

Water Management Reforms, Irrigation Management Transfer and Water Rights: Synthesis from Karakalpakistan Case Study

**Iskandar Abdullaev, Murat Yakubov,
International Water Resources Management Institute (IWMI)**

Abstract

During the Soviet times, the Central Asian states had a unique water management policy and institutions, centrally governed from Moscow. After collapse of USSR, the Central Asian states put into place arrangements for regional cooperation and developed their national policies on water management. At the same time the states embarked, at different rates reforms of agriculture and water management.

The government of Uzbekistan has invited International organizations to contribute to its reform efforts on irrigated agriculture in Karakalpakstan. As a result Ministry of Agriculture and Water Resources Management of Uzbekistan (MAWRM) had requested Program Facilitation Unit of CGIAR office of Central Asia and Caucasus to conduct research and prepare wider project proposal for the potential donors on reforming agriculture and water sector in Uzbekistan.

Karakalpakistan is located in the Aral Sea environmental disaster zone and is foremost affected by both the environment disaster and economic aggravation. The drought of the last 3 years (1999-2001) harshly affected this already depressed area. The crude cotton yields declined to 25%, irrigated wheat yields decreased to 30%, and the harvest of rice dropped to 50%. One hundred sixty thousand ha of irrigated areas from the total of 500,000 ha, or 31%, were severely affected by the drought. All irrigated lands are highly or moderately saline.

The Uzbek government has planned to conduct reforms of the agricultural and water management systems in Karakalpakistan in order to alleviate the impacts of the environment disaster and economic aggravation. The main aim of the reforms is to establish efficient small landholders and farms in place of the old kolkhozes and shirkats, which are bankrupts at the present time.

Currently, neither Uzbekistan nor Karakalpakistan has in place the full requisite legal framework and operational procedure to allow the development of truly independent and self-managed WUAs. The above mentioned project tested legal and procedural principles in promoting participatory irrigation management (PIM). The major obstacles on ensuring sustainable water reforms are: absence of strong legal basis of the reforms and clearly described water rights.

Environmental and Water Management Problems of Karakalpakistan

1. *Environment.* The drying up of the world's former 4th largest sea-Aral Sea became very known story worldwide. The dramatic changes in the sea (table 4) and in the surrounding environment led to crisis in the Karakalpakistan, which is known as environmental disaster area. The distance from Nukus city to dried Aral Sea is 900-1000 km. Mynak town of Karakalpakistan is located right at the former shore of the Aral Sea. Strong north-south winds blows for 60-70% of the year. These winds transporting salt-sands from the dried bottom of the sea to the irrigated areas, cities and villages of Karakalpakistan. The population is greatly affected by the disaster, 85% of the women have anemia. Infant death rate is 110 to 1000 infants, highest among the Central Asian states. The drinking water is major problem; the quality of present sources of drinking water is far from Uzbekistan's drinking water standards. The ground water resources,

used for drinking formerly are contaminated by agrochemicals. Migration of population is observed, because of damaged environment. The environmental problems of Karakalpakistan aggravated by water shortage and low irrigated agricultural productivity. The further improvements on environmental and social situation in Karakalpakistan are very much determined by reforms in water management.

2. *Water Allocation and distribution.* Water management issues (deficit, allocation principles, tail-end differences) are directly affecting overall agricultural production in Karakalpakistan. Drought of last 2 years (1999-2000) is not only natural water scarcity but also non-uniform water distribution in the Amu Darya river basin (figure 7). The water supply rates in the upper reach of Amu Darya was 90% against determined shares, in the middle reach 95% to 350% and in the lower reach 45 % to 70%. The average water supply rates were close to 100%. In 1999-2000 Karakalpakistan received only 24% and 31% respectively, from its 6.5 km³ water share in Amu Darya. As a result, 80% of rice and 65% of cotton yields were lost in year 2000. According to the Ministry of Agriculture and Water Management of Karakalpakistan (MAWRM), 200,000 ha of irrigated lands have been not cultivated and 200,000 ha has been prepared and sowed expecting water. As a result the non-cultivated irrigated lands are becoming unfit for crop growing due to salinity. According to MAWRM Karakalpakistan, about 85% of irrigated lands are saline. Those in the non-vegetation season (October-April) salt leaching were practiced. In the mid 1980's about 350,000 ha of land were leached annually. However, during 2001-2002 non-vegetation season, only 106,000 ha have been leached.
3. *Water quality.* Water quality in the Amu-Darya has gradually deteriorated, and now contains up to 2 gram/liter of salts. It is a result of return drainage water from the upper and middle irrigated areas in Tajikistan, Uzbekistan and Turkmenistan. Around 6-8 km³ of drainage water annually is returned in the growing season from the upper and middle irrigated areas. While having once good quality, the river was a source of drinking water for Khorazm, Dashgaouz (Turkmenistan) and Karakalpakistan population. The low quality water limiting the use of water to drinking purposes, in the industry and event in the irrigated agriculture.
4. *Ground Water and Salinity.* Ironically, the annual average per capita water supply in KK is around 1500 m³, which is higher than in other water stressed countries (less than 1000 m³/per capita/year). However, the extensive use of ground water resources last 2 years led to ground water levels dropping down to 3-4 meters below surface. Population has severe problems with irrigating even small (0.08 to 0.20 ha) family plots, which provide food for families. The large irrigated areas, almost 95% from total are saline. The salinity together with low water supply makes irrigated agriculture in Karakalpakistan almost impossible.
5. *Technically outdated infrastructure.* Technical conditions of irrigation systems are deteriorated, average delivery efficiency of irrigation water in Karakalpakistan equals to 0.45 (average of Uzbekistan is 0.58). The losses in the irrigation systems of tail located areas are irreversible, 50% water withdrawn for irrigation lost due to poor technical conditions. The poor technical conditions of irrigation system led to high water tables in high water years and severe inequities in low water years.
6. *On-farm water management.* The privatization of former collective farms led to collapse of former on-farm water management system. The newly created farmers lack with skills on planning and distributing of water among each others. As a result competition for water led to dramatic head-tail inequities.
7. *Institutions on Water Management.* In spite of stepwise approach on land reforms, the water management was kept unchanged until 1999. The old policies and institutions showed its incapability to cope with water shortages and organizational vacuum in the on-farm level. The steps taken by state on water reforms: WUAs and hydrographic principles of water management may improve the situation. However, the lack of trained

staff and clear understanding of WUA concept may lead to creation of unsustainable WUAs. The absence of financial base (water fees) may be major obstacle of successful water reforms.

The major causes of environmental problems and water shortage in Karakalpakistan are not only natural disastrous dry years, but also inefficient water management. The unequal water distribution and unreformed system were leading to enormous inequity of water distribution. The root of water management problems of Central Asia, particularly in Karakalpakistan is institutional. However, the poor technical conditions of irrigation infrastructure also contributing into causes. The started agricultural and water resources reforms in Uzbekistan targeting those inefficiencies.

The major trends of the History of Water Management and Agricultural Development in Karakalpakstan

In the *first stage* (till 1970's) of agriculture and water management development in Karalpakistan is marked by collectivization of agriculture, introduction of state policy on increasing gross and net cotton production, rehabilitation of irrigation and drainage network and extending of irrigated areas. The dramatic technical improvements not took place due to limited inputs from state; the major works had been conducted by local population. The institutionally water management had been reformed in accordance to the collective agriculture requirements. It brings both positive and negative impacts: the rights of small water users were ignored and first right for water was given to collective units. In other hand, the productivity land in the collective units increased dramatically, influencing also on water productivity. The institutional set up in the first stage of the development can characterized as semi-centralized, production oriented, and technical system. The users were represented by collective units, which were the lowest level in the hierarchy of water management.

In the *second stage (1970-1990)* there were very few changes in the water resources and agricultural management in this stage. The centralized system, with state quotas for all agricultural crops, water resources was planned according to the quotas. The planning, allocation, distribution and management of water resources were conducted by state agencies on water resources management. These agencies were created in each administrative unit, lasting with collective farms. The agencies fully financed, equipped by state. The technical equipness and capacity of such water management units were relatively high. Monitoring of water resources use, soil salinity, ground water levels and use were regular and special yearly reports issued in the end of the year. However, the administrative sub ordinance of these organizations prevented information flow up to decision making level, keeping it within the administrative unit. As result, the real situation in the irrigated areas was unknown for long time to the upper hierarchical policy making system. The absence of the transparency in the water and agriculture management led to further deterioration of environmental, water management and agricultural productivity.

The *third stage (since 1990\|s)* of agriculture and water management in Karakalpakistan marked by stiffening of the environmental, water allocation and distribution, water quality, ground water and salinity, infrastructural, on-farm water management and institutional problems. Also, the third stage of agriculture and water resources management is period of privatization of irrigated lands and institutional changes in water resources management. After long period of collective agriculture in Karakalpakistan land privatization led to creation of thousands of landowners. The land reforms requiring changes in water management, the planning, managing and distribution of water among vast numbers of water users showed inefficiency of old water management principles. The approach on improving water management in the on-farm level through introduction of water users associations can be seen as attempt of reforms of water sector.

Irrigated Agriculture

For last 12 years (1990 to 2002) irrigated area of Karakalpakistan remained unchanged. The irrigation water withdraws has declined from 8455.2 million m³ to 6279 million m³. For last 4 years (1999-2002) water withdraws declined by 31% and irrigated areas by 50%. The main reason is the water shortage in Amu Darya basin. The worst drought of 2001 resulted 4 times decrease of water withdraws and 2.5 times on irrigated area.

Because of droughts of last 3 years (1999-2001) per unit water supply has been decreased up to 8400 m³/ha in 2001. In the last 10 years (1990-2000) cotton yields decreased by 56% and rice yields by 51%. The total cotton areas declined by 88%, rice areas declined by 52%, the areas under wheat increased by 10 times in 2002 in comparison with 1991 indices. The crop yields, except wheat yields, were declining during above period reaching lowest levels in 2002, the cotton yields 1.1 t/ha, rice 1.7 t/ha and wheat yields 3.0 t/ha. The declining of crop yields was due to water and agricultural problems, explained above.

New Agricultural and Water Management Policies

In Uzbekistan, including Karakalpakistan agricultural reforms started early. The reform approaches in Uzbekistan are different from other neighboring countries. Uzbekistan uses stepwise land reforms approach and privatization goes with lower speed. However, because of socio-economic problems of Karakalpakistan, the land reforms have been advanced in order to prevent degradation of agricultural sector. The number of private farms has increased from 1664 in 1999 up to 3999 in 2002. The number of collective farms has decreased from 136 in 1999 to 114 in 2002. The average landholding sizes dropped 270 ha in 1999 to 122 ha in 2002. The land reforms have created more effective land users in Karakalpakistan. However, high land salinity and water shortage are limiting factors on higher agricultural production in Karakalpakistan. State policy on cotton, rice and wheat order system also hindering development of farmers' independency from state. Local farmers are experienced in agriculture and they have good capacity on entrepreneurship.

The land reforms led to creation of high productive private farms; however it had increased competition for water in the irrigated agriculture. Hundreds of the new private farms had been created in the place of one collective farm in the reformed areas. The distribution of water in these areas became real problem for water management organizations.

Water Reforms in Uzbekistan

Water Users Associations- new form of water management for Agriculture

The agricultural reforms predetermined changes in water management, institutional set up of existing water management do not match with the structural changes in agriculture. The water supply into newly formed private farms became very difficult, because old irrigation infrastructure, water use plans were oriented into collective system.

The Cabinet of Ministers of Uzbekistan in December, 1999 issued decree # 543, according to which 5 unprofitable shirkats (type of semi-collective farms) in three districts of Karakalpakistan were broken into private farms. In order to ease water management in the private farms 5 "Water shirkats" (collective of water users) were created. It was first step on reforms of water management in Karakalpakistan. The "water shirkats" were initiated from top to down, water users were not part of the process of reforms.

The second stage of reforms in water management started in 2002; Cabinet of Ministers of Uzbekistan issued resolution # 8. According to this resolution in Karakalpakistan 15 former

shirkats were privatized and 557 private farmers were registered. This resolution was first legal documents, which recognizes WUAs as the lowest water management unit in the water hierarchy. The resolution consist the exemplary bylaw, structure, responsibilities, steps and order of formation and registration of WUAs. After the resolution issued, in Karakalpakistan 40 WUAs was registered, it covers 50% irrigated areas. In most cases WUAs were created by active pressure from local authorities. As a result many WUAs in Karakalpakistan do not operational due to passive position of water users.

The next step of water reforms in Uzbekistan was marked by Presidents decree on reforms of water management, issued in June, 2003. According to this document, the water resources in Uzbekistan will be managed hydrographically, WUA will be the lowest in the hierarchy of water management. Instead of district and province water management units canal management units (CMU) will be created, water resources planning, allocation, distribution and drainage will be managed through CMU. The WUAs will sign contracts with CMU on water supply. This document created legal base of water reforms in Uzbekistan.

According to Water Management and WUA development Department of MAWRM KK, first WUAs were established in 2000. During the last 3 years 20 WUAs (a list of WUAs and command areas is attached to report) have been established in Karakalpakistan. However, only a few activities were conducted for supporting WUA development. One meeting and one workshop was conducted in the last two years on water management reforms at the on-farm level. No financial support was provided for successful WUA establishment. Ministry approved activities aimed to the supporting of WUA development for 2002-2008.

MAWRM of Karakalpakistan proposed to create a “WUA Support Unit” in Karakalpakistan, and make an experimental WUA in “Jambul” as demonstrative for training leaders and members of WUAs in the other parts of Karakalpakistan. According to the plans of Uzbek Government, during the next year more collective and shirkat farms will be privatized, and the need for the WUAs at the on-farm will be critical.

Transfer of knowledge and experience of IWMI with regard to Irrigation Management Transfer (IMT) worldwide, experience of the Fergana Valley Project, and experience of the neighboring countries (Kazakhstan and Kyrgyzstan) may be also good support on WUA development in Karakalpakistan.

Water Rights- Major Obstacle on Improved Water Resources Management

Traditionally, water management in the Soviet era was based on the supply principle. Since the Central Asian states have become a part of the interdependency-based system, no major economic seemed to arise and water in the Amu Darya and Syr Darya was kept flowing. Commodities were exchanged amongst the Republics under Moscow rule and water was one of them. After the Central Asia States became independent, the water management organizations maintain the water allocation similar to what it was under the FSU. Nevertheless, problems arose, since the demand exceeded the supply. The delivery on demand of the users was kept in the format of traditionally large norms, according to the type of crop and planted area.

The water allocation principles applied in the FSU had two major problems. They were lacking realistic and equitable water right administration system, and only lately under the internationally funded irrigation improvement projects the water rights system and equitable allocations have come into play. Gradually, the governments have become more aware of the need for developing a reliable water rights administration system, as a pre-requisite for the development of water rights market, but only after all water users have been registered (or given a title). Capacity building is important for achieving sustainable implementation and that is going on in each Central Asia state, along with an effort to modify the legal basis.

Second, the physical water allocation and distribution system has not considered any principles for water conservation or an incentive for saving water. In many cases the real water supply rates were 2-3 times higher than recommended water needs. The absence of incentives for conserving water resources led to overexploitation of available water resources.

In late 1980s, "limitation of water demand" was introduced in Central Asia, as the demand for water was almost equal to the available water resources within the region. Under the limitation principle, the water shares to users were adjusted in accordance with water availability in the sources (rivers, reservoirs, etc.). After the collapse of the Soviet Union, the Central Asian states did not change any of the water allocation principles. Only in Kyrgyzstan, an up-stream country, the limits were abolished, and in fact water has been delivered according to the users' demand. In the water-scarce down-stream states (Uzbekistan, Kazakhstan and Turkmenistan) the limited demand principle of water allocation is still operational.

The principle of limited demand made the process of water allocation more complicated. In reality there are two separate processes of planning and allocating water in irrigated agriculture. The first process consists of collecting the demand from water users, collective/cooperative and private farms, or from water users' associations towards higher water management levels (district-province-state). The second process includes the preparation of limits for users; it comes from a higher hierarchy of water management (Ministries of Agriculture and Water Management) to the lower units (district water management organizations). The "limiting" demands and the collected demands are translated into water use plans at the district level, according to which water is allocated to the users.

At present, the water management organizations in Central Asia states are struggling with the delivery of water based as demanded by the users, although this is happening prior to the approved water use plans. The water use plans are prepared for each primary water users for each season. There are 2 irrigation seasons in Central Asia: vegetation - April to September, and non-vegetation - October to March. The demands for water are determined according to climatic zones, size of irrigated area, crop type, and soil and groundwater conditions. There are so called "hydromodule districts" within the irrigated zones of Central Asia. For each type of crop, within each hydromodule district recommended water demand norms are calculated. The collected demand for water includes all losses above the on-farm level (in main and secondary canals) by dividing the demand by the "delivery efficiency coefficient" of the higher systems. However, the delivery efficiency coefficients of the systems do not seem monitored, and only "normative" values are used for the calculations.

Therefore, the needs-based planning of water distribution is essentially a "top-down" mode of management, in which detailed decisions are taken in the government bureaucracy. By contrast, water rights-based management empowers water users to make their decisions, individually or in groups according to the level at which rights can be assigned and protected in each particular situation. A lot needs to be done in capacity building in this regard in all states.

WHAT CAN BE SUGGESTED FOR BETTER WATER MANAGEMENT

Participatory Irrigation Management and Water Resources Management

The PIM is worldwide known term and it has been part of the overall water management reforms around the world. The Philippines (Wijayaratna and Vermillion 1994, Svendsen 1992), Indonesia (Soenarno 1995), China (Xu Zhifang 1995) and Sri Lanka (Ratnayake 1995) in Asia, Mexico (Gorriz et al 1995) and Colombia (Garcia-Betancourt 1994) in Latin America, and others such as New Zealand (Farley 1994) and Turkey (Devlet su Isleri et al 1996), have made major efforts in this direction. Transferring responsibilities has become seen as a way to reduce pressures on thinly stretched government finances while at the same time improving irrigated agricultural production and ensuring the long term sustainability of irrigation systems (Geijer et al 1996, Vermillion 1991).

The successful Water Users Associations in the FSU conditions requires accomplishment of special rules which stipulate the following principles:

- Clear responsibility for public irrigation agencies: The role of water supply agencies consists of (i) develop irrigation infrastructure, hand it over to WUAs for O&M through formal Transfer Agreement, (ii) supply water to WUAs on the basis of formal annual Water Delivery Contracts signed before the onset of the irrigation season, (iii) oversee the performance of WUAs and enforce the provisions in the Transfer Agreements, and (iv) provide institutional development support to WUAs.
- Clear responsibility for WUAs: The role of WUAs is to serve the common interest of their membership by (i) operating and maintaining the irrigation facilities serving them on the basis of the technical guidelines agreed in the Transfer Agreement, (ii) developing and maintaining the interest of their membership in the sustainability of the irrigation infrastructure for which they accepted responsibility under the Transfer Agreement, and (iii) ensuring the fair distribution among their members of the amount of water received under the water delivery contract.
- Autonomy: WUAs are self-governed, self-financed, self-managed non profit oriented legal entities established by their membership for the purpose of operating and maintaining an irrigation system, with due regard to the interest of all members and to the sustainability of the system itself. While the public sector has an important role to play in ensuring the sustainability of the system, and in providing the necessary institutional support for the development of WUAs, particularly during their formative stage, that role should be assumed without direct intervention in the internal issues and management of WUAs.
- Accountability of WUAs: WUAs are given the irrigation system in trust. Each WUA is, thus, accountable for the state of the system it manages, on the basis of the provisions in the Transfer Agreement. This accountability is enforced through continuous system monitoring by the public sector agency responsible for irrigation system development.
- Accountability of public irrigation agency: Public agencies should be held accountable for the timely delivering of the quantity of water agreed in the context of the annual water supply contract. Such contract should specify modalities for compensating WUAs in cases of untimely or failed water delivery.
- Viability: WUAs have to acquire the technical, management and financial capacity to operate as viable business entities, operating as non-profit organizations in the long-term interest of their membership. To that end, WUAs will have the authority to collect

membership fees and charges for irrigation system O&M, in such amounts that will be necessary to (i) effectively operate and maintain the system, and (ii) create a reserve fund to meet unexpected expenditures or to replace operational equipment.

- Financial accountability of WUAs: WUAs are held accountable for proper management of their financial resources in the same manner as any business in the country through (i) internal means specified in the by-laws which ensure transparency and provide for checks and balances, and (ii) external means as specified in the rules of the public audit process and the courts

All above listed principles of successful PIM conditions must be integrated into legal documents on water management

Concepts to Improve Water Allocation and Distribution

There is a recent concept of applying management capability, combination of staff numbers and staff skills. The technology used in irrigation system should be related to the available level of management capacity (Horst, 1990). According to Horst (1987, 1990) the water distribution must be simplified. The quality of decisions is likely to decline, if designers or decision makers have to make too many decisions (e.g., by installing more control facilities).

Abernethy (1988) noted that the absence of efficient communication systems, decisions on continuously adjustable structures may default downwards to the local gate-operators, who may then act on the base of what they know at any given moment, which may be limited to direct observation of local conditions such as upstream water level. The summation of independent local decisions may lead to a kind of anarchy and variability of canal conditions.

Anarchy or rent seeking can occur also if the rules do not seem appropriate to those who are expected to implement them, and if their implementation would cause difficult relationship between managers and the farmers who use the irrigation system.

Morabito et al. (1998) describes strong irrigation organization as the one delivering water according to the rights of each association. The organization does not become involved in the distribution of water to individual farmers. That is done within each irrigators association.

The equitable water distribution according to Morabito et al. (1998) characterized by three aspects: a) long established system of water rights, with both traditional and legal enforcement; b) long established organizations among the irrigators, which take over the lower levels of water distribution; c) structures explicitly designed and installed for water measurement.

Central Asia is one of the world's oldest irrigated regions, history of which estimates thousand years. In the early 20s century Central Asians had clear set of the rules for water distribution, recognized by the water users/landowners. Each landowner had certain rights on water, these rights mainly based on size of the land. Water distribution was organized by elected mirabs (water masters) and rules were based on "sharia" – Islamic law. According to the "sharia" water can not be private good and all canals and ditches were owned by public. The main principle of water distribution was that each land owner received water equal to the volume for filling his/her field. Water rights measured by so called "ditches", for example for filling of 1 hectare one need 3 full ditches of water, it was his/he water right. However, this all then translated into time for irrigation (Mukhamedjanov 1986, Bartold 1970). Historically, in Central Asia time-based principle was applied for water distribution. Even, after the introduction of collective farming in the mid 1930s, whenever water was in deficit, the distribution of water was based on time

schedules. In Fergana valley “avron” system - water rotation between canals and water users was very popular. However, there was no unique or recognized water distribution principle applied for the overall on-farm level in Central Asia.

Since mid 1960s in Central Asia water distribution approach has been based on water use plans, applying regulated normative principle as major path for water distribution. Water supply rates, tested in the specific pilot areas for specific crops were suggested as normative means and irrigation should be based on those normatives. For the collective farms, where mainly monoculture crop was grown, this approach was justified. But, water requirements of farms were overlapped due to the cotton monoculture, normative principles superseded again by the time based water turns.

Research community and water managers of the Central Asia keep defending the normative approach to water distribution. There is reason behind this position. Three large cotton-growing countries (Uzbekistan, Tajikistan and Turkmenistan) of the Central Asia are trying to keep large size agricultural units and cotton as major crop. Even in the most reformed countries of the region (Kyrgyzstan and Kazakhstan) cotton is the prevailing crop. In this situation the normative-based principle for water distribution is the only way for securing high crop yields. Contrary to this, under the rotation/time delivery farmer receives water not according to the crop requirements, but on the fixed time or turn. Ignorance of the crop water requirements in the case of time-based water delivery may lead to lower yields.

Nevertheless, the application of the normative principle requires some instrument to control the delivery of norms. One of the ways of controlling may be introduction of the water measuring system (instruments and monitoring) for all levels of water use (Figure 1).

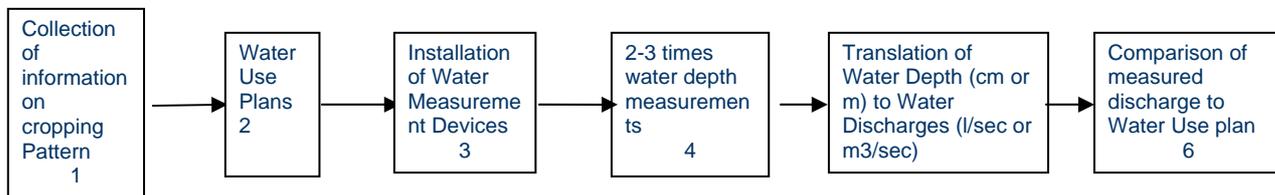


Figure 1. Algorithm of normative based water distribution principle (Abdullaev I, Ul. Hassan.2004)

Analysis of water distribution around the world showed, that there are indicators of “best” water distribution (Figure 2). Water distribution rules must be clear and agreed with water users; request or need for water should be stable and forecastable. The major requirement of “best” water distribution is that the water users are entitled to make water distribution decisions at different levels. From an organizational point of view the technology and approaches for water distribution must be fitting into the “management capability” of the water users’ organizations, which are responsible for water distribution.

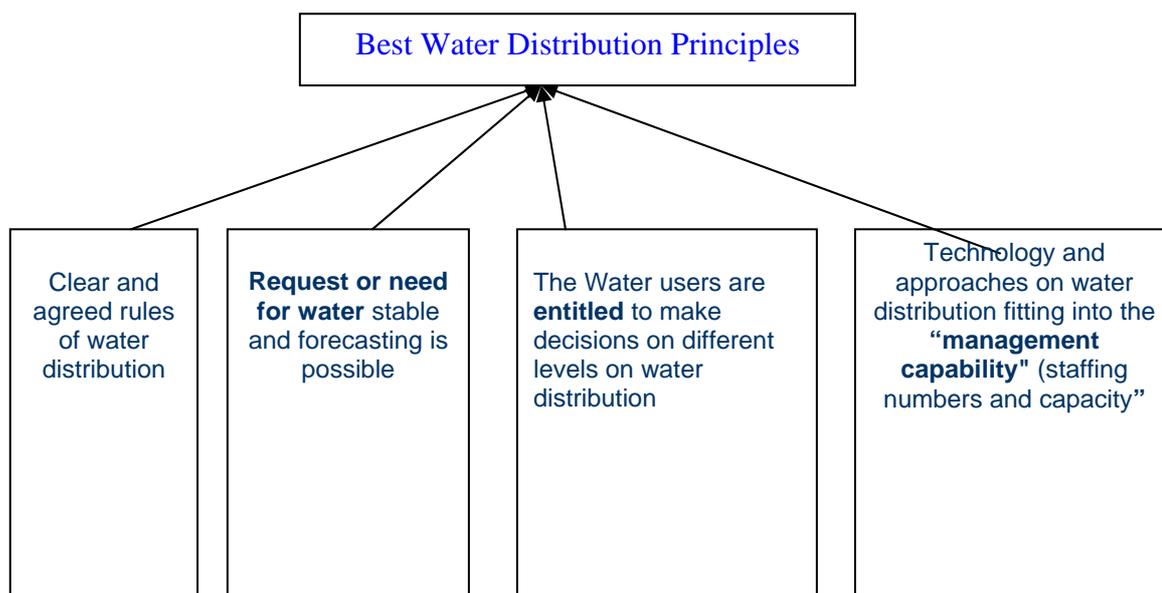


Figure 2. Best Water Distribution Principles (Abdullaev I, Ul Hassan.2004)

Approach for water distribution must be based on two principles: the first is clarity and simplicity and the second – satisfaction of the crop water requirements. These two indicators may be combined into irrigation time with the volumes calculated as water requirements. Irrigation time, which is the calculated on the basis of water use plans, takes into account both crop type and its irrigation regime (Figure 3). This, at the same time is very easy and clear water distribution indicator.

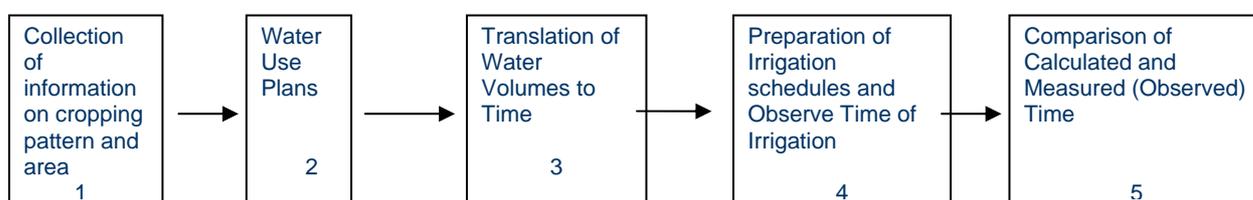


Figure 3. Algorithm of time based water distribution principle (Abdullaev I, Ul Hassan.2004)

For securing achievements of the started reforms in the legal documents, related to the water resources management: laws and resolution clear time, area or crop based water rights must be integrated. For the water scarce zones, such as Karakalpakstan, the water rights must be defined by time of the water supply.

CONCLUSION AND PERSPECTIVE

The Karakalpakstan, one of the largest agricultural areas of the Uzbekistan are experiencing problems related with environment, water allocation and distribution, water quality, ground water and salinity, technically outdated infrastructure, on-farm water management and mainly with institutions.

The Uzbekistan government following up agricultural reforms with water management ones. As a result in the on farm level WUAs should take over water management. For successful and sustainable reforms following aspects must be addressed through legal system:

- Clear responsibility for public irrigation agencies
- Clear responsibility for WUAs:
- Autonomy: Accountability of WUAs:
- Accountability of public irrigation agency:
- Viability:
- Financial accountability of WUAs:

There is a world-wide recognition that clear water allocation/distribution rules make implementation of sound irrigation water management feasible, and therefore securing also water rights of poor people. Distribution of water to users involves decisions on who gets water, how much each user is entitled and at what time water will be delivered. Such system, however, needs a proper administration, regulation and enforcement of the rules to become equitable. This can happen only if users, either individually or as an association, can legally obtain their share of water and/or can officially receive a permit or license for withdrawal.

For securing achievements of the started reforms in the legal documents, related to the water resources management: laws and resolution clear time, area or crop based water rights must be integrated. For the water scarce zones, such as Karakalpakistan, the water rights must be defined by time of the water supply.

The efforts to reform water management sector have mainly concentrated on transferring of state responsibility to water users in the on-farm level. The planning, distribution and managing water in on-farm level will be business of Water Users Associations. Therefore, a major push is being given to the development of Water Users Association and capacity building, so that these farmers' organizations can administer their water rights given by the new legislation.

REFERENCES

1. Abdullaev I.; Mehmood Ul Hassan.2004. Feasibility of time based water distribution principles in Central Asian Tertiary Canals. Article submitted Irrigated Agriculture Journal.27 pages.
2. Abernethy, C.L. (1988). The concept of flexibility in irrigation systems. The paper presented at Irrigation Management Conference, Wuhan, China
3. Horst, L. (1987) Choice of irrigation structures: the paradox of operational flexibility, in: Irrigation Design for Management. Proceedings of a Workshop at Kandy, Sri Lanka (HR Wallingford and International Water Management Institute)
4. Horst, L. (1990) Interactions between Technical Infrastructure and Management, network paper 90/3b, Irrigation Management Network (London, Overseas Development Institute)
5. Mainuddin, M., Loof, R., Abernethy, C.L. (2000) Operational Plans and Performance in the Phitsanlok Irrigation System, Thailand. Water Resources Development, vol.16, #3.
6. Morabito, J.Bos, M.G., Vos, S and Brouwer, R. (1998) The quality of service provided by the irrigation department to the users associations, Tunuyan System, Mendoza, Argentina, Irrigation and Drainage Systems, 12(1), pp.49-65.

Devlet su Isleri, Economic Development Institute and International Irrigation Management Institute. 1996 *Assessment of IMT in Turkey*, paper presented for the International Seminar on Participatory Irrigation Management, Antalya, Turkey, and 10-17 April 1996.

- García-Betancourt, G. 1994. *The Emergence of Federriego: The Colombian Federation of Irrigation Districts*, Short Report Series on Locally Management Irrigation No. 8, International Irrigation Management Institute, Colombo.
- Geijer, J. C. M. A., Svendsen, M. and Vermillion, D. L. 1996. *Transferring Irrigation Management Responsibility in Asia: Results of a Workshop*, Short Report Series on Locally Managed Irrigation No. 13, International Irrigation Management Institute, Colombo.
- Gorriz, C. M., Subramanian, A., and Simas, J. 1995. *Irrigation Management Transfer in Mexico: Process and Progress*, paper presented at the International Seminar on Participatory Irrigation Management, Mexico, 8-15 February 1995.
- Gopal Naik, Karlo H.Amar.1998. Two Case Studies on the Role of Water Users Associations in Irrigation Management in Maharashtra, India. The World Bank/WBI's CBNRM Initiative. 7 p.
- Farley, P. J. 1994. *Privatization of Irrigation Schemes in New Zealand*, Short Report Series on Locally Management Irrigation No. 2, International Irrigation Management Institute, Colombo.
- Ratnayake, R. 1995. Irrigation Management Transfer in Sri Lanka, pp 79-87 in J.C.M.A. Geijer, ed., *Irrigation Management Transfer in Asia: Papers from the Expert Consultation on Irrigation Management Transfer in Asia*, Bangkok and Chiang Mai, 25-29 September 1995.
- Soenarno. 1995. Irrigation Management Transfer in Indonesia, pp 89-98 in J.C.M.A. Geijer, ed., *Irrigation Management Transfer in Asia: Papers from the Expert Consultation on Irrigation Management Transfer in Asia*, Bangkok and Chiang Mai, 25-29 September 1995.
- Svendsen, M. 1992. *Assessing Effects of Policy Change on Philippine Irrigation Performance*, Working Papers on Irrigation Performance 2, International Food Policy Research Institute, Washington.
- Vermillion, D. L. 1991. *The Turnover and Self Management of Irrigation Institutions in Developing Countries*, International Irrigation Management Institute, Colombo.
- Vermillion D.2002. Framework for Adopting Integrated Water Management for Irrigated Agriculture in the Fergana Valley, Central Asia. Draft. IWM.2002
- Wijayaratna, C. M., and Vermillion, D. L. 1994. *Irrigation Management Turnover in the Philippines: Strategy of the National Irrigation Administration*, Short Report Series on Locally Managed Irrigation No. 4, International Irrigation Management Institute, Colombo.
- Xu Zhifang. 1995. Irrigation Management Transfer in China, pp 157-165 in J.C.M.A. Geijer, ed., *Irrigation Management Transfer in Asia: Papers from the Expert Consultation on Irrigation Management Transfer in Asia*, Bangkok and Chiang Mai, 25-29 September 1995, RAP Publication 1995:31, Food and Agricultural Organization and International Irrigation Management Institute, Bangkok.