Financial and Economic Instruments

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Financial and economic mechanisms are the most important tools for supporting the activity and development of any economic sector or enterprise. At that, the efficiency of their activity mainly depends on how these mechanisms were correctly selected and used. Undoubtedly, this refers to the water sector in the field of both operation and development including new construction, rehabilitation, nature protection and other aspects. At the same time, in the water sector these mechanisms also play an important role of regulating water demand and promoting the saving of water resources.

Unfortunately, during the Soviet period the economic mechanisms and financial system have suffered from the certain one-sided approach. The governmental financing of the water sector at all levels of the water resources management hierarchy up to the farm level did not create the incentives for saving water and funds. While under planning and constructing water infrastructure, the system of economic indicators ("a profit against costs" and "cost recovery" that are similar to such indicators as the NPV and IRR in the western practice) was used for evaluating the feasibility of constructing those or other waterworks, the method of "planning based on reached results", with some corrections depending on development trends in the national economy, has dominated in the field of O&M. Economic indicators were mainly used under designing and very rarely under evaluating the reached results, basically under auditing. Insufficient attention to the actual efficiency of construction, inability to use completely economic mechanisms in the process of O&M, the lack of record keeping of financial responsibility of water users under different conditions, ignoring of the environmental profits and losses have resulted in many shortcomings of water resources management in the former Soviet Union including Central Asian republics. At the same time, the level of financial support of the water sector was considerably higher.

In spite of the lack of the integrated mechanism of planning operational costs and investments in the practice of water management and financial organizations, the upgraded system of standards on O&M of irrigation and drainage systems has provided better financial status of the water sector.

Trends of technical and economic indicators of the water sector in three Central Asian countries (Uzbekistan, Kyrgyzstan and Tajikistan) over the last twenty years (in the Soviet period since 1987 until 1991 and in the post-Soviet period since 1992 until 2006) are given in the table below.

This table shows that in the Soviet period the government spent considerable funds for O&M and development of water infrastructure (from 200 to 325 USD/ha) under the ration of O&M and investments into development of water infrastructure – 39.2% and 60.8% respectively, on average.

After independence, abrupt drop in new construction and even reducing irrigated areas took place in Kyrgyzstan and Uzbekistan, which were accompanied by drastic reducing of operational costs – by 60% in Uzbekistan, ten times in Kyrgyzstan, and a few times in Tajikistan. However, the indicators of Uzbekistan do not reflect the fact that expenditures for power make up about 70% of all operational costs; although formerly they did not exceed 20%. A situation related to capital investments much worse; since investments in developing water infrastructure were reduced in many times.

Table 5. 36 Technical and Economic Indicators of the Water Sectors in Central Asian Countries

No	Indicator	Units	Averaged over the periods:			
			1987 to 1991	1992 to 1996	1997 to 2001	2002 to 2006
	Uzbekistan					
1.	Irrigated area	000' ha	4141.9	4219.4	4228.9	4209.3
2.	Total water withdrawal	billion.m3	48.2	52.4	52.8	56.4
	Including for irrigation	billion.m3	42.1	46.1	46.3	48.8
	% of total water withdrawal		87.3	88.0	87.7	86.5
3.	Expenditures for the water sector, in total	mln. USD	1347.7	413.5	333.9	389.1
	Including O&M of water infrastructure	mln. USD.	527.7	410.7	322.3	321.4
	For development	mln. USD.	820	2.8	11.6	67.7
	Indicators per unit area (ha)					
	Water withdrawal for irrigation	000' m^3/ha	10.2	10.9	10.9	11.6
	Expenditures for the water sector	USD/ha	325	98	79	92.4
	Including O&M of water infrastructure	USD/ha	127	97.3	76.2	76.4
	For development	USD/ha	198	0.7	2.8	16.0
	Kyrgyzstan					
1.	Irrigated area	000' ha	434	414	405.5	401.6
2.	Total water withdrawal	mln. m^3	4936.5	4882.3	3676.6	3632.7
	Including for irrigation	mln. m^3	4694.0	4673.5	3536.1	3512.3
	% of total water withdrawal		95.1	95.7	96.2	96.7
3.	Expenditures for the water sector, in total	mln. USD	87.2	41.7	2.61	4.88
	Including O&M of water infrastructure	mln. USD	87.2	22.4	1.97	4.18

No	Indicator	Units	Averaged over the periods:			
			1987 to 1991	1992 to 1996	1997 to 2001	2002 to 2006
	For development	mln. USD	–	19.3	0.64	0.7
	Indicators per unit area (ha)					
	Water withdrawal for irrigation	000' m^3/ha	10.8	11.3	8.7	8.7
	Expenditures for the water sector	USD/ha	200.9	100.7	6.5	12.2
	Including O&M of water infrastructure	USD/ha	200.9	54.1	4.9	10.4
	For development	USD/ha	–	–	1.6	1.8
Tajikistan						
1.	Irrigated area	000' ha	667.2	678.2	676.5	690.2
2.	Total water withdrawal	mln. m^3	11128	11014	11159	11179
	Including for irrigation	mln. m^3	10190	10184	10237	10147
	% of total water withdrawal		91.6	92.5	91.7	90.8
3.	Expenditures for the water sector, in total	mln. USD	148.4	9.56	12.68	53.5
	Including O&M of water infrastructure	mln. USD	45.1	6.82	12.68	53.5
	For development	mln. USD	105.3	2.74	0	0
	Indicators per unit area (ha)					
	Water withdrawal for irrigation	000' m^3/ha	15.3	15.0	15.1	14.7
	Expenditures for the water sector	USD/ha	222.4	14.1	18.7	77.5
	Including O&M of water infrastructure	USD/ha	67.6	10.1	18.7	77.5
	For development	USD/ha	157.8	4.0	0	0

*) Data of the project «CAREWIB» without accounting investments into the hydropower sector and urban and rural water supply

It can be mentioned that in the post-Soviet period, the budget allocation for the water sector was considerably reduced in all three countries, but especially in Kyrgyzstan and Tajikistan where a fee for water use was introduced. The table reflects the expenditures at the expense of the national budgetary funds.

At present, financing of the water sectors in Uzbekistan, Tajikistan and Kyrgyzstan has different sources depending on the resources to pay for water in the agricultural sector. The national budget is the major

source of financing the water sector in the Republic of Uzbekistan. Here, additional sources of financing are the payments being received by the water management organizations for their services to water users, WUAs or other customers related to repairing irrigation and drainage systems or other works in the course of O&M of water infrastructure.

Nowadays, substantial additional sources of financing the water sector in Kyrgyzstan and Tajikistan are the payments for water services to agricultural customers.

The current financing of the water sector in the Republic of Uzbekistan is linked with the pricing policy in respect of major crops (cotton and wheat) cultivated under the state order with purchasing prices that are considerably lower the real market prices. In other words, the established prices (under state orders) include "free of charge" water services.

However, the existing system of financing the water sector in the Republic of Uzbekistan does not allow:

- to establish the mechanism of economic relations between water management organizations and water users and to stimulate saving of financial and water resources;
- to attract water users' funds for financing the water management interventions and to enhance the mutual liability of water suppliers and water consumers under implementing their duties;
- to establish the national water market as a key factor of redistribution of water resources from low-effective water users to high-effective ones and to create the mechanisms of overall and personal incentives of water users and water professionals in saving water; and
- to develop economic incentives for improving the environmental situation under using water resources.

Moreover, the lack of the efficient encouragement mechanism of rational use of allocated funds for financing water-related interventions is also the shortcoming of the existing system of financing. At present, in the system of financing O&M of the public water infrastructure, a share of payments for electric power together with a personnel salary makes up about 80%, and a share of repairing works is only about 20%. Such financing takes place under the current technical status of water infrastructure when a design operational life of 70% waterworks (especially, pumping stations) was exceeded 1.5 to 2 times.

Most of waterworks needed to be reconstructed, and consequently considerable investments are needed for implementing these interventions that are quite capital-intensive. Of course, all these issues should be solved not only by introducing water charging but also by providing the governmental support in the form of direct participation in financing the water sector and establishing the system of preferential crediting and taxation.

The all above said refers to the irrigation network within the former on-farm irrigation system. In the past, financing of the former on-farm irrigation and drainage systems (now serviced by a WUA) at the expense of farms was considerably lesser than financing the inter-farm irrigation and drainage systems by the government (about two times). At present, a share of the WUA's budget for these purposes makes up a negligible amount (from $2.5/ha to $7/ha). Issues of financing WUAs are one of major aspects of the economic mechanism, which will be described below.

The foreign experience of water charging

There is not the overall approach for setting up the payment rates for different categories of water users in the world practice. Practically everywhere, water charging is based on reimbursement of expenditures related to water withdrawal, transportation and distribution among water users, as well as is the factor facilitating the improvement of water resources management and use in the national interests. Water sector's expenditures can be reimbursed in different ways:

- payment for volumes of consumed water;
- payment for water use per an accounting unit (per a person, irrigated hectare etc.);
- payment for water overuse against established limits;
- payment for water pollution;
- sale of water rights (payment for a license);
- a tax that includes a fee for water and water services; and
- a joint-stock right for water.

Practically everywhere, the highest payments for water are observed in the industrial and water supply sectors where a share of water sector's expenditures related to water services is completely paid for. Agricultural water users are in the preferred position because of the government subsidies covering expenditures of the water sector. In developing countries, where the introduction of water charging is at the initial stage, the encouraging arrangements for agricultural water users are being applied in the form of:

- liberalization of agricultural output markets;
- preferential crediting of farmers;
- preferential taxation; and
- involving water users in works that are related to maintaining water infrastructure on the paid base.

The government is completely financing (sometimes with use of local budget funds and financial input of water users) development of the water sector, large-scale construction of water infrastructure and land reclamation works. The following principle general statements can be mentioned:

- most of countries set up a water price for industrial and municipal use taking into account the self-repayment of the systems plus a certain profit share;

- most of countries have introduced the block-incremental system of pricing[1] when *a payment is minimum* for limited normative water consumption, but with the progressive growth of water prices under increasing of water consumption; and

- rural and municipal water supply is mainly self-supporting. Only water supply through the kilometers-long water pipelines can be exception. In this case, the government subsidizes part of expenditures.

A level of subsidies mainly depends on population incomes and institutional types of organizations that supply water and maintain the irrigation systems. According to the review of the International Commission on Irrigation and Drainage (ICID), in 1997, organizations that operate in the water sector all over the world were represented by governmental organizations (44%), community-based organizations (23%), private companies (6.7%) and joint-stock companies (13.5%). Therefore, most of large-scale water infrastructure is mainly maintained at the expense of national budgets; at the same time, some governmental and municipal participation is observed in maintaining smaller waterworks being the private or mixed ownership. On average, the cost of 1m^3 of water in the water supply systems in the developed countries ranges from \$2/m^3 to \$13/m^3. Payments of water users and governmental subsidies under financing investments and operational costs in the water sector are given in Table 5.37.

Table 5. 37 Shared Financing of Investments and Operational Costs in the Water Sector, %

Country	Investment for water sector development		Operational costs	
	Government	Water users and municipalities	Government	Water users and municipalities
Spain	70	30	50	50
France	50	50	0	100
Canada	75	25	50-70	30-50
Japan	100	0	0	100
the USA	70	30	50	50

Table 5.37 shows that a share of the governments ranges from 50% to 100% for investments; and correspondingly a share of water users makes up 25-50%. As regards the operational costs, the governments bear 50 to 70% of expenditures or all operational costs are repaid by water users and municipalities (France and Japan). Indicators typical for some countries are given below:

Israel: under an average production cost of water in the public company "Mehorot" that equals to \$0.35/m^3 to \$0.40/m^3, the differentiated water tariffs are applied: for drinking and municipal needs – \$1/m^3; for industrial needs – \$0.60/m^3, and irrigation needs – \$0.19/m^3. Water use in excess of the established limits is

[1] The tiered block rate schedule

being penalized at the rate of tenfold tariff. The government subsidizes the public company "Mehorot" at the rate $0.20 per each cubic meter of water delivered to the agricultural sector.

The USA: the water tariffs for municipal and industrial water consumers vary from $40 to $2500 per 1000 m3. At the same time, water tariffs for agricultural water users amount to from $19 to $120 per 1000 m3. As a whole, the government spends about $ 1 billion for supporting the water sector including $500 million of subsidies allocated to the US Bureau of Reclamation. The going public of water rights and sale of water stocks are widespread in the USA in the recent years along with an abrupt growth of their price. The practice of the North Colorado Agricultural Water District in Colorado can be an example. In 1980, one stock that provides the right of eternal receiving one acre-foot of water has cost about $1000; in 1990, its cost has raised up to $15,000; and in 2000, its cost has reached $20,000. At the same time, water prices differ drastically over the states and even over counties.

Canada: CAD 5.3 billion[2] from the federal and municipal budgets are subsidized into the water sector, including CAD 2.2 billion for O&M and CAD 3.1billion for development and rehabilitation. Water deliveries for irrigation are paid as a constant fee per one hectare in production. Owners of irrigated farmland pay CAD 110 per one hectare in production, on average.

Spain: a payment for urban municipal water supply amounts to $0.75/m3; rural water supply - $0.25/m3; industrial water supply up to $2/m3; and water supply for irrigation from $0.02/m3 to $0.20/m3. Irrigation and rural water supply are subsidized by the government through its participation in maintenance of river basin organizations and through the municipalities.

Developing countries: in accordance with the review jointly prepared by the World Bank and Asian Development Bank, a share of payment for irrigation amounts to only 5% of revenue in Nepal; 6% in Pakistan; 8% in Indonesia; 9% in Thailand; and up to 26% in the Republic of Korea. There is the typical example of China, where while the industrial sector pays from $0.06/m3 to $0.10/m3, the irrigation sector only $0.008/m3 to $0.015/m3 under gravity irrigation and up to $0.02/m3 under pumped irrigation. Chinese economists consider that the payment for water shouldn't exceed 2 to 4% of gross annual revenue.

At present, the situation in the agricultural sector in Central Asian countries is the following:

Two types of payment for water were established in Kazakhstan:

1. in the form of a tax on each used cubic meter of surface water resources (payment for a resource) - Kaz Tiyna 3.02/m3[3] or $0.00021/m3;

2. in the form of services granted by water management organizations to the agricultural sector – Kaz Tenge 148.65 per 1000 m3 or $0.00105/m3.

[2] CAD – Canadian dollar
[3] The national currency

In Kyrgyzstan, the payment for water by agricultural water users is differentiated over seasons: B

- during the growing season - Kyr Som 30 per 1000 m3 or $0.00069/m3; and
- during the off-vegetation period - Kyr Som 10 per 1000 m3 or $0.00023/m3 (as of 1.01.1999).

Collected fees cover about 40% of O&M costs and a remaining part is subsidized by the government.

In Tajikistan the payment for 1 m^3 supplied to agricultural consumers amounts to Diram 0.6 or $0.00205/$m^3$; for industrial use – Diram 1.2 or $0.00415/$m^3$ (as of 1.01.2004). Expenditures related to pumped irrigation are covered at the expense of budgetary funds - $16/ha, on average.

In Turkmenistan the payment for water delivered to industrial enterprises and other water users amounts to Manat 28.8/m^3. A coefficient of 1.7 is used in case of lifting water for irrigation. Water for irrigation is free of charge within established limits for water use. Water use in excess of the established limits is paid at the rate of threefold tariff.

Introducing the system of water charges has facilitated reducing volumes of water use by 10% in Kazakhstan, 21% in Kyrkyzstan, and 6% in Tajikistan. The main principles of water charging should be the following:

- incentive water pricing to achieve more efficient water use by water users;
- establishing the free market prices of agricultural output, enabling water users to be capable to pay for water services;
- enhancing the responsibility of water management organization for water delivery to water users in proper volumes and in a timely manner; and
- equipping the irrigation systems with advanced water measurement devices for monitoring flow rates.

The following options and phases of the introduction of water charging are possible:

- transition towards water charging is implemented simultaneously over the whole country. In this case, the thorough preparation of legal documents and the irrigation network that should be equipped with all necessary off-takes and gauging stations and matching of the prices of major crops (cotton and wheat) with the system of water charges are needed; and
- phased transition towards water charging, employing the block-incremental (tiered) system of water charges.

The backbone of block-incremental system of water charges consists in arranging three blocks of tariffs for water services:

***The first block**:* a tariff for water supply (per 1 m3) according to the rates corresponding to the advanced technology of water use or, in case of irrigation, according to the rates necessary to meet biological needs of crops. This kind of tariffs (the first block) established for agricultural water consumers has to be covered by the government at the first transition stage because of the difficult economic situation of agricultural producers and the existing policy of pricing in the agricultural sector.

***The second block*:** a higher tariff rate for the amounts of water used in excess of biological needs of crops but within the established limits of water use.

***The third block**:* the highest tariff rate for the amounts of water used in excess of the established limits of water use. Tariffs of this block can be also considered as a penalty for water use exceeding the established limits; and a size of water charges should stimulate water users towards saving water, including the introduction of state-of-the-art irrigation methods. The penalties for unproductive discharges of irrigation water and unauthorized water diversion from the irrigation canals have to be also considered here. The system of penalties for the wasteful way of water use may be effective only when the size of penalty will be "painful" for the water user's budget. The system of penalties should also cover the issues related to water pollution.

As was mentioned before, in most countries all over the world, the payment for water use is established based on partial or complete reimbursing the operating costs taking into consideration the capability of water users to repay these costs.

Principles of Establishing Tariffs for Water Services

Tasks to be solved under transition towards water charging:

1. Developing the mechanism of financing the water sector and land reclamation projects based on the market principles and parallel establishing the basis for sustainable operation and development of the water sector;

2. Forming the economic relations in the frame of the water sector that create the enabling environment and direct and indirect incentives for saving all resources and reducing unit costs under water governance, O&M and development of water infrastructure; and

3. Water charges as the incentive and priority for saving of water and water resources conservation.

Pricing of water and land reclamation services

In the water sector under establishing the mechanism of pricing, it is necessary to differ the following:

- the price of water as a renewable natural resource;
- cost of services related to water delivering and distribution;
- operating costs for O&M of drainage systems;
- costs for both simple and extended reproduction of the water sector and its assets;
- costs for compensation (or prevention) of damage possible under different kinds of water use, especially in the environment sector; and
- difference in costs for land reclamation activity on lands belonging to different natural fertility classes.

The pricing factors and the state policy

Undoubtedly, the natural aridity affects water demand in Central Asian countries. At the same time, the state policy predetermines the tendencies of developing the water sector and hence forming water deficit (or its absence).

The former USSR's policy aimed at developing the irrigated farming to meet the national needs in raw cotton and also the development of the Central Asian region oriented on production of raw materials have resulted in the man-made deficit of water resources, although the integrated development aimed at profound processing the total output of the agricultural sector (as, for example, in Japan or South Korea) would prevent the arising of this deficit. In addition, target investments and the protectionist policy in the water sector (as in the USA and other developed countries all over the world) have created the large-scale water complex consisting of costly engineering irrigation and drainage systems that were not designed to be self-supporting. Most of these systems built in recent years had quite low economic indicators. Hence there are complexities that should be taken into consideration under transition towards water charging, namely: diversity of systems being built over the centuries that at present are rehabilitated and developed, creating the extreme differentiation of production costs and water productivity, as well as causing the complicated consequences of different social and ecological factors.

At that, it is necessary to keep in mind that investments for forming capital assets were made in the different periods (during tsarist and Soviet periods and nowadays in the period of transition towards the market economy).

The introduction of water charges requires pricing of water, which, to a considerable extent, depends on operational costs for O&M of water infrastructure, however, nobody never asked and does not ask now whether water users agree with a price of supplied water or not. Hence, sometimes we face the systems where costs for water supply are higher than the increase in water productivity. However, the government compels the land users to participate in maintaining and developing the irrigation practice to solve social problems related to the employment and supplying foodstuffs to the population.

At present, there are considerable differences in approaches to the problem of financing the water sector in different countries: in Turkmenistan, the government completely finances the national water sector; in Kazakhstan, Kyrgyzstan and Tajikistan, water users cover mainly O&M costs. The position of Uzbekistan is quite cautious for the time being, although water charging was introduced in all economic sectors with the exception of irrigated farming.

Table 5.38 Financial Input of the Governments and Water Users in O&M of Irrigation Canals, %

#	Country	Government					Water users				
		2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
1	Kyrgyzstan(Som)	16	25	36	19	45	84	75	64	81	55
2	Tajikistan (Somoni)		10	11	12	9		90	89	88	91
3	Uzbekistan (Sum)		100	100	100	100	-	-	-	-	-

Shares of governments and water users in financing O&M of the former inter-farm systems (now the systems that serve several WUAs) are given in Table 5.38. It is obvious that 90% of financing O&M of irrigation systems in Tajikistan is incurred by water users, and as a result, the farms hardly cover these considerable expenditures that amount to 16% of their revenue. In Kyrgyzstan, a share of the government varies from 16% to 45% and cannot provide the sustainability of financing.

Models of tariffs for water services

There are three kinds of tariffs for water services:

- volumetric tariff (per cubic meter of delivered water);
- fixed-area tariff (per a hectare under irrigation); and
- combined two-part tariff (per cubic meter of delivered water and per a hectare under irrigation).

The method of volumetric pricing has three options: i) a fixed price that is independent of a volume of water consumption; ii) a subside price that is reducing with the increase in a volume of water consumption; and iii) an incremental price that is rising with the increase in a volume of water consumption. The last option is usually used under conditions of water deficit (California, some regions of India)

One of options of the incremental tariff for water is a penalty for water used in excess of the established limits of water use.

Factors Conditioning the Pricing

In principle, there are not considerable divergences in factors of pricing, but some aspects should be kept in mind:

- changes in water availability over years that require establishing the insurance fund;
- it is obligatory to take into account water as a resource under establishing the mechanism of water charging if a task of reproduction of water resources is set or under assessing a new investment project;
- a tariff should take into account depreciation in case of simple reproduction (it is necessary to keep in mind that sometimes under the current economic policy the depreciation rates are erroneously underestimated resulting in depreciation of the water sector's assets);
- assessment of repairing costs under calculating tariffs should be made according to the norms rather than actual data (it is necessary to keep in mind that the policy of pricing on the basis of the reached level is always fraught with deteriorating the existing status of O&M); and
- assessment of normative profit.

Analysis of changes in annual water availability is based on evaluating the variability of water availability from year to year under relatively stable water demand in both the agricultural sector and other economic sectors. Under establishing tariffs for water delivery, calculating the cost of water delivery is made for a year with the 50% water availability. Therefore, a cost of water delivery will be different in years with different water availability. For example, in years with 75%, 90%, and 95% water availability, a cost of water delivery will be higher because a volume of water supply will be lesser and a level of conditionally-constant flow rates will not change with the alteration of water supply volumes.

To provide the sustainability of the water sector it is necessary to take into account this factor in the price model in the form of the insurance fund. A size of the insurance fund is computed according to the following procedure: a sum of conditionally-constant costs per 1 m3 of water supplied at off-takes is calculated and then multiplied by a value of the deficiency in water supply in a dry year in comparing with a year with mean annual water availability.

As known, under conditions of budgetary financing of the water sector, depreciation charges on capital assets were not being assigned. Under water charging and the need in reproduction of capital assets due to the self-repayment of costs, depreciation charges on capital assets are assigned. However, prior to specifying depreciation charges, it is necessary to receive evidence that the cost of capital assets corresponds to its real value. This can be done by means of reappraising capital assets.

In Kyrgyzstan the water management organizations have assumed 8% of water services costs as a scheduled profit under establishing tariffs. Prior to transition towards water charging this value of the scheduled profit can be accepted.

Without sufficient justification many specialists propose to assume a scheduled profit as 12% of costs of production. However, any percentage of a scheduled profit with respect to a production cost of water services will be disputable if to proceed from the assumption that the extended reproduction of irrigation and drainage assets will be provided at the expense of sectoral incomes. A high capital intensity of construction of new waterworks and water reservoirs, development of virgin lands, and rehabilitation of irrigation and drainage systems all over the world has forced the governments to subsidize the water sector even under conditions of developed infrastructure and high productivity.

Pricing for water services should base on optimal satisfaction of requirements inherent in transition towards water charges:

- a paying capacity of water users;
- stimulating of the public perception of water resources and water infrastructure as personal property, as well as of the responsibility for their sustainable development; and
- enabling environment for introducing the market mechanisms.

Pricing for water services should also base on the fact that a normal price provides for the "normal water quality." If a water quality does not meet primary standards, water price should be reduced. Under certain conditions it is necessary to pay "incentive bonuses" to water consumers for using brackish water i.e. drainage water, water abstracted from drainage tube-wells etc.

As yet, *three hierarchical levels can be distinguished in the framework of water management organizations.*

Level I – the inter-republican level: Basin Water Organizations (BWO) "Syr Darya" and "Amu Darya" that assess water resources forming within the basins and distribute them among consumers in the aggregated manner (for different economic sectors) through republican and provincial water authorities. Expenditures at this level can be referred to the category of water charge "payment for a resource", and have not to be taken into account in tariffs for water services being granted to water users.

Level II – the national level: water allocation to provincial water authorities taking into account local water sources. Under establishing differentiated tariffs for each province, expenditures related to water services are aggregated in the manner that allows referring part of expenditures incurred at the inter-provincial level to the municipal budget in proportion to water volumes diverted by this province.

Level III – the level of intra-basin systems and canals where the finite output of the national economic sectors is produced under using services on conveying and distribution of water, land reclamation and repairing water infrastructure.

Models of tariffs for water services can be presented as follows.

For non-agricultural water users, a water price (S_{nau}) can be computed using the following formula:

$$S_{nau} = \frac{\sum U_w + \sum C_f + \sum P_p}{W_{tlwu}} + P \text{, Sum/m}^3, \qquad (5.1)$$

where:

$\sum U_w$	= total annual operational costs of the water sector related to water supply, Sum;
$\sum C_f$	= insurance fund, Sum;
$\sum P_p$	= profit per water volume supplied, Sum;
W_{tlwu}	= total limit of water use, m3;
P	= amount for extended reproduction per 1m3, Sum/m3.

The total annual operational costs of water management organizations (U_w) related to water supply are made up of costs at all existing hierarchical levels and represent the sum of annual costs including a salary of personnel, social insurance tax and unemployment insurance tax, expenditures related to network cleaning, power supply, depreciation charges on capital assets (for full replacement), a sum of capital and running repairs, transportation costs and other expenditures.

A one-part (volumetric) tariff for agricultural water users (S_{ir}) can be computed using the following formula:

$$S_{ir} = \frac{(\sum U_w + \sum Cf) * K_{li} + \sum U_{lr} + \sum P_{wu}}{W_{ILW}} \text{, Sum/m}^3, \qquad (5.2)$$

where:

K_{lr}	= share of the limit for irrigation that equals to the ratio of W_{lwi}/ $W_{lio;}$
$\sum U_w$	= total annual costs of the water sector, Sums;

W_{lwi}	= limit of water withdrawal for irrigation, m^3;
$\sum U_M$	= total annual costs of water management organizations for ameliorative works, Sums;
$\sum P_{wu}$	= normative profit of agricultural water users, Sums;
W_{lio}	= limit for irrigation at off-takes of water users, m^3.

Models of tariffs for water services being granted to different water users can be considered according to different options.

Let us consider a two-part tariff for agricultural water users. The first part represents a payment for each hectare under irrigation, and the second part is a payment for each cubic meter of water delivered.

The first part includes only costs related to land reclamation constituent with an appropriate share of profit; and *the second part* represents all other price-forming constituents with an appropriate share of profit.

I. Formula for computing a payment for each hectare under irrigation:

$$S_{ha} = \frac{\sum C_{lr} + \sum P_{lr}}{\omega}, \text{ Sum/ha,} \qquad (5.3)$$

where:

$\sum C_{lr}$	= total costs related to land reclamation constituent (a prime cost);
$\sum P_{lr}$	= profit related to land reclamation constituent;
ω	= irrigated area, ha

II. Formula for computing a payment for each cubic meter of water delivered:

$$S_{m^3} = \frac{(\sum O + \sum C_f) * K_{ir} + \sum P}{W_{wli}}, \text{ Sum/m}^3, \qquad (5.4)$$

where:

$\sum O_в$	= total operational costs related to water supply, Sum;
$\sum C_ф$	= insurance fund related to water supply, Sum;
$K_{пр}$	= share of the limit for irrigation;
$\sum P$	= profit related to water supply, Sum;
W_{wli}	= amount of water limit for irrigation, m^3.

Reimbursement of costs related to water supply to consumers can be provided according to the following proposed way. Covering costs by agricultural water users should be linked with the opportunity to sell their output at free market prices. In addition, agricultural water users should have the opportunity to cover their costs related to irrigation water supply and land reclamation activity at the expense of their incomes being gained under conditions of the financial sustainability.

The case study of the SFC demonstrates the results of establishing tariffs for water services using the proposed models for two options. According to undertaken assessment for the SFC command area, a water price under computing according to the one-part tariff model amounts to 6.65 Sum/m3 ($0.0051/$m^3$); and under computing according to the two-part tariff model, the first part (*a payment for each hectare under irrigation*) amounts to 4,984 Sum/ha and the second part (*a payment for each cubic meter of water delivered*) makes up 5.98 Sum/ha. In the case when the crop water requirement amounts to 7,500 m^3/ha, the costs related to irrigation water supply per unit area (ha) makes up $38.25/ha (7.500 m^3/ha * $0.0051/$m^3$).

Table 5. 39

Computing the Tariffs for Irrigation Water Supply and Land Reclamation Works for the SFC Command Area

No	Indicator	Unit	Amount	Design formula, notes
1	Irrigated area	000’ ha	85.5	

No	Indicator	Unit	Amount	Design formula, notes
	served by the SFC			
2	Total annual limit of water supply (in a year with mean annual water availability)	mln.m^3	841.06	$W_{tot} = W_o + W_{industry}$
	including: water for irrigation	mln.m^3	641.06	W_o - volumes of water for irrigation according to established limits for water use
	water for industrial needs	mln.m^3	200.0	$W_{industry}$ - volumes of water for industrial needs according to established limits for water use
3	Share of irrigation water supply	–	0.762	$K_{ws} = \frac{W_o}{W_{tot}}$
4	Capital assets in the SFC system without drainage facilities	mln.Sum	24,657.7	Shares of the BISAs “Syr Darya-Sokh” and “Naryn-Karadarya” BDSA for the FV, Andijan Reservoir, PSA of Fergana and Andijan provinces
5	Capital assets of drainage systems in the SFC command area	mln.Sum	1,165.6	Share of PHAE in Fergana and Andijan provinces
6	Total capital assets of irrigation and drainage systems in the SFC command area	mln.Sum	25,823.3	P.4 + P.5
7	Total costs of the irrigation sector (TCIS), including:	mln.Sum	4,247.7	TCIS = OC + $DC_м$ = 2768.2 + 1479.5

No	Indicator	Unit	Amount	Design formula, notes
	operational costs	mln.Sum	2,768.2	
	depreciation charges	mln.Sum	1,479.5	$DC_м$ = 24657.7 * 0.06 = 1479.5
8	Total costs of the drainage sector (TCDS), including:	mln.Sum	394.54	Share of PHAE in Fergana and Andijan provinces
	operational costs	mln.Sum	324.6	
	depreciation charges	mln.Sum	69.94	DC = 1165.6 * 0.06 = 69.94
9	Conditionally-variable costs of the water sector in the SFC command area	mln.Sum	1276.16	CVC = power + cleaning = 1217.76 + 58.4 = 1276.6
10	Conditionally-constant costs of the water sector in the SFC command area	mln.Sum	2,971.54	P.7 – P.9 = 4247.7 – 1276.16 = 2971.54
11	Insurance fund	mln.Sum	445.73	IF = P.10 * 0.15 = 2971.54 * 0.15 = 445.73
	including a share of irrigation systems	mln.Sum	399.64	SI_o = 445.73 * 0.762 = 339.64
12	Profit related to the irrigation constituent	mln.Sum	258.94	Pi = P7 * 0.762 * 0.08 = 4247.7 * 0.762 * 0.08 = 258.94
13	Profit related to the land reclamation constituent	mln.Sum	31.56	P.8 * 0,08 = 394,54 * 0,08 = 31,56

No	Indicator	Unit	Amount	Design formula, notes
14	Costs of the land reclamation constituent taking into account the profit	mln.Sum	426.1	P.8 + P.13 = 394.54 + 31.56 = 426.1
	Water tariffs			
15	**One-part tariff for irrigation and land reclamation**	Sum/m^3	6.65	$S_{ir} = \frac{(\sum U_w + \sum Cf) * K_{li} + \sum U_{lr} + \sum P_{wu}}{W_{ILW}}$ $S_{ir} = \frac{(4247.7 + 445.73) * 0.762 + 426.1 + 258.94}{641.06} = 6.65$
16	**Two-part tariff for irrigation and land reclamation:**			
	- a tariff part that reflects a payment for each hectare under irrigation	Sum/ha	4,984	$S_{ha} = \frac{\sum C + \sum P_{lr}}{W_o} = \frac{394.54 + 31.56}{85.5} = 4984$
	- a tariff part that reflects a payment for each cubic meter of water delivered	Sum/m^3	5.98	$S_{m^3} = \frac{(\sum O + \sum C_f) * K_{ir} + \sum P}{W_{wli}}$ $S_{m^3} = \frac{(4247.7 + 445.73) * 0.762 + 258.94}{641.06} = 5.98$

In respect of reimbursing the expenditures related to water supply of consumers the following can be proposed:

Covering costs by agricultural water users should be linked with the opportunity to sell their output at free market prices. In addition, agricultural water users should have the opportunity to cover their costs related to irrigation water supply and land reclamation activity at the expense of their incomes being gained under conditions of the financial sustainability. The international practice shows that water fee usually makes up 5% of gained profit.

Let us review the potential of private farms that grow different crops to pay for water under the conditions of irrigated farming in the SFC command area and the assumption that water fee makes up 5% of profit. Data on the crop profitability and capabilities of the private farms in the SFC command area to pay for water under average and maximum crop profitability are given in Table 5.40.

Table 5.40

Assessing the Capability of the Private Farms in the SFC Command Area to Pay for Water

No	Crop	Crop profitability, $/ha		Water fee, $/ha	Capability to pay, $/ha	
		Average	Maximum		Average	Maximum
1	Cotton	150	420	38.25	7.5	21
2	Cereal crop	160	500	38.25	8.0	25
3	Orchards	700	1200	38.25	35	60
4	Vineyard	1510	2200	38.25	75.5	110

The table shows that the capability to pay for water at the rate of $38.25/ha occurs under average profitability of orchards and vineyards when 5% of profit make up from $35/ha to $60/ha and from $75.5/ha to $110/ha respectively.

Now let us consider the expenditures of the pilot WUAs (the IWRM-Fergana Project) and profitability of farms serviced by these WUAs (Table 5.41).

Table 5. 41

Trends of Costs per Unit Area in WUAs and Farmers' Profits (2003 to 2006), $/ha

Indicator	Year			
	2003	2004	2005	2006
Uzbekistan				
WUA expenditures	3.2	3.3	4.3	4.7
Farming's profitability	48.6	48.4	88.3	107
WUA expenditures as percentage of profit, %	6.6	6.8	4.9	6.3
Kyrgyzstan				

WUA expenditures	2.14	2.44	8.95	2.83
Farming's profitability	365.2	401.0	302.4	288.5
WUA expenditures as percentage of profit, %	0.6	0.7	2.95	1.0
Tajikistan				
WUA expenditures	3.5	2.13	3.43	4.49
Farming's profitability	207.4	32.9	106.8	27.2
WUA expenditures as percentage of profit, %	1.7	6.5	3.2	16.5

As shown, in Uzbekistan, farmers pay for WUA's services up to 5 to 7% of net profit; and according to the world experience this is quite realistic. In Kyrgyzstan, the overall payment of water users to WUAs and WMOs amounts to 5 to 6% of net profit, and this is also rather reasonable. There are absolutely unrealistic payments in Tajikistan (fees collected by WUAs have reached 15% of farms' net profit). However, this payment percentage from net profit is a result of low average revenues of farms serviced by WUAs – 100 to 200 $/ha (only in Kyrgyzstan – 300 to 400 $/ha).

Average and maximum water productivity that was reached on project demonstration fields (Table 5.25) shows that it can be risen without special investments only due to implementing good agricultural practice (the increase in productivity of cotton and wheat almost two times, and correspondingly the growth of net profit up to 420 to 500 $/ha). This means that an average acceptable fee for services of WUAs and WMOs can be at the level of 21 to 25 $/ha in the case of a fee at the rate of 5% from gained profit. A higher fee is possible if the same approach is employed for orchards and vineyards. Here, an acceptable size of fees can be increased up to 60 to 110 $/ha.

What conclusions can be done based on this analysis?

- The government should fix the limiting fee for services of WUAs and WMOs at the rate of 5% of net profit. This fee of farmers, first of all, covers the WUAs' operational costs;
- The government should encourage farmers in every possible way in order to reach higher productivity and profit, and for this purpose to finance O&M of inter-farm water infrastructure providing sustainable agricultural production. In line with the growth of irrigated farmland productivity and profit, the government will start to reduce its share of financing; and
- WMOs have to conclude the agreements with WUAs, and the latter with farmers, which should include the provisions with strict requirements to provide the compliance with the irrigation schedules.

Creating material incentives for water management organizations and water users associations

Matters of creating material incentives for water management organizations (WMOs) and WUAs are quite topical, keeping in mind that water is scarce natural resource. At that, supplying of water to water users in proper time and in proper volumes with appropriate quality requires considerable investments and operational costs. As was mentioned, water supply for irrigation of one hectare in the SFC command area requires about 40 $/ha only for running costs.

What measures should be stimulated?

1. Encouraging the water-saving practice, first of all, in WUAs and private farms should be considered as the most important issue. For this purpose, the special funds ("Water-Saving Fund") should be established in the framework of WMOs and WUAs. Inpayments due to use of water in excess of the allowed maximum should be deposited into this fund in the WMO, and then water users who saved a part of water supplied according to the limits of water use should receive a bonus at the expense of this fund, i.e. the WMO transmits money to the WUA's account to give this bonus that is equivalent to payment for unused water volumes according to established tariffs.

2. As far as the reclamation of irrigated farmland is one of major factors of the increase in water and land productivity, it is necessary to encourage personnel of WUAs and the Hydro-Ameliorative Expedition to improve soil and hydrogeological conditions in farms serviced by WUAs for enhancing the crop productivity. Incentive criteria should be agreed with farmers and WUAs, for example, such criteria as shifting irrigation lands from the category of heavy and medium saline lands into the category of slightly and non-saline lands; lowering watertable and the level of groundwater salt content; improvements in drainage network operation; and rise of crop yields.

3. Well-organized service of water users by WUAs can be characterized by uniform water distribution over private farms in accordance with the established irrigation schedule. Such services promote reducing the number of disputes and conflicts between WUAs and water users and between WUAs and WMOs, and hence WUA personnel also needed to be encouraged.

4. Personnel of WUAs and WMOs should be encouraged both in the case of implementation of planned scopes of repairing works in full and in the case of reducing operational costs.

5. Incentives are also necessary under implementing other measures: i) saving water due to improving organizational and technical efficiency of irrigation canals serviced by WUAs and WMOs; ii) introduction of efficient technologies of water distribution between WUAs and water users; iii) improving of water availability of the irrigation schemes at the expense of use internal water resources, etc.