%. Looking ahead to 2025-2028, the reconstruction of approximately 2,551 km of irrigation networks is planned, supported by annual allocations of UZS1.3 trillion and USD300 million [14].

The Republic of Uzbekistan has established a comprehensive legal and institutional framework to promote water conservation and efficient management of water resources:

- The new Water Code, adopted in 2025, recognizes the economic value of water and provides incentives for farms implementing water-saving technologies.
- The "National Strategy for Water Supply and Water Conservation 2030" sets targets for the annual adoption of new irrigation technologies on at least 100,000 ha [27] and aims for full digitalization of irrigation systems by 2030.

Within the scope of international cooperation, Smart Irrigation projects are developed in partnership with Israel, Turkey, the Netherlands, and China, as well as international organizations such as FAO.

Consequently, the efficiency coefficient of the national irrigation network has increased from 0.63 to 0.68. Furthermore, the adoption of water-saving technologies resulted in the conservation of approximately 10 billion m^3 of water in 2025 alone – resources that were primarily reallocated to support double cropping [27].

CONCLUSIONS AND RECOMMENDATIONS

Across Central Asia, the majority of irrigation networks were constructed during the 1970s and 1980s and are now characterized by significant physical deterioration. High seepage losses in earthen canals, inadequate lining, and the limited adoption of water metering and automation persistently undermine the efficiency of these systems. Nevertheless, large-scale rehabilitation and modernization programs are currently being deployed across the region to mitigate these losses.

The analysis indicates that strategic water management has become an imperative in Central Asia, driven by the intersecting challenges of climate change, receding glaciers, expanding irrigated lands, and aging infrastructure. The primary objectives of current government reforms are to enhance water-use efficiency, modernize infrastructure, and bolster agricultural productivity (Table 2).

Across all Central Asian nations, mitigating seepage losses through canal reconstruction and lining remains the cornerstone of water conservation. However, the rate of rehabilitation and the proportion of reinforced canal sections vary significantly across the region.

A secondary but equally vital factor is the digitalization of water management, encompassing SCADA and GIS platforms, remote sensors, and national water information systems. These tools enhance the transparency, accountability, and precision of water distribution while minimizing losses attributed to human error. Their impact is most profound when integrated directly with the modernization of physical infrastructure.

Table 2

Comparative overview of key water-saving indicators in irrigation networks of Central Asian countries

Country	Irrigated area, Mha	Network length, thous. ha	Losses/Targets	Key measures (reconstruction/digitalization)
Kazakhstan	2.2	39.6	40-50% (plan: 35% to 2028)	6,000 km reconstructed (2020-2024); digitization/monitoring (including 5,000 km of networks, NISWR systems, Tasqyn)
Kyrgyzstan	1.0	6.7	35-40% (goal: decrease by 30-50% in reconstruction program)	Concrete lining 8,000 km (<30%); 1,600 km reconstructed (2020-2024); SCADA/GIS plans
Tajikistan	0.8	32.25	up to 50% (45% to 2030; 40% to 2035; 35% to 2040)	70% earthen channels; high proportion of pumped supply; digitalization: 50% by 2030, 60% by 2035, 80% by 2040 (strategy targets)
Turkmenistan	1.8	42.7	35-40% (potential: 20-25% with consistent modernization)	Karakum Canal as a key facility; reconstruction of 4-5 thous. km of canals; automation of certain sections
Uzbekistan	4.3	183.6	ntwork efficiency: 0.63 0.68; goal: 0.73 to 2030	Lined 39% (71.6 thous.ha); reconstruction 2018-2024: 3,813.3 km of canals and 741.4 km of flumes; 12,992 Smart Water devices; water saving (including 10 bln m^3 in 2025)

Currently, **Kazakhstan and Uzbekistan lead the region with the most ambitious modernization programs**, particularly in the rapid expansion of digital accounting. In Kazakhstan, where canal losses are estimated at 50%, the government has targeted a reduction to 35% by 2028. To date, approximately 3,500 km of canals have been outfitted with digital monitoring, establishing a robust foundation for a data-driven water management ecosystem. Between 2020 and 2024, canal reconstruction and digitalization served as the cornerstones of Uzbekistan's efforts to enhance water-use efficiency and distribution transparency. Looking ahead to the 2025–2028 period, the planned rehabilitation of an additional 2,551 km of irrigation networks, combined with the continued rollout of digital management systems, is expected to further bolster the efficiency, accountability, and long-term sustainability of the nation's water supply.

Both the **Kyrgyz Republic and Tajikistan grapple with a preponderance of unlined (earthen) canals and a sluggish rate of rehabilitation**. These structural deficits contribute to persistent seepage losses and underscore the urgent need to accelerate the modernization of regional irrigation infrastructure.

In Kyrgyzstan, only about 30% of the 26,700 km irrigation network is concrete-lined. From 2020 to 2024, reconstruction efforts addressed roughly 6% of the network (approximately 1,600 km), successfully boosting the conveyance capacity and efficiency of the upgraded sections. Parallel to these physical works, the country has launched digitalization initiatives to enhance the monitoring and systematic control of water supply.

Similarly, roughly 70% of Tajikistan’s irrigation network consists of earthen canals, leading to

water losses as high as 50%. While current digitalization data is sparse, the nation has set ambitious strategic targets of 50% coverage by 2030 and 80% by 2040. A unique constraint for Tajikistan is the high energy intensity of its pumped water delivery; consequently, water-saving measures must be integrated with the modernization of pumping stations [5].

In Turkmenistan, efforts are concentrated on main irrigation systems, including the Karakum Canal, with a particular focus on the phased modernization. Current water losses are estimated at approximately 40%. For the 2025-2030 period, the government plans to rehabilitate at least 1,000 km of canals annually, aiming for a cumulative total of 5,000 km. While the implementation of automated water accounting and digital management remains selective, the full potential for water conservation hinges on scaling these solutions to inter-farm and on-farm networks, where the majority of losses occur.

The continued expansion of reconstruction, canal lining, and digitalization – grounded in scientifically informed practices – is of strategic importance for strengthening water security, building climate resilience, and ensuring long-term food security both in Turkmenistan and across the broader region.

PROPOSALS FOR KAZAKHSTAN

Currently, water losses in Kazakhstan's irrigation networks are estimated at 40-50%. Although approximately 6,000 km of canals were rehabilitated during 2020-2024, additional measures are needed:

- accelerate the reconstruction canals built in the 1970s-1980s;
- reduce water losses in irrigation canals to 35% by 2028;
- expand the deployment of digital water metering and automated control systems;
- free up an additional 3-4 km³ of water resources through modernization.

PROPOSALS FOR TURKMENISTAN

Turkmenistan is the driest country in Central Asia, with water losses in canals estimated at 35-40%. To enhance water efficiency and ensure sustainable irrigation, the following measures are recommended:

- modernize approximately 4,000-5,000 km of irrigation canals by 2030;
- implement digital water management systems, including SCADA platforms, Smart Water systems, and other automation technologies, based on the experience of Uzbekistan, to reduce water losses in canal networks to 20-25%;
- expand collaboration with international partners (e.g., JICA, World Bank) and donor organizations to increase the scale and effectiveness of canal rehabilitation and modernization programs.

PROPOSALS FOR TAJIKISTAN

Although approximately 60% of Central Asia's water resources originate in Tajikistan, the efficiency of its irrigation networks remains low. Currently, water losses in canals reach around 50%, and the average canal efficiency coefficient is 0.42. The following measures are recommended:

- increase the efficiency of irrigation networks to 0.70 by 2030;
- develop and implement a real-time digital platform to monitor water distribution and optimize allocation;
- transfer gradually to energy-efficient pumping stations and closed pipeline networks;
- reduce water losses in irrigation networks by 35-40%.

PROPOSALS FOR UZBEKISTAN

As a result of investments totaling UZS60 trillion and USD622 million in the water sector during 2020-2024, the efficiency coefficient of irrigation networks increased from 0.63 to 0.68. Building on this positive trend, the following measures are recommended:

- complete the reconstruction of 2,551 km of irrigation networks during 2025-2028;
- achieve cumulative water savings of approximately 14 billion m³ by 2028;

- fully digitalize irrigation networks and implement real-time monitoring and control systems.

GENERAL PROPOSALS FOR CENTRAL ASIA

The following priority areas are relevant for all countries in the region:

- reduce water losses in irrigation networks from 30-50% to 20-25%;
- apply innovative anti-filtration technologies on a wide scale, including geomembranes, geotextiles, geocomposite materials, bentonite anti-filtration layers, and 500-micron thick polyethylene films;
- establish unified digital water management systems based on SCADA, GIS, and real-time sensor networks;
- expand cooperation with international organizations (e.g., JICA, ADB, SDC, CAREC/ECO) to enhance financing and technology transfer;
- strengthen professional training in the water sector, and promote applied scientific research.

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