IWRM as an Instrument for Improving Water Security in Central Asia

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Introduction

Central Asia includes territory of five countries – former republics of Soviet Union: Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan (see map in figure 1).

Figure 1. Central Asia

Water resources management is the art of delivering required amount of water to a necessary place in needed moment of time. The history of this art in Central Asia accounts millenniums, but the most intensively water resources started to be used in XX century, especially after 1960. That was caused by fast growth of the population, intensive industry development and, mainly, irrigated agriculture. Total water diversion in 1960 within the Aral Sea Basin was 60,6 billion m^3, and by 1990 it has increased up to 116 billion m^3, or about 2 times. For the same period the population in the specified territory has increased by 2.7 times, the irrigation area has increased by 1.7 times, crop production - by 3 times, gross national product - almost by 6 times (see basic indicators in table 1 below).

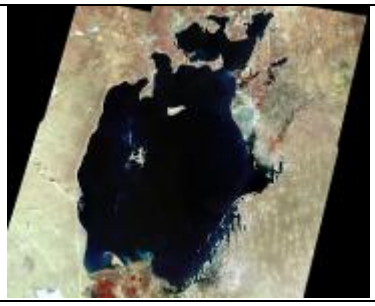
Table1. Baseline indicators of water development in the Aral Sea Basin (the biggest part of Central Asia)

Indicator	Unit	1960	1970	1980	1990	2000	2008	Forecast (2020)	
								Optimistic	Pessimistic
Population	Million	14.6	20.3	26.8	33.6	41.8	47.5	54	70
Irrigated area (netto)	1 000 ha	4510	5150	6920	7600	7896	8100	9330	9300
Irrigated area per capita	hectare	0.31	0.27	0.26	0.23	0.19	0.17	0.16	0.12
Total water diversion	km3/year	60.61	94.56	121	116	105	98	105	117
Including for irrigation	km3/year	56.15	86.84	107	106	94.66	89	86.8	96.7

Indicator	Unit	1960	1970	1980	1990	2000	2008	Forecast (2020)	
								Optimistic	Pessimistic
Specific diversion per hectare	m3/ha	12450	16860	15430	14000	11850	10990	9300	10400
Specific diversion per capita	m3/capita	4270	4730	4500	3460	2530	2065	1935	1670
GNP	Bln.US$	16.1	32.4	48.1	74.0	27.5	40.0	109	77
Contribution of agricultural production	Bln.US$	5.8	8.9	18.3	22.0	9.0	15.5	31	20

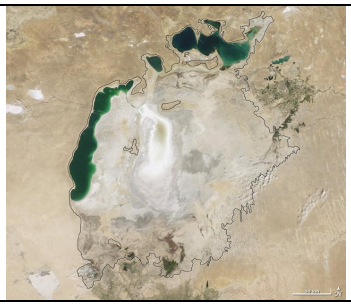
Source: www.cawater-info.net

Unfortunately, until 2000 in Central Asia, priority for water development has been given to the covering basic needs of human beings and satisfaction of economic development, but not for ecosystems' needs. As a result we can observe the disaster of the Aral Sea and its coastal zone. Today's the Aral Sea – these are two separate lakes with total volume of water about 9 % of the Sea, which was in 1960. The mineralization of water in the western part is above 150 g/l, and in the northern part is about 20-35 g/l. There have been heavy losses of biodiversity occurred: more than eighty common species have disappeared from the aquatic fauna and flora.



Aral Sea in 1973

Aral Sea in August 2005



Aral Sea in August 2009

Another problem is salinization and waterlogging on the irrigated area (approximately 5 million hectares of 8 in total - require artificial drainage). Irrigation creates a return flow, which is a source of environment threats. This polluted water constitutes more then 30 percent of totally available water resources in the region.

Also there is uncertainty about the possible impact of global climate change on water resources in the region. Over the last thirty-five years, the average temperature has increased by 1 ^{o}C and the size of glaciers in the Pamiro-Alay system has been reduced by 30 percent. Different scenarios predict a greater water deficit by the year 2030 as result of evaporation increase and a decrease of water resources of between 6 and 20 km^3 annually (5–15 percent of total renewable water resources).

During the Soviet period, federal government constructed water infrastructure and allocated water resources in order to maximize irrigated agriculture. This policy brought some economic benefits and social stability to the region, but it also resulted in environmental challenges (as shown above). The key water management institutions were the republican water ministries, which effectively managed water allocations and construction projects, and today remain the foundation for interstate water management (with some transformation by status and authority). For operative water management along two main rivers in 1986-87 two Basin Water Organizations (BWOs) Amudarya and Syrdarya were established. The federal Soviet government conducted compensatory schemes to regulate trade-off between republics

concerning agriculture, energy and other sectors. Thus, there was not any serious competition for water among the republics.

As the USSR collapsed, the Central Asian republics continued to rely on Soviet water legislation. With the creation of the five independent states, the big number of former domestic river basins were now transboundary and water had been turned into a source of potential interstate disputes that had not only environmental, but also political and economic implications. During the Soviet period, the Aral Sea Basin was managed as an integrated economic unit. Economic priorities, defined by Moscow, dictated that water was allocated to optimize agricultural production and provision of hydroelectricity was a second priority. With independence the integrated economic system broke down. Each country began to redefine its own economic priorities. They became acutely aware of their resource inputs and outputs and it became evident that their respective goals conflicted regarding water usage (by volume and by schedule).

The potential conflicts were most pronounced for the populations living furthest downstream, especially Karakalpakstan and Kzyl Orda. Here the water was of very low quality consisting mainly of polluted drainage water that had been returned to the river. These populations had – and still have – little bargaining leverage over upstream users (agriculture users at midstream and hydropower users further upstream) because they lacked any resources needed by the upstream users.

In sum, the benefits from cooperation were highly asymmetrical and unevenly distributed. It is largely due to the leadership of the water authorities from five countries and the support from the international community that major conflict did not erupt after independence.

In order to avoid collapse of the agricultural sectors the countries extended the water management principles and quota systems inherited from the Soviet era. In February 1992, the five countries entered into agreement on *Cooperation in the Joint Use and Protection of Water Resources of Interstate Significance,* affirming the "existing structure and principles of allocation" of transboundary waters. By signing this agreement, the Central Asian states pledged "strictly to observe the coordinated procedures and established rules on use and protection of water resources," while recognizing the Aral Sea as of common interest to the five countries. The agreement also formed an Interstate Commission for Water Coordination (ICWC), which subsumed the two existing basin water organizations, and was authorized to determine annual water consumption limits in accordance with actual water availability[1].

Present hierarchy in the relations between main water governance institutions at the regional level was agreed by the Head of States on 9 April 1999 in Ashgabat. The agreement set up the following distribution of obligations between the regional organizations, which still is valid (but need to be revised):

- Board of the International Fund for the Aral Sea (Board of IFAS), represented by Deputy Prime Ministers of five States – this is the highest political level for decision making and final approval of activities before (if needed) the Head of States;
- Executive Committee of IFAS – a permanent body, which is represented by 2 members from each State and carries out all activities for implementing decisions made by the Board of IFAS via the National Branches of IFAS. Also, EC-IFAS, on behalf of the Board could

[1] The quotas for the Syrdarya river basin are: Uzbekistan (50.5 %); Kazakhstan (42 %); Tajikistan (7 %); Kyrgyzstan (0.5 %). The numbers reflect the share of total run-off in the main channel, tributaries not accounted.

organize the Agencies or PMCU for different projects (international and donors) implementation;

- Interstate Commission for Water Coordination (ICWC) – the highest level of transboundary water resources management, water allocation, water monitoring, water use and preliminary proposals assessment for principal improvement and change of organizational, technical, financial, environment approaches and decisions related to water at the interstate level.
- BWOs, SIC ICWC and Secretariat - are executing bodies of the ICWC.

International agencies and donors saw the Aral Sea crisis as an opportunity to link economic and political reforms with environmental and conflict issues. Fifteen to twenty international organizations have provided technical and financial assistance related to the Aral Sea under agreed in 1994 Aral Sea Basin Program -1 (ASBP-1). A donor community review of the ASBP -1 conducted in 1996 recommended major changes to the water management institutional framework. It suggested: (a) stronger leadership by regional institutions as opposed to donor influence in program formulation and implementation; (b) increased political and financial commitment by the Central Asian countries towards regional institutions; (c) clearer priority setting between national and regional tasks and more focus on real implemented activities; and (d) clarification of the roles of the various institutions. Despite the clear recommendations, however, many of these challenges remain today.

As example, the management of water releases from the Toktogul reservoir on the Naryn river (within the Syrdarya basin) in Kyrgyzstan illustrates the water-energy nexus. Initially, after independence, the Central Asian states upheld the legacy interdependencies whereby Kyrgyzstan supplied Uzbekistan, Tajikistan and Kazakhstan with water during the summer months in return for gas and coal during the winter months. This set-up was soon to be challenged. Whereas Toktugul was originally designed to meet irrigation demands downstream, Kyrgyzstan quickly saw the possibility of increased hydropower generation. Instead of storing the water for release during the spring and summer irrigation periods, the water could be released during the winter when the domestic need for electricity peaked.

As it was mentioned, during the Soviet era, power generation was regulated by pooling all hydro- and fuel-energy resources. Electricity demand and supply did not correspond to state borders. Instead, the hydropower resources of Kyrgyzstan and Tajikistan were used as the peak energy resources for Kazakhstan, Uzbekistan and Turkmenistan. Meanwhile, coal-fired, gas-and-oil-burning heat power plants met the Kyrgyzstan and Tajikistan basic power demands. Thus, due to integrated and centrally designed Central Asian Energy Grid, it was possible to operate an optimal schedule for energy and water management.

As Central Asia opened to world commodity markets in the mid-1990s, disagreements over the use of Toktogul emerged. Uzbekistan and Kazakhstan started to charge world market prices for gas, oil and coal exports to Kyrgyzstan. In response, as it faced energy shortages during the winter months and was unable to muster the hard currency for carbon imports, Kyrgyzstan began to operate the Toktogul power plant for electricity generation during a season where it traditionally had been storing water. The downstream countries experienced the negative effects of this: less water available for irrigation during the summer months and floods during the winter.

The natural deficit of available water resources observed in 2008 was the most critical ever in the Syrdarya basin. The capacity of the Toktogul water reservoir was close to “death level” already in April 2008, thereby impacting both power generation and irrigation during vegetation season. This situation called to provide further incentives for effective water and energy management. On 10 October 2008 in Bishkek Heads of Central Asian countries using opportunity to meet within

framework of the Commonwealth of Independent States had a discussion addressing regional cooperation on water-energy issues. There was confirmed one more time willingness for regional cooperation in this sphere. On 16-17 October Vice-Prime Ministers of five states signed agreement about joint measures to overcome water problems within the Aral Sea Basin during Winter – Spring season of 2008-2009. Later on, there was inaugurated the new EC IFAS during regional conference held on 17-18 November 2008 in Almaty. The all these events gave a new positive impulse to regional water cooperation.

On December 3, 2009 in Almaty, Kazakhstan was held Board of the International Fund for the Aral Sea Saving (IFAS), leaded by Vice-prime Ministers of the five Central Asian countries. The Board approved ***Action Plan*** for realization of the Decisions of the Presidents of the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan, and the Republic of Uzbekistan, which was done in the city of Almaty on 28 April 2009. It worth to remind that one of the principal Presidents' decisions was the following:

"The Parties assign the Executive Committee of the IFAS together with the Interstate Commission for Water Coordination, the Interstate Commission for Sustainable Development of IFAS, with involvement of national experts and donors, to develop a Program of Actions for support of the Aral Sea basin countries for 2011-2015 (ASBP-3)"

The approved Action Plan is mostly addressing to development of the ASBP-3. There were agreed objectives and framework of the ASBP-3, which will include four main directions:

1. Integrated Water Resources Management with consideration interests of all states
2. Environmental issues
3. Socio-economic issues
4. Strengthening of the institutional and legal mechanisms

The Action Plan scheduled submission of the final draft of the ASBP-3 to the heads of states in June 2010, and to conduct donors meeting in October 2010 to attract additional funding to the countries' contributions for the ASBP-3 implementation during period 2011-2015 and beyond.

Improving Water Security and Indicators to Measure Progress

The following definition of Water Security could be proposed:

> "Water security is a completed set of conditions, processes and actions needed to provide water balance that ensure absence of risks/threats for nature and human society within the entire hydrological basin".

Water policy within the context of water security should provide system of measures (legal, institutional, engineering and others) aiming to keep balance between biosphere and anthropogenic interventions, and other external factors impacted to water cycle in the basin. There are three keys to sustainable development – as a way to water security and harmony: 1) the social equity, 2) economic growth, 3) environmental and ecological sustainability. The practical instrument for these - is proper implementation of integrated water resources management (IWRM). The IWRM could be seen not only as a good theory, but as a real practical instrument. Proper implementation depends on clear understanding of the concept. For that I recommend de-fragmented vision on IWRM = water resources management (WRM) process + governance system + managerial tools. Water resources management process involves a number of key interrelated components (see table 2).

Table 2. Components and Indicators of Water Resources Management Process

WRM Components		Tasks	Indicators
Available water resources	Governance	Monitoring Development Protection	Amount, quality, regime, renewability, variability
Infrastructure		O&M	Costs / efficiency / cost recovery
Water requirement		Evaluation Demand management	Level/amount/quality/time/location
Water balance and allocation		Participation Plan (schedule) Regulations	Norm for flow rate Equitability & rationality criterion (rights / share / quota / limit)
Water delivery		Secured water supply	Sufficiency of water supply, uniformity, sustainability, minimum unproductive losses
Water use and productivity		Output and water saving	Productivity (more crop per drop)
Water use effects (MDGs)		Sustainable development	Sustainable use index
Management assets		Maintaining waterworks in operable conditions	Operability indicators
Water quality & ecological flows management		Meeting the environmental requirements	Quality indicators and ecological flow rates
Monitoring & Evaluation		Day-to-day services	Availability of on-line information from all key points of water delivery and distribution
Long-term planning		Adaptation to long-term changes	Water requirements over the planned period are met

First of all, there should be available water resources (surface, underground, etc.) and engineering infrastructure for water abstraction, storage and delivery to water consumers and users. Management process envisages the obligatory water requirements assessment, procedures for water allocation based on permanent balancing of water resources and demands, after that - water delivery service and, finally, managing the process of water use and consumption. Water quality control and meeting environmental requirements can be also added to above process. In addition, management process has to include forecast of long-term changes of key factors and water balance components, as well as to specify a mechanism for adaptation of the water use system to all possible changes.

Naturally, outcomes and efficiency of water management process should be regularly monitored and evaluated. Monitoring, assessment, protection and development of available water resources are key objectives of the first component. A key indicator to demonstrate the progress in achieving established objectives is a renewability of water resources in regard to their reserves or level in a source, water quality, and variability of these parameters over time.

One of key objectives related to engineering infrastructure (reservoirs, irrigation and drainage canals, hydraulic structures, water supply network etc.) is proper operation and maintenance (O&M), including maintaining necessary operational regimes and design parameters of structures; their repairing, up-grading, and, if it is necessary – reconstruction or rehabilitation. At present, a quality of O&M is defined by such indicators as costs (financial and material), cost recovery, efficiency and operational life of infrastructure.

Next component of water management process (water requirements) is aimed at assessing the needs of all stakeholders in water resources and managing these requirements are based on available water resources. Major indicators of this component are a record-keeping of all points for water delivery,

required amount and time of delivery (some water users may be interested in maintaining necessary water level or water quality in their systems).

After specifying available water resources and water requirements, the next component – water allocation – has to be implemented. In other words, this is the process of drawing up a balance taking into consideration available water resources and water demands. Here, major objectives are maximum possible involving all stakeholders in the process of negotiations (coordinating water allocation) and development of acceptable for all procedures (rules) for water allocation. The proposed indicator for this component is criteria of equity and rationality for establishing quotas or limits of water use (in case of water deficit).

A next component of the water management process is water delivery from a source to water users (water supply). Proposed indicators for evaluating a quality of these services are uniformity and sustainability of water supply under minimum non-productive water losses.

Finally, the last key component is water use, including irrevocable water consumption. Here, the major objective is to produce maximum output by using water or its optimal utilization. The proposed indicator is specific water productivity i.e. an amount of water consumed per unit output – product. Producing output and using water, we should be guided by the principles of sustainable development (providing opportunities for future generations to use water in the same extent as today); and the proposed indicator can be a sustainable use index, exceeding of which is inadmissible.

Within the IWRM system the all above mentioned water management process components should be managed by proper governance framework. The main goal of governance framework is to provide equal democratic opportunities for all stakeholders involved into water resources management process. The main components of the governance framework are the following: political commitment; institutional arrangements; legislative framework; financing and incentives; public participation; managerial tools and instruments; capacity development.

The governance framework is not static in time – it should be permanently adapted to changes: natural, political, social, economic, technological. In the large extent it can be referred to management rules that are the most vulnerable parts of the modern management system, and require paying the most attention of all specialists from the water sector because each basin, each sub-basin, and each water management or irrigation system, as each man, has its own features. This is not predetermined only by specific landscape, configuration and lithology of a watershed, but also by conditions of water withdrawal and distribution (surface water sources or groundwater; regulated or unregulated flow), parameters of water distribution system; the combination of hierarchical water management levels, composition of operational works and conditions at different levels of the water management hierarchy.

To put IWRM into practice it is necessary to develop specific mechanisms providing the joint interested motives for water users and water management organizations in increasing the water productivity, and at the same time to assist them in achieving this goal. These mechanisms should take into account specific factors causing unproductive water losses, instability in water supply, and unevenness of water distribution. As a whole, the ranking of causes of water productivity reduction that arise within the irrigation system promotes the development of practical measures for achieving the basic criterion of IWRM – provision of “potential productivity” of the water by all water users or, at least, approaching to it. The most part of approaches to improve the water productivity are based on the engineering measures and IWRM tools in combination with organizational, legal, and financial measures. To implement these measures in the first place it is necessary to combine efforts of all participants of the multistage

water supply process within water management organizations and water users. Such joint efforts are needed to use agreed procedures and methods for stabilizing water supply, providing equitable water distribution, and establishing the proper public control by water users themselves. At the same time, the technical and financial assistance of the State and local governments is necessary.

Finally, it is important to gain a general understanding of the importance of the co-ordination at all levels of water management hierarchy, and of the input of each participant into integrating water resources management. From the other side, the governance framework should provide horizontal integration among sectors. There should be created platform for effective participation in decision-making process of different sectors (government, NGOs, science, private sector, professional organizations) and sub-sectors (agriculture, hydropower, nature, water supply and sanitation and etc.).

The main criteria for evaluation success of this integrity are: inclusiveness (voice), equity (opportunities), transparency, effectiveness, accountability, coherency, responsiveness, comprehensiveness, ethical considerations. The Governments should define those frames, within that water management agencies should operate for the interests of all economic sectors and water users. The management system should provide conditions for achieving (or approaching to) the maximum water productivity by all water users (in irrigated farming, industry, and domestic water supply, etc.) and for successful surviving. It means that for producing unit of production the minimum water volume should be used that is close to biological or technologically needed water consumption under minimum water losses over all the technological cycle including water intake, water conveyance, water supply, and water use (so-called potential water productivity). Such approach needs in the clear-cut co-ordination of all technological processes as well as the observance of other technological requirements (non-related with water resources).

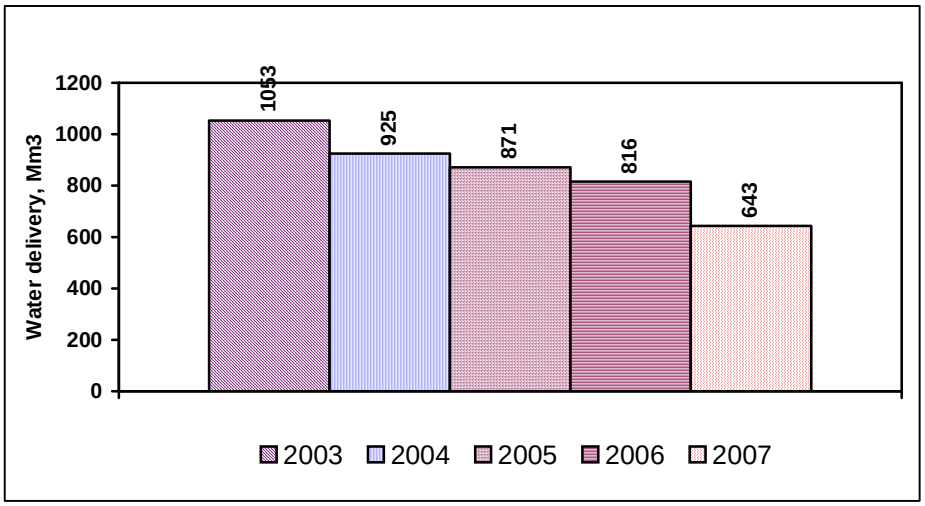


Figure 2. South Fergana Canal: Total Water Withdrawal from River during Vegetation Period

The principal goal of governance and management processes for recent stage of water development in Central Asia is to achieve significant reduction of water withdrawal from river, and in the same time to improve indicators of water use efficiency and water productivity. As it follows from the figure 2, we have achieved this goal in some pilot areas.

Knowledge Networking

Scientific-Information Center of ICWC serves as IWRM Knowledge Hub with the priority topic on water resources management in Central Asia. The main topics of Knowledge dissemination are river basin management, non-conflict water allocation, organization of water management and conservation on transboundary waterways, environmental disaster management, irrigated agriculture, including irrigation and drainage. Moreover, to pursue the regional collaboration for effective water use, SIC ICWC focuses on examining and managing issues such as:

- Improve efficiency and sustainability of water resources management in Central Asia through promotion and application of IWRM principles.
- Extend information coverage of available web-portal and information system
- Become a bridge in knowledge dissemination, linking the international water society and the Russian-speaking audience.
- Develop a regional decision support tool, i.e. integrate the Central Asian Water Information Base (CAREWIB) into decision-making processes of national, regional and international bodies.
- Strengthen water management organizations in Central Asia through sustainable capacity building network.

Further development of information exchange in the region and application of information systems in routine activities of the National authorities responsible for Water Resources and Agriculture and the provincial water organizations, as well as at lower level, i.e. district water organizations and Water User Associations, followed by expansion of extension services and training is undoubted.

The principal clients of WaterHub are:

- Research and design institutions in water sectors of Central Asia.
- Water-management organizations, water users and local authorities.
- Higher education institutions (specialized in hydraulic engineering, agriculture, hydrology, etc.).
- Organizations dealing with monitoring of water quantity and quality (meteorological, hydrometric, hydrogeological and land reclamation services, organizations under umbrella of environmental authorities, etc.).
- National authorities responsible for Emergency Situations in countries.
- Organizations responsible for operation of national and regional energy systems.
- Non-governmental, private organizations.
- International organizations and donors.
- Mass media

Information resources are available in Internet (*www.cawater-info.net*), which is unique. This is Central Asian water, land, and environment info-portal including big number of web-sites. CAWater-Info News and ICWC press-releases are issued and disseminated regularly in Russian and English among water organizations, ministries and departments in Central Asia, as well as among foreign embassies in Uzbekistan. Bibliographic database was developed, and E-library includes e-versions of SIC and its partners' publications, international and national water law documents, international conventions, etc. This e-library is the most popular resource of CAWater-Info portal.

Water related Data Base within the portal contains information on more than 200 parameters over the period 1980-2010. Analytical tools within Information System allow to analyze the water-related situation in the Aral Sea basin over a number of years (actual water consumption of riparian states, basin's river flow dynamics, etc.). The all consumers of the portal products can be served on the basis of specific agreements and requests, according to the list of available services.

Conclusion

The above suggested approach for indicators setting is a good basis for assessment of the real effects of the IWRM implementation as a key element on the way towards water security.

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