Institutions and transition: does a better institutional environment make water users associations more effective in Central Asia?

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Abstract

Integrated water resource management (IWRM) is a widely recognized management framework that is currently being adopted throughout post-Soviet Central Asia to inform and guide national water sector reforms, and to keep up with the pace of the faster moving land reforms taking place in the region. With hydrographic principles and public participation being at the core of this framework, the process in the region has started with the reform of on-farm irrigation systems by creating water users associations (WUAs), transferring irrigation management to them and introducing irrigation service fees. This paper draws on the experiences, over four years, of three study WUAs set up in the Ferghana Valley in Uzbekistan, Tajikistan and the Kyrgyz Republic. Aiming to explore the differences in institutional environment and arrangements in these three countries for establishing WUAs, as well as assessing WUA performances (particularly from users’ perspectives), the study reveals that it is not only the newly-established institutional arrangements in the irrigation sector but also their internal operations, coupled with other important factors such as size of area farmed, overall viability of agriculture and a wider economic context that crucially determine overall irrigation performance.

Keywords: Central Asia; Ferghana Valley; Institutions; Transition; Water users association; WUA

‘Socialist economies are beginning to learn the hard lesson that the underlying institutional framework is the source of the current poor performance and are attempting to grapple with ways to restrict the institutional framework to redirect incentives that in turn will direct organizations along a productivity increasing path’ (\textit{North, 1994}: 20).

1. Introduction

Irrigation infrastructure is a vital part of agricultural production in Central Asia, which provides a livelihood for the majority in the region. Many problems in irrigated agriculture have become worse and...
new ones have emerged since the disintegration of the Soviet Union and the creation of five independent states in the region. First, the main problem was the collapse of the centrally-managed irrigation system for the whole of Central Asia and the pursuit of individual water policies by each country. The skewed location of each country in relation to water sources, the transboundary nature of rivers and the differing political power of each state within the region have led to the deterioration of an already uneven distribution of water, and to an increase in disputes between states (Herrfahrtd et al., 2005). Second, the vast irrigation system built during the Soviet era is not environmentally sustainable and has led to the desiccation of the Aral Sea, widely documented in literature and mass media (Welsh, 2000; Vlek et al., 2001; Dalby, 2002; Murray-Rust et al., 2003; Noble et al., 2005; Greenberg, 2006). Third, the low financial capacity of national governments to maintain and repair irrigation canals in their respective countries has resulted in the loss of vast amounts of water at all levels of the irrigation system, affecting the supply to downstream water users. Fourth, institutions for on-farm water management did not exist following the dismantling of collective farms. Hence, for example in the Kyrgyz Republic, there has been a significant deterioration in the condition of on-farm irrigation systems and in water access for the majority of farmers. Additionally, the decentralization of collective farms and low wages forced irrigation specialists and other professionals to seek employment in countries like Kazakhstan and Russia, leaving the increasing numbers of private farmers on their own with no proper irrigation expertise and knowledge. Moreover, poor repair and maintenance of drainage systems, excessive use of water and other inefficient farming practices from Soviet times that have continued to be practiced by farmers after independence, have added to increasing salinity levels of agricultural land and to rising water tables in the last decade (Vlek et al., 2001; Murray-Rust et al., 2003). Hence, at the farm level, land degradation has escalated, product yields have decreased substantially, local water services have deteriorated and conflicts between many newly-emerged individual farmers over water resources have soared. As a consequence, the livelihoods of the rural population dependent solely on irrigated agriculture have been significantly affected (Nizamedinkhodjaeva, 2007).

In order to alleviate these problems, an integrated water resource management (IWRM) framework is being promoted and adopted throughout the region, including such measures at the national level as the establishment of river basin management organizations, and the organization of water users and water users associations (WUAs) on a hydrographic basis. The process has started with the creation of WUAs, the transfer of on-farm irrigation management to WUAs, the introduction of irrigation service fees (ISFs) to water users, and water charges in some countries. This is aimed at (i) filling the institutional gap that has emerged in on-farm irrigation systems with the process of dismantling the collective farms which used to be responsible for these services, and (ii) improving the efficiency of water resources usage in the region.

1 Water user association (WUA)—Association of water users combining both governance and management functions (they are not the owners of the infrastructure) (FAO, 2005). It is ‘a voluntary, nongovernmental, nonprofit entity established and managed by a group of farmers located along one or several watercourse canals. Water users consist of farmers, peasants and other owners who combine their financial, material and technical resources to improve the productivity of irrigated farming through equitable distribution of water and efficient use of irrigation and drainage systems’ (Winrock International, 2007).

2 Although the wider definition of ISF includes water charges, a distinction has to be made between the ISF rate and water fees in the context of Central Asia. In some countries, namely The Kyrgyz Republic, Kazakhstan and Tajikistan, the ISF rate includes water fees. Water fees are ultimately the ISF for canal management organization. However, in Uzbekistan there is no water fee; hence, Uzbek farmers only pay their WUAs for irrigation services.
However, the extent of institutional changes in irrigation differs and the speed of implementation varies between the countries, due to the pace of land reforms and the varying socio-economic conditions in each country. The Kyrgyz Republic has been at the forefront of institutional reforms in land and water in the region, even though it started off, in the early 1990s, with similar institutional and organizational structures to the rest. In contrast, Uzbekistan and Tajikistan have been slow to adopt irrigation reforms. This is partially related to the slow pace of land reforms. Many large cooperative farms have maintained Soviet-style management, fulfilling government orders for wheat and cotton in Uzbekistan, and for cotton alone in Tajikistan (Kandiyoti, 2003; Noble et al., 2005; Sehring, 2006; Abdullaev et al., 2009). In addition, the vicious circle of debts for Tajik farmers, as a result of the ginning system, is also contributing to the slow pace of the process (World Bank, 2005a; Sehring, 2006).

The experiences of transitional and developing countries show that early establishment of proper institutions is the key to a successful development process (North, 1990; Stiglitz, 2002) and irrigation management transfer (IMT) is no exception. Among many factors, institutional issues have been identified as major determinants of successful implementation of IMT. Hence, this paper attempts to address the key question of whether or not a better institutional environment/setting implies a better WUA performance and leads to the efficient and equitable use of water resources. All the results and inferences made in the paper are based on three consecutive farmer perception surveys (Yakubov, 2004, 2006; Yakubov & Matyakubov, 2004) of WUAs in three countries of Central Asia conducted within the framework of the project Integrated Water Resources Management in the Ferghana Valley (IWRM-Ferghana)³.

The following section of this paper proceeds with the conceptual framework of the study. The third section describes the methodology of selecting the study sites and collecting data. The fourth section describes the current institutional environment in the three countries, as well as the results of the case studies. The last section discusses the results and makes some concluding remarks.

2. Conceptual framework

2.1. Defining institutions

Institutions form the ‘incentive structure of a society’ (North, 1990: 3). They coordinate or govern the relationships between individuals or groups and consist of formal and informal rules and their enforcement characteristics (Kherallah & Kirsten, 2001). Formal rules refer to laws, constitutions, contracts, political systems, organizations and markets. Informal rules refer to norms of behavior, conventions, customs and self-imposed codes of conduct. Institutions have been increasingly recognized as one of the key factors in economic growth and development. At the same time, economic growth and development also change and shape institutions (North, 1990; Kherallah & Kirsten, 2001). Yet, not all institutions are efficient. Some institutions hinder development and lead to stagnation (Bardhan, 1989; North, 1990).

³ The project has, since 2001, been funded by the Swiss Development Cooperation (SDC) and implemented by the International Water Management Institute (IWMI) and the Scientific Information Centre of the Interstate Coordination Water Commission (SIC-ICWC). The three WUAs used in this study are the project’s pilot WUAs.
A distinction is made between the institutional environment (rules governing property rights and general relations between agents) and institutional arrangements (specific rules governing the ways in which its members can cooperate/compete) (Kherallah & Kirsten, 2001). However, it has to be noted that many organizations such as households and firms are, collectively, institutions but not all institutions are organizations, for example, laws and money (Kherallah & Kirsten, 2001).

2.2. Water institutions and IMT

Water institutions encompass all formal rules, laws and regulations and the organizations that implement them, and the linkages that govern individual or collective decisions related to water development, allocation, use and management (Livingston, 2005; Saleth & Dinar, 2005). They play an important role in the development and prosperity of a nation (Livingston, 2005). For efficient use of common pool resources such as water, collective action and clearly defined property rights (use and income rights) are vital (Bruns & Meinzen-Dick, 2000). According to Coase (1960), well-defined property rights internalize the externalities, so that the outcome is efficient regardless of who owns the property rights. On the one hand, common pool resources when unregulated are said to be tragedy-prone facing the risk of ultimate extinction due to free for all access and over-exploitation (Hardin, 1968). On the other hand, there is strong evidence that their use and management can be successfully sustained and improved through collective choice, institutional arrangements, decisions and rules (Olson, 1971; Ostrom, 1990).

IMT has become a key institutional intervention whereby the management of on-farm irrigation is shifted to a non-governmental organization, a private firm, to local government or a WUA, as the prime decentralizing activity of irrigation management (Vermillion & Sagardoy, 1999). In most cases, the responsibilities are transferred to primary water users by establishing WUAs. No matter what type of institution takes over the on-farm irrigation system, the main conditions are that water users should have a decision-making power in irrigation management and its internal organization, and that it has to be financially autonomous to a certain degree (Vermillion & Sagardoy, 1999; Svendsen et al., 1997).

Literature on IMT experiences in many countries, particularly WUA developments, has been extensive (Svendsen et al., 1997; Vermillion, 1997; Vermillion & Sagardoy, 1999; Svendsen & Murray-Rust, 2001; Saleth & Dinar, 2005; Samad, 2005). Due to various underlying factors, the outcomes of IMT and its effectiveness vary in each country (Bruns et al., 2001; Svendsen & Murray-Rust, 2001). Experience shows that institutional framework, amongst other factors, is essential in implementing IMT.

Four main institutional principles that influence the success of self-governing systems have been identified by Merrey (1996):

- the institutional environment, including supportive policy, regulatory and legal environment, recognizing the water rights of the irrigation community;
- the capacity of these organizations for operation and maintenance, including emergency repairs and modernization;
- benefits of participation by users should exceed the costs;
- effective collective choice arrangements, which include WUA organizational autonomy, financial autonomy, allocation and distribution of water, etc.

According to Facon (2000), institutional factors among others affect not only the success of the self-governing institution but also their water productivity.
3. Methodology

The analyses in this article are based on (i) a review of literature and relevant national legislation on water and WUAs, and (ii) farmers’ perception surveys. While the former allowed the basic features of IMT-related institutional environments in each country to be determined, the latter was used to measure farmer-perceived WUA efficiencies in delivering irrigation service using four criteria (water delivery, infrastructure, social impact and agricultural productivity) to reflect Merrey’s four institutional principles, outlined in the previous section.

Water delivery performance was measured in terms of its adequacy, timeliness and equity (see Bos et al., 2005). The state of infrastructure was evaluated against the amount of canal maintenance needed, of both a routine and periodic nature, that was required but failed to be performed, as well as the farmers’ own contributions to canal cleaning. Social impact was assessed against the incidence and settlement of water disputes, and payment of ISFs. Crop yields were used as a measurement of agricultural productivity.

Adequacy and timeliness were assessed using the delivery performance ratio (DPR) calculations, based on (1) farmers’ responses about the number of irrigations requested, (2) those actually received and (3) those received on time. The ratio of (2) to (1) defined water adequacy while that of (3) to (2) defined timeliness. At 90% and above, both adequacy and timeliness are considered to be satisfactory; less than 90% is considered unsatisfactory. Equity of water delivery along the canal was assessed by comparing results for adequacy and timeliness indicators at different locations along the irrigation system.

Some indicators, such as infrastructure condition, were calculated using multiple choice questions and rank-ordering. For example, if the answer to having any maintenance problem unattended to was “Yes”, then the respondents were asked to select from a multiple choice list or, alternatively, report and rank (in order of importance) all the needs that were required but failed to be performed. Each such selected item was given a value reverse to its rank, e.g. the most important item, ranked first, was given 3 points, the second most important: 2 points, and the third: 1 point. The values for each particular problem were then summed up across all observations to arrive at the overall WUA score for each such problem. Specifically, for infrastructure rehabilitation needs, rehabilitation problems were divided into routine (including cleaning canals of silt and vegetation, required every season) and periodic (namely the installation and repair of measurement devices etc., that are required periodically) and their scores where aggregated across all canal levels (Yakubov & Ul-Hassan, 2007).

3.1. Sampling

The survey involved initial stratification of the entire irrigation system into three major zones: head, middle and tail, with further sub-stratification of each such zone into head, middle and tail sections. Following this, a quota of farmers was assigned to each such major stratum and sub-strata for random selection. As a result, three major off-takes representing the head, middle and tail reaches of the main or secondary canals of the study WUAs were selected first, and then water users were randomly selected using one of the following two patterns (subject to further splitting of tertiary off-takes): (i) in the case where a tertiary had no further off-takes, a specified number of respondents were evenly spread between the head, middle and tail; otherwise (ii) the quota was evenly divided into two parts between off-takes located at the head and tail, with respondents randomly selected from the head- and tail-ends of such final watercourses.
3.2. Study areas and sample size

The surveys were conducted in 2003, 2004 and 2006 at three pilot WUAs of the IWRM-Ferghana project (Figure 1). As already mentioned, farmer water users in the three study WUAs (Isan in the Kyrgyz Republic, Akbarabad in Uzbekistan and Zarafshan in Tajikistan) were first stratified by their hydraulic location along major WUA canals (head, middle or tail) and then randomly selected to make up a sample of 60 respondents at each site, or 180 people in total.

3.2.1. Kyrgyz WUA. When first established in May 2003, the Kyrgyz WUA had a total service area of over 3,000 ha, including over 2,000 ha of irrigated area shared by 985 smallholders. The local WUA irrigation system consisted of one main branch canal and 14 secondary off-takes.

The main local farm types include private farms based either on a single household or multiple/joint households with average land size of 0.87 ha and 1.7 ha, respectively, or kitchen gardens of 0.10 ha (where people also keep some livestock/poultry) and tenant farms. The basic crops grown are winter and spring wheat, tomato, capsicum, tobacco, sunflower and apples. The membership and size of the WUA have not changed since it was first established in 2003.

3.2.2. Uzbek WUA. When first established in March 2003, the service area of the Uzbek WUA comprised a total of 2,820 ha, including 33 individual farms averaging 13 ha each and 3 large quasi-state cooperative farms (locally called shirkats). As a result of ongoing agricultural reforms under, which land

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4 Referred to below as Kyrgyz WUA, Uzbek WUA and Tajik WUA, respectively.
from big *shirkats* is being gradually parceled out to individual farms, since 2003 the number of individual farms has been steadily increasing (to 45 in 2004, to 55 in 2005, to 65 in 2006, to 125 at last count in 2007–08). The local irrigation infrastructure of the WUA consists of 3 major secondary canals with a network of 105 lower off-takes.

The major farm types in the WUA include *shirkat* farms with crop areas of thousands of hectares and hundreds of farm workers, individual farms normally owned by one household with farmland of 1–50 ha on a long-term lease (up to 50 years), and kitchen gardens (locally called *dehqan* farms) with an average 0.10–0.15 ha of land with livestock and/or poultry. The basic crops grown in the first two farm types are cotton, wheat and fruit, while a wide range of vegetables are mostly grown in the kitchen gardens.

### 3.2.3. Tajik WUA.

The Tajik WUA, when first established, was made up of 1,050 ha in total service area, cultivated by 12 private cooperative farms with 60–80 ha of land each (established to replace one big, Soviet-style, kolkhoz farm), one brigade (a unit of a collective farm) of a still operating large quasi-state collective farm, and several households with their kitchen gardens, as well as presidential plots\(^5\) in the WUA area. Due to ongoing land reforms, the private cooperatives present at the time of conducting the second survey have been further fragmented, resulting in the formation of additional 20 smaller private farms. Two years later in 2006, the total number of such farms increased by another 30. This process of further fragmentation of the bigger cooperatives is expected continue for at least one more year until fully complete. The irrigation system of the WUA consists of 3 big gravity canals, including two secondary and one tertiary, with a network of 21 lower off-takes, as well as one water lift distributary canal with a wider network of 21 lower off-takes.

With regard to the land size of different farm types existing in the WUA area, the largest is the quasi-state Soviet-style collective farm, mentioned above, then followed by medium-sized private farmer cooperatives\(^6\), much smaller private farms with an average size of about 6 ha each, as well as kitchen gardens and presidential plots both cumulatively averaging 0.25 ha. Major crops grown in the WUA are cotton, winter wheat, potato, onions and kidney beans.

### 4. Research findings

#### 4.1. Institutional environment for irrigation reforms in the three countries

**4.1.1. The Kyrgyz Republic.** Privatization and liberalization in agriculture was rapid in the Kyrgyz Republic. In the early 1990s, following the collapse of collective and state farms and land privatization reforms, thousands of smallholder farming units with a land size of 0.1–1 ha suddenly emerged (Spoor, 2004). The collapse of the collective farm system also resulted in the collapse of all the services they provided, including irrigation. As a result, thousands of newly established smallholders were left to their own devices to manage their farming and related activities. However, a lack of arrangements for operation and maintenance of on-farm irrigation systems, coupled with the differential water needs of

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\(^5\) A presidential plot is a small piece of land granted by Tajik President’s Decree between 1996–1998 to each rural household in Tajikistan, to supplement their backyard crop production. The total area of backyard garden plus presidential plot should not exceed 0.25 ha.

\(^6\) The average size within the four years of this study decreased by half from 60–80 ha in 2002 to 37 ha in 2005.
thousands of small farmers with very small land holdings, have resulted in the emergence of numerous problems (Ul Hassan et al., 2004) featuring endless conflicts, inequitable water distribution and degradation of the canal infrastructure, which was especially evident from the canal head-versus-tail perspective. Thus, there was a pressing need for a proper institutional structure to be put in place in order to normalize on-farm irrigation management.

As a result, the Kyrgyz Republic, compared to other countries in the region, was the first to adopt IWRM principles which were instrumental in shaping new legislation concerning water and on-farm irrigation systems, including WUAs. In 1994, a decree issued by the Ministry of Agriculture and Water Resources (MAWR) passed the responsibility for operations and maintenance of on-farm irrigation infrastructure to village councils. In 1997, a Government Resolution on the establishment of WUAs was signed by the Prime Minister which, in 2002, finally led to passing the WUA Law, the first of its kind in Central Asia. A new Water Code adopted in 2004 proved the country’s adherence to IWRM principles. Moreover, since 1995, the Kyrgyz Government has established and introduced basic water fees which laid the basis for WUAs to charge for irrigation services they provide. The level of basic water charges was fixed by Parliament. Two differential rates for in-season and off-season water use were applied. In 2005, the ISF rate, including the basic water fee, in the Kyrgyz study WUA was set at 26 Kyrgyz Som (approximately USD 0.65) per 1,000 m³ of water.

Due to the above measures, WUA formation since the late 1990s has been rapid throughout the Kyrgyz Republic. By early 2005, there were 397 registered WUAs in the Kyrgyz Republic covering 68% of irrigated land; in some areas, the coverage even exceeded 80% (World Bank, 2005b). However, despite all of this, most of these WUAs were weak and inefficient.

4.1.2. Uzbekistan. Unlike in the Kyrgyz Republic, land reforms in Uzbekistan have been slow (Kandiyoti, 2003). Following the collapse of the USSR, the majority of local collective farms were transformed into cooperative farms/shirkats, where the old Soviet-management style remained (Spoor, 2004). This type of farm was dominant in Uzbekistan until 2005\(^7\). The number of private farms was growing but rather very slowly. While in other Central Asian countries, private farms already occupied over 20% of all agricultural land in 2002, in Uzbekistan this number was only 5% (Spoor, 2004). Private farms lease their land from the government on a long-term basis (between 10–50 years). Farmers with lands previously used for cotton and wheat cultivation are obliged to grow these crops and fulfill the set state quotas. Therefore, the production system for wheat and cotton has changed little since Soviet times, with the government purchasing these crops from farmers at below market prices. Because cotton and wheat are considered to be strategic products, most inputs for their production such as seed, fertilizer and fuel are subsidized and provided by the state through a centrally controlled distribution network of local outlets. These two crops are also given first priority when allocating and delivering irrigation water. Meanwhile, the situation of private farms specializing in other products is the opposite: farmers are responsible for all inputs, as well as the marketing of their products and receive second rate or no water allocation (see Kandiyoti, 2003).

Due to the dominance of shirkats in the farming system in the last decade and government subsidies for production of the two strategic crops, on-farm irrigation infrastructure and services in Uzbekistan have deteriorated less compared to the Kyrgyz Republic. Nevertheless, the increasing numbers of private

\(^7\) Since 2005, dismantling of all remaining shirkats into private farms has been rapid and the process is now fully complete.
farms, the growing importance of household plots/kitchen gardens in the livelihoods of rural people, the pressing need to fulfill state orders and the priority of giving irrigation water to shirkats have all increased the quantity of water requests, as well as the number of disputes between users.

Although the legal basis for WUAs is embedded in other laws, such as the Law on Water and Water Use, Law on Farms, Law on Dekhan Farms, Law on Agricultural Cooperatives/Shirkats, there is no specific law concerning WUAs. Moreover, there are gaps in the current legislation. According to Vlek et al. (2001), the legal uncertainty regarding agricultural activities, particularly the water use rights and maintenance obligations of irrigation systems, is a big obstacle for private initiatives and new investments. A WUA Law was drafted in 2006 but its consideration by Parliament has been postponed.

ISF in Uzbekistan started to be practiced in 2001. Unlike in the Kyrgyz Republic, there are no basic water charges in Uzbekistan. Water is accounted for as a free resource. In 2005, the ISF rate in the study Uzbek WUA was 630 Uzbek Soums (approximately USD 0.63) for each 1,000 m$^3$ of water, proportionately charged on a per-unit-of-area basis from all its water users.

WUAs have been created in Uzbekistan since 1999 (FAO, 2006) with their numbers rapidly increasing since 2005. In 2008 there were 1676 WUAs registered in this country (Uzbek Ministry of Agriculture and Water Resources (MAWR), 2008) compared to 887 in 2005 (Asian Development Bank, 2005). The majority are established along the administrative boundaries of former shirkats and in a top-down fashion. The number of hydrographically formed WUAs, a very important factor for sustainable operations of these new water management organizations, is very small. Moreover, due to gaps in the existing legislation, many new WUAs in Uzbekistan are still unregistered and uncertain about their formal status to start operating on a sound basis. As a result, many do not function properly and fail to fulfill their required roles.

4.1.3. Tajikistan. The land reforms in Tajikistan have been slow and were partly affected by the civil war. Since the war, the land privatization process has gained pace and has ‘gone further in just a few years than Uzbekistan and Turkmenistan have in a decade’ (Spoor, 2004: 17). Although the number of private farms has not increased substantially, the growth in the acreage of these farms has been remarkable. It is recorded that in 1998 there were 8,000 private farms occupying only 3.3% of total agricultural land, rising to 12,000 farms on 39% of agricultural land in 2002 (Spoor, 2004). The slow increase in the numbers of private farms are related to: (i) the belief that scarce arable land should be owned by the government; (ii) poor knowledge and a lack of information regarding land rights amongst farmers; and (iii) abuse and misinterpretation of the land law by the officials and former managers of collective farms (Chemonics International & Prime International, 2003). The land remaining is in the process of being allocated to private farms. As in other countries in the region, local irrigation reforms are also proceeding slowly.

In 1993, a Water Code was adopted for the first time in Tajikistan, later to be replaced by a new one in 2000. It addressed some legal aspects relating to WUA establishment. Nevertheless, WUAs were, until recently, established according to the Law on Public Associations. In November 2006, Tajikistan
became the third country in Central Asia to pass a dedicated WUA Law, following the Kyrgyz Republic (in 2002) and Kazakhstan (in 2003).

Based on a Presidential Decree, ISF in Tajikistan have, from 1996, been charged equally to both those who rely on water lift irrigation and those who use gravity water. Due to a high reliance on pumped irrigation, ISF in Tajikistan are the highest in Central Asia. In 2005 in the study Tajik WUA, it amounted to 8 Tajik Somoni (about USD 2.6) per 1,000 m³. This rate included the cost of water (about USD 2.0) and a WUA mark-up for services provided (about USD 0.60). Hence, the provision of 1,000 m³ of water to Tajik farmers cost more than four times the amount in the Kyrgyz and Uzbek study WUAs. Consequently, the price sensitivity of local farmers to such high water tariffs results in very poor ISF collection rates.

Another major obstacle in the development of agriculture and, in particular, the implementation of IMT in Tajikistan is an enormous indebtedness of farmers to cotton investors. The indebtedness of farmers has reached such levels that they virtually do not see any cash in their hands, since everything goes to investors as a loan repayment. Farmers have even taken loans for 2–3 years ahead.

Incomplete data from international development agencies implementing WUA projects throughout Tajikistan states that there were at least 100 WUAs in 2005 (Sehring, 2006). According to Sehring (2006) since there is a general trend for WUAs to be formed with the assistance of donor organizations. Those without any assistance are usually not registered. In addition, the process of dismantling large cooperatives is still ongoing in Tajikistan. Hence, the structure of existing WUAs is continually changing. It is expected that the process of dismantling the large cooperatives will take at least one more year.

The summary of institutional environments in all three countries, as provided in Table 1, suggests that the Kyrgyz Republic does indeed have a well-established institutional framework for WUA development, compared to its neighbours. The situation in Tajikistan is improving, while Uzbekistan is rather lagging behind the other two countries.

4.2. Water delivery

Water delivery performance, as mentioned earlier, was measured using three indicators: adequacy, timeliness, and equity. Over the four-year period, water adequacy during the cropping season in the Kyrgyz WUA was steadily improving (Figure 2) as the number of farmers who received sufficient water deliveries increased. Meanwhile, over the same period despite improvements seen in the Uzbek and Tajik WUAs in 2003 compared to 2002, adequacy indicator has sharply fallen by 33% and 20% in 2005 compared to 2003 results, respectively. This indicated that 30–40% of farmers in the Uzbek and Tajik WUAs did not receive sufficient water for irrigation in 2005.

9 At present, in order to pay their ISF and previous water debts, farmers have to ask their investors to pay water charges. Investors only pay a part of the ISF directly to the canal management organization (CMO), bypassing the WUA. This action undermines the role of the WUA in the irrigation system. Neither investors nor farmers are interested in paying the ISF in full because, for the investors, this would be a reduction in profits while, for farmers, it would be an increase in debt. Besides, there are no strict enforcement rules followed by local administrations for ISF. Furthermore, investors only deal with farmer associations or organizations that represent a certain group of farmers. Due to these arrangements, when hydrological WUAs are created, the structure of the farmer ‘debt’ associations has to change/regroup. Otherwise, investors have to deal with individual requests for ISF payment from farmers who were previously in one association but now in a different WUA due to hydrographic division. Neither change is desirable for investors and, thus, they are not willing to make them. And this is contributing significantly to the difficulty of forming hydrographic WUAs in Tajikistan.
Water adequacy alone is not enough to guarantee farmers a good irrigation service; there is also the correct timing of water supply that is crucial in irrigated agriculture. The results show that farmers’ satisfaction with timing of water delivery is rather low compared to adequacy in all three countries (Figure 2). Overall, in 2005, 40–50% of farmers did not receive water on time. Amongst the three WUAs, only the Tajik WUA showed considerable improvement (by 30%) since the previous survey. However, even with this improvement more than half of Tajik farmers reported having experienced untimely irrigations. Despite the fact that the situation in the Kyrgyz WUA was more stable, the percentage of farmers who did receive water on time was still very low. The biggest instability, though, was observed in the Uzbek WUA where the percentage of farmers with timely irrigations in 2005 had decreased by 12 percentage points compared to its 2003 level, despite being almost 20 percentage points higher than in 2002.

The degree of problems related to water delivery faced by water users at different hydrographic locations along the canals seemed to vary, irrespective of the country. Thus, in terms of water adequacy, the pattern from the head-tail perspective for all three WUAs was found to be almost identical. The head users experienced very little or no inadequate irrigation, while midstream and, especially, tail-end users were most likely to suffer (Figure 3).

Detailed analysis of the Kyrgyz WUA (Figure 3(a)) shows that the situation with regards to water adequacy was clearly much better for those in the head than in the middle and tail of the canal. This trend

![Fig. 2. Percentage of farmers received adequate and timely water deliveries during the cropping season (2002–2005).](https://iwaponline.com/wp/article-pdf/12/2/165/406821/165.pdf)
was consistent across all hydraulic levels (secondary, tertiary and plot location) and across all locations (head, middle and tail). Most disadvantaged were the farmers with their fields furthest from the inlet. The same trend is observed for timeliness of water delivery in this WUA (Figure 3(b)).

A similar picture for the adequacy indicator can be seen for the Uzbek WUA (Figure 3(c)) where all water inadequacies reported (37% of farmers) occurred in the middle and tail-end of the tertiary and

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**Fig. 3.** Percentage of farmers received adequate and timely water deliveries by head, middle and tail sections of the canal (2005).
secondary canals. No inadequate irrigations were reported by the farmers whose plots were located at the head of the canal. In contrast, the timeliness of water deliveries in the Uzbek WUA was almost equally poor across all hydraulic locations (Figure 3(d)).

In the Tajik WUA, the general trends for adequacy (Figure 3(e)) and timeliness (Figure 3(f)) show that the differences in water deliveries vary relatively less between the head and tail parts of canals, compared to the other two WUAs. Yet, the general tendency to worsen towards the tail part is still present.

4.3. Irrigation infrastructure

4.3.1. Repairs and maintenance of canals. The Repair and maintenance status of the irrigation infrastructure has, since 2002, seen a visible improvement at both watercourse and distributary canal level, across all study WUAs (Table 2). Especially dramatic was the decline in the aggregate volume of unfulfilled maintenance needs, for both routine and periodic maintenance needs.

As for the most urgent problems at the watercourse level, in 2005 the majority were of a periodic nature across all study WUAs. Installation of water measurement devices and reinforcing the watercourse banks were reported as the most needed improvements in the Tajik WUA, while in the Kyrgyz WUA, they were repairs to inlet gate structures and mechanized removal of silt. At the secondary canal level, the required actions were mostly of a routine nature: in the Tajik WUA it was removal of silt from inside the canal, while in the Kyrgyz WUA it was both removal of vegetation along the canal banks and removal of silt. No major problems were reported in the Uzbek WUA.

4.3.2. Labor contribution to canal cleaning. The contribution of labor to community canal cleaning, or hashar (or ashar in most local languages), is deeply rooted in the history and traditions of Central Asian countries and is an institution that has an important role in irrigation agriculture. Yet, the analyses show some certain differences in the way that hashar is perceived and treated in different countries.

Almost all farmers in the Uzbek WUA and the majority in the Kyrgyz WUA perceived community cleaning as a voluntary action (Table 3), while almost half of the respondents in the Tajik WUA considered it to be compulsory. Whenever hashar is announced all or almost all community members were usually there to contribute to the event. Only a very small fraction of the respondents in the Uzbek and Kyrgyz WUAs admitted non-participation in this activity. Interestingly, according to the respondents, there were almost no penalties reported against non-participants in the Uzbek and Tajik WUAs, which could be attributed to a high participation rate. Amongst the most popular measures against non-participators in the Kyrgyz WUA were cash fines. Other measures reported here also included relegating non-participants to the end of the irrigation schedule, depriving them of 1–2 irrigation turns, exercising social pressure by community elders/well-respected people and imposing salary deductions through village councils.

As far as criteria used by different WUAs for labor allocation when cleaning canals, the farm boundaries principle was most popular in the Tajik WUA, whereas in the Kyrgyz WUA it was regarded as everyone’s business, i.e. all should participate. Different criteria for work allocation were found in the Uzbek WUA where land size, plot boundaries, or the number of family or farm members were used.

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10 Due to the different structure of canal systems in the sampled WUAs, secondary (mainly) and tertiary (occasionally) canals that carry water are referred to as watercourses. The canals from which farms receive water, which are mostly tertiary (and below) level canals, are referred to as distributary canals.
An interesting pattern in the frequency of communal canal cleaning was observed (Table 3). The responses suggest that in the Uzbek WUA almost all those interviewed cleaned their main watercourse, tertiary and secondary canals three times a year: before, during and after the growing season. Meanwhile, Tajik farmers usually cleaned their canals two times a year: before and during the crop season. About a quarter of local farmers also reported having contributed to cleaning their secondary canals three times a year. As for the Kyrgyz WUA, most local farmers cleaned their canals only once: before the cropping season; the number of those who also cleaned their canals during the irrigation season was very low.

4.4. Social impact

4.4.1. Water dispute resolution. The Kyrgyz WUA was the only WUA where dispute incidence lowered (Figure 4). In the Uzbek WUA the number of disputes showed no change since the survey of 2003, while for the Tajik WUA it significantly increased in 2005 compared to 2002 and 2003.

According to farmers, the major reasons for disputes to arise were lack of water, lack of coordination between farmers, unfair distribution, etc. Most disputes, when they occurred, tended to be settled by the

Table 2. Routine and periodic maintenance needs at watercourse and distributary canal levels, by WUAs (2002–2005).

<table>
<thead>
<tr>
<th></th>
<th>Kyrgyz WUA</th>
<th>Uzbek WUA</th>
<th>Tajik WUA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watercourse</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routine</td>
<td>241</td>
<td>95</td>
<td>25</td>
</tr>
<tr>
<td>Periodic</td>
<td>291</td>
<td>134</td>
<td>58</td>
</tr>
<tr>
<td>WUA Score</td>
<td>532</td>
<td>229</td>
<td>83</td>
</tr>
<tr>
<td>Distributary canal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routine</td>
<td>114</td>
<td>55</td>
<td>41</td>
</tr>
<tr>
<td>Periodic</td>
<td>144</td>
<td>105</td>
<td>34</td>
</tr>
<tr>
<td>WUA Score</td>
<td>258</td>
<td>160</td>
<td>75</td>
</tr>
</tbody>
</table>

Indicators for infrastructure rehabilitation were calculated using multiple choice questions and rank-ordering. The respondents were asked to select from a multiple choice list or, alternatively, report and rank (in order of importance) all the needs that were required to be performed. Each such selected item was given a value reverse to its rank, e.g. the most important item, ranked first, was given 3 points, the second most important: 2 points, and the third: 1 point. The values for each particular problem were then summed up across all observations to arrive at the overall WUA score for each such problem. Rehabilitation problems were divided into routine (including cleaning canals of silt and vegetation, required every season) and periodic (namely the installation and repair of measurement devices etc., that are required periodically) and their scores were aggregated across all canal levels (Yakubov & Ul-Hassan, 2007).

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According to farmers, the major reasons for disputes to arise were lack of water, lack of coordination between farmers, unfair distribution, etc. Most disputes, when they occurred, tended to be settled by the

Table 3. Participation of farmers in canal cleaning in 2005: nature, pattern, enforcement and frequency (% of respondents).

<table>
<thead>
<tr>
<th>Participation is regarded as</th>
<th>Kyrgyz WUA</th>
<th>Uzbek WUA</th>
<th>Tajik WUA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary</td>
<td>62%</td>
<td>95%</td>
<td>50%</td>
</tr>
<tr>
<td>Compulsory</td>
<td>21%</td>
<td>5%</td>
<td>45%</td>
</tr>
<tr>
<td>No response</td>
<td>16%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Participated by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All or almost everyone</td>
<td>66%</td>
<td>73%</td>
<td>89%</td>
</tr>
<tr>
<td>Any penalties exist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22%</td>
<td>2%</td>
<td>7%</td>
</tr>
<tr>
<td>Frequency of canal (watercourse)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-season</td>
<td>94%</td>
<td>100%</td>
<td>93%</td>
</tr>
<tr>
<td>In-season</td>
<td>5%</td>
<td>97%</td>
<td>78%</td>
</tr>
<tr>
<td>Post-season</td>
<td>0</td>
<td>76%</td>
<td>3%</td>
</tr>
</tbody>
</table>
farmers themselves, by local water masters/mirabs (in most Central Asian languages - water masters or ditch riders who are responsible for water distribution to tertiary canals) or the WUA committee. Interestingly, the average number of reported disputes per farmer is highest in the Tajik WUA, somewhat lower in the Uzbek WUA and lowest in the Kyrgyz WUA (Table 4).

4.4.2. ISF payment. Most farmers in the Kyrgyz and Uzbek WUAs reported having paid their irrigation service fees in full (Figure 5). The lowest revenue collection was observed in the Tajik WUA where more than a fifth of the interviewed farmers paid nothing for water services while only two thirds paid it, but partially. The reasons for non-payment according to Tajik respondents are a general lack of money either due to lack of cash in hand or unsold crop, a perception that their former parent cooperative farm was still accountable for the ISF payment, or that they had no legal responsibility as their land was not yet registered.

The willingness and capacity to pay for irrigation services were found to be much higher in the Uzbek and Kyrgyz WUAs, where irrigation service fees were much lower. Nevertheless, a quarter of all the respondents in the Kyrgyz WUA also expressed their concerns about increasing tariffs.

4.5. Crop yield

Yield trends for major crops in WUAs might give some indications of irrigation performance. For this purpose, this analysis employs two ways of comparing the yields: current versus past yields, and WUA yields versus national average yields (Figure 6).

The yields of all major crops in the Kyrgyz WUA (Figure 6(a)) rose consistently over the four years under consideration and show a better trend than in the other WUAs (Figure 6(c) and (e)). The average yields for all major crops in the Kyrgyz WUA in 2005 were consistently higher than the national averages (Figure 6(b)).

In the Uzbek WUA, there was a general trend for the yields of two major crops (cotton and wheat) to decrease by a yearly average of 9% and 4%, respectively, between 2002 to 2005 (Figure 6(c)).

Table 4. Average number of disputes of a farmer with his/her neighbor and WUA authorities over water distribution (2005).

<table>
<thead>
<tr>
<th></th>
<th>Kyrgyz</th>
<th>Uzbek</th>
<th>Tajik</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighbour</td>
<td>1.6</td>
<td>2.3</td>
<td>3.0</td>
</tr>
<tr>
<td>WUA</td>
<td>1.3</td>
<td>1.7</td>
<td>2.5</td>
</tr>
</tbody>
</table>
In contrast, the national figures for the same cotton and wheat crops (Figure 6(d)), showed steady increases in yields from 2002 onward. Given that this area is the most productive in Uzbekistan, and that cotton and wheat are predominantly grown by farmers under government order, the result suggests that farmers lack incentives to improve productivity for these crops.

Two major crops in the Tajik WUA (also cotton and wheat) have shown a slight increase in yield over the four year period (Figure 6(e)). When compared to the average nation-wide Figs. (Figure 6(f)), the yields for both cotton and wheat in the WUA have been consistently higher by 10–30% for cotton and 30–50% for wheat, especially in 2005.

4.5.1. Constraints to improve crop yields as identified by farmers. The reasons why local farmers fail to obtain their optimum crop yields differ between WUAs (Table 5). In the Kyrgyz WUA the constraints were largely dominated by lack of fertilizers, followed by lack of farm machinery and poor quality of fertilizers and other inputs. Farmers in the Uzbek WUA perceived a lack of water for irrigation, lack of fertilizers and no money to buy required inputs as the most serious impediments to good yields. In the Tajik WUA, most farmers reported lack of money to buy required inputs, no motivation due to debts and lack of water for irrigation as their top constraints to good farming. What is worth noting here is the distance between rank-ordered scores calculated for different constraints by each study WUA. While in the Uzbek WUA all such scores are very close to each other, in the Kyrgyz and Tajik WUAs, the difference in scores between the first and second constraints is rather substantial. This suggests that such topmost problems in the latter two WUAs are far more acute, compared to any other problems reported.

5. Discussion

This study aimed to answer the question whether or not a better institutional environment in a country implies a better WUA performance, by comparing the perceptions of farmers in the study WUAs located in three countries of the Ferghana Valley: the Kyrgyz Republic, Uzbekistan and Tajikistan.

The hypothesis suggested that in a country with a well-defined and enabling institutional framework/environment, the performance of the self-governing organization should be higher. Hence, it was expected that the performance of the Kyrgyz WUA would be better than in the other two study
WUAs due to a relatively well-established institutional environment in the Kyrgyz Republic. However, the study reveals that many performance indicators appear to be higher in the Uzbek WUA than in the Kyrgyz WUA, though with a relatively lower performance in the Tajik WUA. In particular, despite the fact that the Kyrgyz WUA consistently showed improvements in adequacy of water deliveries, it lags behind in terms of service timeliness compared to the Uzbek WUA. A relatively similar situation occurs in the maintenance of irrigation infrastructure. Despite the improvements over the study period shown by the Kyrgyz and Tajik WUAs, much better infrastructure maintenance is still found in the Uzbek WUA. Likewise, the frequency of and contribution to canal cleaning among farmers are highest in the Uzbek WUA, somewhat lower in the Tajik WUA and lowest in the Kyrgyz WUA. In terms of the incidence of water disputes, the Kyrgyz WUA shows an overall decreasing trend featuring the lowest average incidence of such disputes per farmer. Nevertheless, the average number of disputes that Kyrgyz farmers have with their neighbours is higher compared to the Uzbek WUA. The ISF collection rate and willingness to pay are again found to be highest in the Uzbek WUA, followed by the Kyrgyz WUA.

Fig. 6. Crop yield in each WUA in comparison to the national average. (*Sources*: WUA data are based on field survey, national data taken from FAOSTAT).
WUA, and lowest in the Tajik WUA. The area where the Kyrgyz WUA does manage to show consistently better and improving results over the study period, compared to the other two WUAs, is crop productivity. It should be noted, though, that farm labor has been found to be far more intensive in the Kyrgyz WUA (4 to 5 workers per ha), than in the Tajik and Uzbek WUAs (about 1 and 2 farm workers per ha, respectively).

Though the outcomes as discussed above may not appear to be consistent with the proposed hypothesis, a somewhat closer look at the situation suggests otherwise. The results reveal that, on the whole, the situation with the Kyrgyz WUA is gradually and consistently improving compared to the Uzbek and Tajik WUA. There is evidence that the capacity of the Kyrgyz WUA to operate and maintain its infrastructure is being enhanced, resulting in consistent gradual recovery since 2002. The adequacy of water delivery is also steadily improving. The existence of effective collective choice arrangements and the benefits that farmers consequently get can be seen through declining water disputes, improved water services and the acceptance of ISF rates by the majority of the respondents in the Kyrgyz WUA.

However, there are still many aspects that need addressing and the results, such as poor water delivery towards the ends of canals, infrequent and poorly participated hashars despite the penalties imposed, as well as low ISF collection rates (although water tariffs are accepted by the majority), indicate that these are mainly related to lack of enforcement mechanisms and large numbers of smallholder farms that the Kyrgyz WUA has to deal with. Compared to Uzbekistan and Tajikistan, where the size of a typical farm in a WUA is much bigger, the WUAs in the Kyrgyz Republic normally consist of hundreds and even thousands of smallholders with the size of their land holdings less than one hectare. Hence, the timely and equitable delivery of water to these numerous small plots is extremely difficult, resulting in differential irrigation service quality between the head and tail parts of all canals. The WUA does not have a required capacity or a system in place to deal with multiple water requests from numerous individual farmers, whose water requirements frequently differ substantially due to cultivation of different crops, not only from farmer to farmer but also within each particular small plot of an individual farmer. In order to resolve these problems, especially along tertiary and lower irrigation networks where most problems reside, farmers are starting to organize themselves into water user groups to ensure effective and equitable water delivery between head and tail of the canals, and to achieve better recovery of irrigation fees. So the WUA, instead of dealing with thousands of water requests, water deliveries and ISF collections, can effectively deal with much smaller numbers of water user group leaders, thus making its workload much easier to handle and ensuring better services to farmers. However, although the creation of water user groups has been effective, this practice is not yet widespread.

Table 5. Constraints faced by farmers to improve crop yields.

<table>
<thead>
<tr>
<th>Yield constraints</th>
<th>Kyrgyz WUA</th>
<th>Uzbek WUA</th>
<th>Tajik WUA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score</td>
<td>Rank</td>
<td>Score</td>
</tr>
<tr>
<td>Lack of water for irrigation</td>
<td>20</td>
<td>5</td>
<td>57</td>
</tr>
<tr>
<td>Water is not delivered on time</td>
<td>41</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Excessive water losses in canals</td>
<td>124</td>
<td>1</td>
<td>52</td>
</tr>
<tr>
<td>Lack of fertilizers</td>
<td>23</td>
<td>4</td>
<td>51</td>
</tr>
<tr>
<td>Lack of money to buy required inputs</td>
<td>17</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Lack of chemicals</td>
<td>23</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Poor quality of fertilizers &amp; chemicals</td>
<td>61</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Lack of farm machinery &amp; devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No motivation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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In contrast, in Uzbekistan and Tajikistan the institutional environment for WUAs is far less enabling\textsuperscript{11}. Irrigation services in these countries, especially in Uzbekistan, are still handled in the old Soviet way. This might be the explanation for the overall high performance indicators of the Uzbek WUA, including high ISF payment compared to the other two countries. Also, well-organized canal cleaning activities with a high participation rate suggests the existence of a stronger and more effective hashar arrangement compared to the Kyrgyz Republic.

Yet, this old command system does not provide sufficient room for WUAs to function properly and fulfill their role. Water delivery services have considerably declined in Uzbekistan in terms of adequacy and timeliness. Crop yields for cotton and wheat are low even though the Valley has always been considered as the most productive area in the region. This gives an indication that farmers do not have incentives to improve their productivity, yet the priority in water services are received by cotton and wheat growers. In Tajikistan, overall equity of water delivery is poor. Dispute numbers per farmer are high in Uzbekistan and Tajikistan. Moreover, dispute levels have risen sharply in Tajikistan. This is perhaps not surprising given the fact that there is an increased pressure of very high irrigation fees. In addition, water problems related to WUA operations are ranked as the major obstacles in farming in Uzbekistan and Tajikistan. Therefore, these results indicate that the effectiveness of the old system is declining, yet the capacity of the WUA is low.

Furthermore, the majority of farmers in Tajikistan cannot afford to pay their ISF (including water fees) mainly because of very high ISF rates by regional standards, and because of high indebtedness. This situation further jeopardizes the operation of WUAs and their sustainability.

Hence, not only the institutional environment but also the economic setting, the viability of agriculture and the size of farm land affect the performance of a WUA. These factors were beyond the scope of this research but show that more detailed research, both in terms of depth and scope, is needed.

6. Conclusion

Based on the summary of findings, the following recommendations can be made.

In the Kyrgyz Republic, mechanisms for enforcement of legislations are required to ensure water users fulfill their obligations. Also, encouraging the creation of water users groups can be an effective method to increase the effectiveness and equity of irrigation service delivery and increase fee collection, which is a vital component for WUA sustainability. Without these measures, sustainability of WUAs and improvements of infrastructure and water services are questionable.

The majority of WUAs in Uzbekistan and Tajikistan are not based on coherent hydrographic units, are not registered and do not operate according to the bottom-up principle. Therefore, there is a pressing need to establish an institutional environment where WUA operations can be maintained as a user-driven institution and not limited and overshadowed by the old command system. In addition, in Tajikistan, issues related to water fees and farmers debts need to be reconsidered and tangible measures, such as lowering or subsidizing water charges and settling debt issues that where inherited from the Soviet times, need to be taken by the government. Otherwise, these factors not only jeopardize the viability of WUAs and the effectiveness of irrigation systems, but also the viability of agriculture itself.

\textsuperscript{11} As mentioned earlier, the Law was absent until recently in Tajikistan.
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