SIC ICWC Policy brief

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Water Use Efficiency in Irrigated Agriculture of the Aral Sea Basin Countries: Current Status and Prospects

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Since 2005 to 2019 in the Aral Sea Basin (ASB) countries:

- the arable area decreased by 3.4 million ha, mainly, due to land degradation and pasture, orchard and vineyard reduction, while the irrigated area increased by 443 thousand ha through the development of new irrigation land and conversion of poor-condition land into agricultural use;

- cropping patterns have changed radically, mainly, through the reduction of area under cotton (by 30.8%) and the increase of horticultural area (by 47.7%);

- crop production, mainly in irrigated land, increased more than 2.5 times on average, and more than four-fold in Uzbekistan;

- water use efficiency in the crop production sector increased on average from 0.08 US$/m^3 in 2005 to 0.31 US$/m^3 in 2014 and then dropped to 0.22 US$/m^3 in 2019.

By 2030, under an optimistic forecast the ASB countries will witness:

- an increase in the irrigated area by 1.3 million ha (without Turkmenistan) through the development of new land and reclamation of previously withdrawn land, due to water shortage or poor soil fertility;

- growth in crop production by 160.4% on average, with the highest rates in South Kazakhstan (288.4%) and Uzbekistan (153.1%);

- improvement in water use efficiency on average from 0.22 US$/m^3 in 2019 to 0.42 US$/m^3 in 2030, with the highest rates in South Kazakhstan and Uzbekistan (0.45 US$/m^3).

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Introduction

SDG Target 6.4 aims to substantially increase water use efficiency across all sectors by 2030. The improvement of water use efficiency in irrigated agriculture, which uses over 90% of water, is among the key tasks for economic sustainability and population prosperity in the Aral Sea Basin (ASB). This is especially important given that irrigated agriculture is a significant contributor to national revenues, foreign currency earnings, employment and livelihoods in the riparian countries.

Target 6.4 aims to increase water use efficiency across all sectors

This policy brief provides an overview of the status of irrigated agriculture and water use efficiency in ASB (South Kazakhstan and Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) from 2005 to 2019 and forecast by 2030.

The water use efficiency in the crop production sector is estimated as the ratio of gross production (US$) to irrigation water ($m^3$).

Changes in irrigated agriculture and water use efficiency from 2005 to 2019

As of 01.01.2020, the total arable area in ASB was 87.3 Mha; this is by 3.4 Mha or 3.8% lower than in 2005. The lowering is mainly due to land degradation, desertification, and reduction in pasture, orchard and vineyard. Kazakhstan, Turkmenistan and Uzbekistan account for about 90% of arable area in the basin (Fig.1).

The irrigated area in ASB increased from 7.5 Mha to 7.9 Mha or by 5.9% since 2005 to 2019. A significant increase was observed in South Kazakhstan (12.7%) and in Turkmenistan (10.5%). More than the half of irrigated land in ASB (54.7%) falls to Uzbekistan (Fig. 2).

Meanwhile, about 120 thousand ha in South Kazakhstan was not used in the recent years due to significant deterioration and failure of irrigation and drainage systems and, consequently, worsening of land conditions, salinization, poor water supply and diverse economic-financial problems [14].

In the south of Kyrgyzstan, a part of irrigated land is not used because of poor land conditions, lack of finances for seeds, etc. [15].

In Tajikistan, 22% of irrigated area shows higher degree of degradation, 38% is subjected to low or moderate degradation and 40% has no signs of degradation [16].

More than 40% of irrigated land is still medium- or strongly saline in Uzbekistan.

Figure 1. Arable area dynamics and country shares in ASB

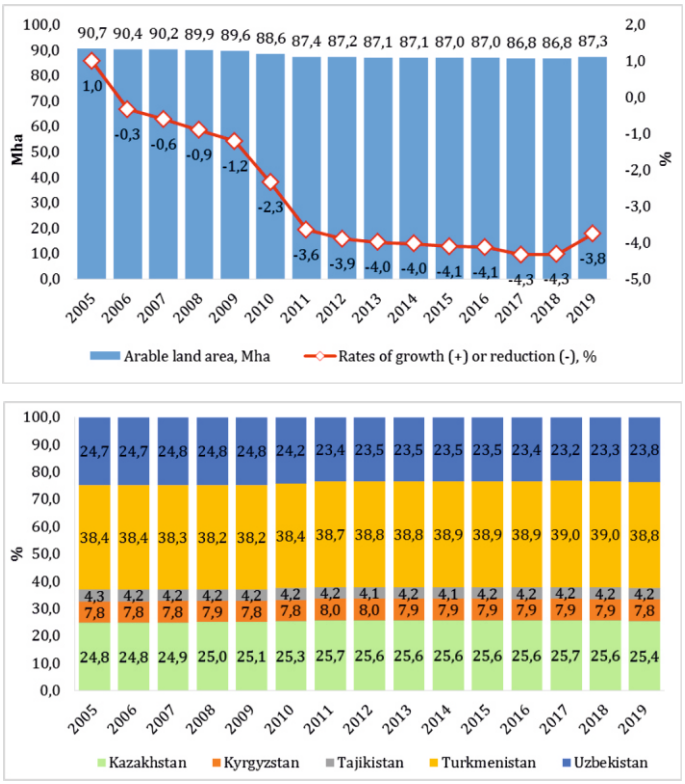
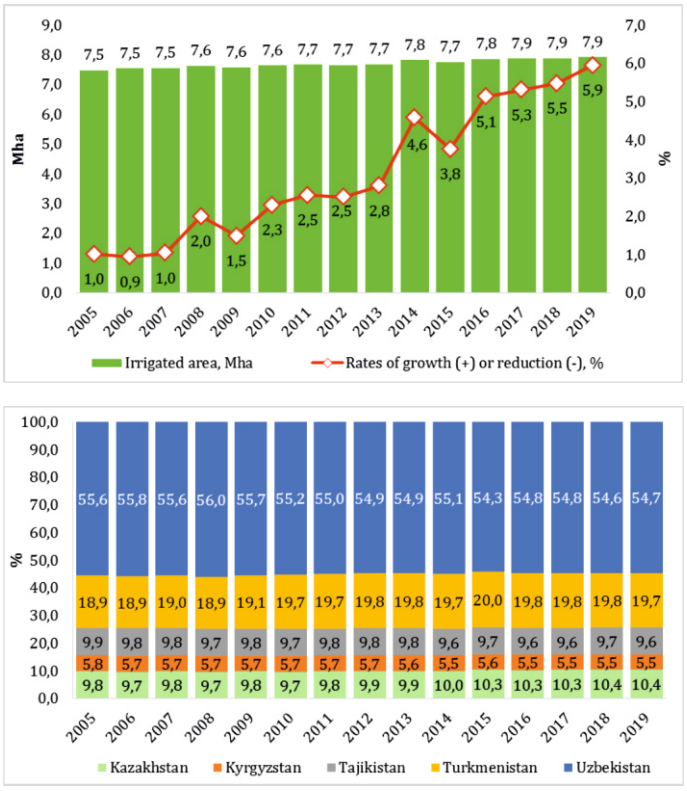


Figure 2. Irrigated area dynamics and country shares in ASB



Over the last 15 years, cropping patterns have changed in ASB. The area under cotton has decreased from 2.0 up to 1.4 Mha (30.8%) through the reduction of such areas in the southern regions of Kyrgyzstan (21.4 thous. ha or 46.4%), Kazakhstan (73 thous. ha or 35.7%), Tajikistan (103 thous. ha or 35.7%) and Uzbekistan (422 thous. ha or 28.7%).

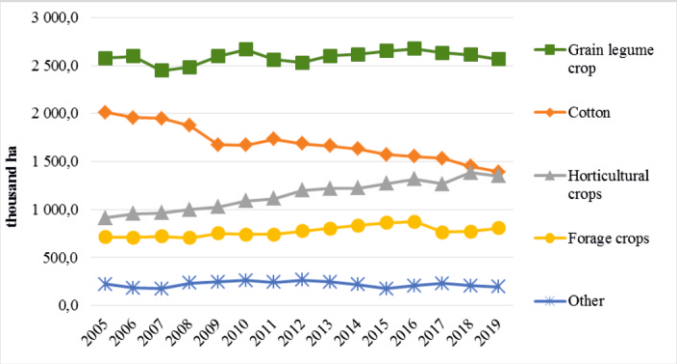
The horticultural crop area increased by 47.7% or 434.9 thous. ha. The grain legume area is still within 2.5-2.6 Mha.

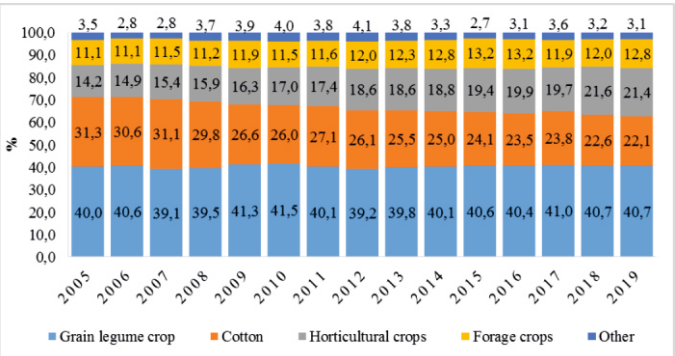
This is explained by the need to ensure food security, in particular bread self-sufficiency. The share of grain legume crops remains high (40.7%). Despite the substantial reduction in the area under cotton, its share in cropping patterns is still considerable (22.1%). The share of horticultural crops grew by 7.2% from 14.2% in 2005 to 21.4% in 2019 (Fig. 3).

As a result of structural changes in irrigated agriculture in the riparian countries, crop production, mainly in irrigated land, increased on average more than 2.5 times in the last 15 years. Higher irrigated crop production is in Uzbekistan mainly (production increased more than 4 times), the irrigated land of which accounts for more than 50% of the total irrigated area in ASB. The rates of growth in crop production increased on average twofold in the south of Kazakhstan and Kyrgyzstan and dropped by 23.6% in Tajikistan.

Fundamental structural changes have a positive effect on irrigated agriculture in the riparian countries. Thus, water use efficiency in the crop production sector changed insignificantly from 0.08 to 0.22 US$/m^3 (i.e. by 0.13 US$/m^3) over the period of 2005-2019. Moreover, this indicator showed a steady growth (0.31 US$/m^3) until 2014-2015. And in the recent years, the water use efficiency has decreased slightly (Fig. 4).

Figure 3. Changes in cropping patterns and crop shares



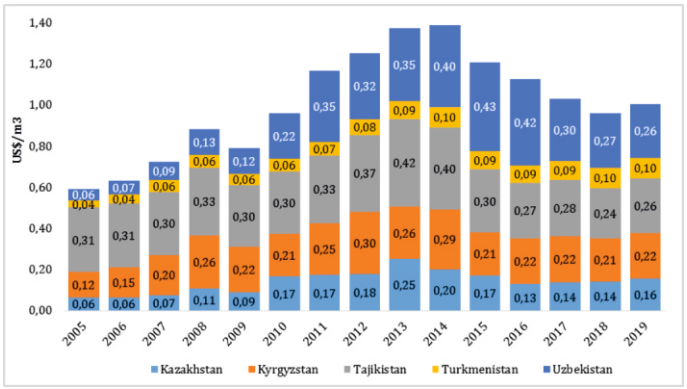


Estimation of water use efficiency in irrigated agriculture by 2030

Forecast estimates are made for the baseline and optimistic scenarios. The baseline scenario is calculated on the basis of trends over the past 15 years. The optimistic scenario relies on official indicators set in country long-term development strategies (programs, strategies, concepts, etc.), including separately for agriculture.

The CA countries adopt strategic programs for reclamation of irrigated land withdrawn from agricultural use and development of new land in order to achieve food security, create jobs, and increase incomes of rural population. This is taken as a basis for forecast estimates of changes in irrigated area under optimistic scenarios. The latter do not consider the data on Turkmenistan as long-term strategies of the country do not show indicators.

Figure 4. Dynamics of water use efficiency in the crop production sector in ASB countries



In Kazakhstan, in the message of the Head of State in September 2019 [11] and as part of the State Program [4] the task was set to gradually increase the irrigated area up to 3 Mha as a whole and by more than 1 thousand ha in the south of the country by 2030.

According to the State Program [8] and by expert estimations [13], Kyrgyzstan has land, which can be converted into irrigated area at certain costs. Whereas the irrigated land area was 433.5 thousand ha in the Syr Darya River basin in 2019, it would be possible to develop about 1,162 thousand ha of new land in the basin and almost the same area in other river basins of the Republic in the future.

As the Agency for Land Reclamation and Irrigation of Tajikistan predicts, fulfillment of the tasks set in relevant State Programs [7] will allow extending irrigated area to 807.3 thousand ha in the future.

In Uzbekistan, as part of the Water Development Concept [5], by 2025 it is planned to convert 298.5 thousand ha of withdrawn irrigated land into agricultural use (Fig. 5).

Prospective irrigation expansion set as a priority in national country development strategies would allow steady and accelerated growth of crop production in all the countries (Fig. 6).

As experts estimate [12], gross crop production in South Kazakhstan will increase more than 2.5 times, with the main share of crop production in rainfed lands.

In Kyrgyzstan, to support development of the agricultural market and increase export potential, a number of decisions were made [1,6,9] to reach the gross production of agriculture, forestry and fishery at 314.7 billion soms and the feasible growth rate of 2.3% (through a growth of 2.4% in crop production and 2.3% in animal husbandry) by 2025. In South Kyrgyzstan, the average annual growth of crop production is planned at 3% until 2023 and in the following years (2025-2030) [10].

The National Development Strategy of Tajikistan until 2030 [2] envisages a 1.25 times decrease in the share of the agricultural sector in GDP (18.0 to 18.5% in 2021-2025 and 17-18% in 2026-2030). The forecast of crop production until 2030 is calculated through the forecast average annual growth of GDP and the share of agriculture and crop production, respectively. In particular, the forecast growth of crop production is 36.3% in 2025 and 49.5% in 2030.

The Strategy of agricultural development in Uzbekistan for 2020-2030 [3] provides for the annual increase in gross crop production by 5% up to 2030.

Irrigation expansion and gross crop production growth under the optimistic scenario will lead to the improvement of water-use efficiency in ASB as a whole and mainly in Uzbekistan and South Kazakhstan (Fig. 7). It should be noted that the data on Turkmenistan is not taken into account in estimations of this indicator.

Figure 5. Forecast of irrigated area changes in ASB countries by 2030

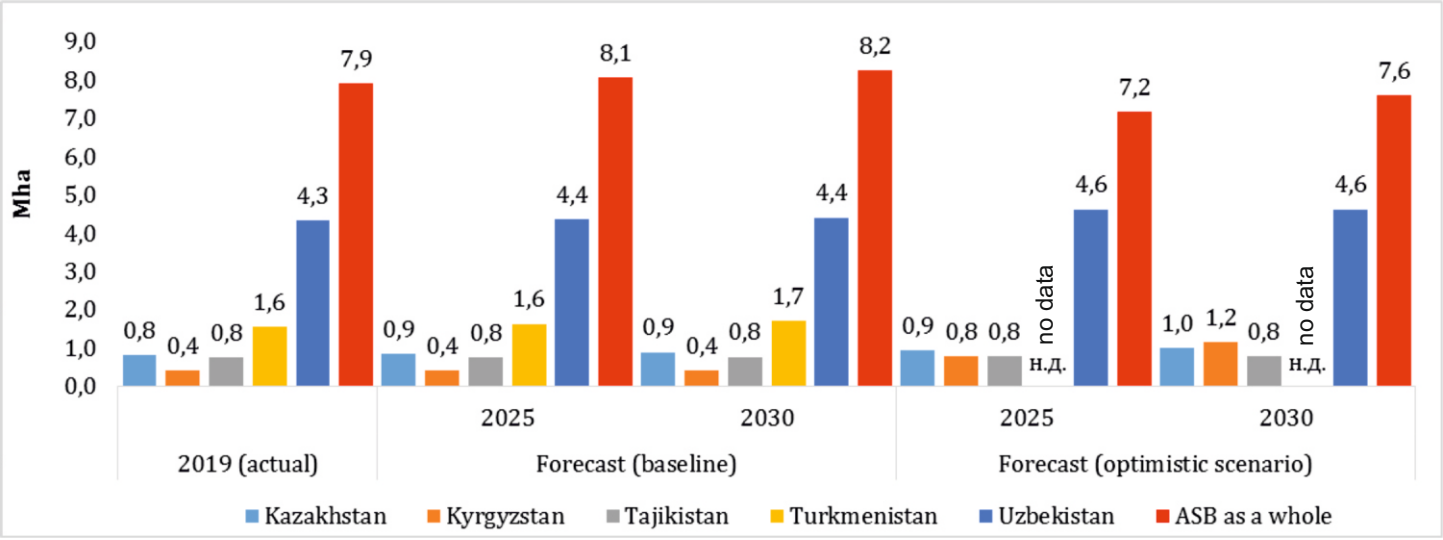


Figure 6. Forecast of gross crop production changes in ASB countries by 2030

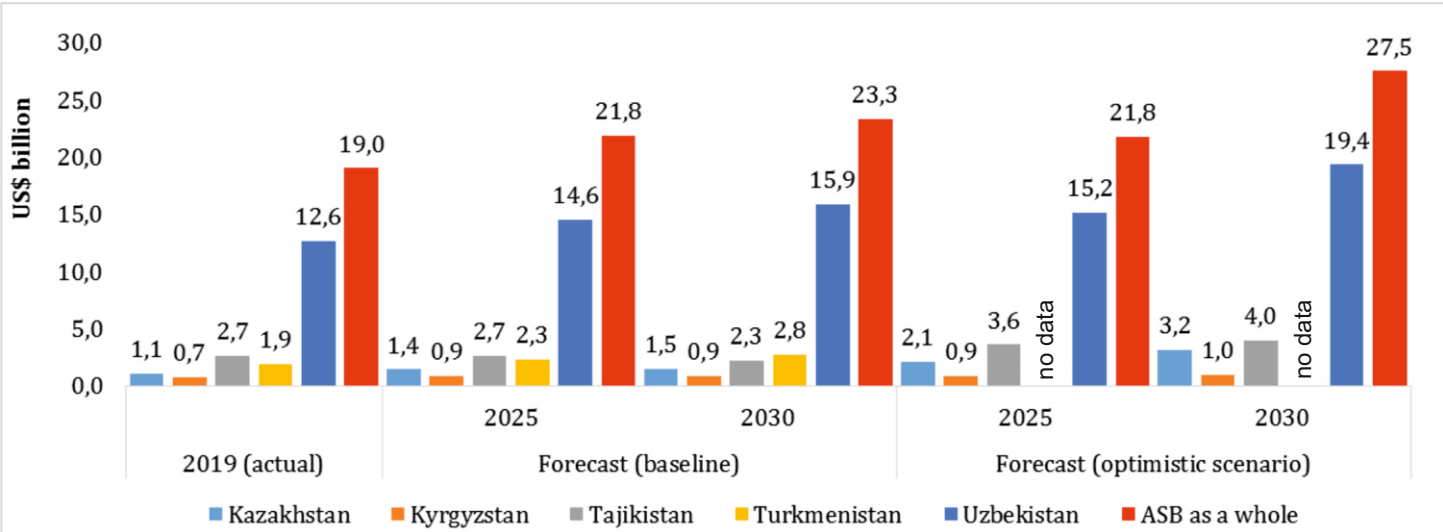
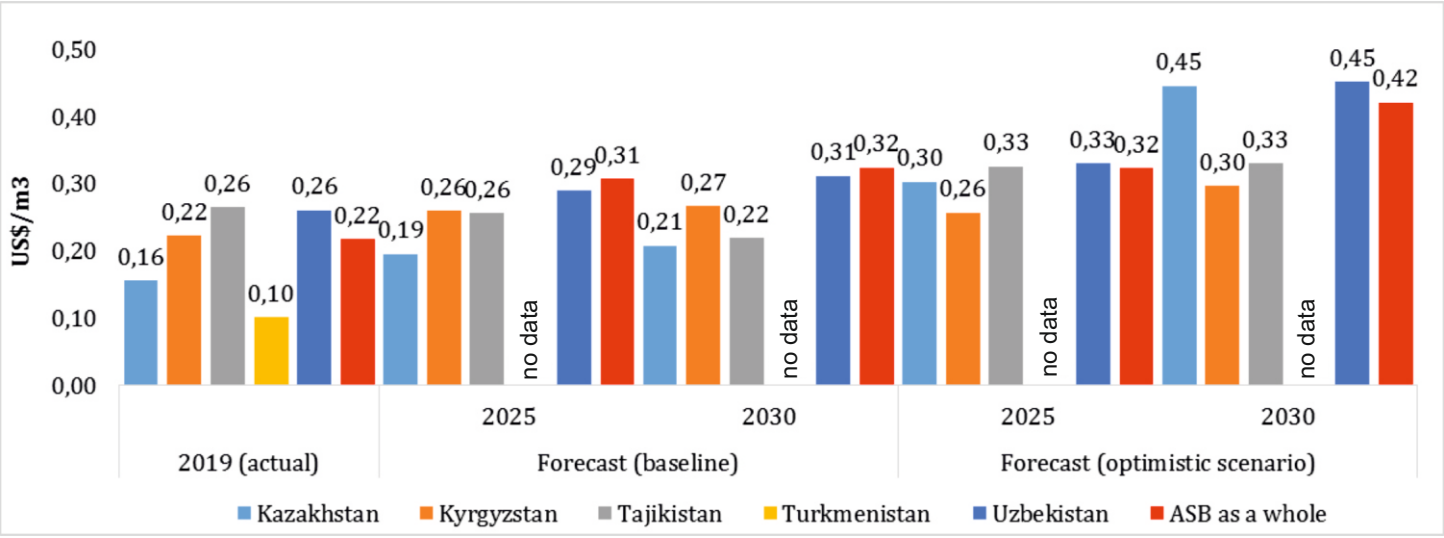


Figure 7. Forecast dynamics of water use efficiency in the crop production sector in ASB countries by 2030



Recommendations

The following measures and mechanisms can be taken to improve the water-use efficiency in irrigated agriculture of the ASB riparian countries in the long-term:

- ensure government support to water users in the form of subsidies, economic and fiscal mechanisms for adoption of water-saving technologies, mainly drip and sprinkling irrigation, and full accounting of water value in the production of end product;

- strengthen agricultural extension services through introduction of new methods in agrotechnology, meteorology and yield programming in combination with field passportization, identification of soil fertility reserves and application of RS data;

- grow double crops, drought-tolerant varieties that increase soil fertility through nitrogen-fixing bacteria (mung bean, bean, pea, lupine and others);

- increase crop production in nursery conditions (hothouses, under film, etc,), especially in the areas adjacent to cities;
- use effectively drainage water and wastewater;

- fundamentally revise the water financing system, while taking into account principles of public-private partnership and focusing on development, implementation and financing of water infrastructure projects (construction, modernization and reconstruction of large waterworks facilities, main canals, pumping stations, etc.) that currently are financed at the expense of public budget;

- improve the national water management and use system with the involvement of water users and water-management organizations.

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