Traditional Water Management Systems in Afghanistan; Lessons for the Future

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Abstract

As far as the Afghans could remember, water resources management was a fundamental part of their life. They learned through history to administer the available water supplies to deal with their environment's challenges. Also, climate change intensifies the problems at present. The Afghan communities by using techniques and rules could manage the water. Mir Ab is the person, administering the water distribution systems and works along with local communities to regulate water efficiently and fairly. Mir Ab controls the systems such as karezes, canals, and wells which has important role in different places around Afghanistan based on their geographical settings. Firstly, Kareze plays a critical role in water management and consisted of multiple shafts and main inclined tunnel to bring subsurface water to the surface. Secondly, Canals brings waters to the areas where are rather close to main rivers. Thirdly, wells used in most area and the common one, traditionally, they provide drinking water for societies. Understanding the traditional water supplies facilities in the country remind Afghan people that water is highly valuable commodity, and then the current water associated officials should pay more attention and do their best to manage it. The main goal of this work is highlighting the importance of water for our ancestors, while it ignored significantly by current Government of Afghanistan. Besides, providing a guideline map to look forward and applying right strategies. In short, we hope this paper remind those who are responsible in this field to value the importance of water in Afghanistan.

Introduction

'Every living thing is made from water' (Qur'an 21:30)

Water management is one of the vitally concerns of our modern societies. Water management systems are not a modern term as it has been applied many centuries ago and then various civilizations were familiar with it globally. That is to say, strategies to manage water resources are crucial and they were and will be one of the main concerns for human communities from the past until now. Throughout history when human settlements have faced water-related problems in terms of both quality and quantity, for instance when they have been faced water scarcity during lasting and frequent droughts, the water management strategies came forward as a reasonable solution. These societies knew the water rule, human life largely depends on water supplies. Indeed, availability and management of water bodies in Central Asia were a highly challenging issue. To deal with the challenge, the residents in the area took some wise measurements to control the water budget fairly and efficiently. Because of this, the management procedure of this source plays a fundamental role in addressing the water problems.

The Syr Darya and the Amu Darya are the two vitally important sources of water in Central Asia for more than several millennia. Developments of different civilizations in this area were mainly influenced by these two rivers. Approx. in 6000-5000 BC, In Central Asia there have been areas where water availability and accessibility were a big deal due to natural barriers, then evidence showed that the earliest water diversion structures (canals) had developed for those regions. The aforementioned regions had an exceptionally long distance from main flowing water bodies. What is more, it seems the first applied

irrigation systems came into existence in the first century BC, including the major local rivers the Amu Darya, the Syr Darya, and Zarafshan. Except for the development of irrigation techniques, regional water bodies have a great contribution to the navigation networks growth, as early as 6000-5000 BC in the Amu Darya (Rtveladze, 2012), and spreading of fishery spread for the human settlements to some degree (Zhiltsov et al. 2018).

As a Central Asia country, Afghanistan has its history in terms of water resources management. In this case, it has a shared history with one of the greatest ancient civilizations in the area, i.e., Persia, as Afghanistan was its eastern district (Afghanistan recently has celebrated its 100th Independence Day in 2019). The main traditional water-related management networks in Afghanistan have some constituents, including Mir Ab, Karize, wells, and canals. Out of these components, kareze is one of the oldest and most important techniques that has been used to bring underground water into the surface through a system of wells (shafts) and an inclined tunnel (Mostafaeipour, 2010). Ancient Persia is the host of this technology (Beaumont and Bonine 2002; Wulff 1968; Motiee et al. 2006). As time goes by, it is adopted by other regions such as the Iberian Peninsula, southern Italy, and North Africa (Motiee et al. 2006) where their climatic regime was similar to the host regions. This technique largely is common in the areas whose climate is arid or semi-arid along with are far enough from main surface water resources such as rivers and streams. As to Fig. 1., it can be seen from spatial distribution of karezes that they mostly occupied south and west part of the country

Afghanistan has two types of landscape for living; narrow valleys with flowing rivers as well as deserts and plains where are far enough from the main surface waters. In the past, people who live in this territory have adopted efficient techniques to regulate the water budget to deal with serious environmental stressors such as droughts and floods. The aim of this study was to develop a better understanding of major water management models and showing their importance to international scientific communities and in particular current Afghan generation. That is to say, introducing the Afghan water heritage to the world and the philosophy and intelligence behind these techniques. In addition, by stating the importance of these processes, the officials should take a look at the past and realize the importance of the water management methods in this nation to measure efficient and new techniques to improve the water condition in terms of both quality and quantity. In a word, this would be a map to look forward to the potential plans for managing waters in the country.

Area of study

Afghanistan experienced a long period war from 1779 to 2002. In this period, most of infrastructures, institutional, academic and financial sources lost and importantly the capacity building for the current and near future has been destroyed. Afghanistan has a mountainous landscape and covers an area of 652,000 Km^2, its population is estimated 32 million. In terms of geographical position, it grouped into Central Asia countries. 6.5-7.8 million ha of the country’s areas is potential arable, roughly 10-12% and 82% of the lands are rangeland and bare land, less than 2% occupied by forests (Shroder 2016). One

quarter of Afghan territory has altitude more than 2,500m (Habib et al. 2014). Afghanistan climate is arid and semi-arid, hot in summers and freezing in winters, the temperature range is -20° C to 50° C. Precipitation of snow in the winter and rain in the spring and autumn recharge the subsurface and surface water bodies. The annual precipitation is varying in terms of geographic position of the area it is varying from 75 mm in the southeast to 1270 mm in the northeast, totally the average annual precipitation is about 300 mm, roughly equals to one-third of the average global precipitation (JICA, 2011). Long term total annual precipitation is 164 Billion Cubic Meter (BCM), evaporation is 87 BCM, groundwater systems recharge is 16 BCM, surface water is 61 BCM, and the available water resources is 77 BCM (Ministry of Energy and Water, 2016) (table 1).

Table 1. Basin's annual precipitation data in Afghanistan (MEW, 2016)

Basin	Area (Km^2)	Annual average precipitation (mm)	Total precipitation (BCM/year)	% of total precipitation
Kabul	108,392	298	32.3	20
Helmand	202,006	180	36.36	22
Amu Darya	101,498	393	39.88	24
Northern	78,099	268	20.93	13
Harirud	162,659	210	34.16	21
Total	652,654	300	163.64	100

Water resources of Afghanistan

When water management issues come forward, it is worth pointing out that to provide some introductory information about the status of water supplies. then main characteristics of existing water resources in terms of both surface water and subsurface water are presented. In terms of hydrochemistry in both surface and underground sources, there are multiple published research that characterize the main quality problems in the sources and have introduced the hazardous contents around the country and the most important issues provided in the table. 2.

Table. 2. listing the excess contents in the water resource in Afghanistan (H and B 2017)

River Basin	Harmful chemicals*	References
Kabul River	U, Th, As, Mn, Ni, Cu, Se, Sr, Zn, Cr, NO_3, B, SO_4	Mahaqi et al. 2021, Houben et al. 2009, Kato et al. 2016, Tanha et al. 2018, Saffi and Eqrar 2016, Saffi and Kohistani 2013, Frahmand 2100, Broshears 2005, Mack et al. 2010b, Mack et al. 2014, Brati et al. 2019
Helmand River	As, F, SO_4, NO_3	Saffi and Kohistani 2013, UNICEF 2011 a, b, Ansari 2014,
Northern basin	NO_3, F, B, SO_4, As	Mahaqi et al. 2018, Saffi and Kohistani 2013, UNICEF 2011 a, b, Saffi 2007, Amini et al. 2008
Hari Rud River	NO_3, F, B, SO_4	Mahaqi et al. 2020, Saffi and Kohistani 2013, Saffi 2007
Amu Darya	-	-

* The presented components exceeding the World Health Organization and National Drinking Water Standards

It has been showed clearly that the Amu Darya basin has no quality data sets; the main reason is that the basin is remote, hard-to-access and also high-altitude terrains, the highest mountains of the country exist there, intensify the problem. As the most altitude point of Afghanistan, Noshak is the highest point in

Afghan territory and the-second-high peak, 7,492m, in the Hindu Kush lies in Wakhan corridor, Badakhshan province, NE of Afghanistan (Fig. 2a). What is more, new emerging Taliban groups in these areas get worse working in the location. This fact easily can be seen in the quality control map of Afghanistan as well as large gap in the quality data in the northeast territory, Amu Darya basin (Fig. 2b).

Surface water

Rivers in Afghan territory, like other parts of the world, are categorized into two groups: perennial and seasonal ones. Similar to other perennial streams, water derived from melting process of multiple glaciers of high-altitude mountainous regions. The seasonal streams largely depend on the scattered precipitation during spring and autumn. With regard to hydrologic regime, Afghanistan has five major hydrologic basins, of which four basins have a main river that draining into surrounding countries, these basins are shown in Fig. 3.

The total water budget in Afghanistan is roughly 75 BCM including 57 BCM as surface water and 18 BCM as subsurface supplies. The cumulative application of water is approximately 20.3 BCM annually nationwide (Ahmad and Wasiq, 2004; JICA, 2011; Mahmoodi, 2008; Habib, 2014). Obviously, the 75 BCM is not precise and at present an estimation based on the recent reports by Ministry of Energy and Water explained that the number increased by 2 BCM, i.e., 77 BCM.

This increase is a crystal-clear sign of the speed-up of high-altitude glaciers, melting due to negative climate change impacts. A recent study regarding Afghan glaciers has shown that in the time period 1990-2015, 14% of them were lost and the main reason was harmful global warming effects. Given the current climatic situation, it expects that declining trend of glaciers loss will continue and intensify in the ongoing years (Bjelica, 2021). What is more, Afghanistan will experience a higher temperature and warming climate than before and the shrinking and vanishing of remaining glaciers will heighten (Climate Risk Country Profile: Afghanistan, 2020). More recently, in consistent with the previous claims, it is proposed that the Hindu Kush Himalaya regions will lose close to 60% of glaciers by 2100 (Hock et al. 2019). Following glaciers melting, the volume of flowing water in the rivers and streams which derive from these snowy, the Hindu Kush mountains, areas increase dramatically. The mountain has round about 4,000 glaciers which most of them are in altitude between 4,000-5,000 m, also this site is the host of the three main Afghan rivers including Kabul river, Amu Darya river, and Helmand-Arghandab river (ICIMOD, 2019).

In terms of surface water availability, the volume of the basins as follows: Amu Darya 22 BCM, Kabul 20.7 BCM, Helmand 9.3 BCM, Hari Rud 3 BCM, and Northern 1.8 BCM (Water sector strategy of Afghanistan, 2008). Storing surface water through dams, large- and small-scale, for irrigation, hydropower, and in some cases drinking purposes is of great concern nationwide. Totally, 62 dams, of these 20 are large dams, are operating full or in partial capacity to meet the water demands of the locals. Some of the most important dams which are built on the main rivers are Salma dam, Herat province, Kajaki dam, Helmand province, Sarobi, Naghlu and Mahipar, Kabul province, Dahla dam, Kandahar

province, Darunta dam, Nangarhar province. In a word, management of surface water should be a great priority for Government of Afghanistan (GoA) as regulating of this source is more convenient through water structures. Furthermore, it made a big challenge for Afghanistan in both national and regional scale as the flowing Afghan rivers, draining into surrounding countries without any monitoring and controlling.

Groundwater

Groundwater, like most of the regional countries, is the most available and accessible water supply, especially for those areas where are far enough from fertile valleys. The subsurface host for groundwater aquifers in Afghanistan has consisted of five different formations which include Cretaceous-Palaeocene fracture-karstic aquifers, crystalline rocks (igneous and metamorphic units), quaternary aquifers, Triassic-lower Cretaceous pressure thermal water, and Neogene aquifer-aquitard (Saffi and Kohistani, 2013). Of these potential hosts, the major aquifer systems consist of three main geological formations. First, Quaternary deposits can be found in the major rivers' valleys such as Kabul river, Helmand river, Hari Rud river, Amu Darya, and along the Northern basin rivers. Second, semi consolidated Neogene deposits in the Kabul river and other river basins. Third, Carbonate rocks, karst systems, in the northern edge of the Hindu Kush mountains and in some parts along the Helmand river (Uhl, 2006). The quaternary sediments are the pivotally important ones as roughly 90% of the existing aquifers are found in these units. The proposed annual groundwater recharge for basins as follows; Amu Darya is 2970 Million Cubic Meter (MCM), Helmand river is 2480 MCM, the Northern basin is 2140 MCM, Hari Rud-Murghab basin is 1140 MCM, and 520 MCM for Kabul river (Uhl, 2003). In terms of subsurface water for irrigation, Uhl 2006 stated that a high percentage of Afghan groundwater allocated to the irrigation, approx. 95%. likewise, Hayat and Baba 2017 mentioned that 15% of irrigated farming lands around the country have used groundwater as the main source.

Components of historical Afghan water management network

There is some very ancient sign of civilization and irrigation systems in Afghanistan that are among the oldest in the world, 2,000 BC. Most Central Asian communities considered, even now, water as a valued gift from God and heaven, bringing for them peace and welfare, and so it is a kind of sacred resource (Viala 2004). More importantly, water in Islam has considered a substantial commodity for sustaining life.

The historical background of Afghanistan territory has tied closely with water management practices. Afghan communities have mainly depended on farming lands, and a significant proportion of individuals who live in the rural communities have confirmed it, roughly 75% (Sadat, 2013). The location of most of the Afghan's historical and modern villages, communities, and cities has emphasized the pivotal role of water. Almost all of them are close to different water resources such as rivers, springs, glaciers, lakes, and water channels. This pattern shows obviously that how most communities depend on water accessibility. Besides, water becomes a central incentive for social, economic, environmental, and political developments. Besides these advantages, it has made some of the biggest challenges to the Afghan

nation largely due to substandard and inefficient water distribution systems, frequent, intense, and long-lasting droughts, and importantly mismanagement of existing water resources.

Mir Ab

Mir Ab (Fig. 4a), water master, composed of two words; Mir means chief, and Ab, which means water in Dari. This word, also, has been used in Iran and Central Asia. This model highly worth studying as during over 30 years of civil war and political turmoil, this method has been worked nationwide effectively. At present, when the GoA did not engage actively in the management of aquatic resources, this fashion has been worked nationwide effectively (Viala, 2004). Traditional irrigation systems, to a great extent, depend on Mir Aab for efficient operation and maintenance. Afghanistan likes other Central Asia and Middle East states, relied significantly on agricultural practices and related activities. What is more, most Afghan farmers have learned to deal with the frequent shortage of existing water supplies over time (Viala, 2004). Anymore, it is important to know that Mir Ab administers (Fig. 4b) a high percentage of current water distribution systems in the country, notably canals and karezes.

Mir Ab and his assistants supervise the opening and closing time of water gates along with sharing flowing water from main canals to the rest of the network, secondary and tertiary canals. Conventionally, Mir Ab has been selected by a Shura, village, or community council. Shura comes from the Arabic origin Mashwara (to discuss). As an established rule, Mir Ab was chosen from one of the downstream communities. For the reason that making sure, all the shareholders along the streams and canal pathways received their own share fairly. If Mir Ab did not perform water distribution properly and fairly, individuals can refer to *Jirgas* or the aged community council. Commonly, these two components, Mir Ab and Jirgas, have an important role in water administration and water associated struggles and conflicts (Ahmadzai 2016). In addition, if a distribution system was large enough, a council of Mir Ab tries to manage it. In order to become a Mir Ab, a volunteer should pass an apprenticeship period and those who want to take the Mir Ab position should serve the systems for a while. Furthermore, in some cases, this position has been inherited from a father or family to his sons. Besides complimentary service to system maintenance when needed, residents who benefit from Mir Ab and his assistants should pay for their service. Fundamentally speaking, it is about 5 kg of wheat per Jerib (approx. 0.19 ha) for the chief Mir Ab of the canal or kareze (Viala, 2004). Afghanistan has experienced the modern aquatic management systems in the 1950s, the potential and capacity of the modern ones were exceedingly larger than the traditional ones in terms of area coverage, approx. 10,000 ha. Administration of the modern structures was a mixture of modern and traditional methods; for the main channels/streams and associated facilities, a cognizant came from the capital, Kabul. This is because in those areas were not “pre-existing social structures and technical skills.” However, managing secondary and tertiary canals of the systems was Mir Ab’s task. So, Mir Ab system has remained and then took the responsibility of regulating the smaller water distribution networks.

During the Soviet invasion of Afghanistan (1979-1989), this period was too short to imply their water strategies to the Afghan nation. Then, most of Mir Abs back to the work and their networks. If some disruption in water distribution and management occurred, those were result from infrastructure destruction, devastating of fields, displacement of residents because of conflict between Mujahedin and the Soviet army in war zones. Indeed, civil war (1989-2001) also has the same damaging impacts, even worse, on the water sector. When Taliban took control of a place, they tried to destroy local infrastructures as much as they could as a logical military strategy. Moreover, they imposed a tactic of “scorched earth” to the Hazarajat region, mainly central Afghanistan, and in the Tajik Shamali plains, North Kabul. Besides, they had decided to destroy the water facilities and structures in most non-Pashtun areas where they occupied (Ahmadzai 2016).

Simply put, Mir Ab’s role in Afghan society became rather insignificant since 1979 due to chaotic conditions. Besides the wide destruction of water infrastructures, the social order and communities practically collapsed. Given this situation, some negative impacts have been shown in the local communities such as farmers did not follow Mir Ab established roles and even, they deliberately over irrigated their farming lands to damage the downstream farmers. Furthermore, warlords increasingly take the water and land rights countrywide, they announce their roles. They structured numerous turnouts to divert flowing waters as much as they want to their fields. In modern Afghanistan, Mir Ab’s capacity is crucial to maintain the social and community cohesion. The present-day irrigating and distributing systems need a link between government and local users in order to inspire people to participate in the maintenance of the existing facilities. Consequently, it is time for Mir Ab to come to the scene, and play its role as trusted option (Viala, 2004).

Kareze

Advantages of karezes are not only providing potable water for drinking, but also bringing needed water supplies for agricultural purposes. Some of the main benefits of the kareze including producing energy by installing multiple mills on the main tunnel and subsequent surface canals, sustaining local ecology as regulating groundwater balance naturally, and it more resilient to the droughts rather than surface aquatic supplies. Indeed, in terms of social influences, communities around the kareze, to a great extent, relied on it for sustaining life, farming lands, and livestock. Subsequently, individuals who have more share of kareze water have more social prestige (Hussain et al. 2008). This subsurface system is a well-known structure of the people who live in Central Asia, the Middle East, North Africa, however, they called it Qanat, Foggara, Khitara, or Kanerjing. Globally, most of the recorded kareze systems are in Iran, Afghanistan, Pakistan (Baluchistan), Saudi Arabia, and China (Hussain et al. 2008). Kareze is a rather complicated network of multiple subsurface tunnels and shafts that are made the oldest irrigation methods in Afghanistan, especially in areas whose climate is arid or semi-arid, i.e., south, east, and northern territories. In arid areas where the surface water budget is very limited or there are a few seasonal rivers, the only accessible and reliable water alternative is placed underground. Kareze typically consisted of a sloping narrow tunnel, connecting several hand-dug wells (*chah*) (Fig. 5). The tunnel dug

underground until reaches the water table and then water flows due to gravity force. Mother well, locally named *Sarchah*, is the first and deepest shaft of the tunnel and the last one is the eye of the kareze system, *Owkura*, pouring into a surface reservoir. Following water storage, the distribution process will commence from the water reservoir to the agricultural lands, domestic usage, and livestock.

Kareze is considered an environmentally friendly as well as sustainable irrigation and water supply method in Afghanistan history. Mostafaeipour 2010 asserted the kareze spread from Persian civilization to the east and through Silk Road reach the technology to current Afghan territories, however, as a part of the ancient civilization, Afghanistan had a shared history with Persian regarding kareze. It is estimated 5,887 (Stinson et al. 2016) to 6000-7000 karezes (Azimi et al. 2002; Hussain et al. 2008) have documented, of those a significant proportion, 89% are inactive (Stinson et al. 2016) mostly due to long-lasting and multiple droughts along with small-scale subsurface water resources recharge. Most of the karezes in the country are in the west, south, and south-eastern side of the country (Himat and Dogan, 2019) (Fig. 6). What is more, 95% of those phenomena are concentrated in South and Southwestern areas including Ghazni, Faryab, Zabul, Kandahar, Paktia, Nangarhar, Farah, Wardak, Kabul, Helmand, and Herat provinces. The author believed that based on the geographical and climatic conditions and his field experiences in the Northern basin where there is closed watershed and has a blind river, further field investigation will find reasonable evidence of karezes in that areas, but until now there were no official documents. Moreover, Egitto 2013 just corroborated the idea as in central and northern part of Afghanistan kareze is a “less common” source of water supply and support the author suggestion.

Pedersen 2009 has estimated that roughly 6,761 karezes bring water for approximately 163,000 ha of arable lands that made 4.5% of the total irrigated arable land of Afghanistan. The importance of the kareze is not in the percent coverage of lands, but in the distribution of water for, in most cases, in dry and remote communities that did not benefit from GoA supports and facilities. The average cost of both recovery and rehabilitation of a kareze is around US$ 6,000, and then recovering all of the kareze networks in the nation needs roughly US$ 40 million (Hussain et al. 2008). In the current condition, maintaining of the available karezes and try to recovery the inactive one should be a significant priority in provincial and national scale.

Canals (Diversion structures)

In terms of surface water distribution, canals (Fig. 7) – locally known as *Nahr* or *Juie*- is the most important structure. A typical canal network is often diverted from main rivers or streams, water that reaches remote areas depends on the volume of precipitation on the river source region (Ahmadzai 2016). In terms of historical background, the canals as old and known as the Mir Ab. The main river basins in Afghanistan are Panj-Amu Darya River, Kabul River Basin, Hari Rod-Murghab River Basin, Helmand River Basin, and Northern River Basin (Fig. 3). The diversion structures, connected to the major rivers, have provided needed waters for the Afghan communities, living far enough from the main rivers. Definitely, the main host of the canals are areas were next to the main flowing water bodies. If they have located far

enough from main streams, the Kareze systems would be the best and sustainable alternative. Diverted structures are mainly observed in the narrow flowing rivers valleys in Afghanistan. Totally, these networks are used for bringing water to more than 3 million ha of arable lands (Savage et al. 2009) nationwide. A network of diverted canals from rivers, dams, and main streams is a significant irrigation plan that has been administered by GoA. The main canal converts into smaller scale canals or secondary ones; then water can reach the different and, in some cases, remote villages or communities (Rout, 2008). When water brings to the arable lands by a system of canals, water management and distribution will manage by local inhabitants under Mir Aab supervision. In a word, canals and Mir Ab went hand to hand from the past to regulate water supplies in the target areas and then its historical importance in the water sector is obviously substantial.

Wells

Like pervious historical constituents of the water sector in Afghanistan, water wells have existed as far as local communities could remember. In the 1960s, the importance of wells rather than canals and karezes is not significant, it was used for irrigation of 12,000 ha (about 1%) of Afghanistan (Rout, 2008). This percentage emphasized the excess availability of water in the rivers, streams, and canals, then a small number of areas depend on and use the wells especially for farmlands. Besides, in the past, the main goal of digging a well was providing potable water for the local families and communities. Using well waters largely linked with the level of the water table, and it has experienced an increasingly decreasing trend due to overexploitation and long run and intense droughts due to looming climate change (Fig. 8). During the civil war, the warlords who occupied an area try to devastate the existing water wells or polluted them in order to punish the residents.

Notably, after the Taliban regime in 2001, the number of wells rocketed as international Non-Governmental Organizations (NGOs) have proposed the main priority is to meet the basic water needs of Afghan people and installing new wells around the country. In the same vein, Mack et al. 2013 argue that, for example, between 1997-2005, NGOs in Kabul province only have been installed roughly 1,500 shallow water wells, with an average depth of 22m. Commonly, the wells mostly used for potable usage and in some cases, it used for irrigation (Ahmadzai 2016). Then, wells' role in irrigation processes is very limited. Additionally, in areas where the water table is higher, an ancient irrigation system was used for a long period of time. In this method, groundwater lifts to the surface with the buckets attached to the wheel. This system is called "Persian" wheel or in some places, local residents called it *rahat*. This method is not common around the country, just some cases have been observed in the eastern areas whose water table stands higher.

Conclusion

Historical background of water management strategies in Afghanistan have experienced a series of measurements such as community solution, governmental assistance, international aid through NGOs

co-operation; all measures halted during wartime, especially civil war and particularly Taliban insurgents frequently attack the infrastructure facilities and cities and the following recovery practically is not possible. As Afghanistan is an agriculture-based nation, the most of past and existing water management systems are closely associated with this sector (Ziaee et al. 2015). Over 50% of total arable lands in Afghanistan were irrigated (3.7 million ha out of 7.5 million ha). Of these lands, approximately 65% are irrigating by Mir Ab supervision, however, there are some mismanagement and corruption in this irrigation system due to warlords' influence and force in the local and provincial scales.

After the Taliban collapse in 2001, the new GoA and international contributors found out that there was a huge water-expert gap. The main reasons had to do with an estimated three decades of devastating war. The civil war leading to the mass leaving of various groups of experts and notably water-related professionals and cognizant. The replacement process of the previous expert generation is very slow and frustrating as a significant number of these officials take a position just based on their political/ethnic relationships. Water experts are pivotal for improving the current water situation in Afghanistan both quantitatively and qualitatively. Also, they will play a major role in the future negotiation/cooperation with surrounding countries regarding transboundary rivers.

This paper showed that the people of ancient Afghanistan pay attention to the water and associated techniques to use it efficiently. The current residents and importantly GoA officials should consider those measures and try to protect the water resources more than this current chaotic status in terms of water management nationally and internationally. This paper sheds light on the previous, in order to show that water was an all-important commodity and increasing the public and scientific awareness regarding the issue.

Simply put, the discussed methods and administration have explained the importance of water resources for who lived in this territory. Unfortunately, protecting and management of water supplies is not a big concern or priority for current inefficient GoA, and this is mainly because most of the water-related positions and officials are occupied by not relevant individuals or political/ethnic relationships rather than expertise or competency. In a word, the GoA priorities are not environmental protection issues as the GoA hardly struggle with security problems; therefore, most of the governmental budget will designate to the battlefields and army forces. Finally, in recent years, climate change has significantly intense impact on the Afghanistan water supplies. The situation is worse for traditional water management and distribution systems. Practically, most of them lose their efficiency and do not yield sufficient water no longer for different purposes.

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