

Codifying Water Rights in Contested Basins of Afghanistan

Netherlands Organisation for Scientific Research

**WATER RIGHTS, WATER DISTRIBUTION RULES AND CODIFICATION IN
SPATE IRRIGATION SYSTEMS
COPING WITH CHANGE IN PAKISTAN**

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1. Introduction

This paper describes the codification of water rules and rights system in spate irrigation systems in Pakistan. It particularly discusses their ability of being adjusted in view of changes in the water resources system. These water rights and rule systems in Pakistan have a long and unique history of codification. They were first recorded between 1870 and 1920 - during the British colonial administration. At this time the British Colonial Empire had expanded its borders to the 'other' Western side of the Indus, among others in the districts of DI Khan and DG Khan. The area had relatively little economic value, i.e. no perennially irrigated crops and no industrial base (Saeed et al, 2014). The registration of the water rights in these spate-irrigation dependent areas had a straightforward motivation, i.e. to create a resource system that would generate revenues that would pay for the colonial administration. Recording water rights and rules in the volatile spate irrigation systems was to, first, significantly reduce conflicts and hence the burden of administration and, secondly, to come to a more predictable and economically productive flood-based production system – with among others with land users more willing to invest in land preparation and system improvement. The codification indeed set the stage for the stable development of the spate irrigated areas. A unique example of water right codification came into being – with water rules being recorded to field level. Even more special is that these codified rights and rules are still being followed more than a century later and that the names of the land and water registrars of that time are still remembered and revered, in spite of all the general turmoil in the area.

This paper first introduces in section 2 the nature of spate irrigation, a unique resource systems encountered in semi-arid areas making use of sporadic flood events in temporary rivers. It then discusses in section 3 the system of codification as introduced in Pakistan and maintained till today in regulating water distribution and dealing with the uncertainty that is inherent to all flood-based farming systems, including spate irrigation. The main interest of this paper, discussed in section 4, is whether the codified systems are not only just able to regulate the distribution of the unpredictable flood water, but able to deal with major changes in water resources availability, triggered by recent investments in land and water development. This is discussed on the basis of three cases. The last chapter then summarizes the value of settling water rights and codifying them under different arrangements and for looking at investing in water governance on the basis of clear cost and benefits.

2. Spate irrigation in Pakistan

Spate irrigation is a flood-based livelihood system that makes use of short-term flood events in dry rivers in semi-arid areas (van Steenberg et al 2010). Farmers manage these floods but the total volume and range of small, medium and large floods vary from year to year and in timing. In these spate irrigation systems, changes to riverbeds and sedimentation levels are common as are river course alterations, adding another layer of unpredictability. In spite of this, there is a millennia-long history of water management practices based on local knowledge in Pakistan. In spate irrigation floods are turned into an asset, forming the basis for productive livelihood systems.

Spate irrigation in Pakistan covers a huge area, though it is largely unknown. The spate irrigation systems are primarily located near the western mountain ranges, away from the large canal areas. The rains in the vast catchment areas that spread into Afghanistan create hill torrents. The water from these torrents comes down through the mountains, gathering volume and comes down flooding through the arid plains. With variations from place to place it normally rains briefly but heavily in two periods of the year – in the summer monsoon season and during the winters. When the floodwaters caused by heavy rainfall enter the plains, they are diverted and guided by earthen *bunds* that depend on the lay of the land. Some *bunds* are many kilometres long, several meters high and up to 20 meter wide at the base. Close to the mountains, the *bunds* tend to take part of the fast flowing flood, but lower down they block the river and divert the entire flow. Water is then guided through a system of flood channels, sometimes marked by low side *bunds* – all constructed by the local farmers in preparation for the flood seasons.

With the introduction of bulldozers and tractors, the *bunds* can be built faster, but the engineering has not changed and the farmers still have to construct earthen diversion structures (called *wakra*) which raise the waters in the flood channels and lead them into the *bunded* fields. These *bunded* field (called *bundat*) are often very large – as much as 15 hectares sometimes, though they may be divided into sections. The common spate water diversion system is the use of earthen structures, constructed across the river, which are locally known as *gandhas*. Traditionally, these earthen diversion structures are breached upon completion of irrigation, allowing another structure downstream to divert water to areas that have water rights. Only medium and small floods are diverted through this method. In case of large floods, the *bunds* would break to prevent the force of large floods to destroy dividing and distribution networks within a command area. Through such methods damages of flood are avoided and flood water is efficiently and economically utilised through local water rights (Saeed et al. 1998).

There are different spate irrigation systems located in the mountain areas. These are smaller and make use of free intakes. Spate irrigation certainly supports local farming systems, but also rangelands, trees and drinking water supply – either by filling water ponds or through the recharge of shallow aquifers in some places. However, due to its reliance on floods as the source of water it is inherently risky and uncertain. Even then in dry areas it is the most cost-effective way to retain and store water. Improvements in soil and water management, agronomy and governance have considerable potential to increase water productivity and enhance livelihoods in one of the most-poverty stricken areas of Pakistan. These lands can be transformed if enough attention is paid to them by scientists, policy makers and fund managers in Pakistan.

Spate irrigation is today practiced in all the four provinces of Pakistan as well as in FATA and is called *Nai* in Sindh, *Sailaba* in Balochistan and *Rod Kohi* in KPK and Punjab (Saeed et al 2014). The largest areas under spate irrigation are on the plains bordering the mountain ranges, along the Koh-I-Suleiman and Kirthar Ranges as well as on the Kacchi Plains. Spate irrigation is practiced mainly in the arid areas of Kohat, Dera Ismail Khan, Tank, Lucky Marwat (in KPK), FATA, Dera Ghazi Khan, Mianwali, Rajanpur (Punjab), Larkana, Dadu, Jamshoro, Thatta, Nangarparker (Sindh) and Barkhan, Las Bela, Kila Saifullah, Kharan, Loralai, Musakhel, Makran and the Kacchi plains of the province of Balochistan. The largest area under the spate irrigation farming system is in Balochistan followed by the KPK, Punjab and Sindh. It is estimated that the land prepared for spate irrigation in Pakistan today is around 2.1 million hectares, out of which only around between 400,000 to 1 million hectares are commanded in a normal year. This is almost 5 to 10% of the entire irrigated area of Pakistan. As a whole, the systems have been largely ignored, despite their potential to promote inclusive development by better water management, improved agronomy, and better equipment.

3. Water distribution rules and codification practices in Pakistan

Water rights and distribution rules in spate irrigation regulate access to water and are fundamental to minimise conflict (van Steenberg et al 2010). Water distribution rules make it easier to predict which land will be irrigated. As such they encourage pre-flooding land preparation, which is important for adequate water storage and moisture conservation. Water rights and water distribution rules define the likelihood of irrigation for different areas and hence serve as the key to the collective maintenance and rebuilding of diversion infrastructure. Particularly where floodwater users depend on one another to maintain flood canals and reconstruct diversion structures, agreement on how water will be distributed is a precondition for co-operation. Hence, demarcation rules precede all other water distribution rules by defining the command area entitled to irrigation, and with this the land users that are entitled to access spate flows (Van Steenberg, 1997). The corollary of such demarcation rules are the penalties for negligence in the maintenance of bunds and channels.

Spate water rights and rules are different from water rights in perennial water resources. Water rights to perennial water resources come in the shape of entitlements – defining the quantity and timing of the water resource. In contrast in spate irrigation water rights and rules are reactive, dealing with different situations – i.e. years with low, medium and high floods and defining access to this (Mehari et al 2005). Spate water rights and rules may also include rules on what to do if a river changes course or is scoured out.

As mentioned, the spate irrigation systems in Pakistan have the unique feature of being captured in official records of water land rights. This codification took place in the last two decades of the nineteenth century and in the first decades of the twentieth century¹. It was more or less complete by 1915-1920. While preparing the land and water records, special officers at the time were deployed to register the existing rules who would spend considerable time on local duty missions. The land and water rights were recorded by actively involving stakeholders keeping in view that the entire local rules and possible improvement were best known to them. The rules as discussed were loudly narrated in meetings of land and water users, village elders, tribal and religious leaders. The document was then prepared and again recited in general assembly of all local stakeholders (in this case land/water owners and sharing parties/groups) and their signatures/thumb impression were taken along with government officials signatures and with its official stamping.

The records were written down on durable cloth or parafine paper – making it easy to keep and to inspect. In the record each ephemeral river/stream has the distribution rules of the spate flows written down. Distribution rules include division among villages, tribes, upstream and downstream and to groups of land plots and individual fields. Distribution also covers division and use of season's flows among owners/users. The document, which is part of land record, also include the spate river's name, its origin with location, tributaries, boundaries of watershed, routes from start, command area, drainage to the end. The most common season of spate occurrence is mentioned besides any abnormal flows. Registration was done extensively for the areas now in Punjab Province (former district of Dera Ghazi Khan) and KPK (former district Dera Ismail Khan), but less extensively for Balochistan and not for Sindh. All spate rivers in these two former districts were individually recorded with full detail in the land record.

The documents include maps of water source(s), tributaries, name of villages situated along the passage and any mile stone or significant reference point. The length of river and streams are mentioned as well as the location of each diversion structure. The width at different location is also mentioned and past changes in the bed are documented too. Depth of river/stream at various sites, possible erosion danger and or overflow from banks at various locations, slopes towards down streams and left and right direction is also described. The sites to construct earthen structures for diversion of spate flow were well defined and demarcated physically as well as on cadastral record maps.

The area/fields to be irrigated through each diversion structure is defined with the sequence in which they are irrigated. These areas are predefined and cannot be increased even when the spate volume is

¹ For a translated example see Bolton (1908); for several original examples see <http://spate-irrigation.org/special-projects/water-rights-pakistan/>

higher. Here timings of irrigation rule may mentioned particularly, if and when applicable. The document includes total area to be irrigated with spate rights. In case of surplus water or uncontrolled water (due to breaches in canals or structures) water is drained to adjacent areas but those area have no formal rights. Additional documents were prepared for the rules and practices in construction, operation, repair and maintenance of spate irrigation structures. This was often recorded in the form of certain questions and probability of issues occurrence on special occasions or circumstances and answers are recorded. The contributions to operation, repair and maintenance were usually based on land ownership and are mutually agreed by owners. In certain cases, hereditary tenants also contribute in construction activities according to agreements with land owners. Different positions and roles are also defined in cadastral record along with land ownership rights and water rights such as water master, water guards etc. Their roles, responsibilities and administrative powers in managing spate water rights and practices are sometimes well defined. Reward and punishment rules are also defined in case of proper functionality and violation accordingly.

Copies of these rules are part of land record and kept at three sites – at local level with government functionary called Patwari, sub district level and district level with government administration besides a copy is also maintained at provincial level with archive department. The civil courts cases related to land and water issues are dealt by courts and the above documented is the key source for decision making. Courts also use this record in case criminal cases are involving land and water issues. This record (land and water) is also used in dealing land acquisition, compensation and resettlements issues by the government.

Copies of these documents (land and water share record) can be obtained by all including non-owners from the relevant land authority(s) (department/ministry/authority/ municipality) against a nominal fee. More than a century of being recorded the codified water rights are still used on a daily basis. Thanks to the existence of the codified land and water rights, the management of the spate irrigation system in Punjab and KPK is orderly, in spite of the uncertain nature of the spate water resource. Incidents of big landlords developing unauthorized off-takes do not occur in Pakistan – unlike elsewhere as in Yemen.

Table 1 gives one such set of rules for the Kanwanh spate river (Rod-e-Kanwanh) in Dera Ghazi Khan District. The rules in this case were recorded during a land settlement of 1918/19, and are still used.

Table 1 Example of water management rules in Rod-e-Kanwanh (Kot Qaisrani, Dera Ghazi Khan)

Water distribution	Command area protection
Water distribution starts from the head and goes to the tail	Even if field(s) remain barren for long periods the right to irrigation remains valid.
When after a first irrigation the upstream fields are watered, but the downstream fields are not irrigated sufficiently, then the upstream field can still take precedence in using the second flow.	The location of a diversion structure, channel intake or division structure can be changed with mutual consent of land owners
There is no limit on depth of irrigation of an upstream field.	If after filling his own field a land owner delays breaching his diversion structure and a nearby field is destroyed, then the losses will be met from the person who did not breach the diversion structure in time
When a diversion structure has been washed away during irrigation, it is allowed to construct a new diversion even if water is already reaching other fields.	No person has a right to construct new branch / flood canal that deviates from the prevailing situation. However, when the channel has changed naturally, then a new flood canal can be constructed, provided the earlier flood canal is completely damaged.
A field cannot be supplied by more than one diversion structure	When a person intentionally destroys the water then according to common loss is recovered both for the loss of water and the destruction of the field
If a bund in a flood channel irrigates two fields, water will first be applied to the higher land.	On reappearance of eroded land, (through siltation) the rights are vested with the original owner.
Nobody can sell or donate his share of water. In land transactions water is transferred as well	

Maintenance	Others
Common maintenance work is performed on the basis of area of land	Ownership of the flood channel – including trees inside, is based on ownership of the adjacent fields
To maintain the flood embankments close to a main bund is the responsibility of all users of the gandha (diversion bund)	A diversion structure can be constructed on one's own land as well as others land, wherever it is most suitable
Strengthening flood canals banks is responsibility of the owner of the land facing the bank.	Nobody can expand his land by encroaching the river bed.
Landowners whose fields are irrigated through overflow (chal) and not through bunds and embankments do not take part in the common maintenance work.	When one shareholder does not contribute in the common labour during the specific period, he will not get right of water in the current year. In case he wants to contribute in future then first he will have to compensate the previous year costs of common labour and also by a fine of eight days labour.

Source: van Steenberg et al (2010)

4. Codification challenges of the recent decades

The codified water rules in the spate irrigation areas served to normalize the systems and act as a point of reference for local conflicts. As was observed in the different spate irrigated areas, the records of more than one century ago are still utilized and consulted on a daily basis for land transactions and settling local water disputes.

Yet the context within which flood-based systems operate changes under the influence of factors such as population growth, land development pressures, upsurge of the use of groundwater, availability of new earth moving technology, the introduction of more robust diversion structures, power relation shifts, and changing enforcement levels. This section discusses that how the codified water rights and rules reduced conflict dealt with such change and how their relevance is today.

There were some major changes in the management of the spate irrigation systems in Pakistan over the last decades. A major change in particular was the removal of juridical powers from the District Commissioners, i.e. the administrative heads of the districts, and several of their subordinate staff. Until the mid-1990's District Commissioners had the power to place fines and prison terms on local violators of land and water rules. This power was often used to force the cooperation of unwilling parties in water distribution or in maintenance works on the spate diversion structures and canals. Immediately after the removal of these powers, some persuasive powers remained with some District Commissioners for a number of years with the administrative staff still issuing warrants, even though their formal legal value no longer existed. Also this practice disappeared from the early 2000's, leaving a void in the governance of the systems. In some spate irrigation systems an effort was made to strengthen the organization of the water users through the creation of Water Users Associations (WUAs), but by and large these stopped to function even exist, partly because they were never made part of the regular administration and governance.

Another force of change in Pakistan has been the development of new infrastructure. Because spate irrigation systems are often seen as having low productivity there have been in the last decades several engineering interventions that aimed to 'modernize' the systems. Not all these investments were appropriate and moreover often they were not matched by efforts at resetting the water rights or even developing the command area. Construction of new permanent, more robust head works has in particular often resulted in:

- Large control of flows in the upstream: has put upstream land users in the position to control flows that would have previously destroyed their intakes. While this reduces the risk of scour and gullyng, the attenuated flows may no longer reach the extreme ends of the command area;
- Combination of independent intakes: creates dependency and new tail ends. Water is being distributed sequentially, while earlier each area diverted part of the floods for itself;

- Changed maintenance burden: this generally reduces the dependence of upstream land users on the labour of downstream land users, giving rise to shifts in the power balance.

To illustrate the codification challenges created by external investments, the following describes three spate systems in Pakistan that have been subject to important investments that have altered the water distribution situation.

Case 1: Koura system at Vehoa, Punjab

In DG Khan District of Punjab Province the Chashma Right Bank Canal is now serving a large area under perennial irrigation that was previously irrigated by spate irrigation. This development had a severe impact on the spate irrigation systems in the area:

- The tail end areas of the spate systems no longer had to be served by the flood flows as they became part of the perennial irrigation areas. This freed up water for use elsewhere;
- The morphology of the spate rivers changed. The first reason was that with the water no longer used at the tail and no longer diverted the river beds deepened in the tail section. The regression of the river bed was 'eating' its way up causing more regression further upstream – making some areas harder to control;
- This was counterbalanced in some areas where new river crossings (by new canals or roads) blocked some of the flow and caused the sedimentation of river beds and flood canals.

To address some of the adverse effects of the CBRC, in the Dera Ghazi Khan district, the Punjab Irrigation Department implemented a large project of USD 27 million to better manage several spate rivers, of which the Koura and Sanghar schemes are discussed here. In the Koura spate system (serving 15,000 ha) that is situated in the extreme north of the Dera Ghazi Khan district, the Department has constructed engineered headworks, which now include a main diversion and various free channel intakes. Before, farmers used to have a series of soil diversion bunds in the ephemeral river that were broken when their command area was irrigated satisfactorily. The water would then be passed on downstream. With a new single diversion bund, this is not possible anymore and the series of breaching bunds was replaced with a single water distribution at the new diversion. In this the channels at the system's tail end (Shadiwala Wah) are entitled to 25 percent of the total flood volume. However, as a result of more controlled spate flows at the main diversion, the main diversion channel tends to silt up immediately after the first storm flood. This changes the river level upstream and causes more water to go to upstream Patifi Wah than it entitlement at the cost of the downstream Shadiwala Wah. Moreover, farmers in Patifi Wah do not allow the farmers from Shadiwala Wah to desilt and deepen their canal, as they are afraid that it will damage their agricultural lands.

Another issues in the Koura system concern the minor Lakhani canal. As a result of the changes in the overall morphology of the ephemeral system, the Lakhani Channel has gone deep due to excessive water that has gone through the inlet. The deepening of the off-takes to this minor canal has diverted the entire flow, causing the river to change its route, making much of the water to go to waste. The channel needs to be rehabilitated through bed stabilizers that are placed at different sections of the about 10 kilometers long channel, to raise the bed level and irrigate the fields.

Both issues are largely unattended and have created a clear void in the water distribution arrangements of the Koura system. There has not been an effort to mediate and set this right. Part of the explanation is that there is no clear authority of these issues anymore with the changed power of the District Commissioner. The water rights as codified in the land and water records also had no role in addressing the issue. They were never updated neither after the changes with the conversion of land to the CRBC, nor after the construction of the new headworks or at any other time in the past decades. The records are still consulted but more as historical records for the situation where they still apply.

Case 2: Sanghar system at Taunsa, Punjab

The Sanghar is another river effected by the changes in the command area of the CRBC. Sanghar is among the main spate rivers in Pakistan, serving an area of 25,000 ha. Originating in the Musakhel,

Loralai and Zhob regions of Baluchistan, it flows through the Suleiman Range and drains into the Indus River near Taunsa, where the spate flow is diverted to the command area. A substantial investment was made by the Punjab Irrigation Department of about USD 4.5 million, consisting of a low weir, bed stabilizer and two open gates. The low weir unlike what happened in Koura did not interfere with existing water rights, as it did not stop or divert the flood water. Besides serving as a road crossing, it primarily stabilized the very wide river bed, making it considerably easier for farmers to make reliable temporary diversion structures with the help of bulldozer and tractors – consisting of soil and brushwood. The system of water rights hence stayed in tact.

In principle with the stabilized river bed, it should have been possible to extend the command area in Snaghar using water that was no longer needed downstream. However, command area development was not foreseen in the investment plan, which concentrated on main works in the river. This caused the new opportunities to be largely unutilized and chances for livelihood improvement and economic security to be missed in this poverty-stricken area. The Sanghar system would needs further investment that addresses the opening of new tertiary channels, lower-level distribution works and command area development activities, to make better use of the available floodwater. This would have to go parallel to an effort to redefine the water rights to accommodate the larger availability of water at the head of the system.

This did not happen. A number of meeting were organized by local influential persons: journalists, lawyers and main water users, but though the need was recognized the meetings did not lead to a follow up. It was for one unclear who would be the one to organize the sensitive job of resetting water rights. In the absence of this however nothing happened. The floods of 2010 then also did considerable damage to the headworks and the intakes, placing all plans on the back burner.

Case 3: Narri System at Bhag, Balochistan

With approximately 90.000 ha, the Narri River is the largest spate river in Pakistan in terms of area served. Since 2012, the spate irrigation system along the Narri in Bhag has seen major investments in diversion structures, which have affected the water distribution pattern. The system of breachable earthen diversion bunds that were used for centuries, have been replaced by six government-operated mini barrages, constructed by the Baluchistan Provincial Irrigation Department. This has reduced annual construction costs of earthen structures which were very substantial to zero. It has also shifted the responsibility for water control and operation from the traditional systems of water master to the government.

The conversion of the system to modern engineering has come with two major issues however. First is that the barrages allow for a diversion of only a part of the spate waters and thus for a better controlled flow into the irrigation canals. Before, the earthen diversion bunds were able to divert the entire flow to the canals, making it possible to irrigate the entire command area and inundate the canals. With the new barrage-based engineering, the canals in the spate command area are no longer inundated. However, these main canals and their further tertiary channels are now becoming silted up more quickly as a result of reduced spate flows and lower capacity to flush and push out silt. The second issue is that the system of barrages have changed water distribution practices in the command area, shifting from a sequential system of water rights into a single-point flow distribution system. No water distribution rules have been designed for the tertiary canals that dissect from the main channel at various locations. The new water distribution that is implicit to the barrage infrastructure has not been translated into new distribution rules and rights, both between command areas, as well as within it. There is a large similarity with the Kouro case.

Moreover, as in Sanghar Command area development initiatives were overlooked in the Narri system, as the necessary re-design of distribution arrangements was not included in the investment plans. Bringing a more controlled flow in the upstream of the command area has benefitted upstream farmers, while the siltation of the canal has mainly brought negative consequences for downstream farmers in the command area, exacerbating inequality in the spate irrigation scheme. In the current situation, farmers at the mid and lower end of the command area may need to wait for different flows to irrigate the entire command area. In Narri discussion of this issue has started recently (in 2016) at the behest of some of the farmer leaders and key government persons. There is no central steering in the process but an attempt is being

made to get a critical mass of stakeholders and powerbrokers and get to broad consultation and reformulation of the water distribution. Intriguing, unlike the past, it is no longer clear who is the main responsible party for taking the initiative.

5. Conclusion: how can water rights be adjusted?

Water distribution rules and water rights in spate irrigation stand at the core of water security and water justice in spate systems. They are water governance and river basin management 'in practice'. Water distribution rules and rights help to mitigate the unpredictability that is inherent to this flood-based livelihood system.

Rules and rights impose a pattern, and reduce the risk of conflict by regulating relations between land users that have access to floodwaters (Mehari et al 2005). The way rights are defined in spate systems is diametrically different from perennial systems. In essence water rights in spate systems are reactive. They deal with agreed claims in a changing and variable environment. They describe acceptable practices in a given situation, rather than quantifiable entitlements to a resource, as in perennial systems. Having the rules codified in spate irrigation systems helps to create order in the use of a resource that varies from year to year, increasing the chance of opportunistic behaviour and outright conflict and making it difficult for water users to cooperate and with this also maintain the systems.

While the rules impose a certain predictability and equity in spate water distribution, there is more and more evidence that the water distribution principles that date back to British colonial times are becoming outdated. Several engineered interventions in large spate schemes shows that they unwittingly altered water distribution rules, and created new winners and losers among water users. What often tends to be neglected is to update water distribution rules to a new situation. Hence, there is much reason to focus on the design of water rules that do justice to new water distribution situations. In various areas, there have been major interventions in the systems (new diversion structures, major changes in command areas) but these have not been translated in revised water distribution rules, leaving the systems in suboptimal state. The three cases in the previous section illustrate this. Major engineering interventions took place, affecting the water distribution between areas and requiring adjustments in the way water is shared at lower level, in the different command areas. In all three cases however there was no attempt to reset the water rights and adjust what was registered in the official records. There were several reasons: first is that there is a development practice where all attention goes to the development of headwork, but no attention is given to the actual distribution and field level use of water – either physical (command area works) or institutional (water rights and local organizations). The second important reason is that with the shift in powers of the District Commissioners, however this may be justified for other reasons, the land and water records became static, risking to turn into historical records rather than guiding systems.

In creating effective water governance arrangement it is hence required to not only create better systems as with the land and water records in Pakistan but also systems that have the capacity to incorporate and deal with change. This is more than adaptive management: it is the management of adaptation integrated in the governance arrangements.

There is large value in codifying water distribution rules – particularly if this is backed up by arrangement in which they are not only effectively enforced but also updated. Such codification clarifies and completes local water management arrangements and introduces a neutral factor in any dispute. A testimony of the importance of codifying water distribution rules is the continued use made of water registers, prepared as long ago as 1872. The register contains a list of all the communities that are responsible for labour on each water diversion bund. A special functionary was responsible to enforce these rules, exhorting farmers to plug gullies and rebuild their bunds.

The value of such governance arrangements is high – its origin in Pakistan can also be traced to a policy of generating sufficient revenue from this particular resource systems to pay for the (colonial) administration. Apart from this case, there is a strong argument to invest in water governance as this has its own cost and benefits and often probably very high returns. There is a need to invest in institutions as we invest in infrastructure, and appreciating the social and economic values created by better

governance. It is important as the cases in this paper illustrate to come to systems that are effective and have a long lasting power, but also the capacity to be updated and stay relevant.

To make water distribution rule systems relevant again, a new investment should be made in Pakistan to update the distribution rules, starting with certain hotspots, as the cases in the previous section. An even better scenario would be to create a system in which water rights and rules are continuously assessed on their relevant, based on conflicts that emerge between water users as a result of voids and unclarity in the current distribution system. Such a system would be more resilient on the long-term. However, it also brings along much higher and continuous costs and it requires a general context of good governance, to prevent misuse that could emerge as a result of power inequalities between water users at to upstream and tail-end of diversions.

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