SIC ICWC Policy brief

№4, May 2023

Territorial Water Security Outlook: Case Studies of Khorezm, Navoiy, and Samarkand Provinces in Uzbekistan

Prepared by: Dinara Ziganshina, PhD, Sherzod Muminov, DSc, Shavkat Kenjabayev, PhD, Aurika Galustyan, PhD

Introduction

Water security is among the main priorities for most countries, including Uzbekistan. According to the United Nations (2013), water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.[1]

In 2021-2022, the SIC ICWC in Central Asia at the request of UNESCO developed a methodology for the assessment of water security in administrative territories of Uzbekistan.

The present review provides the key characteristics of the proposed methodology and a brief description of the results of water security assessment for three administrative territories of Uzbekistan as case studies.

Territorial Water Security Assessment Methodology

The assessment methodology developed by SIC ICWC is based on general approaches to water security applied by ADB in its Asian Water Development Outlooks.[2]

ADB assesses water security at country level based on the following five key dimensions: (1) household water security, (2) economic water security, (3) urban water security, (4) environmental water security, (5) water related disaster water security. Assessment criteria and indicators have been developed for each of key dimensions.

SIC ICWC adapted the ADB's approach to administrative territories (provinces) of Uzbekistan proceeding from the following characteristics and needs:

- consumption of 90% of water in the country by irrigated agriculture and poor condition of irrigated land;

[1] UN-Water. (2013). Analytical Brief on Water Security and the Global Agenda. https://www.unwater.org/sites/default/files/app/uploads/2017/05/analytical_brief_oct2013_web.pdf

[2] Asian Water Development Outlook (AWDO) Series www.adb.org/publications/series/asian-water-development-outlook

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

- obsolete water infrastructure and inadequate staffing in the water sector to ensure adequate governance;
- a need to integrate targets set in relevant national strategies and concepts in the assessment;
- the importance of taking into account trends and characteristics of individual administrative territories in addition to country-wide indicators traced in the process of achievement of Sustainable Development Goals and in preparation of such documents as Asian Water Development Outlooks;
- decentralization and investment mobilization processes for which water indicators and risks shall be considered at administrative territory level;
- data availability and/or accessibility at administrative territory level.

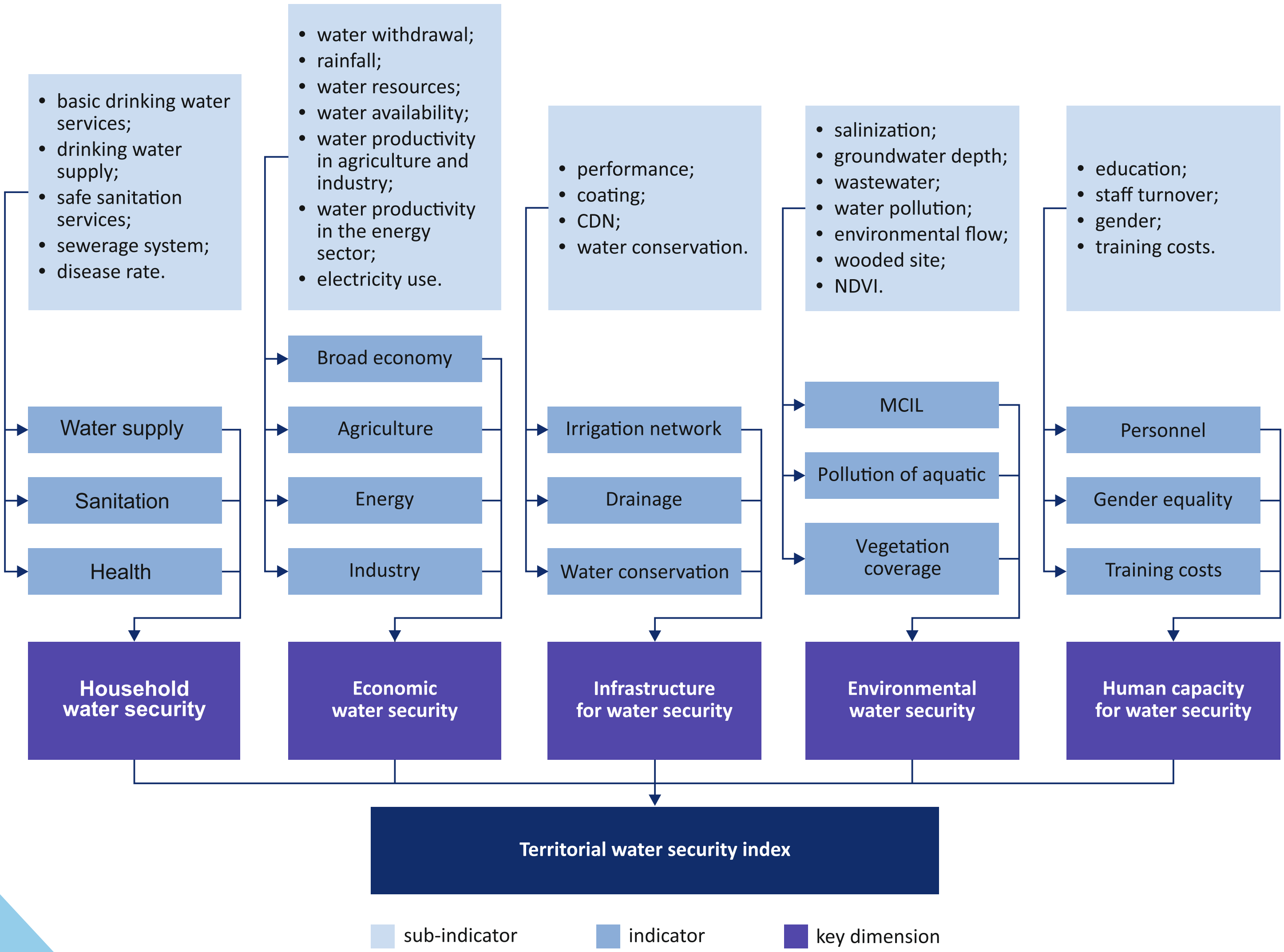
Thus, at given stage, without prejudice to other elements of water security, the SIC's methodology focuses on five key dimensions, namely: (1) (rural and urban) household water security, (2) economic water security, (3) infrastructure for water security, (4) environmental water security, and (5) human capacity for water security. These key dimensions can be added and extended further on.

Each dimension is characterized by a set of indicators and sub-indicators.

The territorial water security is assessed as the composite result of five key dimensions scored from 1 to 5: critical (1), inadequate (2), engaged (3), effective (4), and model (5).

At index 1, the water situation is critical and a large gap exists between the current state and the acceptable levels of territorial water security. With the index equaling 5, the territory has profound water security level.

Structure of Water Security Index



Key Dimensions, Indiciators, Subindicators and Scoring of Water Security

№	Indicators and subindicators of five key dimensions	Scoring				
		1	2	3	4	5
	Key dimension 1: Household water security					
	Water supply indicator					
1	**Proportion of households that are provided with at least basic drinking water services, %**	<60	60-70	70-80	80-90	>90
2	**Provision of apartments (houses) with drinking water, %**	<60	60-70	70-80	80-90	>90
	Sanitation indicator					
3	**Proportion of population using sanitation services that meet safety requirements, %**	<60	60-70	70-80	80-90	>90
4	**Connection of apartments (houses) to sewerage system, %**	<20	20-40	40-60	60-80	>80
	Health indicator					
5	**Acute intestinal infection rate, per 100 000 people a year**	<190	190-500	500-1,200	1,200-1,800	>1,800
	Key dimension 2: Economic water security					
	Broad economy indicator					
1	**Inter-annual variability of actual water withdrawal**	>0.25	0.25-0.20	0.20-0.15	0.15-0.10	<0.10
	Long-term average annual water withdrawal (2005-2010, 2010-2015, 2015-2020, etc.)					
	Standard deviation from long-term average annual water withdrawal (2005-2010, 2010-2015, 2015-2020, etc.)					
2	**Intra-annual variability of rainfall**	>0.15	0.10-0.15	0.05-0.10	0.025-0.05	<0.025
	Average monthly rainfall (2010, 2015 and 2020)					
	Standard deviation from average monthly rainfall (2010, 2015 and 2020)					
3	**Inter-annual variability of rainfall**	>0.75	0.60-0.75	0.40-0.60	0.20-0.40	<0.20
	Long-term average rainfall over last 30 years (1980-2010, 1985-2015 and 1990-2020)					
	Standard deviation from long-term average rainfall over last 30 years (1980-2010, 1985-2015 and 1990-2020)					
4	**Storage out of total renewable water, %**	<3	3-5	5-20	20-50	>50
	Total useful capacity of reservoirs					
	Total volume of renewable surface water and groundwater					
5	**Proportion of total water withdrawal out of total renewable water, %**	>80	40-80	20-40	10-20	<10
	Total actual water withdrawal					
	Total volume of renewable surface water and groundwater					
6	**Water supply per capita, m^3/capita/year**	<500	500-1,000	1,000-1,700	1,700-2,500	>2,500
	Population (end of year)					
	Agriculture indicator					
7	**Inter-annual variability of irrigation water withdrawal**	>0.20	0.20-0.15	0.15-0.10	0.10-0.05	>0.05
	Long-term average annual irrigation water withdrawal (2005-2010, 2010-2015, 2015-2020, etc.)					
	Standard deviation from long-term average annual irrigation water withdrawal (2005-2010, 2010-2015, 2015-2020, etc.)					
8	**A decrease in unit irrigation water withdrawal, %**	<5	5-10	10-15	15-20	>20
	Total actual irrigation water withdrawal					
	Irrigated area					
	Unit irrigation water withdrawal					
9	**Water productivity in agriculture, $/$m^3$**	0-0.10	0.10-0.20	0.20-0.35	0.35-1.00	>1.00
	Volume of crop production					
	Irrigation water consumption					
	Energy indicator					
10	**Decrease in the average use of electricity for water pumping, %**	<5	5-10	10-15	15-20	>20
	Use of electricity by PSE&CA					
	Quantity of pumped water					
11	**Water productivity in the energy sector, kWh/m^3**	<10	10-25	25-50	50-100	>100
	Energy generation					
	Water consumption in the energy sector (consumptive)					
12	**Industrial water productivity, $/$m^3$**	<2.1	2.1-5.5	5.5-20.0	20.0-50.0	>50.0
	Volume of industrial production					
	Water consumption in industry					
	Key dimension 3: Infrastructure for water security					
	Irrigation network indicator					
1	**Coefficient of performance of irrigation network**	<0.58	0.58-0.62	0.62-0.66	0.66-0.70	>0.70
2	**Proportion of coated canals, %**	<30	30-35	35-40	40-45	>45
	Total length of irrigation network					
	Length of coated canals					
	Length of canals (flume network)					
	Drainage network indicator					
3	**Proportion of collector-drainage network owned by state out of total length of the network, %**	>40	40-35	35-30	30-25	<25
	Total length of collector-drainage network					
	Length of collector-drainage network owned by state (land reclamation field office)					
4	**Proportion of very poor collector-drainage network out of total length of the network, %**	>45	45-35	35-25	25-15	<15
	Total length of very poor collector-drainage network					
	Water conservation indicator					
5	**Proportion of irrigated land, where water conservation technologies are introduced, %**	<10	10-20	20-30	30-40	>40
	Total area of irrigated land, where water conservation technologies are introduced					
	Key dimension 4: Environmental water security					
	Meliorative condition of irrigated land indicator					
1	**Proportion of strongly and medium saline land area out of total irrigated area, %**	>40	40-30	30-20	20-10	<10
	Total medium saline land area					
	Total strongly saline land area					

№	Indicators and subindicators of five key dimensions	Scoring				
		1	2	3	4	5
2	**Proportion of land area with groundwater bedded not deeper than 2 m out of total irrigated area (growing season),%**	>80	60-80	40-60	20-40	<20
	Total irrigated land area with groundwater bedded not deeper than 2 m					
	Pollution of aquatic ecosystems indicator					
3	**Proportion of safely treated wastewater, %**	<60	60-70	70-80	80-90	>90
	Annual quantity of wastewater					
	Annual quantity of treated wastewater					
4	**Proportion of CDW out of the total water withdrawal, %**	>80	60-80	40-60	20-40	<20
	Annual quantity of CDW generated in the territory					
5	**Proportion of CDW discharged into rivers out of total volume of CDW, %**	>80	60-80	40-60	20-40	<20
	Annual quantity of CDW discharged into rivers					
6	**Water pollution index (WPI)**	>4.00	2.51-4.00	1.10-2.50	0.31-1.00	<0.30
7	**Environmental flow needs, %**	>80	60-80	40-60	20-40	<20
	Vegetation coverage indicator					
8	**Proportion of wooded sites of the total forest fund, %**	<25	25-30	30-35	35-40	>40
	Total area of forest fund					
	Total area of wooded sites					
9	**Normalized difference vegetation index (NDVI)**	≤0	0.0-0.2	0.2-0.4	0.4-0.6	>0.6
	Key dimension 5: Human capacity for water security					
	Personnel indicator					
1	**Proportion of specialists with higher education out of total personnel, %**	<45	45-50	50-55	55-60	>60
	Total staff of BISA, ISA, RID, PSE&CA, LRFO					
	of which: with higher education					
2	**Proportion of specialists at above 50 years out of total personnel, %**	>80	60-80	40-60	20-40	<20
	Total staff of BISA, ISA, RID, PSE&CA, LRFO					
	of which: specialists at above 50 years					
3	**Staff turnover, %**	>10.0	10.0-7.5	7.5-5.0	5.0-2.5	<2.5
	Number of dismissed employees at BISA, ISA, RID, PSE&CA, LRFO					
	Average headcount of staff at BISA, ISA, RID, PSE&CA, LRFO					
	Gender equality indicator					
4	**Proportion of women out of the total personnel, %**	<2.5	5.0-2.5	7.5-5.0	10.0-7.5	>10.0
	Total staff of BISA, ISA, RID, PSE&CA, LRFO					
	of which: women					
	Training costs indicator					
5	**Proportion of training costs out of total budget of water management organizations, %**	<6	6-8	8-10	10-12	>12
	Total sum by budgets of BISA, ISA, RID, PSE&CA, LRFO					
	of which: training costs					

Case Studies

The authors conducted assessment of water security in Navoiy, Samarkand and Khorezm provinces of Uzbekistan over the period from 2010 to 2020. The data of the State Statistical Committee, the Ministry of Water Management, the Center of Hydrometeorological Service of Uzbekistan, as well as the Meteocenter and the Global Environmental Flow Information System were used in the studies.

Khorezm province

Khorezm province is located in the west of Uzbekistan. It borders the Republic of Karakalpakstan on the north-west and north, Turkmenistan on the south, and Bukhara province on the far south-east, east and north-east. The total area is 6.3 thousand km^2 (1.5% of the whole area of Uzbekistan). The main water source is the Amu Darya River. As of 01.01.2021, the permanent population was 1.9 million, including 0.6 million of urban population and 1.3 million of rural population.

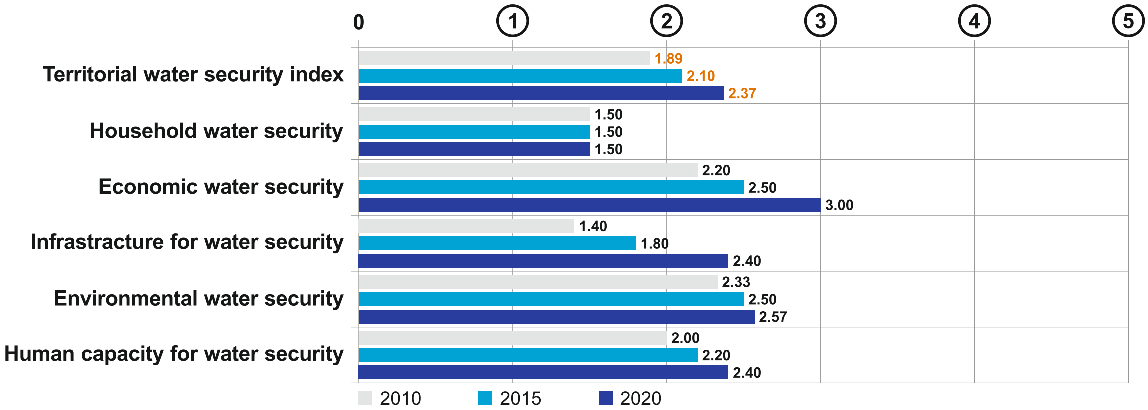
Khorezm province is one of agro-industrial regions in Uzbekistan, with agriculture playing major role in the economy. Animal husbandry accounts for considerable share in the total agricultural production. The total agricultural land area is 408.7 thousand ha, while the crop area is 262.1 thousand ha. Processing industry is the main driver of industrial growth in the province. Cars, trailers and semitrailers, textile and food have larger contribution here. Tourism, especially provision of services to foreign guests, rapidly grows.

Analysis of water security in Khorezm province over 2010, 2015 and 2020 by SIC's methodology identified the following main trends.

Over the period from 2010 to 2020, the water security index of Khorezm province grew from 1.82 to 2.37 or from 'inadequate' to 'engaged' stage. This indicates to efficiency of the ongoing work aimed to achieve wider access to safe drinking water, sanitation and hygiene facilities and to improve ecosystems.

However, yet serious risks are posed by deficient water management systems and technical setbacks of water infrastructure. Improvements in economic water security (25.3%) and infrastructure for water security (20.2%) mainly contributed to such growth of the water security index. At the same time, there is a downward trend in contribution of household water security (from 16.5% to 12.6%) and human capacity for water security (from 22.0% to 20.2%).

Overall Water Security Index in Khorezm Province



Against the background of increasing number of apartments (houses) and their insufficient connection to piped water supply, the household water security in Khorezm province is evaluated as inadequate in the recent decade. In 2020, about 1.2 million people did not have access to improved water sources and three fourth of apartments (houses) were not connected to the sewerage system. Even the users connected to piped water supply do not have uninterrupted access to water. The situation is particularly severe in the rural area, where relevant facilities often break or centralized water supply system is not available at all.[3] Access to centralized sewerage system is very limited, and most rural households use pit latrines.

The level of economic water security in the province, which is one of main dimensions of the territorial water security, is assessed as satisfactory. This is not surprisingly as local authorities and private sector contribute substantial material and technical resources to growth of economic sectors in the province. As a whole, the situation is characterized as positive but more efforts should be made to improve security.

Infrastructure for water security has improved considerably since 2010 and is assessed as 'engaged' as of 2020. The positive effect results mainly from the substantial reduction of the proportion of poor collector-drainage network. Nevertheless, insufficient investments in maintenance make large irrigation networks inefficient in terms of water services and infrastructure sustainability.

Environmental water security remains virtually unchanged during the last decade and is assessed as 'engaged'. This is because most indicators of this dimension are directly related to geomorphological, lithological and hydrogeological conditions that remain almost unchanged.

Human capacity for water security is assessed as 'engaged', with a moderate improvement. Despite the improvement, there are still high staff turnover and critical shortage of skilled personnel in the sector. The high proportion of specialists at above 50 years and unattractiveness of the sector for young professionals have a negative effect, particularly, on adoption of innovative technologies and new management approaches. All those factors explain why this key dimension remained unchanged in the last decade.

Navoiy province

Navoiy province is youngest in the Republic. It was formed of parts of Bukhara and Samarkand provinces in April 1982.[4] Navoiy province has the second largest area (10,948.1 km^2) in Uzbekistan after the Republic of Karakalpakstan (16,656.1 km^2), takes the second last place before Syrdarya province in terms of population (1,013.6 thousand by 01.01.2021)[5] and the last place by density (9.3 person/km^2 by 01.01.2021)[6]. Population is distributed very unevenly throughout the province. The lowest density is in Uchkuduk district.

Irrigation is the basis of agriculture. The water sources of the province are the Zarafshan River (Konimeh, Tos, Shavot, Chovli, right- and left-bank canals, Navkar and other canals) and the Amu Darya River through the Amu-Bukhara Main Canal (ABMC) system (Navoiy, Ortatchol, Amu, Sumbula and Maina canals), as well as sais (gully), springs and groundwater. In addition, water is accumulated in Kuymozor and Todakol reservoirs in autumn and winter. With the total irrigated area of 126.4 thousand ha, water is diverted from the Zarafshan River to six irrigation systems of 66.6 thousand ha, from the Amu Darya River along the Amu-Bukhara Main Canal (ABMK) to two systems of 29 thousand ha, from wells and springs to individual systems of 30 thousand ha and from collecting drains to an area of about 0.8 thousand ha.

The main agricultural subsectors of the province are Karakul sheep breeding and cotton growing. Navoiy province is a major industrial center in Uzbekistan, playing an important role in the country's economic development. Besides gin plants located in district centers, the industry is comprised of energy, non-ferrous metallurgy, chemistry, building industry and food industry.

The main results of quantitative and qualitative assessment of key water security dimensions for Navoiy province over 2010, 2015 and 2020 are shown below.

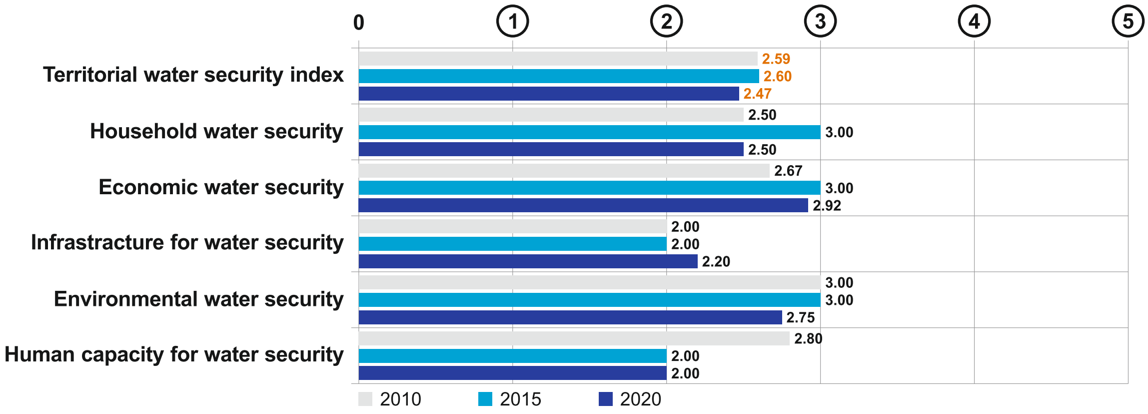
[3] SDG 6. Clean water and sanitation. State Statistical Committee of Uzbekistan, 2022, http://nsdg.stat.uz/goal/9

[4] Navoiy province khokimiyat's (local provincial authority) website, https://navoi.uz/uz/menu/vilojat-tarihi

[5] Resident population (as of 01.01.2021), https://stat.uz/uz/rasmiy-statistika/demography-2

[6] Cadastre agency at the State Tax Committee of the Republic of Uzbekistan (as of 01.01.2021), https://kadastr.uz/ru/yer-hisobi-yo'nalishi

Overall Water Security Index in Navoiy Province



Over 2010-2020 the water security index of Navoiy province remained at 'engaged' level, with a slight decline. Thus, further measures need be taken to provide safe drinking water to remote settlements, cities and districts, first of all, Zarafshan and Navoiy cities and Khatyrchi district with the highest density of population (4,255 pers/km^2, 2,938 pers/km^2, and 142.2 pers/km^2, respectively). Human capacity for water security (from 21.6 to 16.3%) and environmental water security (from 23.1 to 22.3%) are the main factors of such a decline in the water security index.

The key dimension of **household water security remained at 'inadequate' level** over the period under consideration. Provision of apartments (houses) with safe drinking water and sanitation shows a moderate decline.

The key dimension of **economic water security** remained as **'engaged'** over 2010-2020 through industrial water productivity (almost twofold growth), water productivity in the energy sector (1.5 times), and a decrease in unit irrigation water withdrawal by 3.4 pct.

The key dimension of **infrastructure for water security has improved and is assessed as 'engaged' as of 2020**. A certain positive effect is reached mainly through the substantial reduction of the proportion of poor collector-drainage network out of total length of the network. However, the service life of most water facilities exceeds 40-50 years, and the conditions of infrastructure deteriorate from year to year. As a result of bad technical condition of the irrigation network and poor water use planning, performance of irrigation networks is poor (within 0.61-0.62 for 10 years). There is no water accounting at the on-farm level. Water use plans and schedules of irrigation between water users do not correspond to the current water availability of clusters. Water allowance duty and crop irrigation regimes developed as early as in 1989 are still in use in irrigation planning. Also, the limited nature of water resources prompts measures to improve irrigation water use efficiency and use additional water sources (increase drainage water re-use for irrigation). Nevertheless, other subindicators remain unchanged over the period under consideration.

Environmental water security slightly deteriorated over the last decade and remained at the 'engaged' level. An increase in the annual amount of drainage water generated in the territory and quantity of drainage water discharged into rivers contribute to a decline of this key dimension. Of equal importance are the proportion of wooded sites of the total forest fund and NDVI value in Navoiy province.

Human capacity for water security is deteriorating. A "critical" level of staff turnover and acute shortage of skilled personnel are observed among key water management organizations. There is still insufficient allocation of funds for training and professional development of the staff. The moderately increasing proportion of specialists at above 50 years and unattractiveness of the sector for young professionals also have contributed to a decline in this key dimension.

Samarkand province

Samarkand province is an important economic and cultural region located in central part of Uzbekistan in the Zarafshan River basin. The total area[7] is 16,773 km^2, while the population is 3,947.7 and the density is 235.4 pers/km^2.

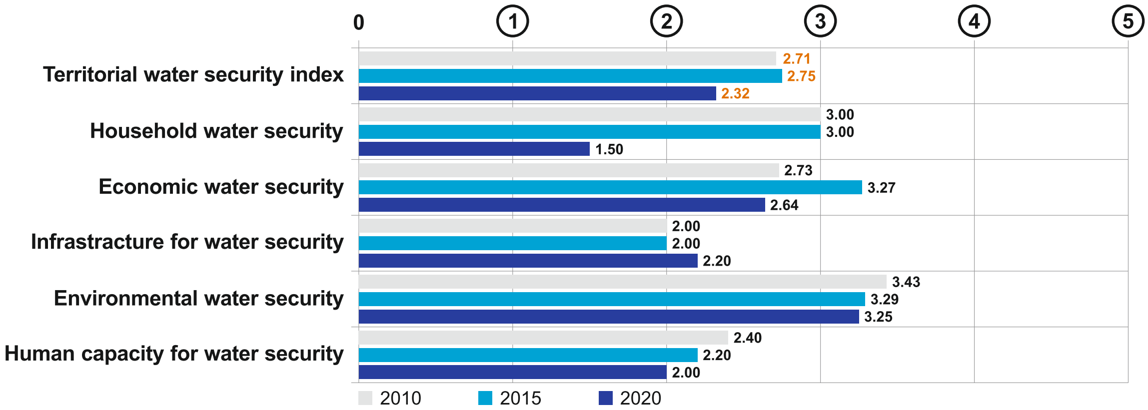
The Zarafshan River is fed by snow and glacial waters. The flow regime of the river is quite stable and, thus, contributes to smooth operation of hydropower plants throughout the year and eliminates the risk of floods. For more efficient use of water, Kattakurgan and Kuyumazar reservoirs were built in the Zarafshan middle and lower reaches, respectively. The Eskiankhor Canal brings Zarafshan water to Kashkadarya province. 90% of Zarafshan's flow is used for irrigation.

Agriculture plays a special role in the Samarkand production system. Crop production accounts for 75% of gross agricultural output. The leading branch is cotton growing. Other industrial crops include tobacco, sesame, flax, and safflower. Province's Urgut district is specialized in the cultivation of tobacco. Here, 96% of the republic's tobacco is produced. High-grade wheat and barley are grown on rainfed fields.

Textile, food and electrical industries, agricultural processing, mechanical engineering, metallurgy, as well as production of building materials are the main drivers of growth in Samarkand province.

[7] Land fund of the Republic of Uzbekistan (by January 2021), http://kadastr.uz/ru/yer-hisobi-yo'nalishi

Overall Water Security Index in Samarkand Province



Over 2010-2020 the water security index of Samarkand province decreased but remained at 'engaged' level. Despite the measures taken, risks remain due to limited access to safe drinking water, sanitation and hygiene and deficiencies in water management and water infrastructure. The decline in household water security (from 22.1 to 12.9%) and, to a lesser degree, human capacity for water security (from 17.7 to 17.3%) mainly contributed to such lowering in the water security index.

Because of delays in connection of newly built residential buildings to piped water supply, the household water security in Samarkand province is evaluated as inadequate. Even the users connected to piped water supply do not have continuous access to water. The situation is particularly severe in the rural area, where relevant facilities often break or centralized water supply system is not available at all.[8] Access to centralized sewerage system is limited, and most rural households use pit latrines.

Over the last decade, the economic water security in Samarkand province slightly declined and remained as 'engaged' despite reaching an 'effective' level in 2015. Among the key negative factors are the intra-annual variability of rainfall, the proportion of total water withdrawal out of total renewable water, water supply per capita, an increase in unit irrigation water withdrawal, and the deterioration, over the last 5 years (2015-2020), of inter-annual variability of actual water withdrawal, including for irrigation, unit irrigation water withdrawal, water productivity in agriculture, and average use of electricity for water pumping. Nevertheless, over the period under consideration, the indicators of broad economy (inter-annual variability of actual water withdrawal, inter-annual variability of rainfall, storage out of total renewable water), agriculture (water productivity in agriculture), and industry (industrial water productivity) are kept at effective level.

Infrastructure for water security has improved since 2010 and is assessed as 'engaged' as of 2020. A certain positive effect is reached mainly through the substantial reduction of the proportion of poor collector-drainage network out of total length of collector-drainage network. There is also an increase in the area of irrigated land where water conservation technologies are adopted. Nevertheless, this aspect and an increase in the proportion of coated canals out of total length of irrigation system and the transfer of the collector-drainage network to the ownership of the private sector remain critical for water security in the province.

Environmental water security slightly deteriorated over the last decade but remained at the 'effective' level. A slight decrease is caused mainly by regulation of flow of the Zarafshan River and uncontrolled sand and gravel extraction from the riverbed that led to lowering of deep and shallow groundwater. To improve this indicator, it is necessary to reduce the proportion of drainage water out of the total water withdrawal and the proportion of drainage water discharged into the Zarafshan River by extending re-use of low-saline drainage water for irrigation, maintain environmental flow at the level of 2020 or higher and improve quality of water in the Zarafshan River. Increasing the proportion of wooded sites out of the total forest fund and the NDVI in Samarkand province is equally important.

Human capacity for water security is assessed as 'engaged', with a moderate decline over the last decade. In key water management organizations the number of specialists with higher education decreased, and there are staff turnover and critical shortage of skilled personnel. Moderate decline in the involvement of women in water management and insufficient allocation of funds for training and professional development of staff are also observed. The high proportion of specialists at above 50 years and unattractiveness of the sector for young professionals also have contributed to the decline in this key dimension.

Recommendations

Water security is crucial for the achievement of sustainable development goals in Uzbekistan and its administrative territories. To improve water security in three selected provinces, it is **recommended** to pay particular attention to the following:

- increase **quantity of hydrological and meteorological observation points** to improve water monitoring and accounting; **ensure accessibility and transparency of the data** on all water security dimensions; it is important to have spatially disaggregated data on all indicators and sub-indicators for more reliable assessment of the level of key dimensions and tracing of their dynamics;

[8] SDG 6. Clean water and sanitation. State Statistical Committee of Uzbekistan, 2022, http://nsdg.stat.uz/goal/9

- against the background of continuous population growth, construction of new residential buildings, expansion of cities and settlements, it is necessary to **take effective measures to radically improve the water supply system**. This implies modernization and advanced development of diversion structures, off-takes, pumping stations, distribution units and water supply networks, with intensive adoption of modern energy and resource-saving technologies;

- improve **quality and reliability of services** providing access to safe drinking water and sanitation, especially in rural and remote areas; reduce water pollution;

- increase **efficiency and productivity of land and water use** to meet the growing water demand of the population and the economy by improving water management and water use in all economic sectors (i.e., improving the key dimension of economic water security to effective or model level);

- improve **flow regulation** along the Zarafshan River (Samarkand and Navoiy provinces) and operation of Amu-Bukhara Main Canal for better water supply to Bukhara province and Kyzyltepa district of Navoiy province;

- improve **performance** of inter- and on-farm canals, irrigation and collector-drainage systems (reconstruction, rehabilitation, coating, transfer to the private sector) and increase the pace of adoption of water conservation technologies;

- improve **water diversion and transportation and irrigation technique and technologies** by applying science evidence-based irrigation regimes and advanced technologies;

- revisit current **irrigation regimes and water duty zoning**, taking into account changed crop production conditions (crop diversification, sowing of new crop types and varieties for which no irrigation depths were set in irrigation regimes), water and soil conditions (groundwater bedding), and applied water-saving technologies;

- **re-use collector-drainage water** in the zone of their generation thereby improving available water supply of irrigated land and reducing polluting discharges into rivers;

- introduce **modern systems of monitoring** over soil and water conditions of land, particularly consider the **criteria for assessing** the critical level of groundwater bedding (up to 2 m) taking into account low land salinization and groundwater salinity;

- **regulate extraction of sand and gravel** from the Zarafshan River while keeping a 300-500-m water protection zone for environmental preservation of the watercourse and prevention of groundwater drop in Samarkand province;

- **arrange bank strips** along watercourses, including canals, irrigation and collector-drainage networks and adjacent to other hydraulic structures to facilitate their operation, reconstruction, repair and rehabilitation and for sound water use, water accounting and other measures;

- speed up **modernization, reconstruction and replacement of irrigation pumping stations and aggregates, as well as adoption of up-to-date energy-saving technologies** to reduce electricity consumption and achieve the 25%-reduction of annual electricity consumption by pumping stations until 2030;

- continuously and regularly invest in institutional and technical **capacity** of the water sector; education and training of **staff** should be one of the main priorities of water leadership and local authorities;

- develop and operationalize public private partnerships (PPP) in water and agricultural sectors to achieve real return and create incentives for the private sector to finance water; in particular, develop and operationalize **PPP models for recultivation of abandoned irrigated agricultural land, with the development of irrigation networks and hydraulic structures** and involvement of large industrial enterprises as private partners;

- strengthen measures for better **environmental resilience** in the context of climate change and increased desertification;

- raise gender **awareness** in the water sector and involvement of women in water management;

- promote **water cooperation** between Uzbekistan and Tajikistan, given the transboundary nature of the Zarafshan River, the main water artery that feeds Samarkand and Navoiy provinces.

Conclusion

There are multiple assessments of water security that allow comparison of progress between countries. Despite undeniable advantages, the nationally averaged evaluation of water security may simplify and not correctly represent complex water-related aspects at the level of country's administrative territories.

The methodology developed by SIC ICWC on the base of ADB's approach and adapted to the conditions and needs of Uzbekistan has demonstrated its good performance in identifying progress and vulnerabilities of water security in administrative territories against the targets set in national programs and strategies. This helps to take location- and context specific measures.

Other advantages of given methodology are:

- coverage of different water user sectors (household water supply, agriculture, energy, industry) and ecosystems, and consideration of legal, policy, social and financial aspects;

- applicability of the methodology at district, province and country level;[9]
- due regard for opinions of local water organizations in the process of development of given methodology;
- multidimension – both water quantity and quality factors considered;
- benchmarking and comparison in different contexts, proceeding from the targets set in sectoral development strategies and concepts;
- demonstration of concrete results to be used in making decisions on sound water use and protection.

However, further analysis is needed to improve the methodology by updating and extending the traced indicators.

It seems also necessary to extend the assessment on other administrative territories in Uzbekistan and on other Central Asian countries.

Source:

Ziganshina D.R., Muminov Sh.Kh., Kenjabayev Sh., Galustyan A.G. Assessment of Water Security in Administrative Territories of the Republic of Uzbekistan: Methodology and Case-studies of Navoiy, Samarkand and Khorezm Provinces in Uzbekistan. SIC ICWC-UNESCO. 2022. Tashkent

SIC ICWC thanks the UNESCO Office in Uzbekistan and Alexandros Makarigakis personally for the provided support.

[9] For adaptation of given approach to other countries, threshold values of some indicators need to be modified, taking into account specific characteristics, particularly geomorphological, lithological and hydrogeological conditions of territories to be studied so that they be comparable and reasonable.