Socio-Economic Impact on Water Conservation Implementation in Uzbekistan

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Abstract. Employing water-conservation methods for crop growth amid water shortages driven by climate change is a prominent socio-economic challenge globally. Enhancing the efficacy of water-conservation methods and optimising the economic structures for their broad deployment necessitates a focus on both scientific and practical research in this domain. Hence, this review study delves into the socio-economic landscape of Uzbekistan's water sector and investigates economic strategies to augment the efficiency of water-conservation techniques.

1 Introduction

In the past three decades, the effects of global climate change have resulted in a decrease of approximately 10 to 12 billion cubic meters in volume of water resources in Uzbekistan. The majority of water consumption in Uzbekistan is attributed to agricultural activities, which uses more water than any other sector in the country. The remaining 10% of water is available for other purposes, such as drinking, industrial use, environmental protection, and other economic activities. The primary water supply for Uzbekistan comes from glaciers in neighbouring countries. However, the remaining water needs are met by inland sources. This means that Uzbekistan is reliant on both external and internal sources of water (Fig. 1).

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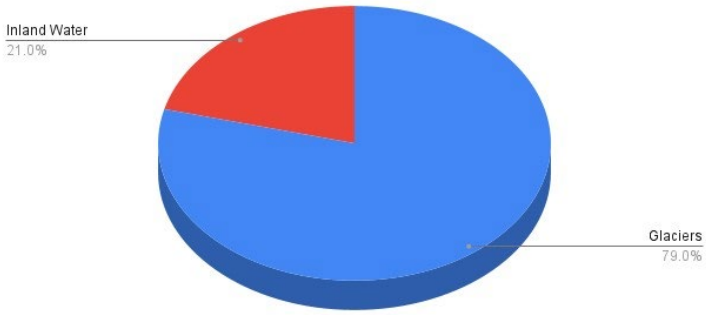

Fig. 1. 41 billion cubic metres of water is originated from Glaciers and 10 billion cubic metres volume of water comes from Inland Water Reserves

Glaciers in Tajikistan and Kyrgyzstan are melting due to climate change.

According to a 2022 report by the World Wildlife Fund, approximately 30% of Tajikistan's more than 8,000 glaciers and about 16% of Kyrgyzstan's nearly 10,000 glaciers have undergone melting since the 1970s. The study also predicts that an additional 15-20% of glaciers in the area are likely to melt by 2030.

The melting of glaciers poses a significant concern for the Central Asian countries, as these glaciers serve as a vital water source for drinking, irrigation, and hydropower. The findings of the study indicate that the region is confronted with a severe water crisis, necessitating immediate action to combat the impact of climate change [4-11].

The forthcoming accessibility of water assets in the locale will be substantially impacted by the rapid dissolution of glaciers, serving as the region's primary water supply. Additional climate change elements, like increasing temperatures and shifts in precipitation trends, will also significantly contribute to this circumstance. Furthermore, escalating water requirements driven by population growth and industrial advancement will exert additional strain on these water resources.

2 Materials and methods

Uzbekistan holds a prominent position as one of Central Asia's leading countries in irrigation agriculture. The judicious utilization of existing water and land resources could substantially amplify agricultural output and yield. As indicated by research findings, even a relatively minor reduction in water availability could have profound implications on the extent of irrigated land and employment levels, consequently causing a decrease in the nation's gross national income. Moreover, the World Institute of Water Resources has classified Uzbekistan among countries confronting the most severe risks of water stress.

In the context of canal usage, it's crucial to evaluate quantitative indicators of reliability tied to detrimental effects like canal wear under the impact of hazardous filtration currents, sinking and uplifting of canal sections relative to the ground. Efficient water resource utilization, catering to the demands of irrigated agriculture, utilities, industry, the environment, and other sectors, coupled with the extensive application of scientific and innovative advancements in the sector, is essential for the sustainable economic development of the country.

In the current epoch, the nation is witnessing commendable progress in augmenting the water management system. Specifically, comprehensive measures are being undertaken to

fundamentally enhance the system managing water resources, refine the technical state of irrigation networks, boost the reclamation of irrigated territories and their water provision, realise modern water-conserving technologies, establish automated control and surveillance systems, and expand agricultural outputs. Considerable emphasis is placed on the diversification of production [1, 2, 3].

In Uzbekistan's agricultural landscape, the year 2019 signified a crucial turning point. The issuance of two Presidential Decrees—DP-4486 and DP-4499—brought about a significant shift in the country's approach towards agricultural water management. They set the stage for establishing a robust scientific, normative, and legal foundation, which was key to radically transforming the water management system and facilitating the widespread adoption of water-saving technologies.

The impact of these decrees has been far-reaching and transformative. They opened up a considerable opportunity for the introduction and application of water-saving technologies in irrigating agricultural crops across Uzbekistan. This change in policy and practice has already brought about substantial progress within a span of a few years.

Specifically, from 2017 to 2021, a substantial total of 584.6 thousand hectares of agricultural land in the country were irrigated using these water-saving technologies. This significant achievement reflects the country's steadfast commitment to promoting sustainable farming practices.

To break down this figure, 280.0 thousand hectares were irrigated using drip irrigation methods, an innovative technique that delivers water directly to the root zone of plants, minimising evaporation and wastage. Further, sprinkler irrigation was employed over an area of 12.3 thousand hectares. This technique mimics natural rainfall, providing moisture evenly to the entire field.

In addition, discrete irrigation—a method that allows water to soak into the soil from a small channel or furrow—was used to irrigate 8.4 thousand hectares. Lastly, a vast expanse of 283 thousand hectares was irrigated using flexible pipes, a system known for its efficiency and adaptability to varying field conditions.

These practices underscore the immense strides Uzbekistan has made in conserving water, enhancing agricultural productivity, and ensuring environmental sustainability. Moreover, they pave the way for a more resilient future for the country's agricultural sector amidst increasingly uncertain climatic conditions.

Furthermore, in 2021, the regions across the country and Karakalpakstan have seen the deployment of water-saving technologies, including drip irrigation in cotton fields, which extended over 136,647 hectares. The widespread application of water-saving technologies has generated substantial benefits for raw cotton producers and businesses involved in the production of drip irrigation components. For each hectare of cotton field implementing drip irrigation technology, the country will allocate 8-11 million Uzbek Sum (UZS), in addition to 6% of the loan amount (Fig. 2).

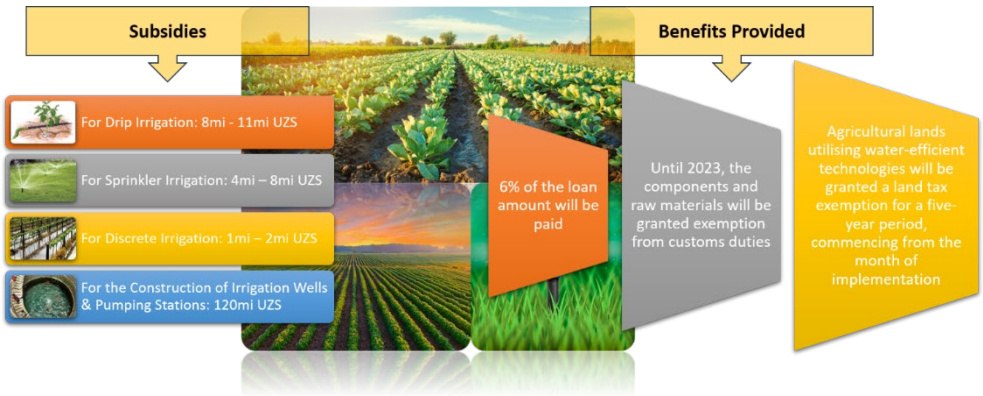

Fig. 2. Incentives provided by the government for the deployment of drip irrigation techniques

The establishment of a legislative framework supporting the adoption of water-saving technologies has greatly facilitated the growth of local enterprises that conserve water, including those involved in manufacturing drip irrigation systems. Presently, over 30 businesses in the country are engaged in the production of drip irrigation technology.

The government is taking a number of measures to support the transformation of water resource management, promote the reasonable use of water resources, and implement water-saving technology. In particular, a new framework for government support has been established for the application of water-saving technology in the country, namely a subsidy distribution mechanism.

Over the past half-century, water-saving irrigation technologies have been applied on a total of 891.4 million hectares. This includes 290.3 million hectares of drip irrigation, 13.5 million hectares of sprinkler irrigation, 10.6 million hectares of discrete irrigation technologies, 299.3 million hectares of flexible pipes, and 91.9 thousand hectares of plastic-based irrigation technology. In addition, 185.8 million hectares of land have been laser-levelled to improve water distribution efficiency.

In 2021 alone, water-saving irrigation technology will be applied to an estimated 490.1 million hectares. To facilitate the construction and installation of these water-saving technologies, a service and installation team composed of more than 6,000 specialists from the Ministry of Water Resources has been set up.

In terms of fiscal support, 125.4 billion UZS were allocated to agricultural enterprises that implemented water-saving irrigation technologies in 2019, which increased to 236.1 billion UZS in 2020. It has been decided that starting from the given year, the amount of government subsidies will be determined based on the quality of the technology implemented. As such, in 2021, a significant 846.4 billion UZS was allocated, out of which 745.8 billion UZS were directed towards technologies deployed in cotton fields.

3 Results and discussions

The introduction and adoption of water-saving irrigation technologies in many regions have yielded significant benefits, as evident from the data analysed in this study. In regions where these technologies have been deployed, a substantial reduction in resource usage has been observed. The conservation of water resources is especially prominent, with savings reaching up to 35-40%.

Simultaneously, the use of mineral fertilisers and other resources have seen a considerable decrease, thus highlighting the wider environmental impact of these technologies beyond water conservation. Additionally, these methods have proven to be conducive to enhancing

agricultural productivity. Yields have seen a significant increase, with a growth of 15-30 centners recorded in these regions.

Looking forward, the projections for the year 2021 are quite promising. The estimate suggests that the regions employing water-saving technologies could see potential water savings exceeding 2.3 billion cubic meters. This represents a significant stride towards ensuring the sustainable use of water resources in the country.

Alongside the advancements in water conservation, there has been a noteworthy development in the domestic production infrastructure for water-saving irrigation technology components. In 2019, there were just three local organisations producing components of water-saving technologies. In a span of just a few years, this figure has seen a drastic rise, with the current count standing at 40 organisations.

This increase in domestic production capacity has been accompanied by a reduction in the cost of production. By localising the production process, enterprises have managed to cut down production costs from 25 million UZS to 20.0 million UZS. This reduction in costs represents a significant saving for agricultural producers, with the current season alone yielding savings of about 175 billion UZS.

In summary, the introduction and adoption of water-saving technologies have not only resulted in significant resource conservation and improved agricultural productivity but also stimulated local industry growth and economic savings. These advancements bode well for the sustainable future of the nation's agricultural sector.

4 Conclusion

On October 9, 2019, the President of the Republic of Uzbekistan issued a decree No. DP-4486, titled "On measures to further improve the water resources management system." This was followed by another decree on October 25, 2019, titled "On measures to expand mechanisms to encourage the implementation of water-saving technologies in agriculture," under the identification number DP-4499. These decrees have played a pivotal role in establishing a scientific, regulatory, and legal framework geared towards a radical overhaul of the water management system, which includes the widespread implementation of water-saving technologies in agriculture.

In addition, a novel mechanism for the calculation of subsidies has been approved. These subsidies are intended to offset the costs associated with implementing water-saving technologies. The aim is to expand the implementation of these technologies in irrigating agricultural crops from the current 175 thousand hectares to an ambitious 1 million hectares by 2025, and further to 2 million hectares by 2030.

This plan specifically includes the increased use of drip irrigation technology, with the target to extend its implementation from the present coverage of 77.4 thousand hectares to 300 thousand hectares by 2025, and to eventually reach 600,000 hectares by the year 2030. These measures clearly indicate the country's firm commitment towards the use of modern water-saving irrigation technologies in order to conserve water resources effectively.

References

1. The Decree of the President of the Republic of Uzbekistan dated October 9, 2019 No. DP-4486 "On measures to further improve the water resources management system" (in Uzbek)
2. The Decree of the President of the Republic of Uzbekistan dated October 25, 2019 No. DP-4499 "On measures to expand mechanisms to encourage the implementation of water-saving technologies in agriculture" (in Uzbek)

3. The Decree of the President of the Republic of Uzbekistan dated December 11, 2020 No. DP-4919 "On measures to further improve the implementation of water-saving technologies in agriculture" (in Uzbek)
4. I.E. Mahmudov, Xi Chen, Jilili Abuduwaili, Sh.R. Khamraev, E.J. Mahmudov, R.K. Kuziyev, U.A. Sadiev, N.K. Murodov, A.I. Ernazarov, A.I. Dolidudko, *Research of agro-ameliorative parameters of the territory of the basin of the river Amudarya in the conditions of climate change in Central Asia*, (Monograph, Tashkent, 2019) 320. (in Russian)
5. D. Khaydar, X. Chen, Y. Huang, et al. J. Arid Land **13**, 23–39 (2021) https://doi.org/10.1007/s40333-021-0054-9
6. I.E. Mahmudov, N. Muradov, *"Evalution of the management and Use of Water Resources in the Middle Reaches of the Syrdarya Basin"*, (Trans Tech Publications, Switzerland, 2016) 75-80.
7. R. Z. Karshiev et al., Irrigation and Melioration, **1,** 24-28 (2021)
8. R. Karshiev et al. *Hydraulic calculation of reliability and safety parameters of the irrigation network and its hydraulic facilities*, E3S Web of Conferences, EDP Sciences, **264** (2021)
9. I.E. Mahmudov, E.A. Kazakov, International Journal of Advanced Research in Science, Engineering and Technology, **7 (6),** 14137-14140 (2020)
10. I. E. Mahmudov, N. K. Murodov, E. A. Kazakov, & R. A. Mamutov, European Journal of Innovation in Nonformal Education, 2(1), 142-146 (2022)
11. J. J. Narziev, I. E. Maxmudov, D. T. Paluanov, & A. I. Ernazarov, International Journal of Innovative Analyses and Emerging Technology, **2(1),** 59-62 (2022) http://openaccessjournals.eu/index.php/ijiaet/article/view/949.