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# Shifting to hydrological boundaries – The politics of implementation in the lower Amu Darya basin

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ABSTRACT

During the time of the Soviet Union, the Central Asian states managed their water resources on the meso level according to administrative rather than hydrological boundaries. It was only in 2003 that Uzbekistan shifted from administrative to hydrological boundaries for water management. Using the example of Khorezm Province in the lower Amu Darya basin, this paper shows that redefining boundaries is a political process, which led in Khorezm to new boundaries which are partly determined by hydraulic, not hydrological, and political considerations. Nevertheless, the new management approach has created more equity amongst the different districts in terms of water supply per irrigated area. However, simple equity in water supply did not take into consideration other issues, such as infrastructure, hydrogeological zones and crop production. In addition, the official data show that the achieved equity was based on an overall increase in water supply to the individual districts and to Khorezm as a whole. When only the increase in water supply to the individual districts is taken into consideration, it appears that the location of the main office and the regional provenance of the main staff influenced water supply to specific districts. Finally, based on the data presented for Khorezm Province the paper goes a stage further and questions the real value of the new water management boundaries implemented in Khorezm.



## 1. Introduction

Managing water according to the system-level is commonly emphasised in teaching in irrigations schools. It is somehow believed that head-end and tail-end problems can be more easily bypassed by managing the resource according to its boundaries (Ostrom, 1990). This knowledge has not always been followed up on the meso or even higher level, especially in the old areas of the multiple North (Molle, 2006). On the other hand, the former colonies and the American West were ideal playing fields for these engineering and social engineering approaches. New large-scale irrigation systems directly influenced the development of new settlements that cut across established administrative boundaries. The organisations managing the irrigation systems were structured according to the system-level. Therefore, they were not directly linked and accountable to the governing and administrative units, even though there had been earlier warnings that irrigation system-level management on the meso level can lead to non-transparency and unaccountability (Wade, 1984). Today, the management of water resources according to their boundary, including system-level management of large-scale irrigation systems, is a central tenet of integrated water resource management (IWRM). Therefore, not only forms part of current directives in the multiple North, but also of global policy for the multiple South.

During the time of the Soviet Union, the Central Asian states managed their water resources on the meso level according to administrative rather than system-level boundaries. Even though here also new large-scale irrigation systems directly influenced the development of new settlements, overall, water resources were managed according to administrative boundaries, and therefore water management organisations were directly linked to the administrative units. On the wave of IWRM and particular recommendations of the Global Water Partnership for Central Asia, Uzbekistan, a former Republic of the Soviet Union, passed a law on water management according to hydrological boundaries. Here, in a case study of Khorezm Province in north-western Uzbekistan, the implementation of the policy and its consequences are analysed.

The research was conducted in Khorezm Province, Uzbekistan between July and October, 2006. Structured and semi-structured interviews were conducted in local- and meso level water management organisations and on these levels with key stakeholders in the agricultural sector. Here, official data from the water management organisations are utilised for analysis.

The next section gives a short introduction to the concept of hydraulic boundary management. This is followed by background information regarding the case study, with emphasis on the

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ongoing changes in the water management sector. The fourth section focuses on the implementation of hydraulic boundaries and its consequences for water management between the different districts. The last section presents the conclusions.

## 2. Hydraulic boundary management

Molle (2006, p. 5), looking at the evolution of the concept of river basin and water resource boundary management, argues that at "the beginning and middle of the nineteenth century with the progress of natural science, positivist thinking toyed with the idea of determining 'natural truths' that could be dragged out of, and insulated from the misery of human affairs...subduing nature and marshalling water became part of the mission of western countries, inebriated both by their colonial adventures and by the scientism at the time." Ertsen (2007) distinguishes between three irrigation design schools: the Dutch, the English, and the French. Even though all schools were distinct in their design of irrigation infrastructure, in all schools it was anticipated that management would be in accordance with system boundaries rather than administrative boundaries. Although in the Western European countries the focus on water boundaries as opposed to administrative boundaries came into conflict with prevailing political structures, the situation was different in European countries' colonies.

At the time when political scientists and new institutional economists (NIE) wrote on water management, the need for managing water according to system-level (hydraulic) rather than administrative boundaries was unchallenged. In setting rules for common pool resource management, Ostrom (1990, 1993), as the first design principle for long-enduring irrigation institutions, sets her emphasis on clearly defined boundaries of the service area for management and collective action. Nevertheless, Diemer et al. (1991) highlight the importance of matching boundaries between local political system and irrigation infrastructure. Similar to Ostrom, Uphoff et al. (1991, p. 110) reason for the meso level that "boundaries for the administration of irrigation activities should be (but are not always) aligned with hydraulic realities". In the context of structuring according to hydraulic rather than administrative boundaries, Uphoff et al. (1991, p. 220) put the emphasis on the system manager, stating that "it is up to system managers to weld a consensus together, within their agencies, with other government agencies (which are structured according to administrative boundaries) and with their respective clienteles (water users) at national, regional, district community and field level". The underlying assumption is that the manager acts altruistically. Hence, the irrigation bureaucracy is portrayed in a Weberian perspective as an organisation of positions and not of people (Nelson and College, 1999). However, Wade (1982) had already emphasised the not always altruistic behaviour of irrigation management staff (later acknowledged by Repetto, 1986; Merrey, 1996; Huppert et al., 2001; Mollinga 2003).

System-level and hydraulic boundaries of irrigation infrastructure are portrayed as being the natural management unit for irrigation systems, and as connected to other natural units. Mollinga (2003, p. 22), referring to Uphoff et al.'s level-model on irrigation systems, argues that "the level-model can be extended upward by seeing irrigation systems as part of the watershed, and watersheds part of the regional, continental and world wide agro-ecological systems". However, Wester and Warner (2002) question the naturalness of hydrological boundaries and watersheds. They argue that the determination of boundaries is influenced through political processes. Hence, stakeholders can be included or excluded according to how the boundaries are drawn. In terms of management according to resource boundaries, Barham (2001, p. 189) argues that "we do not have established social and political institutions in place that can assure that deliberation over these new rules will be broadly democratic". Similar questions could be raised for system-level and hydraulic boundaries.

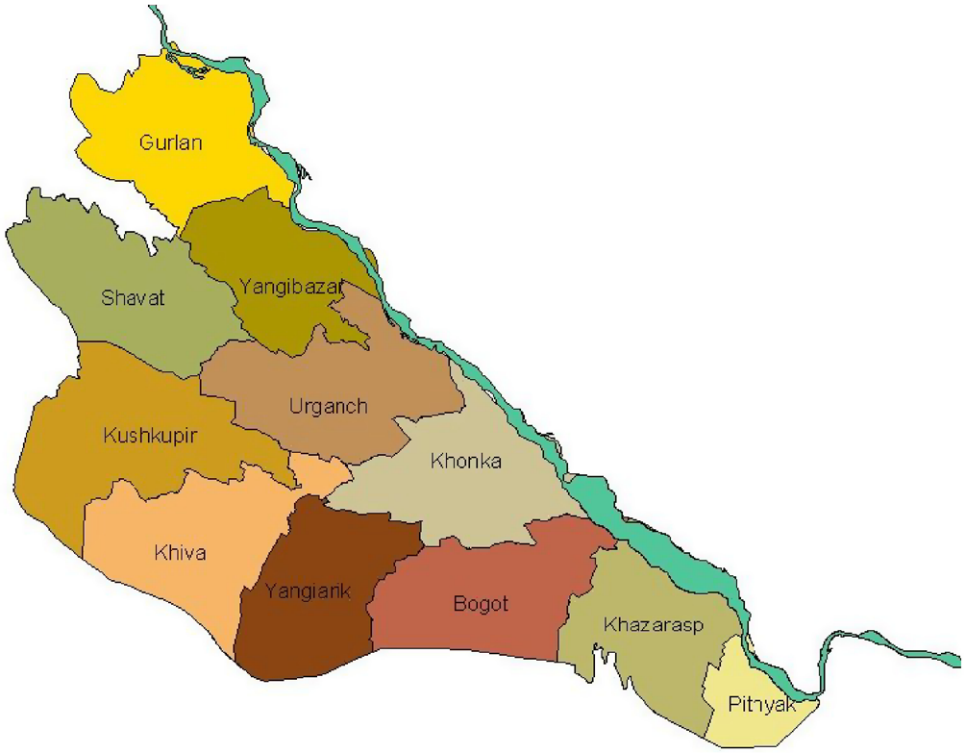
Nonetheless, the management of water resources according to their boundary is a central tenet of IWRM. A key principle for water management in the Central Asian states as recommended by the Global Water Partnership (2007) on its website, is that they should "Reform water management institutions from administrative boundaries to hydrographic ones to control the whole catchment basins".

## 3. Background to the study region

Agriculture in Uzbekistan, a semi-arid country, is mainly based on irrigation. Uzbekistan receives water from three main transboundary rivers: the Amu Darya, the Syr Darya and the Zerafshan. The focus of this research is Khorezm Province, which is located downstream in the Amu Darya basin. The Amu Darya originates in Afghanistan and Tajikistan. It flows through Turkmenistan into Uzbekistan before it finally drains into the Aral Sea. Before the Amu Darya flows from Turkmenistan into Uzbekistan, it is stored in the Tuyamuyun reservoir. Three provinces, Khorezm (Uzbekistan), Dashovuz (Turkmenistan) and Karakalpakstan (Uzbekistan), receive agricultural and drinking water from the reservoir. Khorezm Province has approximately 250,000 ha of irrigated agricultural land.

During the Soviet Union, the Ministry of Water Resources (Minvodkhoz) was responsible for water management. According to Thurman (2001, p. 4), "management was strictly centralised and run by well funded departments at republic, province, and district level that were responsible for operations and maintenance (O&M) on inter-farm irrigation and drainage (I&D) systems. Water allocation was conducted according to highly standardised schedules set by republic, province, and district departments of Minvodkhoz". According to a TACIS report, official water demand was calculated based on the following indicators: (1) Structure and area of cropped land; (2) Irrigation regime (method, norm and period); and (3) Efficiency of irrigation network and irrigation technique (TACIS, 1997). Abdullaev (2005) and Abdullaev et al. (no date) distinguish between two periods, the first starting in the mid 1960s and the second in the mid 1980s. According to Abdullaev (2005), during the first period water distribution was based on demand and during the second period on the adjusted water demand principle. He explains (p. 1) that "this principle was based on adjusting water demand proportionate to water availability". According to him (p. 1), "both principles worked quite well for collective set up of farming during soviet times. Centralised state control and large sizes of farming units made easy delivery of water for irrigation...The competing interests for irrigation water in the on-farm level were not common". However, Siderius et al. (2008), comparing the water supply averages for different crops in Northern and Southern Karakalpakstan, Khorezm and Dashovuz in 1989, show that there were differences between and within provinces. Arguably, their data only look at average water supply and do not take into consideration differences in soil, groundwater levels or irrigation networks.

During the Soviet Union and after independence, each administrative level had one governing authority. The Ministry of Water Resources and the Ministry of Agriculture had at each administrative level a department that was subordinated to the governing authority. After independence, these were the province or district governors (hakims). At province and district levels, the directors of the agricultural departments (AGROPROM) and of the water resource departments (Vodhoz) were deputy




**Map. 1.** Khorezm Province and its administrative units. *Source*: Ruzieva, GIS expert, German Uzbekistan project.

governors. Hence, they were directly linked to the governing authority of the administrative units. In 1997 the two ministries were merged[1], but still the directors of the joint departments were deputy governors (Wegerich, 2005). Even though at this point the collective farms were still operating, Wegerich (2004a) showed that in Khorezm the District Water Management Departments did not have the logistical means to control water utilisation between collective farms. This inability to control became particular evident during the drought years of 2000 and 2001. Also during these years, a high level of competition over water between upstream and downstream provinces and districts was visible (Dukhovny, 2002; Wegerich, 2004a). In addition, during the drought, water management in Khorezm was influenced by political stakeholders – district governors (Wegerich, 2004b).

Meanwhile, land reforms have taken place. Privatisation of collective farms and the establishment of water user associations (WUAs) were completed in Khorezm Province in 2005. Even though collective farms have disappeared, the state order for production of cotton and wheat crops has continued. On the territory of the former collective farms, it is mainly machine tractor parks (MTPs), but also WUAs, that are responsible for the implementation of the state plan. Privatisation led to a rapid increase in water users and therefore to a need to increase water control Map. 1

The President's Decree N УП-3226 of 2003 determines that water has to be managed according to hydrological boundaries. Consequently, the Ministry of Agriculture and Water Resources has been reorganised at its lower administrative levels. Although on the national level there is still only one ministry, on the provincial and district levels the former agriculture and water departments have been separated. The province and district water departments have been dissolved and new departments have been formed according to the boundaries of the water supply delivery infrastructure.[2] The new departments are responsible for either whole river basins or parts thereof, and their subunits, the canal organisations (TIZIMs) are responsible for inter-district canals. The agricultural departments (AGROPROM) continue to be organised according to administrative boundaries, and the direct influence of the governors on AGROPROM has continued at the province and district level, but this is not the case for the new water departments. The basin units and the TIZIMs are now officially disconnected from the governing bodies at the province and district levels.

Yalcin and Mollinga (2007, p. 22) argue that the management reform was mainly based on the activities of one deputy minister. "The Deputy Minister of Agriculture and Water Resources, Abdurakhim Jalalov, responsible for water management took the advantage of the existing atmosphere of change (experiences during the drought) and promoted the idea of transforming the territorial-administrative water management system. . .into an irrigation basin water management system based on hydrological principles in a centralised fashion". According to the deputy director of the lower Amu Darya basin, the change from administrative to hydrological boundaries was supposed to (1) improve the situation between the upstream and downstream administrative units, and (2) decrease the influence of political stakeholders (informal interview, Attikov 22.08.06). Similarly, Yalcin and Mollinga (2007, p. 21/

[1] Wegerich (2005) presents the merger from a meso level perspective and Yalcin and Mollinga (2007) from a national perspective.

[2] The implementation of WUAs started before the President's Decree on hydrological boundaries came into effect, and therefore their boundaries were determined by the former administrative boundaries of the collective farms. Yalcin and Mollinga (2007, p. 22) argue that "the hydrological principle was also introduced (for WUAs) in the already on-going WUA programme". However, the Decree did not lead to a change of the boundaries of WUAs in Khorezm Province. In one pilot district only, Yangibazar, hydraulic, not hydrological, boundaries were established even before the Presidential Decree. However, similar to the European approach to irrigation management, new irrigation areas in the Soviet Union determined the boundaries of collective farms. Hence, within the new irrigation systems in Khorezm, administrative and hydraulic boundaries of collective farms, and therefore of WUAs, coincide – for example the WUA studied by Veldwisch (2007a, 2007b) and Zegwaard, (2007).

22) reason that the reform was designed "to 'depoliticise' certain sectors to achieve more effective and efficient planning and management while maintaining centralised control [and] to reduce the competition between the districts over water distribution". Yalcin and Mollinga's paper presents the new organisational structure as well as the number of irrigation management (sub-) basins and canal organisations. However, they do not analyse the implementation of the reforms. The only example they give is within Khorezm Province. They mention that the Khorezm Province Water Department moved office, away from the Province Hakimyat. Yalcin and Mollinga use this example as a justification for their reasoning that the reform led to a depoliticisation. Given that Yalcin and Mollinga do not incorporate in their analysis the logistical problems of the District Water Management Organisations to control water utilisation, it appears that the establishment of canal organisations and the introduction of hydrological boundaries is for them already an indication of efficient management.

## 4. Contested implementation of hydraulic boundary management in the lower Amu Darya basin

Organising water management according to hydrological boundaries could be straight forward and at least in theory is a-political. It was proposed to organise a lower Amu Darya basin unit, incorporating the provinces of Khorezm and Karakalpakstan in one unit.[3] At the point when the decision was taken, Khorezm Province used more water than was officially planned and allocated to it. As Table 1[4] shows, in 2003 Khorezm used significant more water than in the previous year, even though the available water in Tuyamuyun did not increase significantly.

The high water use in Khorezm led to the decision in Tashkent to site the head office of the lower basin water management unit in Karakalpakstan (informal interview, 28.07.06). The decision triggered protests from the Khorezm side. Finally, a compromise was reached. It was decided to have a three-year rotation of management offices and of management staff (informal interview, Attikov 22.08.06). To have a balance between the two provinces, it was decided in Tashkent that a person from Khorezm should be the director of the lower Amu Darya basin unit. The chosen candidate, Mr. Attikov, the former director of the Khorezm Province Water Department, refused to leave Khorezm and move to Nukus. He also refused to travel 700 km to Nukus every day (Attikov 22.08.06). Hence, a person from Karakalpakstan became the director of the lower Amu Darya basin unit, and Mr. Attikov became deputy director with an office in Urganch (as mentioned by Yalcin and Mollinga, 2007). As shown in Table 1, although it was stated that Khorezm used too much water in 2003, the compromise reached did not lead to a decrease in water use in Khorezm, even though the available water in Tuyamuyun fell in 2004 even below the 2003 level.

As already indicated in Table 1, with the exception of Gurlan District, all districts receive water from the Tashsaqa canal system. Therefore, the first draft proposal for the implementation of hydrological boundaries suggested having a total of only seven TIZIMs in the lower Amu Darya basin, of which one TIZIM was supposed to be in Khorezm, and another TIZIM was supposed to manage the Kilichbay irrigation canal between Khorezm and Karakalpakstan. This canal originates in Yangibazar District (Khorezm), runs through Gurlan District (Khorezm) and Amu Darya District (Karakalpakstan) before it ends in Dashovuz (Turkmenistan). Despite the President's Decree on hydrological boundaries, in Tashkent it was decided to split the Tashsaqa canal system into three TIZIMs, each managing different parts of the larger system and therefore, not only according to hydrological but also not according to system-level boundaries. In addition, it was determined that the Kilichbay irrigation canal should be managed by two TIZIMs. The Khorezm (Karamazi–Kilichbayniyaz) TIZIM (the office is located in Gurlan) manages the canal as far as the Amu Darya District border. After the province border, a Karakalpakstan TIZIM whose office is located in Mangit (district city of Amu Darya District) takes over. It appears that neither province nor district wanted to lose authority over the canal and influence on water allocated to their province and district. A similar situation to the power play between Khorezm and Karakalpakstan over the Kilichbay canal appears to exist in Tuprakkala. Tuprakkala is an administrative unit located on the north-eastern side of the Amu Darya River and Khorezm is located on the south-western side. Tuprakkala was and is under the political administration of Khazarasp District within Khorezm Province. Tuprakkala receives its water directly from the Amu Darya through pump stations, and therefore, on the basis of the irrigation water delivery system, should have been given its own TIZIM. On the basis of drainage flow, Tuprakkala could have been under the administration of the neighbouring TIZIM located in Beruni District in Karakalpakstan. However, it was decided to include Tuprakkala in the same TIZIM as Khazarasp District. Hence, political and administrative interest influenced the setting of the boundaries.

As stated above, the original plan of having only one TIZIM in Khorezm was changed to three TIZIMs. If the boundaries of the TIZIMs were purely based on hydrological considerations, then there should have been one TIZIM, since all ten districts of the three TIZIMs receive water through the Tashsaqa main canal (Table 1 and Map. 2). In this sense, the setting up of three TIZIMs appears arbitrary and contradictory to the President's Decree. The three TIZIMs are structured according to the hydraulic boundaries of the larger Tashsaqa system. However, as shown in Map. 2, there are many smaller inter-district canals, taking water directly from the river. In addition, even though the main Tashsaqa canal system runs from east to west, the smaller drainage collectors run from north to south. The main drainage collector runs parallel to the Amu Darya in the south of Khorezm and is fed by smaller collectors crossing different districts and different TIZIMs. Since the WUAs have not been restructured according to system-level or hydraulic boundaries, this has led to a situation in which some WUAs receive irrigation water from more than one TIZIM, or irrigation water from one TIZIM and drainage water from another.[5]

Roughly, one can structure the three TIZIMs as follows:

- Tashsaqa (office located in Bogot): Tuprakkala, Pitnyak, Khazarasp, Bogot, parts of Khonka and Yangiarik (upstream to downstream districts).
- Palvan–Gazavat (office located in Khonka): parts of Khonka, a small part of Yangiarik, Khiva and half of Kushkupir.

[3] Dashovuz Province in Turkmenistan is not incorporated in this unit. Water allocation and management between Turkmenistan and Uzbekistan is controlled by the River Basin Organisation (frequently referred to by the acronym BVO, from the Russian designation – Basseinovoye Vodnoye Obyedineniye) in Urganch. The BVO is responsible for the whole Amu Darya basin.

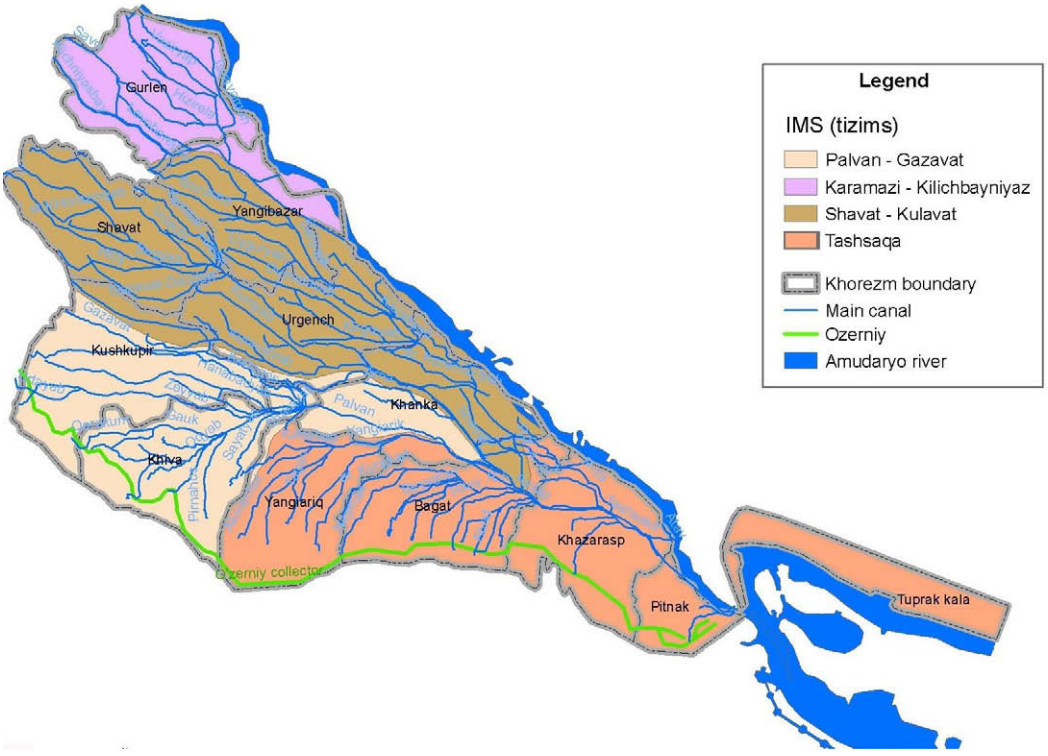
[4] The data presented in the different tables were gathered from the basin organisation (BVO). According to this dataset, no distinction is made between the individual TIZIMs, only between districts and between the individual canal systems (i.e. Kilichbay and Tashsaqa).

[5] Recent research on WUAs in Khorezm shows different results about their water management capacities. Veldwisch (2007a) states that WUAs have full control of water distribution up to the farm level and keep account of how much water is used. Zegwaard, (2007), studying one WUA to which Veldwisch (2007a) refers, shows that the WUA has no influence on water allocation between farmers (only between crops, cotton receives water first) and limited control between head-end and tail-end along the main canal within the WUA. In a later publication, Veldwisch (2007b) changes his reasoning and confirms the findings of Zegwaard.

**Table 1**
Gross irrigation water supply in Khorezm Province

| Darganata station* | 2000 16 km³ | | 2001 13 km³ | | 2002 34 km³ | | 2003 38 km³ | | 2004 32 km³ | | 2005 48 km³ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tashsaqa In 1000 m³ | Total | Tashsaqa In 1000 m³ | Total | Tashsaqa In 1000 m³ | Total | Tashsaqa In 1000 m³ | Total | Tashsaqa In 1000 m³ | Total | Tashsaqa In 1000 m³ | Total |
| Bogot | 217,268 | 222,607 | 146,606 | 153,845 | 259,568 | 271,727 | 348,642 | 366,156 | 348,407 | 363,915 | 379,737 | 394,569 |
| Gurlan | | 354,290 | | 225,294 | | 465,552 | | 526,399 | | 497,493 | | 463,224 |
| Kushkupir | 380,527 | 380,527 | 237,456 | 237,456 | 455,071 | 455,071 | 513,545 | 513,545 | 527,697 | 527,697 | 539,118 | 539,118 |
| Urganch | 319,683 | 336,521 | 207,286 | 227,074 | 291,362 | 418,803 | 426,535 | 458,633 | 429,299 | 467,697 | 426,841 | 446,548 |
| Khazarasp | 168,903 | 212,964 | 117,558 | 163,071 | 185,176 | 230,860 | 234,202 | 296,687 | 240,084 | 308,652 | 263,224 | 342,782 |
| Khonka | 253,300 | 267,026 | 168,876 | 190,851 | 235,897 | 268,308 | 364,907 | 418,449 | 387,473 | 436,284 | 392,144 | 432,449 |
| Khiva | 244,282 | 244,282 | 162,355 | 162,355 | 271,688 | 271,668 | 338,564 | 338,564 | 346,277 | 346,277 | 360,544 | 360,544 |
| Shavat | 313,944 | 313,944 | 172,520 | 172,520 | 324,699 | 324,699 | 443,498 | 443,498 | 448,436 | 448,436 | 448,996 | 448,996 |
| Yangiarik | 247,238 | 247,238 | 147,465 | 147,465 | 284,401 | 284,401 | 326,566 | 326,566 | 324,614 | 324,614 | 331,348 | 331,348 |
| Yangibazar | 138,022 | 226,523 | 69,075 | 214,738 | 39,828 | 367,382 | 174,874 | 350,791 | 174,329 | 376,540 | 183,539 | 384,061 |
| Pitnyak | 20,655 | 86,626 | 18,984 | 84,096 | 29,517 | 91,551 | 32,247 | 115,111 | 38,803 | 107,884 | 35,621 | 130,718 |
| Khorezm total | 2,303,822 | 2,892,548 | 1,448,181 | 1,978,765 | 2,377,207 | 3,450,022 | 3,203,580 | 4,154,399 | 3,265,419 | 4,205,489 | 3,361,112 | 4,274,357 |

* Source: Ikramova (2008). Darganata station (80 km upstream of the Tuyamuyun Hydro-Complex (THC), reference station for THC inflow).




**Map. 2.** Boundaries of the TIZIMs. *Source*: Salaev, GIS expert, German Uzbekistan project.

- Shavat–Gulavat (office located in Urganch): parts of Khonka, Urganch, parts of Yangibazar, Shavat, and small part of Kushkupir.

Despite the system of rotation of office location and main manager on the basin level, on the TIZIM level no rotation is anticipated. Nevertheless, each district kept its former offices. The three main offices of the TIZIMs are located in upstream and mid-stream districts. One could question the logic behind the location of the offices; for example, the location of the main office in the Palvan–Gazavat TIZIM. Here the office is located in the upstream Khonka District. The Palvan–Gazavat system supplies water to a total agricultural area of 43,658 ha, of which 17% are located in Khonka (28% of total irrigated area in Khonka), 2% are located in Yangiarik (5% of total irrigated area), 43% in Khiva (100% of total irrigated area) and 38% in Kushkupir (54% of total irrigated area). The irrigated areas in Khonka are the furthest upstream and the irrigated areas in Kushkupir are the furthest downstream. It would seem logical to have the head office of the TIZIM either in Kushkupir, to facilitate downstream farmers, or in Khiva, since the whole district is dependent on water from the Palvan–Gazavat system. There appears to be no convincing management reason as to why the main office should be based in Khonka District. The most convincing reason for this decision is political. The current province governor and the current deputy director of the Lower Amu Darya basin were both district governors in Khonka in the late 1990s (Wegerich 2006a) and both are from Khonka District. Given that network ties have an influence on political as well as staff

decisions, one could assume that there was a strong political interest in keeping Khonka powerful. To establish a TIZIM in Khonka might have increased the power position of Khonka District (see below) and even institutionalised this power.

Rather than questioning the initial decision on office location however, it is perhaps more important to see what kind of effect the change from administrative to hydraulic boundary management has had in Khorezm. In Table 2 the gross irrigation water supplied (measured in mm) for Khorezm is taken as the average. Since only deviations from the annual Khorezm average are presented, it appears that in the different TIZIMs there was a reallocation from some districts using more water to other districts which used less water. Hence, it appears that the changes furthered water equity between the different districts (Table 2).

Table 2 is structured according to TIZIMs and, within the TIZIMs, from head-end to tail-end. In all three TIZIMs, the districts moved closer to the Khorezm average, with the exception of Pitnyak district in the Tashsaqa TIZIM. It appears that prior to the creation of the TIZIMs tail-end districts received more water than head-end districts (exceptions being Pitnyak and Urganch). Creating TIZIMs appears to have reduced the water amount to tail-end districts and favoured mainly head-end and mid-end districts.

Given the TACIS (1997) report and the different indicators used for calculations of water demand, the perception that the reform increased equity between the districts has to be reconsidered. Simple indicators of water demand could be the location of the district or the official crop specialisation in the districts (Table 3).

In addition, Schieder (2004, p. 6) argues that the "districts far away from the river (Khiva and Yangiarik) show higher water consumption per hectare due to high water losses within the irrigation system, whereas the canal network for Urganch, Khanka and Yangibazar is well extended". In addition, within Khorezm Province groundwater tables and soils differ. For this reason, Ibrakhimov et al. (2007) distinguish between three hydrogeological zones for Khorezm Province. Therefore the number of recommended irrigation turns for particular crops differ, and water allocation to individual fields varies according to hydrogeological zones (Map. 3 and Map. 4).

These differences may explain why there was a difference in water supply. Given these differences, the recent water management changes may have triggered simple water equity, but if other factors are taken into account they may have furthered inequity.

## 5. What happened within the individual TIZIMs?

As shown in Table 1, the overall water supply to Khorezm and to the individual districts increased. The overall increase was not considered in Tables 2 and 3, which focused only on the water equity between the districts. In Table 4, the overall increases are incorporated.

The presented data show clearly that all the districts in Khorezm that received water through the main Tashsaqa system, which delivers water through all three TIZIMs, increased their water supply. These increases do not seem to be linked to the total available amount of water measured at Darganata station (presented in Table 1). Even though at Darganata station the amount in 2004 was lower than in 2002, Khorezem received 22% more water. This puts into question whether the intent to establish the Lower Amu Darya office in Karakalpakstan achieved a balance between the two provinces. Nevertheless, the large increases in 2005 only led to a marginal increase in water supply to Khorezm.

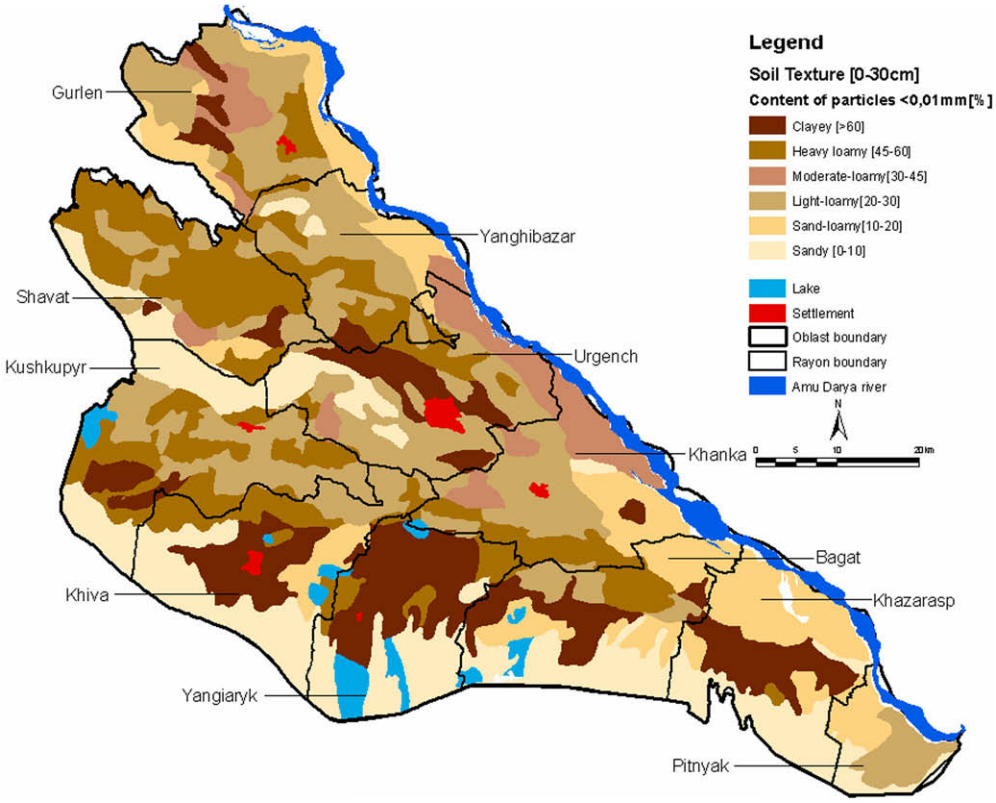
On closer examination of the increases which took place in Khorezm, the data show that, with the exception of the tail-end Shavat District in the Shavat–Gulavat system, head-end and mid-end districts had larger increases than tail-end districts. Looking

**Table 2**
Equity of gross irrigation water supply in Khorezm (in mm and deviations from Khorezm average)

| TIZIM | District | 2000 | | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tashsaqa | Pitnyak | 1444 | 125% | 1402 | 178% | 1526 | 111% | 1919 | 116% | 1798 | 107% | 2179 | 128% |
| | Khazarasp | 1065 | 92% | 815 | 103% | 1154 | 84% | 1483 | 90% | 1543 | 92% | 1714 | 101% |
| | Bogot | 968 | 84% | 669 | 85% | 1181 | 86% | 1592 | 96% | 1582 | 94% | 1716 | 101% |
| | Yangiarik | 1374 | 119% | 819 | 104% | 1580 | 115% | 1814 | 110% | 1803 | 108% | 1841 | 108% |
| Shavat–Gulavat | Urganch | 1202 | 104% | 811 | 103% | 1496 | 109% | 1638 | 99% | 1670 | 100% | 1595 | 94% |
| | Yangibazar | 985 | 85% | 934 | 118% | 1597 | 116% | 1525 | 92% | 1637 | 98% | 1670 | 98% |
| | Shavat | 1121 | 97% | 616 | 78% | 1160 | 84% | 1584 | 96% | 1602 | 96% | 1604 | 94% |
| Palvan–Gazavat | Khonka | 989 | 86% | 707 | 90% | 994 | 72% | 1550 | 94% | 1616 | 96% | 1602 | 94% |
| | Khiva | 1286 | 112% | 855 | 108% | 1430 | 104% | 1782 | 108% | 1823 | 109% | 1898 | 111% |
| | Kushkupir | 1268 | 110% | 792 | 100% | 1517 | 110% | 1712 | 103% | 1759 | 105% | 1797 | 106% |
| Karamazi–Kilichbayniyaz | Gurlan | 1222 | 106% | 777 | 99% | 1605 | 117% | 1815 | 110% | 1715 | 102% | 1597 | 94% |
| Khorezm average | | 1152 | 100% | 788 | 100% | 1375 | 100% | 1655 | 100% | 1675 | 100% | 1703 | 100% |

**Table 3**
Equity of gross irrigation water supply in Khorezm differentiated according to crops and location (deviations from Khorezm average)

| | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|
| Adjacent to river/rice crops | Pitnyak | 125 | 178 | 111 | 116 | 107 | 128 |
| | Gurlan | 106 | 99 | 117 | 110 | 102 | 94 |
| | Khazarasp | 92 | 103 | 84 | 90 | 92 | 101 |
| Adjacent to river | Bogot | 84 | 85 | 86 | 96 | 94 | 101 |
| | Khonka | 86 | 90 | 72 | 94 | 96 | 94 |
| | Urganch | 104 | 103 | 109 | 99 | 100 | 94 |
| | Yangibazar | 85 | 118 | 116 | 92 | 98 | 98 |
| Adjacent to desert | Yangiarik | 119 | 104 | 115 | 110 | 108 | 108 |
| | Khiva | 112 | 108 | 104 | 108 | 109 | 111 |
| | Kushkupir | 110 | 100 | 110 | 103 | 105 | 106 |
| In between desert and river | Shavat | 97 | 78 | 84 | 96 | 96 | 94 |
| Khorezm average | | 100 | 100 | 100 | 100 | 100 | 100 |

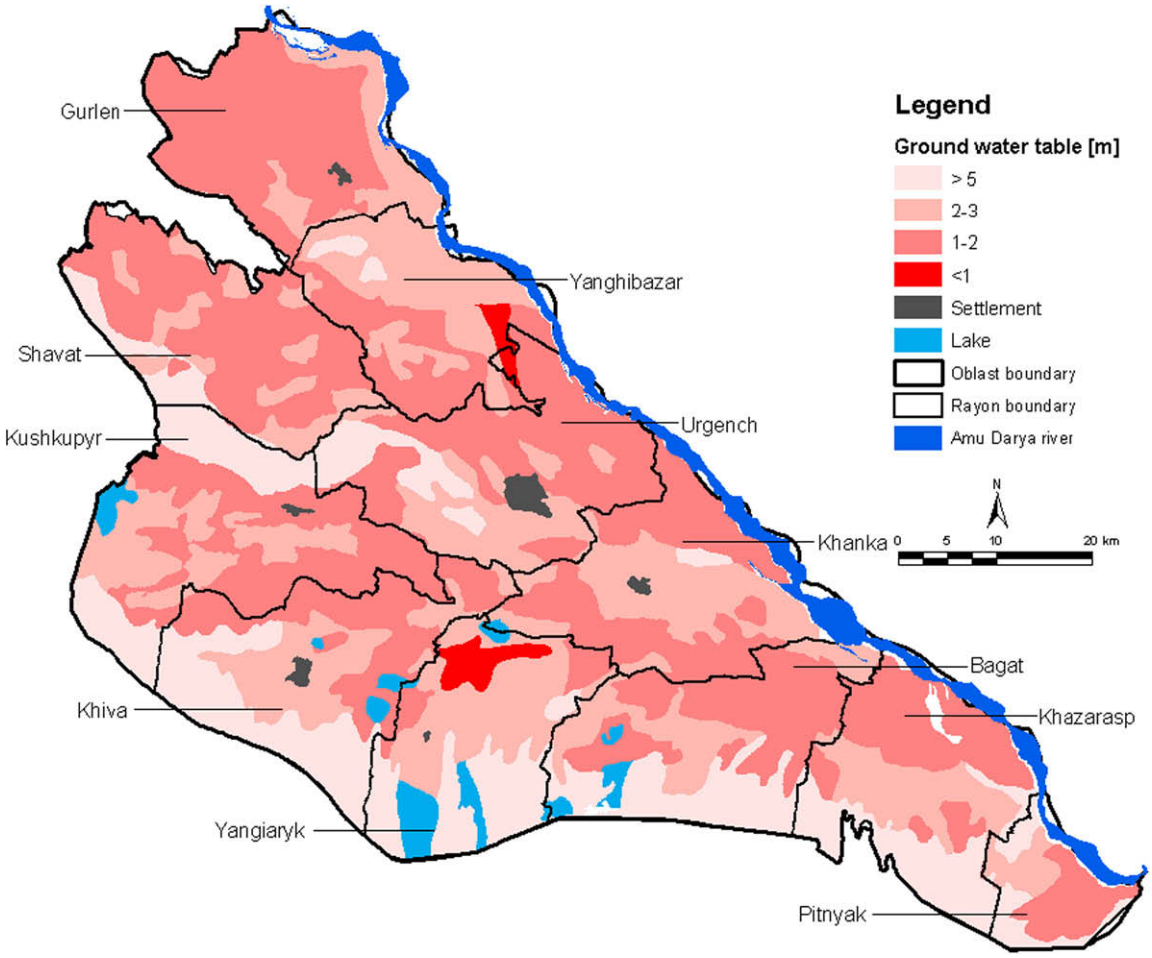



**Map. 3.** Spatial distribution of soil textures of Khorezm in 1999. *Source*: Ruecker (2005, p. 36).

back at the argument made by Uphoff et al. (1991, p. 220) that it is "up to the system manager to weld consensus", one might have to question the role of the water managers at TISIM level. The Tashsaqa TIZIM has its office in Bogot and the head of the TIZIM originates in Bogot District. The data presented in Table 4 show that all three head-end districts as far as Bogot in the Tashsaqa TIZIM increased their water supply equally (about 45%). The increase to the tail-end district, Yangiarik, was only 17%. The Shavat–Gulavat TIZIM has its office in Urganch. Compared to Shavat District, Urganch District hardly increased its water supply. Hence the location of the office may not be a determining factor for increases. However, the head of the Shavat–Gulavat TIZIM originates in Shavat and prior his current appointment was the director of the Shavat District Water Department. His regional provenance may have influenced the increases to Shavat District. In the case of the Palvan–Gazavat TIZIM with its office in Khonka, the head of the TIZIM originates in Khonka. The data in Table 4 show that Khonka experienced the largest increase in water supply within Khorezm. However, as mentioned above, the Palvan–Gazavat TIZIM only supplies 41% of the irrigated area in Khonka. The remaining 59% are either head-end in the Shavat–Gulavat TIZIM (31%) or mid-end in the Tashsaqa TIZIM (28%). The data do not reveal in which part of Khonka and in which of the three TIZIMs the increases took place. Given that in the Shavat–Gulavat system the increases to downstream Shavat are the highest, it is likely that the irrigated areas in Khonka (31% of Khonka), which are managed by the Shavat–Gulavat TIZIM received only marginal increases. Nevertheless, only about half of the 31% of the area in Khonko managed by Shavat–Gulavat TIZIM receives water from the same canal which brings water to Shavat. Hence the emphasis on control might have varied in the different systems, with less emphasis on the part which does not bring water to Shavat. If, as argued, the regional provenance of the manger of the Tashsaqa TIZIM is a determinant of water distribution between the different districts, it is likely that the emphasis on water control after Bogot's administrative boundary was not a priority. Hence, in the irrigated areas of Khonka located in the Tashsaqa TIZIM and having access to the same inter-district canal as Yangiarik (6% of Khonka), the increases could have been somewhere between the average increases of Bogot and Yangiarik. For the other 22% of irrigated areas in Khonko, which are also managed by the Tashsaqa TIZIM but which are not shared by further downstream districts, it could be that the same average increase applies as for Bogot (which is upstream). However, since there are only two districts, it is difficult to estimate. Overall, the large increase in water supply to Khonka seems unexplainable. Further research is needed to find out whether the high increases are related to the lack of enforcement power, or absence of enforcement on the part of the other two TIZIMs to control water intakes at Khonka, or whether there are other factors, such as the regional provenance of the province governor or the deputy director of the lower Amu Darya basin, who do not allow the other TIZIMs to restrict water use in Khonka.

Even though it is evident that some districts benefited more than others, it is still not clear why there is an interest in having more water, especially if cotton is still the state order crop.

Although farmers are supposed to grow cotton, many farmers grow rice on an informal basis. Whereas Wegerich (2006b) links rice production with additional income for WUAs, TIZIMs, its branch offices and even other district organisations, Veldwisch (2007b) argues that rice production is mainly based on informal relationships. The advantage of growing rice instead of cotton is that rice can be sold at bazaars, and therefore provides direct cash in hand. Cotton can only be sold to state cotton gins, which do not provide cash, but rather pay by means of bank transfers. Farmers have problems accessing their bank account (Pomfret, 2000; Wegerich, 2006b). Analysing GIS data, Ruecker (2005) shows, that




**Map. 4.** Spatial distribution of groundwater levels of Khorezm in 2001. *Source*: Ruecker (2005, p. 19).

**Table 4**
Gross irrigation water supply increases in Khorezm by district and TIZIM (deviations from water supply of 2002)

| | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|
| Tashsaqa system | Pitnyak | 95 | 92 | 100 | 126 | 118 | 143 |
| | Khazarasp | 92 | 71 | 100 | 129 | 134 | 148 |
| | Bogot | 82 | 57 | 100 | 135 | 134 | 145 |
| | Yangiarik | 87 | 52 | 100 | 115 | 114 | 117 |
| Shavat–Gulavat system | Urganch | 80 | 54 | 100 | 110 | 112 | 107 |
| | Yangibazar | 62 | 58 | 100 | 95 | 102 | 105 |
| | Shavat | 97 | 53 | 100 | 137 | 138 | 138 |
| Palvan–Gazavat system | Khonka | 100 | 71 | 100 | 156 | 163 | 161 |
| | Khiva | 90 | 60 | 100 | 125 | 127 | 133 |
| | Kushkupir | 84 | 52 | 100 | 113 | 116 | 118 |
| | Gurlan | 76 | 48 | 100 | 113 | 107 | 99 |
| Khorezm | | 84 | 57 | 100 | 120 | 122 | 124 |

in 2002 in Khorezm rice was cultivated on about 100,000 ha. The amount of rice grown in the individual districts varied tremendously in 2002 (Table 5).

Generally, it is difficult to compare the different districts, especially since some districts are only partly covered or not covered at all (such as the official rice producing districts, Pitnyak and Khazarasp). As Table 5 shows, Shavat as a tail-end district compared to other tail-end districts was already producing relatively more rice in 2002. The large increases in water supply are associated with increased rice cultivation in Shavat. As Khonka, and especially Bogot, are not completely covered, it is difficult to compare them to other district adjacent to the Amu Darya. Nevertheless, it appears that Khonka and Urganch were relatively equal in terms of crop production in 2002, but in that year Khonka District received on average 994 mm, while Urganch District received on average 1496 mm. This could suggest that Khonka was extremely efficient with the supplied water compared to Urganch. Increases in subsequent years to Khonka either decreased Khonka's efficiency or, more likely (and as observed), the irrigated area of rice (the most profitable crop) expanded dramatically in Khonka.

Therefore, the equity achieved in terms of water supply per hectare may have furthered inequity of production and profits.

**Table 5**
Area (ha) of land use/land cover classes in Khorezm districts in 2002

| | Undefined | Cotton | Rice (rapid) | Rice (gradual) | Winter wheat/rice | Winter wheat/Fallow |
|---|---|---|---|---|---|---|
| Bogot** | 2696 | 3811 | 1634 | 2427 | 2621 | 2128 |
| Gurlan | 3106 | 4950 | 4174 | 12,683 | 2554 | 2196 |
| Khonka** | 2176 | 7237 | 4059 | 7352 | 3887 | 2529 |
| Khazarasp* | No data | No data | No data | No data | No data | No data |
| Khiva | 3155 | 10,068 | 0 | 2740 | 3402 | 1565 |
| Kushkupir | 3962 | 13,632 | 1311 | 5265 | 3414 | 3394 |
| Pitnyak* | No data | No data | No data | No data | No data | No data |
| Shavat | 3325 | 7919 | 1142 | 6714 | 2318 | 5035 |
| Urganch | 3363 | 7831 | 4247 | 6453 | 3794 | 3494 |
| Yangibazar | 2095 | 6484 | 2124 | 6863 | 2440 | 2582 |
| Yangiarik | 3073 | 7929 | 925 | 2503 | 3670 | 1652 |
| Khorezm total | 26,952 | 69,862 | 19,615 | 52,999 | 28,100 | 24,575 |

Source: Ruecker (2005, p. 80).
* The districts Pitnyak and Khazarasp are not covered by this land cover classification.
** The districts Bogot and Khonka are not entirely covered by this land cover classification. Land cover information is not available for the entire spatial extent.

## 6. Conclusion

The presented data show that the change from administrative to hydrological boundaries for water management is political. Defining management boundaries of an essential resource is naturally a process of negotiation between political stakeholders in different administrative units. In the case of Khorezm, the intention to change from administrative to hydrological boundaries was converted to a shift from administrative to partly hydraulic or system-level boundary management. This approach did not incorporate the drainage system and only focused on the infrastructure delivery system. Hence, the implicitly 'neutral' international policy recommendation to change water management boundaries is not neutral but contested at the formulation as well as the implementation level.

The presented data demonstrate that establishing a lower Amu Darya basin unit with a main office in Karakalpakstan and main staff from Karakalpakstan did not lead to a reduction in water use in Khorezm. Why there was no reduction should be researched further. Nevertheless, the negotiated principle of rotation of office location and main staff appears to be very innovative and could in the long term lead to a balance between the two administrative units. Given the presented results from the different TIZIMs in Khorezm, it appears to be recommendable to establish this rotational principle on the TIZIM level as well.

The change from administrative to partly hydraulic or system-level management appears to have increased the equity of water supply per hectare within Khorezm Province. However, the increase in equity was achieved by an overall increase in water supply to Khorezm. One has to question whether the result of more equity in terms of water distribution was planned, or whether it was just an unexpected result. However, given the data presented on infrastructure, hydrogeological zones and crop production it seems that the simple equity of water supply per hectare increased overall inequity and mainly favoured particular districts. The districts that benefited especially were those in which the head office of the TIZIM was located and with which the TIZIM managers had ties. This highlights the fact that looking at staff members of irrigation bureaucracies only in terms of their role within the organisation, and as altruistic, may not be sufficient. In the old administrative boundary management system, there were appropriate political channels to address issues of water management and water distribution between the districts. The introduction of TIZIMs was a form of centralisation, with the consequence that the established TIZIMs are now operating out of the existing political system. As TIZIMs are outside of the existing political system, and as new controlling social and political systems which are parallel to the TIZIMs have not been introduced, it appears that too much power has been given to the management staff of the TIZIMs.

The Khorezm case shows that one has to question whether all international recommendations are appropriate and therefore should be followed, or whether the old system had advantages that have not been internationally recognised.

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