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Integrated Water Resources Management in Central Asia: lessons learned from the Aral Sea basin

Introduction

Water management and irrigated agriculture in the Aral Sea Basin have been passing through a rather complicated period of political revival and economic transformation in conditions of independent statehood, transition to market economy, intensive impacts caused by internationalization processes and efforts to elaborate new forms of state development. Given the specific features of the arid zone, local demographic situation, critical role of water factor and transboundary relations, these two sectors of economy are of great socio-economic and ecological importance for the region.

1. The background of water management and irrigated agriculture in the Aral Sea Basin

As is well known, one of the seven centers of ancient civilization had been located and developed in Central Asia, contemporizing in its origin with those in Mesopotamia, India and China (VI-IV millenniums B.C.).

Having passed through such stages of development as brook, *keryaz*[*], dike-less and oasis irrigation by the 19th century, regional water management and irrigation had got a powerful spur owing to such Russian engineers as A.N.Kostyakov, V.V.Massalsky, G.K.Rizenkampf and many others who worked in the region at that time. It was in this period that first large-scale projects were undertaken here; among them: - the Hunger Steppe and Karakum Canal schemes, the Choo-Talas and Amudarya delta development, etc. During the Soviet times a number of hydro-power projects were launched, which gradually got implemented in 1925-1990s. Consequently, the immense technical and economic system of irrigation, hydro-power and water supply had come into being in the Basin, but the Aral Sea proper that used to rank the forth in volume among the inland lakes has actually disappeared from the surface of the Earth as a single water body. Figures reflecting the dynamics of water management repeatedly being updated by me in previous papers (they have been often used without references) are shown in Table 1

Table 1

Water use dynamics since 1960

Indicator	*Unit*	1940	1960	1970	1980	1990	2000
Population	***Million.***	**10.6**	**14.1**	**20.0**	**26.8**	**33.6**	**41.5**
Irrigated area	***Thousand ha***	**3.8**	**4510**	**5150**	**6920**	**7600**	**7890**
Total water withdrawal	***km^3/year***	**52.3**	**60.61**	**94.56**	**120.69**	**116.27**	**100.87**
Including irrigation	***km^3/year***	**48.6**	**56.15**	**86.84**	**106.79**	**106.4**	**90.3**
Specific water intake	***m^3/ha***	**12800**	**12450**	**16860**	**15430**	**14000**	**11445**

[*] *keryaz* - water intake filter gallery

per 1 ha of irrigated land							
Specific water intake per capita	***m^3 per capita per year***	**5000**	**4270**	**4730**	**4500**	**3460**	**2530**
GDP	***mln $ USD***	**12,2**	**16,1**	**32,4**	**48,1**	**74,0**	**54,0**

In general, water management and irrigation that had developed in the region by 1990 represented a combination of perfect up-to-date constructions and installations, unique pumping stations and canals (Karshy and Karakum canals, Djizak cascade), dams and irrigation systems utilizing most advanced equipment of drainage and irrigation with integrated system of management (Hunger, Karshy, Kyzylkum Steppes) and outdated systems requiring renovation that were operated on almost one-half of the irrigated area with utterly disordered structure of water delivery and distribution. "Advantages" and "disadvantages" of this immense sector of economy and nature management that used to generate up to 40 % of the whole GNP in the region are reflected in strengths and weaknesses, which became apparent during subsequent phases of development (Box 1).

Box 1.

HERITAGE OF THE SOVIET RULE

Positive	**Negative**
• Immense water management infrastructure • Strict management and planning in water sector • High level of technical knowledge. Close cooperation among water professionals of various countries • Establishment of Basin Water Organizations (BWO)	• Neglect of public opinion and participation. Lack of attention to ecological requirements • Administrative-command system • Inability to accept market mechanisms. Absence of chargeable water use

The high capacity infrastructure had been governed by administrative-command methods at all levels of water management hierarchy on the basis of the "top-down" approach. Some water users within this system used to be restricted (hydropower) while priorities given to the others (irrigation), followed by corresponding compensations at inter-republican level. Such infrastructure with its enormous operation, maintenance and development costs turned out to be absolutely maladjusted to decentralized management in new market environment characterized by multi-sector, multi-level relations and egoistic aspirations on the part of various water users and water management agencies. Enormous increase in number of self-supporting water users, their (and the State's) weak economic basis resulted in the fact that the whole of water management system has got into the situation of - if not a "colossus on feet of clay" – then at least a "giant in knock-down", who has been failing to come to his senses for a long time. The advent of international expertise in the region and attention being focused on environmental and economic oversights of the former system, coupled with minor amounts of real donor support and controversial recommendations as to transition processes – all these have not promoted formation of a new sustainable water management in conditions of state independence.

2. New situation and new institutional formation

Concerns to create a mechanism for regional collaboration in organizing and financing water resources management have arisen since independence. The Interstate Commission for Water Coordination (ICWC) was established in accordance with the "Agreement on collaboration in the sphere of joint water resources management within interstate water sources" dated February 18 1992, and approved by the heads of state on March 23 1993. The ICWC is a collective body that manages transboundary rivers and is responsible for: water allocation among countries; monitoring; and preparing preliminary assessments of proposals on institutional, ecological, technical, and financial approaches, based on decisions mutually agreed by all sides. The two BWOs (Amu-Darya and Syr-Darya), the Scientific-Information Center, and ICWC Secretariat are executive bodies of this Commission.

The ICWC took over responsibilities for water management in both basins directly from the former Soviet Ministry of Water Resources, but with appropriate changes reflecting the creation of five new independent states:

- The commission has five members appointed by the governments. They are equal in rights and obligations. They meet once a quarter to decide on all issues related to their activities and responsibilities. The decisions are reached only on a consensus basis.
- Two BWOs were transformed into the executive bodies of ICWC; in a similar way a part of the Central Asian Scientific Institute for Irrigation (SANIIRI) was transformed into the Scientific-Information Center (SIC) of ICWC to act as a think-tank for the commission.
- All issues for the ICWC meetings, in accordance with their agenda, should be prepared by the executive bodies and disseminated among the members twenty days before each meeting; this allows for preparation of comments and opinions by each country.
- The principles of water allocation that existed in Soviet times have been retained for the purpose of annual planning until new regional and national water management strategies can be developed and adopted.

The mandate of ICWC defines its main functions as follows:

- Development and implementation of annual consumption limits for each state, and operation regimes for large water reservoirs; water allocation control, taking into account actual water availability and the water-economic situation; setting an annual water supply volume in the river deltas and the Aral Sea as well as sanitary releases on rivers and canals; operation, support and maintenance of headworks on the rivers, which are under the supervision of the BWO.
- Definition of common water management policy, and development of its main directions with regard to the interests of the population and the economies of the state-founders; rational water use, conservation, and programs for increasing water availability within the basin.
- Drawing up recommendations to the governments on the development of common price policy and compensation for possible losses connected with joint water resources use, as well as on the legal basis of water use.
- Coordination of large project implementation and joint use of existing water potential.
- Creation of a single database on water resources use, monitoring of irrigated lands, and provision of general environmental monitoring.
- Coordination of joint research to support decisions on regional water-related problems and preparation of master plans.
- Facilitating cooperation in introducing water-saving technologies, as well as irrigation methods and techniques providing improvement of irrigation systems and water use.
- Development of joint programs to increase awareness and prevent emergencies and

natural catastrophes.

The mandate of the BWOs includes:

- Ensuring a timely and guaranteed water supply to water users in accordance with ICWC-established limits for water intakes from transboundary water sources. Control over releases to the deltas and the Aral Sea according to established volumes, as well as operative control over limits, interstate reservoir operation, and water quality.
- Development of plans for water diversions by main water intakes, reservoirs, and cascade operation regimes; preparation and coordination with ICWC of water limits for all water consumers in the Amu-Darya and Syr-Darya basins.
- Creation of automatic control systems for water resources management in the Amu-Darya and Syr-Darya basins; organization of measurements of the main water intakes, and provision of the required devices.
- Performance and monitoring, together with Hydromet services, of measurements on border points to ensure accurate accounting of transboundary river flow for the purpose of balancing allocations.
- Implementation of complex reconstruction and technical operation of hydro-structures, head water intakes, inter-republic canals, and automatic control systems.
- Research, design, and construction of new water structures, and reconstruction of existing structures, which are under the BWOs' administration.

The SIC of the ICWC is responsible for preparing all the technical, institutional, financial, and legal proposals in close cooperation with ministries and members of the ICWC. Those proposals should address the improvement of general activities in terms of water use and environmental sustainability, and should then be approved at ICWC meetings and submitted to IFAS.

In addition, the SIC provides the ICWC's organizations with information, maintains international exchanges, prepares and implements technical and scientific programs of regional importance, handles and updates the regional database, issues bulletins and ICWC publications, and supports the ICWC Training Center. The SIC is responsible for preparations for ICWC meetings.

The 1992 agreement provided that water allocations should be based on "existing uses of water resources" and that the two river basin agencies (BWOs) should continue to perform basin management functions subject to control by the ICWC. Subsequently, the ICWC agreed that the 1992 agreement should remain in force until a *Regional Water Management Strategy* had been formulated that responded to new realities and which outlined more objective mechanisms and principles for water allocation and rational use.

3. Lessons learned on transboundary level

As it is clear from all the above, water resources in the region must be managed in complex conditions, which originated from two opposite challenges. In terms of the first, there is a range of factors:

- There are common ethnic, religious and customary frameworks in all states and nations in Central Asia. Communal activity in the Soviet period stimulated water saving, cooperative water use, and conservation of water, and inculcated the understanding that we can survive in these problematic conditions only through collaboration and cooperation.[2] A deep respect for water and a view of water as the framework of life (as in the old proverb "water means life") promote improvement of water resources and their quality.
- There is the political will to follow the course indicated by these views.

- The close collaboration of water professionals within the ICWC has produced a proper "Aral Sea spirit," which is sometimes lacking in many water related organizations, water users and individuals. Such a spirit has promoted friendship and respect, and led to understanding of the need for mutual solutions.

Those three factors have enabled the water management bodies of the five countries not only to execute properly their obligations (water regulation, delivery, allocation, and operations), but also to create an institutional platform for collaboration in the form of the ICWC and its executive bodies (BWOs, SIC, and Training Center). This platform allows capacity building and the involvement of a great many water specialists in negotiations about future development. The achievement is that the whole course of the actions of the Soviet Government during the last ten years of its existence, together with the past ten years of independence, have made it possible to organize a smooth transition from the command style of water management to new and more democratic water collaboration on a regional basis (see Figure 2 above). The results of this work were demonstrated at the Jubilee Conference of the ICWC in Almaty (February 2002), which underlined the following principal results of the Commission activity:

- Conflicts in water management, operation, and allocation among the countries of the region have been avoided.
- Thirty-two meetings of the Commission have been held, and have determined all activities undertaken by the ICWC and its bodies.
- A range of important legal, financial, and institutional proposals have been prepared and submitted for consideration by governments of the states, defining the principles of interaction on water issues. Two of these have been signed by the heads of state as international agreements.
- The volume of water used in the region has been reduced from 110 to 103 km^3 annually.

In terms of the second, contrasting challenge, three weaknesses should be taken into account:

- Population growth and adverse economic conditions are the two principal destabilizing factors that have made it difficult to improve the water situation, and simultaneously make it necessary to solve the problems with low cost (mostly organizing and economic) methods.
  Water, land, and mineral resources are distributed inequitably among the states. On the one hand this initiated a tendency to "hydroegoism," while on the other it was argued that there was only one way to guarantee survival and future development: close cooperation, collaboration, and the creation of a cooperative Central Asian market for food and agricultural production (perhaps together with Russia).
- Some local and sectoral interests, aspiring to be the "nouveau riche" in the new economic market (sometimes a very erratic market), have speculated in water as they have in oil, gas, and fuel. This has created problems and put obstacles in the path of collaboration, but society needs to make such economic activity unviable.

As a whole the ICWC has managed all the complex situations of water supply and provision even during dry years without conflicts; however, in view of probable restrictions on options for the future, management procedures are not properly adequate or all-embracing. Let us list some of the obstacles to the functioning of ICWC executive organizations, particularly the BWOs:

- Several headworks have not been transferred to the BWOs' authority. This complicates water allocation. Moreover, the ICWC's decisions on water allocation are not always carried out everywhere.
- Major hydrosystems with power stations and reservoirs are under the jurisdiction of the basin states, and the latter quite often plan the operation of reservoirs without

considering the ICWC operating regimes for cascades.

- There is poor coordination between hydrometeorological services and BWOs regarding the accuracy of flow forecasts and water accounting. The lack of calibration for structures and gauging stations decreases the accuracy of water accounting.
- The Syr-Darya and Amu-Darya river beds are the property of the basin states. Thus the BWOs' claims to be responsible for monitoring river water quality have remained idle and unrealizable declarations.
- The historically created command area of BWO "Syr-Darya" (up to the Chardara reservoir) does not allow it to organize rational water use in the zone from Chardara to the Aral Sea; moreover, it is difficult to obtain reliable information about the use of Syr-Darya water within this zone. In practice the BWO is unable to supply the Aral Sea and its coastal zone, which are more than 1,000 km from the boundaries of its command area, with the quantities of water stipulated by the ICWC.
- The ICWC does not control schedules and amounts of groundwater extraction, or of recycled water disposal. Similarly, it has no control over the quality of natural surface, recycled, and groundwater resources.
- The protected zones of transboundary rivers have not been specified or officially transferred to BWO authority.

Though there are slightly different views on the actual situation and suggested national management approaches, everyone can see common shortcomings in the former and current institutional structure of the water economy and irrigated agriculture under transition to the market economy. Those are as follows:

- The water sector at the national level in its present form chiefly represents the interests of agriculture. National water organization needs to represent equally the interests of irrigation and (particularly) hydropower, and set priorities for water supply, water storage, and similar measures.
- The administrative principle in the water sector and irrigation creates local pressures from provincial and district administrations for the principle of equal water supply to all water consumers.

  From the initiation of water management and irrigation projects up to their implementation, relevant decisions are made only by state agencies with no input from current or future water users. As a result, we have a situation where the costs of irrigation systems and water structures, which are transferred to the responsibility (full or partial) of water users, cannot be recovered during their operation. Such situations are found in the cases both of salinized lands and of large water lift systems, where the costs of drainage, maintenance, and water lift cannot be covered by income from irrigated agriculture.
- The policy of transferring all operation and maintenance costs to water users depresses the maintenance system and simultaneously complicates issues related to the development, rehabilitation, and upgrading of irrigation systems. The previously most advanced systems (lined canals, flumes, subsurface and vertical drains) are now past the normal limits of their working life. However, their renovation under current conditions is an issue that falls between two stools: the water users, who do not feel they should be responsible for it, and state agencies, which do not address it pleading a lack of finances.
- In legislative and financial respects, issues concerning the distribution of responsibilities between water users and state budgets in all countries are vague and unclear. A common belief prevails that the governments should not shoulder an increasing share of the financial burden, but this neglects the fact that the decline in irrigation and water saving efficiency can cause productivity losses and a serious decline in the combined efforts of agricultural producers, as well as social harm. These facts pose a grave danger to the states, and even raise the possibility of social disruption, in view of the resulting

decreases in national income and tax returns.

4. Current state of water management in states of the region

Differentiation of development trends in Central Asian states during transition period has evoked discrepancies with regard to current state of water management and irrigated agriculture in various countries of the region. At the same time, there are some specific features common for most of the states:

- Involvement of all countries in processes of privatization and re-structuring of water management in diverse forms with irrigated farms varying in size from 0.2-1 ha in Kyrgyzstan up to 5–100 ha and even more in Kazakhstan;
- Retention of large cooperative and communal farms in some countries (Tajikistan, Turkmenistan, Uzbekistan);
- Establishment of WUA in all places (except Turkmenistan);
- Universal acceptance of IWRM as a general-purpose instrument and means to improve effectiveness of water use;
- Lack of appropriate attention to drainage systems resulting in their deterioration, breakdown, increase in salinity of salt-affected lands, decrease in crop yields and land productivity;
- Scanty capital investments in improvement of water application technology, renovation of irrigation and in sustaining all the systems in working condition.

There are the following major discrepancies between water policies in Central Asian countries:

- Different approaches to "*governance – management*" relation, which show up in various forms, but first of all, in distribution of income generated in agricultural sector between farmers and the State budget – this coupled with State subsidies in agriculture determines efficiency and motivation of farmers' activities, their and WUA's business solvency, ability to invest money in land reclamation (the best situation in Kazakhstan and Kyrgyzstan);
- The extent, to which the State participates in reconstruction and development of irrigation and drainage systems, in rendering support to WUA (the levels of such support are different in Kyrgyzstan, Kazakhstan and Turkmenistan);
- Attitude to water conservation and water saving technologies, provision of incentives;
- Promotion of public participation, capacity building and training of farmers, managerial staff of WUA and water management organizations.

Of great importance is willingness of water management organizations (WMO) to analyze water use practices, with purpose of putting it in order and attracting reserves. Formerly, the strict system of water management had been for 50-60 years of Soviet rule responsible to large collective and state farms for providing timely and guaranteed water delivery. Nowadays thousands of small farms owners have found themselves at the very end of a long "staircase" of hierarchy, along which water descends passing through all the steps "the basin – sub-basin (national) – system – canal – WUA – a farmer" (Fig. 2). It is a long way, indeed, – the way of multi-step interests, caprices, and egoistic claims, at times unbelievable developments that the end user is to endure. But the crop yield depends on exactness of water delivery (at proper time and in needed amounts), on methods and quality of delivery. Staff members of WMO and local authorities must realize how suffering is the fate a farmer, who is now turned out to be dependant on numerous obstacles; they must remember that it is the farmer, who feeds all of them!!!

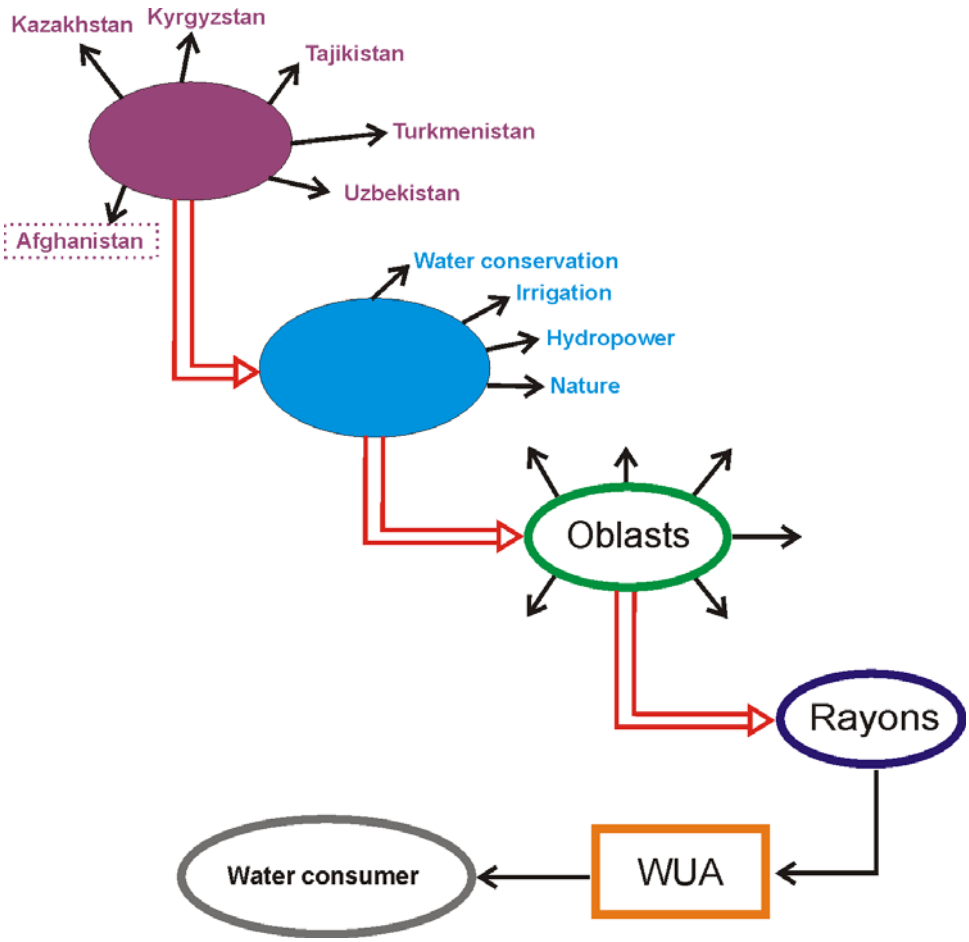


Fig. 2

As is commonly accepted, water users are satisfied with water delivery, provided that these services are stable and timely; delivered water is of required quality and distributed uniformly with regard to each water application. As to WMO, its performance is considered to be satisfactory if the volume of water withdrawn from the source does not exceed the amount of evapotranspiration of all crops by more than 20%.

How do the things look in reality? The total amount of water delivery in some irrigation systems exceeds evapotranspiration by two times!!! This is the result of our poor water management that tolerates overuse and excessive watering in one place and concurrently water scarcity in another – thus leading in both cases to crop yield losses.

The major causes for this state of things are:

- Outdated norms of water use oriented on certain indices calculated for an average year, average soil and hydro-geological conditions within the given area of water duty, which do not reflect real demands of crops for water;
- Water management, which is oriented on meeting ill-founded demands for water, instead of managing these demands;
- Lack of dynamic water use plans adjusted to actual conditions of a specific year. The present plans are calculated with regard to an average year, average crop-pattern and average soil conditions and this is typical for both upper and lower levels of management hierarchy;[*]
- Overestimated demands for water and too high water use quotas, especially at upper and middle reaches, that result in water scarcity at lower reaches and neglect of ecological demands of Nature (deltas, rivers proper, etc.);

[*] Water use during a low-water year differs from average long-term volumes and the latter from a high-water year by 1200 … 2000 m^3/ha!!!

- Absence of water distribution systems in WUA; lack of uniformity and constancy in water use with regard to each user; inability of WMO to maintain control over water distribution between water outlets and ensure equitable reduction of water delivery induced by water scarcity;
- Disregard of necessity to use differential approaches while determining water delivery terms in the process of water use planning;
- Inability of water management professionals to apply mechanisms of maintaining concurrence in water delivery and use at such levels as "farmer - group of users - WUA" and then "WUA - canal";
- Neglect by WMO staff members of necessity to stabilize water delivery through distributor canals of the second order, at least during some base period (decade);
- WMO staff members lack tangible incentives for inducing farmers to save water and, even vice versa, for enforcing them to intake all allotted water – otherwise, WMO would not get payment for their services;
- Inadequate attention to maintaining systems and their refurbishment;
- Inadequate attention to usage of water from alternative sources (return waters, aquifers, etc.).

The major part of these problems may be solved by implementing principles of IWRM throughout the region.

4. What is IWRM?

We regard IWRM as a system of management (in contrast to GWP's suggestion to consider IWRM as a process, Torkil Clanch-Clausen, 2002), which is based on reciprocity of all practicable resources of water (precipitation, surface flow, subsurface and return waters) and related land and other resources within definite geographic boundaries. This system is designed to interlink various sectors of water use and nature management, hierarchical levels of water delivery and water use, as well as to involve all water users in processes of decision-making, planning, and financial support for the sake of meeting the demands of Society and Nature in a sustainable way.

The given system of management provides a steady basis for a joint organization that incorporates all stakeholders with the purpose of attaining determined objectives. The set of functions performed by this organization includes designing and improving proactive mechanisms of response to dynamic changes in water resources use and development with special emphasis on continuous institutional self-perfection and progressive evolution. While the processes of self-perfection and capacity build-up adjust themselves within the system to changing environment, the initial objectives and principles defined at the inception phase of formulating organizational framework remain stable.

What does the IWRM integrate? This system of management incorporates:

- All water resources and demands for water - irrespective of water sources and sectors using the resources;
- Issues of water quantity and quality;
- Water use at upper and lower reaches;
- All stakeholders, including water users, WMO, users of natural resources, economists, local authorities, NGOs, and others, their potential, human/institutional resources, and interests;[*]
- All levels of water hierarchy regulating water demands in the "down-to-top" mode and applying water use limits in the "top-down" chain of command within hydrographic boundaries;
- Water and land management, especially irrigation and drainage;
- Interests of Society (economics) and Nature;
- Costs, expenses and benefits at the level of both – water users/managers and State/Society.

[*] Integration of interests concerning the Basin and each country is of great importance as they apply to transboundary water sources.

Proceeding from these deliberations, we have determined combined criteria of IWRM as – *attainment of optimal total water use productivity, which is derived (by algebraic formula – plus/minus) depending on specific socio-economic and natural features and taking into account impacts of human interventions within (and beyond) the geographic boundaries.* The definition implies both direct and indirect costs, benefits and consequences.

This approach allowed us to work out the Scheme of Interaction Between Levels of Management Hierarchy – based first of all, on the organizational structure (Fig. 3), which strictly maintain vertical and horizontal links of the hierarchy by management vectors: - participatory public governance engaging all stakeholders (Basin Public Council, Systems, WWC, WUA Board); - executive bodies (BWO, System/Canal Administration, Management of WUA). Vertical coordination is carried out through:

- Collective membership of the lower hierarchical level representatives in public/communal governing bodies of higher levels; and
- Flow of fees and payments for water use/services, and charges for water as a resource as well as for land reclamation measures carried out with application of relevant data base, information systems, and sets of models pertinent to water/land resources and irrigation/drainage.

With the purpose of providing necessary scientific support for implementation of IWRM principles, SIC ICWC has offered to apply the set of management models (based on GIS and RS technologies) enabling to interlink numerically various technical and economic parameters of water/land use and evaluate resources. The models allow specifying resources availability and *demands* and identify the ways how to better satisfy common needs of water users – stability and uniformity of water *supply*.

The set of models opens with the Model of Water Use (ISAREQ), which allows considering all types of water resources: precipitation, surface, return waters and groundwater recharge. As to land resources, it takes into account field and farm productivity (reflected in formatted passports). These data are interlinked vertically with non-agricultural water demands (water supply for population, industrial use, etc.), efficiency coefficients and operation of drainage. All these in combination with variables reflecting fluctuations of precipitations, water availability in the given year and forecasts of their changes allow selecting feasible ways of interrelated management under control of public/communal segments of water hierarchy, as well as identifying appropriate methods of water use and irrigation, mutual procedures of considering water and land issues.

But along with the above stated, improvement of water management needs key instruments promoting such principles of regulation, which are based on technological innovations, institutional development and aimed at providing tangible and financial support to all actors. These problems still require additional research and revision. They constitute only a part of general scientific and modeling knowledge base of IWRM to be elaborated in future works, which I hopefully expect will get further development and financial support.

Conclusion

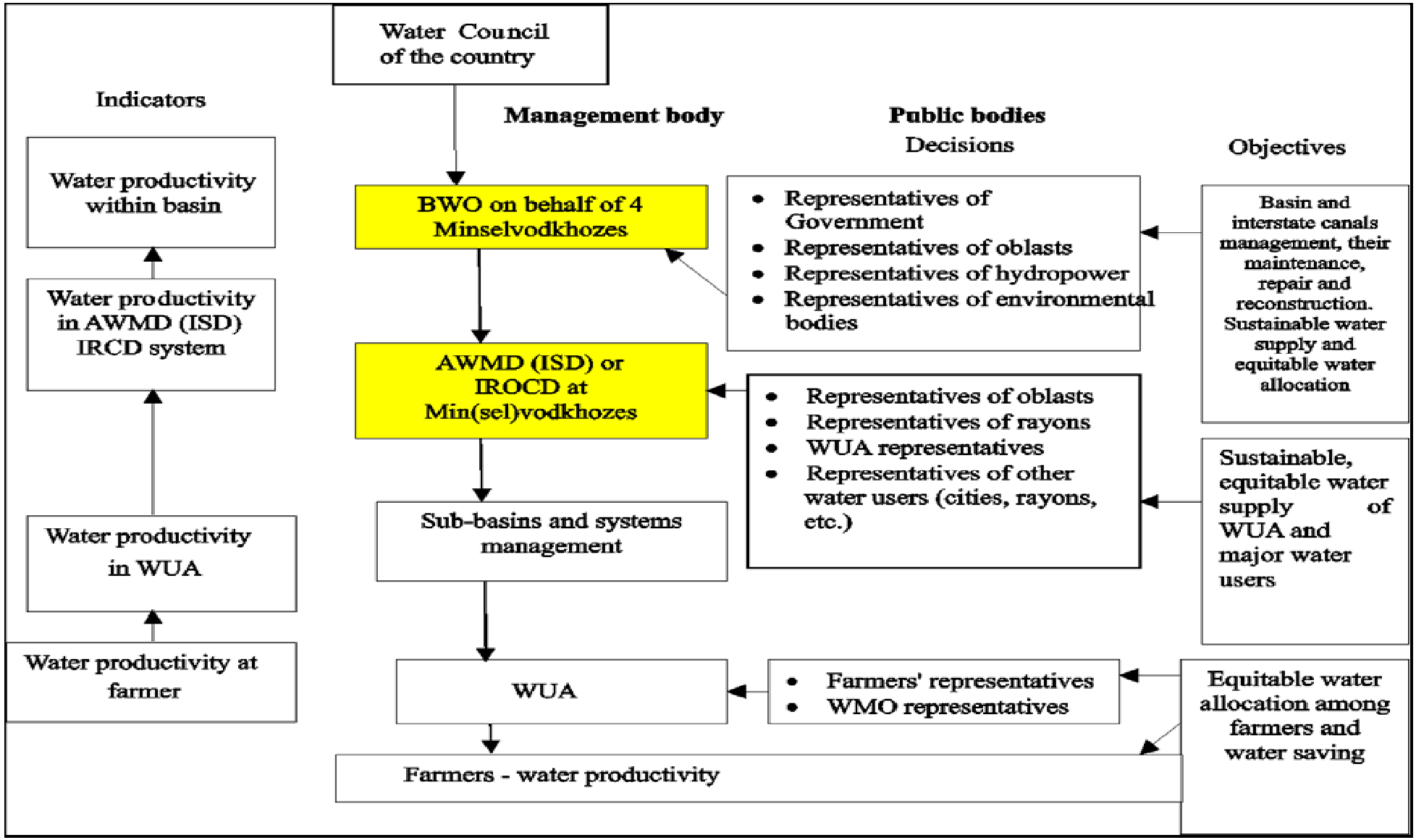
Broad implementation of IWRM should cover many types of activity and involve huge quantity of stakeholders. From this point principal directions of this movement will include:

<u>On the intestate level</u>

- Reassessment of present legal and economic framework of collaboration;
- Implementation of SCADA system;
- Organizing of Basin Water Council with participation of principal water community, provincial organization, environmentalists and so;
- Mutual management of surface, return and ground waters;
- Integration of hydrometservises and water mangers;
- Management of water quality and ecological flow.

On the national level

- Public participation on the all levels of water hierarchy;
- Development of transparent information system;
- Implementation of extension Services WUAs and waterusers;
- Integration irrigation and drainage;
- Implementation of increased block payment system;
- Broad training of water mangers and waterusers;
- Water saving program;
- Broad social mobilization.


Water Council of the country
Indicators
Management body
Public bodies
Decisions
Objectives
Water productivity within basin
BWO on behalf of 4 Minselvodkhozes
Representatives of Government
Representatives of oblasts
Representatives of hydropower
Representatives of environmental bodies
Basin and interstate canals management, their maintenance, repair and reconstruction. Sustainable water supply and equitable water allocation
Water productivity in AWMD (ISD) IRCD system
AWMD (ISD) or IROCD at Min(sel)vodkhozes
Representatives of oblasts
Representatives of rayons
WUA representatives
Representatives of other water users (cities, rayons, etc.)
Sustainable, equitable water supply of WUA and major water users
Water productivity in WUA
Sub-basins and systems management
Water productivity at farmer
WUA
Farmers' representatives
WMO representatives
Equitable water allocation among farmers and water saving
Farmers - water productivity