



SELINUS UNIVERSITY
OF SCIENCES AND LITERATURE

**Transboundary Water-Sharing Disputes:
Helmand River Water Dispute Between Iran and
Afghanistan -Toward an Active Water
Cooperative Framework**

By
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A DISSERTATION

Presented to the Department of
Water Science
Program at Selinus University

Faculty of Engineering & Technology
in fulfilment of the requirements
for the degree of Doctor of Philosophy
in Water Science

2025

DECLARATION

It is hereby declared that this thesis contains original research works and has been submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Water Science at Selinus University of Sciences and Literature at the Faculty of Engineering and Technology, Italy.

The findings, interpretations and conclusions expressed in this study do neither necessarily reflect the views of the Selinus University, nor of the individual members of the PhD committee, nor of their respective employers.

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Dedication

To my parents for their inspiration and useful advice
To my family and brothers for their sincere encouragement
I do appreciate all my family's generous support and encouragement.

Acknowledgements

First and foremost, I express my deepest gratitude to Almighty Allah for His boundless blessings, for granting me life, and for endowing me with the strength and perseverance to successfully complete this academic journey.

I extend my heartfelt thanks to my family for their unwavering support, encouragement, and understanding throughout the course of my Doctor of Philosophy in Water Science and Engineering. Their continuous motivation has been instrumental in my academic success.

I am sincerely grateful to my supervisor, Prof. Salvatore Fava, PhD, MSc, Professor of Selinus University, and a distinguished member of the British Academy of Management (BAM), the American Society of International Law (ASIL), and the International Council for Open and Distance Education (ICODE). His invaluable guidance, consistent encouragement, and insightful feedback during regular review research works and discussions have significantly shaped the quality and direction of my research. His mentorship has played a pivotal role in the completion of this PhD thesis and related research courses.

I would also like to express my appreciation to the administrative staff and academic members of Selinus University for their cooperation and for providing me a supportive and conducive environment throughout the duration of my PhD studies.

Special thanks are due to the university professors, water science researchers and experts, local authorities, former ministers in Afghanistan and Iran including representatives of international organizations from various countries. I am deeply thankful for their willingness to participate in interviews and discussions, and for sharing essential data, insights, and perspectives that greatly enriched my research.

Finally, I offer my profound gratitude to my parents for their unwavering love, endless prayers, and constant encouragement, which have been a source of strength and inspiration throughout the entire academic endeavour.

Said Hashmat Sadat

Abstract

Transboundary water conflicts are an obvious sign of economic and physical water scarcity across the globe. Transboundary river basins cover almost half of the earth surface. Limitation of freshwater resources, increase in population and civilization and living standards are expected to increase the annual demand for water by 2-3% in the coming decades. Global climate change, variations in precipitation patterns and its uneven distribution have also been argued to increase stress over shared watercourses.

Transboundary water management is a critical component of sustainable and equitable development in shared river basins. In recent years, the discourse around transboundary waters has evolved from a conflict-centred narrative to one emphasizing cooperation, integrated management, and mutual benefit among riparian states. However, the absence of binding treaties and multilateral agreements on most of the shared watercourses can deter international investment and the development of basin-wide water infrastructure. Absence of institutional and cooperative frameworks, uncertainties around water allocation and geopolitical tensions may discourage support for long-term water resource initiatives between the riparian countries.

Afghanistan occupies the upstream position in the region, making it a key riparian state in the region which plays a pivotal role in regional hydropolitics. However, downstream countries have significantly advanced their water resources infrastructure over the past decades without recognizing Afghanistan contributions. Following more than forty years of conflict and instability, Afghanistan now aims to develop large-scale water infrastructure such as dams and irrigation canals to support post-war economic recovery and national development. Yet, the absence of formal transboundary water agreements and sustained dialogue has triggered concern and opposition among downstream states, which they perceive these developments as unilateral and potentially threatening. This tension not only undermines bilateral cooperation but may also jeopardize regional security.

In this research, I argue that multiple interrelated factors hinder transboundary water dialogue and cooperation in Afghanistan particularly in the Helmand River basin with its riparian state Iran: i) limited technical and institutional capacity, ii) the absence of a comprehensive hydrological monitoring network and real-time water flow data systems, iii) persistent political instability and weak water governance structures, and iv) the lack of robust cooperative frameworks or multilateral engagement mechanisms. Despite Afghanistan's ambitious efforts to pursue river basin development and large-scale infrastructure projects, these initiatives are unfolding on fragile foundations. The country's lack of an overarching transboundary water governance and treaties except for the Helmand River basin, which also suffers from weak enforcement and poor implementation undermines long-term regional water security and cooperative management.

This research aims to explore the root causes of the persistent disputes between Iran and Afghanistan over the Helmand River basin, despite the 1973 treaty and to propose an active water cooperative framework for effective implementation of treaty by both countries toward exploring how transboundary water management can foster economic, social, and political collaboration between riparian states.

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List of Acronyms

ACW	Active Water Cooperation
ADB	Asian Development Bank
ANDS	Afghanistan National Development Strategy
AREU	Afghanistan Research and Evaluation Unit
CDC	Community Development Centre
EC	European Commission
EIA	Environment Impact Assessment
EIRP	Emergency Irrigation and Rehabilitation Programme
FAO	Food and Agriculture Organization
GIRoA	Government of Islamic Republic of Afghanistan
GoA	Government of Afghanistan
GTZ/GIZ	German Technical Cooperation (German International Cooperation)
GWP	Global Water Partnership
HAVA	Helmand-Arghandab Valley Authority
HERBD	Hydraulic Engineering and River Basin Development
ICOLD	International Commission on Large Dam
IHA	International Hydropower Association
IRD	International Relief & Development
IWRM	Integrated Water Resources Management
MAIL	Ministry of Agriculture, Irrigation and Livestock
MEW	Ministry of Energy and Water
MIWRE	Ministry of Irrigation, Water Resources and Environment
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affair
MWP	Ministry of Water and Power
NGO	Non-governmental Organization
NVDA	Nangarhar Valley Development Authority
RBA	River Basin Authority
RBC	River Basin Council
RBO	River Basin Organisation
SCoW	Supreme Council of Water
SEA	Strategic Environmental Assessment
TWC	Transboundary Water Cooperation
TWM	Transboundary Water Management
USACE	United States Army Corps of Engineers
USAID	United State Aid for International Development
WB	World Bank
WCD	World Commission on Dams
WCQ	Water Cooperation Quotient
WMD	Water Management Department
WRM	Water Resources Management
WSS	Water Sector Strategy

CHAPTER ONE

1 Introduction

1.1 Background

The world's 286 transboundary river basins¹ (Wei et al., 2022) span 151 countries, covering approximately 62 million km² of the Earth's surface and supplying freshwater to over 40% of the global population (UNESCO, n.d.; Van der Zaag, 2011). In many regions, countries rely heavily on shared rivers, with some being completely dependent on upstream contributions, while others hold upstream leverage (Loodin & Warner, 2022). Within this global context, Afghanistan plays a uniquely strategic role as the upstream riparian for all four of its major transboundary rivers except the Chitral River, which originates in Pakistan before joining Afghanistan's Kunar River.

Despite this advantageous position, Afghanistan faces growing pressure to engage in cooperative water governance with downstream neighbours. Transboundary water cooperation is vital for ensuring equitable and sustainable resource sharing. For decades, Afghanistan's water sector has faced persistent governance challenges due to political instability and frequent regime changes. Compounding these issues, in the last two decades the country's technical and financial reliance on foreign aid has historically constrained its autonomy in water policy formulation and implementation.

In an attempt, to modernize its water sector, the post-2001 Afghan government adopted Integrated Water Resources Management (IWRM) principles and established River Basin Authorities (RBAs) in 2004 (MIWRE, 2004). These reforms aimed to decentralize water governance and promote equitable use across regions. However, persistent insecurity and political fragility hindered their implementation. Since taking power in 2021, the Taliban administration has shifted its focus toward unilateral water infrastructure projects, prioritizing dam and canal development with little regard for cross-border coordination regardless of their conservative diplomatic approach with neighbouring countries. This shift has contributed to rising tensions with neighbouring countries, particularly Iran, where competition over the Helmand River has led to repeated disputes, including a violent border clash in May 2023 (Hessami, 2023). Such incidents underscore how unilateral water development absent diplomatic engagement risks destabilizing an already volatile region.

¹ The recent studies in 2022 by (Wei et al., 2022) reported that there are 286 rivers that cross more than one states. From earlier known, UNDESA (1978) identified 214 transboundary river basin delineations, 261 by Oregon State University (1999), in 2002 identified 263 by OSU, 276 by OSU (2012) and the number has risen to 286 in recent years (UNESCO, n.d.) <http://twap-rivers.org/>

During my MSc research, interviews with key actors revealed that the Government of Afghanistan had made several efforts to implement IWRM and promote good water governance to improve transboundary water management in the country (Sadat, 2012). The former republic government and current Taliban authority have been strongly focused on developing water resources infrastructure especially dams to maximize social welfare and economic growth. These projects are critical to supporting Afghanistan's agriculture and energy sectors, which are lifelines for the country's population.

Nevertheless, transboundary water issues remain as lower priority due to several persistent challenges, including limited technical capacity, ongoing insecurity, and insufficient hydrological data. These obstacles contributed to Ex-president Hamid Karzai's reluctance to engage in water negotiations with neighboring countries, despite frequent proposals from riparian states mainly from Pakistan. This general stance also negatively impacted the implementation of the 1973 Helmand River Treaty. The only notable step taken during the Karzai's administration was the establishment of the Helmand River Basin Commission in 2004, which held sporadic and largely symbolic meetings with Iranian counterparts with some limited improvement from 2019 onwards.

Under the Taliban, disputes over the Helmand River and its wetlands have continued, exacerbated by climate change and the commissioning of new dams, such as the Kamal Khan Dam and construction of Pashdan Dam on the Harirud River. These developments have intensified regional mistrust, particularly with Iran, which claims Afghan dams restrict downstream water flow. The core of the dispute centers around water allocation from shared rivers with more than 900 kilometres of shared border, water rights have always been a source of friction between the two nations. Meanwhile, Afghanistan remains one of the least developed countries in the region in terms of water infrastructure development with the lowest water storage capacity (Sadat & Sayed, 2020). As such, dam development is viewed as a national priority for Afghanistan to harness domestic water resources, increase storage, boost power generation and adapt climate risks. However, the lack of structured and active cooperation with neighboring countries has contributed to rising tensions and mutual distrust.

Another critical dimension is Iranian experts and officials' apparent reluctance to recognize climate change as a contributing factor in altering the river's flow regime. For instance, during a visit to Kabul in February 2025, Iran's Foreign Minister Araghchi expressed scepticism, stating, "We do not know the extent of climate change's impact on the river flow regime" (Fahim, 2025). Similar views were echoed by several Iranian experts and interviewees, who downplayed the impact of climate change on river flow and wetlands degradation. They claim these due to water diversion in upstream reaches (Hajihosseini et al., 2016; ZRGIRN7, 2024; HSNIRN9, 2024).

Since 2021, the Taliban have increasingly pursued a hydro-hegemonic approach rooted in their geographical control over river sources (Loodin & Warner, 2022). They resumed construction of legacy projects from 1970s, such as the Qush Tepa Canal in the Amu Darya Basin and the Pashdan

Dam in the Harirud basin, without notifying downstream states or closely adhering to international water law (IWL) principles though the authority said, they will never ignore the rights of neighbors. These unilateral actions have caused alarm in Uzbekistan and Iran, who view them as destabilizing interventions in shared river systems.

Despite the importance of Afghanistan's role in the Amu Darya Basin, the Central Asian republics still refer to Soviet era where the entire river flow was allocated only among Tajikistan, Uzbekistan, Turkmenistan, and the Kyrgyz Republic through Protocol 566 and Almaty agreement in 1991 (Kamil, 2021). Over the past three decades, Afghanistan has not been included in regional water management institutions despite contributing significantly to the basin's annual flow. However, diplomatic ties and trade relations with Central Asian countries remain relatively stable and the water right issue did not become a reason of conflict and is contentious until now but the exclusion of Afghanistan from formal water-sharing frameworks presents a significant gap in regional water governance.

In contrast, the Afghanistan-Iran water conflict over the Helmand River has been historically tense, despite the 1973 Helmand Treaty. Armed skirmishes, infrastructure development, disagreements over river flow and discharge, and wetlands degradation, compounded by a lack of trust, political will, and cooperation willingness, have reignited the dispute in recent years (Hessami, 2023). Given the Helmand River's role as both a breadbasket for Afghanistan and Sistan (Sadat, 2012) and a source of insecurity in the region (Goes, 2016), it is a compelling case study for exploring the root causes of conflict and identifying pathways to active water cooperation and effective implementation of the 1973 treaty.

1.2 Problem Statement

Afghanistan is an arid to semi-arid landlocked country and characterized by rugged mountains and it is divided into five major river basins: the Amu Darya, Kabul (Indus), Northern², Helmand, Harirud–Murghab (Ahler et al. 2014) and 36 sub river basins (Duran, 2015) with estimated 57 BM3 renewable surface water flow (Kamil, 2021). Snow melting and rain are the main sources of flows in the five river basins of Afghanistan of which four of them are shared basins with Iran, Pakistan, and central Asian countries (Tajikistan, Uzbekistan, and Turkmenistan). Since Afghanistan has been going through more than four decades of war and political unrest which cause lack of political and economic trust with its neighbouring countries. Transboundary water management and development could play an important role to bring the regional and neighbouring countries around the table and provide opportunities for cooperation (Duran, 2015).

Afghanistan currently faces significant limitations in its capacity to store, manage, govern, and effectively utilize its freshwater resources (Nori, 2020). Although the country has recently begun to prioritize surface water management as a critical driver of economic growth, its interventions in shared river basins have increasingly triggered concerns and disputes with neighbouring countries.

² Northern river basin is not a shared water course with any of Afghanistan neighbouring countries.

Climate change and alteration in river flow regimes have further intensified tensions among riparian states, exacerbating the already fragile hydropolitical landscape. Despite being an upstream contributor to several major transboundary rivers, Afghanistan is not a signatory to any major international water conventions and is largely absent from multilateral cooperative initiatives over its shared watercourses (Duran, 2015). The only formal agreement is the 1973 Helmand River Treaty with Iran (King & Sturtewagen, 2010).

Transboundary water rights over the Helmand River remain a central source of contention between Iran and Afghanistan, particularly in light of rising water demand in the Helmand basin due to population growth and new infrastructure development. The commissioning of the Kamal Khan Dam by Afghanistan, for instance, has provoked strong reactions from Iran, further straining bilateral water relations (Thomas et al., 2016). *See Figure 1 for a visual representation of the conflict areas.*

The dispute between Afghanistan and Iran over the Helmand River and border demarcation has deep historical roots, dating back to the late 19th century. One of the earliest recorded tensions emerged when Iran claimed that a portion of the Sistan region, located in present-day Afghanistan, rightfully belonged to Iran (Abidi, 1977). This territorial argument evolved into a broader geopolitical conflict, eventually drawing British colonial involvement into the matter. As tensions escalated, Helmand River water rights became entangled with the territorial dispute, prompting British authorities to mediate. In 1872, the British Empire appointed Major General Frederick Goldsmid as an arbitrator to delineate the boundary between Afghanistan and Iran's Sistan province, and to assess water rights in the region (McMahon, 1905). This arbitration marked one of the earliest international interventions over the Helmand waters and laid the groundwork for what would become a prolonged and complex transboundary water conflict (Hajihosseini et al., 2012).

Goldsmid's 1872 arbitral award focused on irrigation, instructing both Afghanistan and Iran to avoid new interventions along the Helmand River that could affect the "requisite supply" of water to Sistan, allowing only the maintenance or reopening of existing canals (McMahon, 1905; Abidi, 1977). Although the term "requisite supply" was left undefined creating ambiguity the award marked the first formal recognition of Iran's water rights in the Helmand basin although it lacked a precise quantification ((Abidi, 1977). According to McMahon (1905) both countries accepted the decision in 1873, with Clause III granting Iran one-third of the river's flow downstream of Bandi Kamal Khan, laying a foundational preliminary framework of water sharing but vague framework for water sharing.

In the course of time, due to natural alteration in the flow regime of Helmand River and drought several disputes arose between Iran and Afghanistan. In 1903, the British Commissioner, Colonel McMahon readdressed the boundary demarcation and water share issue between and committed to define the "requisite supply" of water (Abidi, 1977). Since the Goldsmid award was pro-Persia (Iran) the arbitral award of McMahon also formed according to the Goldsmid award where the delta area of Helmand River fell within the Iranian territory based on the McMahon's demarcation. However, the McMahon commission award was rejected by both parties (Abidi, 1977). The main reason for rejection by Iranian was that the allocated percentage (one-third of the river flow) felt insufficient for them, and Afghanistan's concern was restrictions on their future irrigation development (Abidi, 1977).

When Iranian coup d'état took place in February 1921, and British forces left Persia (Katouzian, 1979) the new government of Iran was very pragmatist and emphasizing on good neighbourhood and Islamic unity with Afghanistan (Tarhan, 2019) therefore Iran prepared treaty of friendship which was signed by both countries in November 1927 (Abidi, 1977). Despite this, the frontier dispute on demarcation and water distribution was not settled till then so both countries agreed in 1938 with the engagement of Turkey as third party (Abidi, 1977). In the 1938 agreement was stated that Afghanistan should not hamper water flow down to Iran and equally share the river flow below the Kamal Khan dam (Abidi, 1977). This stems from a 1933 decision by Afghanistan's King Nadir Shah, who offered Iran half of the Helmand River's water an increase from the one-third allocation listed in the McMahon Award for areas downstream of the Kamal Khan Dam (Mayar, 2023).

In the 1920s, Afghanistan launched the Helmand-Arghandab Valley Authority (HAVA), a large-scale, multi-sectoral development scheme in the Helmand basin with technical support from German and Japanese experts between 1937 and 1941 (Sadat, 2012). The project aimed to modernize Afghanistan's agricultural and water infrastructure and symbolized the country's ambitions for development. Following World War II, in 1946, the United States replaced the German and Japanese teams and took over technical and financial support for HAVA. This shift was part of broader U.S. geopolitical interests in the region. The American-led HAVA project was regarded as an emblem of modernity, and Lashkar Gah then the hub of the project was popularly referred to as the "New York of Afghanistan" (Cullather, 2002).

However, Iran viewed this surge in U.S.-backed water infrastructure development as a threat, particularly in light of economic and national interests. Tehran perceived these developments as a violation of the 1938 agreement, under which both countries had agreed to an equal division of water flowing below the Kamal Khan Dam (Abidi, 1977). It is worth noting that the HAVA project is located approximately 336 kilometers upstream of the Kamal Khan Dam site, raising Iranian concerns that upstream development would reduce water availability downstream. Despite these tensions, there was a subsequent attempt in 1939 to formalize a treaty on Helmand water sharing between Iran and Afghanistan, under the leadership of King Reza Shah Pahlavi of Iran and King Mohammad Zahir Shah of Afghanistan. However, Afghanistan never ratified this agreement, further exacerbating the distrust between the two countries (Fatemeh, 2016).

In 1947, both Iran and Afghanistan sought mediation from the United States to resolve their ongoing conflict over the Helmand River waters. In response, the U.S.-backed Helmand River Delta Commission was established as a fact-finding body. After thorough investigation, the Commission submitted its recommendations on 28 February 1951, which later served as the foundation for the 1973 Helmand River Treaty (Hearns, 2015). During the 1950s, tensions escalated as Afghanistan, without a formal treaty in place, constructed two major dams in the Helmand basin: the Kajaki Dam for hydropower generation and the Dahla Dam for irrigation, both built with assistance from the American engineering firm Morrison-Knudsen. Iran perceived these unilateral developments as threatening to its water security, intensifying the dispute. Despite the ongoing disagreements, bilateral negotiations continued for more than two decades, culminating in the 1973 treaty, which formally incorporated the key recommendations of the 1951 Commission. Under the 1973 treaty both states agreed on releasing of 22 m³/s for Iran in "normal

water year³” (Article III of treaty 1973) whereas Afghanistan then added 4 m³/s more as “goodwill” for the sense of neighbourhood (Hearns, 2015).

Since 1973, the Helmand River Basin remains the only shared watercourse in Afghanistan governed by a formal bilateral treaty with Iran (King & Sturtewagen, 2010). However, despite the existence of this agreement, the treaty has not succeeded in fully resolving tensions or preventing recurring disputes between the two countries. At the time of signing, the Martyred Prime Minister of Afghanistan Musa Shafiq expressed optimism, declaring that the treaty would permanently settle the confrontations and eliminate the need for further negotiation (Nagheeby & Warner, 2022). Yet, successive governments in both Kabul and Tehran have continued to politicize the issue. Water has remained a source of contentions and a highly sensitive subject, often entangled in broader geopolitical narratives. Instead of sustained cooperation or institutional dialogue, both sides have frequently relied on rhetorical posturing, contributing to mutual distrust. Iran, in particular, has consistently sought to maintain a strong presence and influence in Afghanistan, motivated in part by concerns over shared transboundary waters and border security.

Although both Iran and Afghanistan have repeatedly pledged to uphold the 1973 Helmand River Treaty and even earlier protocols from 1927 and 1938, the treaty has ironically become a persistent source of contention. Each country frequently accuses the other of violating its terms due to their interpretation (Nagheeby & Warner, 2022). Tensions have occasionally escalated into broader geopolitical conflict; notably, in 1998, Iran and the Taliban nearly went to war following the killing of Iranian diplomats in northern Afghanistan. Despite this, over the past two decades, Iran has been accused of supporting the Taliban and bribing officials to undermine water infrastructure projects in both the Helmand and Harirud basins (Majiyar, 2018). For instance, in 2011, a Taliban commander claimed Iran offered him \$50,000 to sabotage the Kamal Khan Dam (Glinski, 2020). In contrast, since taking power in August 2021, the Taliban have adopted a hydro-hegemonic stance, asserting their upstream rights to harness and manage Afghanistan’s water resources unilaterally largely disregarding existing transboundary obligations.

While Afghanistan’s Taliban-led government insists it adheres to the 1973 treaty, Iran positioned downstream continues to assert that its water rights are being violated, particularly highlighting the drying of the Hamoun wetlands as evidence of water reduction by Afghanistan (Scollon, 2023). The Taliban, however, consistently deny restricting water supplies and maintain that they are complying with the treaty’s provisions. On 19 May 2023, Iranian President Ebrahim Raisi, during a visit to Iran’s Sistan region, issued a strong warning to the Taliban, urging full compliance with the treaty and respect for Iran’s water rights (Tayebi, 2023). Just days later, on 23 May 2023, a deadly military clash erupted between Iranian and Afghan border forces underscoring that unless the 1973 treaty is effectively operationalized and implemented, transboundary water tensions are likely to persist or even escalate. This ongoing conflict has been insufficiently addressed in existing literature, which often overlooks the practical gap between treaty existence and treaty implementation. Therefore, this study focuses on how the enduring disputes between Iran and Afghanistan despite the presence of a formal agreement can be transformed into cooperative engagement through the effective implementation of the 1973 Helmand River Treaty. To this end, the following research questions guide the study.

³ Normal water year defined in the article I, para-C of the 1973 treaty “means the year during which the total flow of water from the first of October to the end of the succeeding September, measured and calculated at the Dehrawoud Station located on the Helmand River Upstream from the entrance to the Kajaki Reservoir is 5661,715 Mm³”

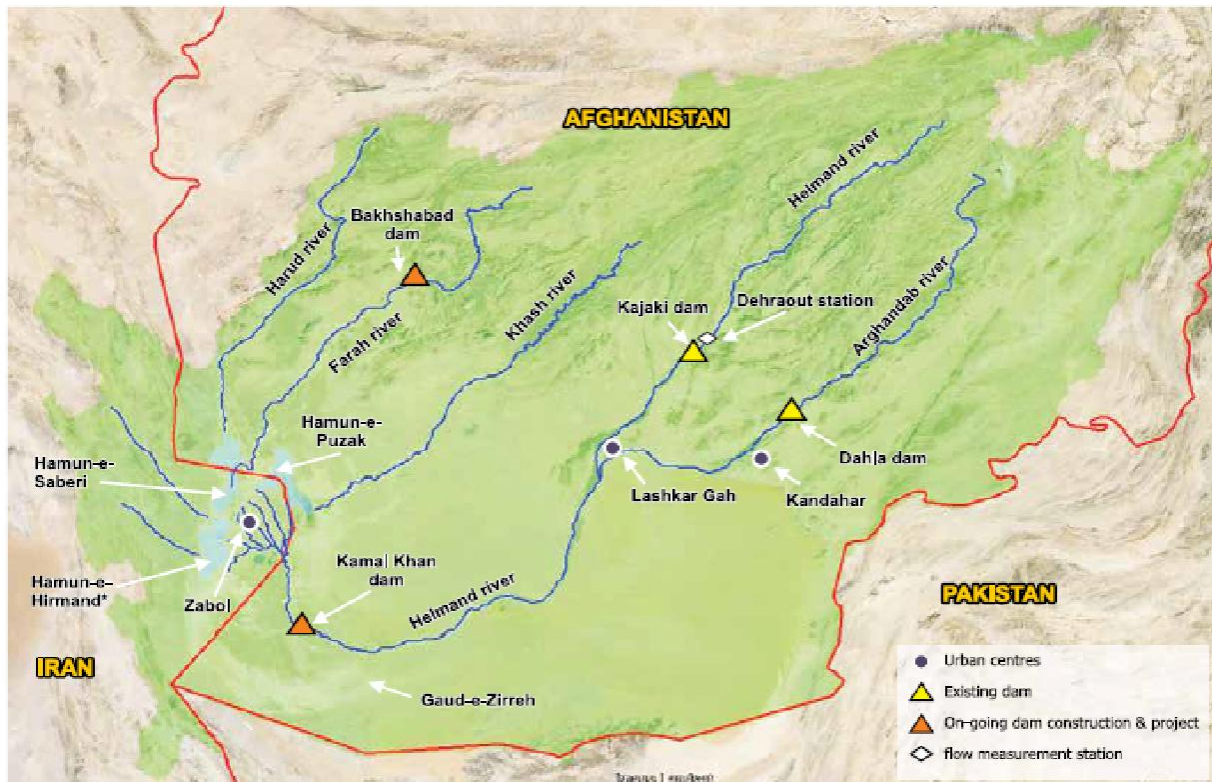


Figure 1: Helmand River Basin and contributing rivers (Source: retrieve from Thomas, 2016)

1.3 Main Objective

The main objective of this study is to explore the root causes of the persistent disputes between Iran and Afghanistan over the Helmand River basin, despite the 1973 treaty. Additionally, the study aims to propose an active water cooperative framework in respect to the treaty's full and effective implementation by both countries toward exploring how transboundary water management can foster economic, social, and political collaboration between the riparian states.

1.4 Research Questions

To further explore the main objective, the research project addresses the following questions:

- i) What are the reasons for continual disputes and contentions between Iran and Afghanistan despite a signed treaty in 1973 over the Helmand River water?
- ii) What is the impact of the dispute over shared water courses between both countries diplomatic, political, and social relations?
- iii) In what ways both countries get engaged in active water cooperation and collaboration for effective implementation of signed treaty over usage of Helmand River waters?

1.5 Case Study

The Helmand River Basin is the largest in terms of area in Afghanistan, covering approximately 45% of the country's territory (Loodin & Aaron, 2022). The river flows for about 1,150 km within Afghanistan before reaching the Sistan Wetlands (Hearns, 2015), eventually feeding into the 18,000 km² Sistan Delta, which spans parts of both Iran and Afghanistan (Thomas et al., 2016). The basin's average annual flow is estimated at 9.3 Bm³ (Mahmoodi, 2008), shared primarily between Afghanistan and Iran, with a minor portion extending into Pakistan. Key uses of the river include hydropower generation, irrigation, and ecosystem support.

The Helmand River supplies nearly 97% of irrigation water for southwestern Afghanistan and about 80% for Iran's Sistan Baluchistan region (Loodin & Aaron, 2022). In 1993, it supported irrigation across 1.5 million hectares within the basin (Ahmad & Wasiq, 2004). According to Afghanistan's 2008 Water Sector Strategy, the total basin area is 264,900 km², almost entirely within Afghanistan, and the river forms a 55 km stretch of the border with Iran.

The Helmand River forms a series of interconnected lake cascades as it flows from Afghanistan into Iran. Many rivers in Afghanistan, including the Helmand, contribute water to wetlands and support diverse ecosystems in the Sistan Delta (Hearns, 2015). Before reaching the Iranian border, the Helmand River splits at a point known as the Helmand Fork. Another significant river, the Shele Charak, marks part of the border between Iran and Afghanistan. It flows northward within the basin and terminates in the Hamun-e-Puzak, located inside Afghanistan (Hearns, 2015; Alka, 2017). Over the past two decades, the drying of the wetlands has become a central issue in disputes between Afghanistan and Iran.

The Helmand and Farah Rivers flow from Afghanistan into the Hamun-e-Sabri wetland, which straddles the border region. Another branch of the Helmand River flows into the largest wetlands, the Hamun-e-Helmand, situated within Iranian territory (see Figure 2) (Hearns, 2015; Scollon, 2023). These three wetlands Hamun-e-Puzak, Hamun-e-Sabri, and Hamun-e-Helmand are interconnected (Thomas et al., 2016) and all are primarily fed by rivers originating in Afghanistan, which serves as the upstream country (Fatemeh, 2016).

The geographical positioning of the wetlands along the Afghanistan Iran border, along with their hydrological systems, is highly complex and interconnected between the two countries. For example, excess water from the Hamun-e-Helmand wetland in Iran can flow back into Afghanistan through a channel, replenishing the Godezari wetland (see Figure 2) (Thomas et al., 2016; Beek, 2008). During normal and wet years, the wetlands in Afghanistan particularly Hamun-e-Puzak and Hamun-e-Sabri continue to supply water to the downstream wetlands located within Iranian territory. However, in dry years, water flow becomes significantly reduced and often fails to reach the Iranian wetlands, which typically remain dry from August through December.

Climate change has further intensified environmental degradation and disasters in the region, particularly through prolonged droughts and frequent sandstorms. These conditions have significantly reduced agricultural opportunities for the local population in Sistan and have forced many residents to migrate (Fatemeh, 2016). According to the head of the Hamun Wetlands Revitalization Committee and a member of the Iranian Parliament, the worsening condition of the Hamun wetlands led to the emigration of approximately 130,000 people from the Sistan region as of 2016 (Fatemeh, 2016).

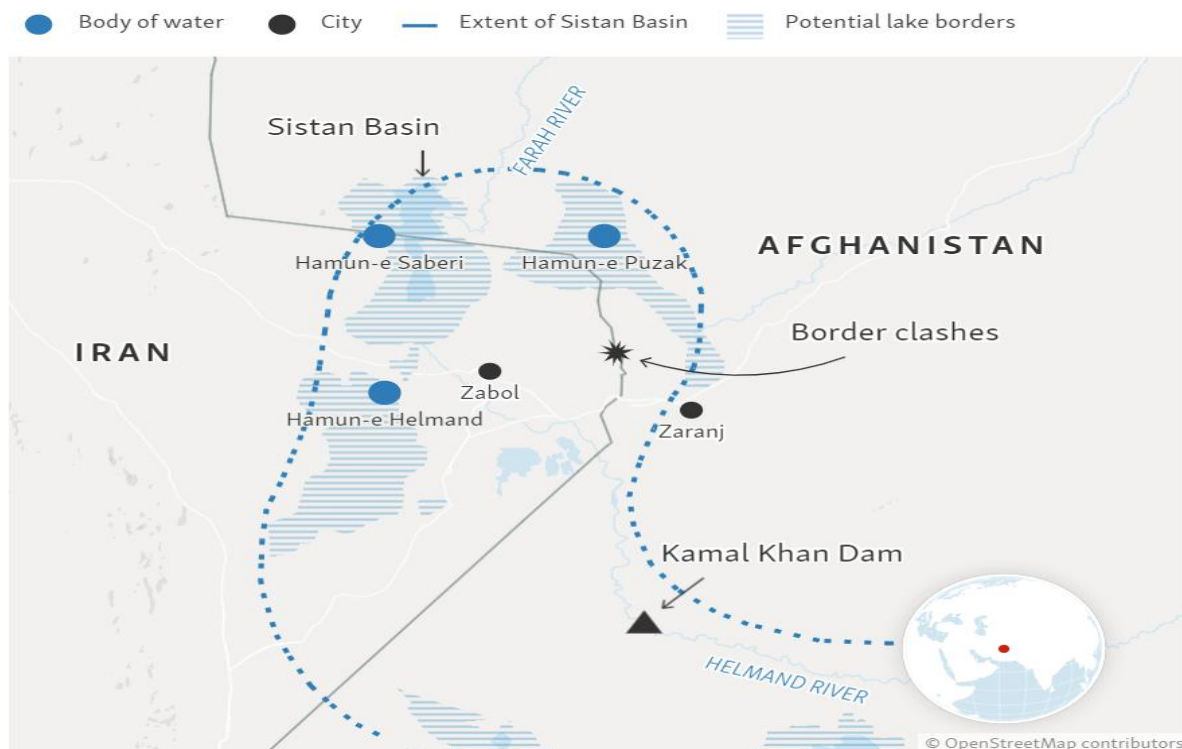


Figure 2: The Helmand River Basin's wetlands in the Sistan Area (Source: Scollon, 2023)

Since 1980, Iran has been constructing the Chahnimah⁴ reservoirs to enhance water storage and improve irrigation reliability in the Sistan region (Thomas et al., 2016). In 2006, Iran began construction of the fourth and largest Chahnimah reservoir, with a total storage capacity of 819 million cubic meters (MCM) equivalent to Iran's water allocation under the 1973 Helmand River Treaty. Collectively, the total storage capacity of all four Chahnimeh reservoirs is estimated to be approximately 1,450 MCM (Yao et al., 2019) which is comparable to the combined storage capacity of Afghanistan's Kajaki and Arghandab reservoirs.

The total available annual inflow to the Sistan Delta, primarily contributed by rivers originating in Afghanistan, is estimated at 5,935 MCM (Beek et al., 2008). One of the major challenges in the Sistan Delta is the high rate of evaporation from the Hamun wetlands, which significantly reduces the effective availability of water. The irrigable agricultural land in Iran's portion of the Sistan region covers around 120,000 hectares and requires an estimated 2,069 MCM of water per year for adequate irrigation (Beek et al., 2008). However, due to limitations in water infrastructure and distribution systems, the actual annual water supply for irrigation is only about 1,169 MCM (Beek et al., 2008). Table 1 provides a breakdown of the inflow and outflow of available water from Afghan rivers contributing to the Sistan region.

⁴ Chahnimah is a local term used in the Sistan region of Iran to refer to man-made water storage reservoirs. The Chahnimah system consists of four reservoirs. Reservoirs 1, 2, and 3 with storage capacities of 220, 90, and 320 MCM respectively were completed in 1983. The fourth and largest reservoir, with a capacity of 810 MCM, became operational in April 2009 (Yao et al., 2019).

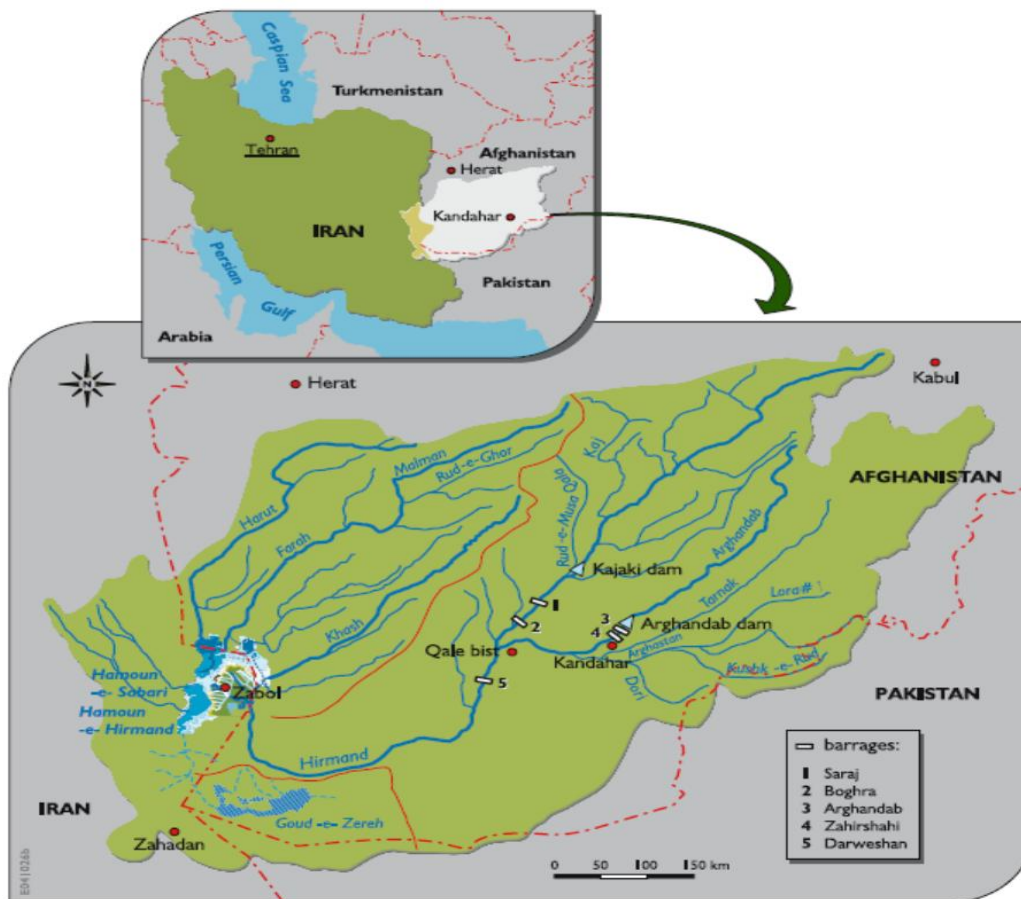


Figure 3: Contributing River basins to Sistan inland delta (Source: Beek, 2008)

The figures in Table 1 indicate that the rivers flowing from Afghanistan have sufficient discharge potential to meet both the water rights allocated under the 1973 treaty and the irrigation demands of Iran's Sistan region. However, extensive evaporation from the Hamun wetlands and the Chahnimah reservoirs combined with inadequate irrigation systems and poor water delivery infrastructure and management, pose significant challenges in Iran Sistan region to fully utilizing total annual inflow (5 935 MCM). This part has been further discussed in Section 2.10.

Table 1: Average annual water balance in Iran's Sistan Delta in MCM/year (Beek et al, 2008)

Rivers name	Inflow	Purpose	Outflow
Helmand River	3 908	Agriculture	1 161
Farah	1 512	Public water supply	34
Khash	455	Hamuns evaporation	4 378
Local precipitation	60	Chahnimeh evaporation	124
		Outflow to Shile	238
Total	5 935	Total	5 935

1.6 Structure of the Thesis

Following the introduction and problem statement presented in Chapter One, **Chapter Two** provides a comprehensive literature review to establish a solid understanding of the research context and main objectives. This chapter reviews key concepts related to transboundary water management principles, the UN Convention on the Law of the Non-Navigational Uses of International Watercourses, water policies and strategies of both Afghanistan and Iran, their respective water governance systems, and regional treaties and disputes given the increasing prominence of water as a source of international tension.

Chapter Three outlines the research methodology and theoretical framework used to analyze the root causes of challenges and disputes over shared watercourses. This chapter is essential for providing the analytical lens through which the study examines transboundary water challenges.

Chapter Four presents the research findings and explores how the operationalization of treaty and water-sharing agreements can play a critical role in preventing conflict and fostering cooperation between riparian states.

Chapter Five offers a detailed discussion that links the research findings with the overall research objectives. It interprets the results of interviews and literature reviews, assesses their significance, and constructs a coherent argument in support of the thesis conclusion.

Finally, **Chapter Six & Seven** concludes the thesis by summarizing the research questions, central problem, key findings, and providing recommendations. It also discusses the study's limitations and proposes directions for future research.

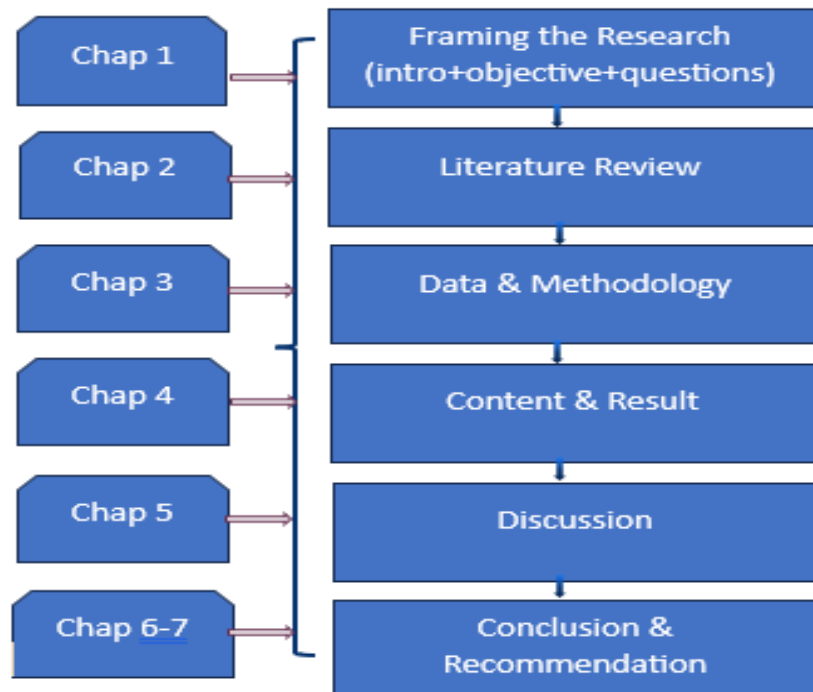


Figure 4: Schematic structure of Thesis

CHAPTER TWO

2 Literature Review

2.1 Introduction

Water is often described as life-giving, finite, and fugitive three intrinsic attributes that collectively underscore its high value (Zaag, 2011). It plays a fundamental role in sustaining natural ecosystems and life. Water naturally moves through various channels such as rivers, streams, lakes, soil, rock formations, and oceans (Varis et al., 2008). Among these, rivers have been most frequently altered by human interventions for purposes such as dam construction, water diversion, irrigation, and flood control (Abtew & Melesse, 2014).

Theoretically, the river basin serves as the most appropriate and natural unit for water management. However, many river basins extend across national borders, creating complex governance challenges (Varis et al., 2008). Currently, there are approximately 286 transboundary river basins globally, shared by two or more countries. A significant number of these basins experience conflict over water resources rather than cooperation (Wei et al., 2022).

In fact, by definition, water resources management is inherently a form of conflict⁵ management. Given the competing demands and interests over limited water supplies, managing water resources often involves navigating complex political, social, and environmental tensions. Water conflicts and negotiations cannot be effectively addressed without the involvement of experts and specialists, as scientific knowledge plays a critical role in both provoking disputes and facilitating cooperation (Jarvis & Wolf, 2013). Sound scientific analysis can inform equitable and sustainable solutions, while misinterpretation or manipulation of data can exacerbate tensions. Moreover, effective negotiation practices contribute to cooperation by enabling joint fact-finding and promoting equitable use of shared water resources among riparian states (Jarvis & Wolf, 2013).

Population density is a key factor influencing the availability of water and the degree of water stress or scarcity, which often leads to disputes and conflicts. Although Asian rivers have some of the highest annual water flows globally, the region's dense population limits people's access to water resources. This limited water availability in highly populated areas creates significant stress and can trigger inter-state conflicts (Ganoulis et al., 2018). The future increase in water stress and the risk of water-related conflicts are closely linked to population growth. Malin Falkenmark's (1989) "water stress indicator," presented in Table 2, remains a widely used tool for assessing water scarcity and managing water resources effectively.

⁵ Conflict definition: Jarvis (2008) addressed this question using Thomasson (2005) who cites Wallensteen (2002) that "conflict is a social situation in which a minimum of two actors (parties) strive to acquire at the same moment in time an available set of scarce resources" (Jarvis & Wolf 2013).

Table 2: Water volume availability and level of water stress (Ganoulis et al., 2018)

Annual renewable water availability per capita (m³/person)	Water stress indicator $\frac{1}{4}$ Country's annual renewable water/population
> 1700	Water Security
1000–1700	Periodic water stress/vulnerability
500–1000	Chronic water stress/stress
< 500	Absolute water stress/scarcity

The global freshwater flows 60 percent shared between two or more countries and cover almost half of the earth land surface which is called transboundary rivers (Earle et al., 2013). In the transboundary river basin, equitable usage and no-harm approach, territorial integrity and sovereign equality, data sharing, environmental conservation, consultation with riparian countries as normative elements could avoid conflict over shared water resources (Conca, 2006). Transboundary waters can even contribute to regional development and peace if the institutional capacity exists to manage their water resources cooperatively between all the basin states (Earle et al., 2013)

This chapter explores the concept of transboundary water management and cooperation, drawing on case studies of conflicts and disputes from various international river basins. It examines the water policies and governance structures of Iran and Afghanistan, with a particular focus on the Helmand River and the 1973 treaty governing its use. The chapter also reviews the institutional arrangements in the water sectors of both countries and analyses key frameworks and concepts related to conflict resolution. These elements are assessed to provide a comprehensive understanding of the underlying causes of disputes between Iran and Afghanistan over the Helmand River.

Furthermore, the chapter presents a framework aimed at fostering effective and active cooperation, as well as the operationalization of the 1973 treaty. This proposed framework is grounded in principles of international water law and is designed to promote reasonable and sustainable management of shared watercourses between the two riparian states.

2.2 Conceptual literature reviews

Transboundary watercourses refer to international rivers that cross the territorial borders of two or more riparian countries. The issue of water cooperation over shared watercourses has been contentious (Xie & Shaofeng, 2017). In Asia, transboundary water management is particularly debated due to the differing approaches countries take toward the sustainable development of river basins (Xie & Shaofeng, 2017). National interests and competition over the use of shared water resources often lead to interstate conflicts. Although transboundary waters can be a source of contention and conflict, they also play a crucial role in achieving Sustainable Development Goal (SDG) 6 (Saikia et al., 2020). As Mark Twain famously remarked, “Whiskey is for drinking; water is for fighting over.” However, Aaron Wolf pointed out that the last major international armed conflict over water occurred for 4,500 years ago. Despite this, international water cooperation has been practiced in various forms for the past thousand years (Fry & Chong, 2018).

Similarly, the Pacific Institute has documented 166⁶ examples of international⁷ armed conflicts over shared water resources in recent decades. One such case involved Turkey's purported attack on water infrastructure in northern Syria in 2018 (Fry & Chong, 2018). The most recent incident occurred in May 2023, when armed conflict broke out between Iran and Afghanistan over the Helmand River waters. Although there is no definitive scientific evidence that water disputes directly cause international conflict (Fry & Chong, 2018), numerous incidents demonstrate how water resources and infrastructure have been weaponized intentionally poisoned, cut off from civilian populations, or used to flood areas (Gleick & Shimabuku, 2023). Both physical and economic water scarcity often exacerbate tensions and contribute to conflict among various actors and users (Gleick & Shimabuku, 2023).

According to the UN International Watercourses Convention, every country has the right to utilize shared water resources, provided it does not harm the environment or infringe upon the rights of neighbouring countries (Sadat & Nasrat, 2019). Without adherence to Chapter VII resolutions of the UN Security Council, unresolved water disputes may pose serious threats to international security.

Taking this into account if the ongoing transboundary water disputes in various shared river basins do not pursue the international water law and principles, then the most parts of the world may face with water-related conflicts and tensions (Fry & Chong, 2018). Water dispute and conflict over shared water resources can be resolved by initiating and going through to the negotiating process to engage the countries around the table aiming for water cooperation (Xie & Shaofeng, 2017). Developing diplomatic relation between countries simplifies negotiation process and bring actors around the table to discuss their national interests and differences over shared water resources and mitigate risk of water dispute between riparian countries (Xie & Shaofeng, 2017).

Water cooperation pave ways for formalizing accords between countries over usage of water towards preventing conflicts and dispute (Sadat & Nasrat, 2019). Numerous practical studies and research efforts have examined conflict and cooperation in the management of shared watercourses at both international and local levels (Wei et al., 2023). These studies have proposed various frameworks to assess the factors influencing conflict and cooperation over shared water resources (Wei et al., 2022).

For example, Wolf et al. (2003) developed the International Water Event Database (IWED), which tracks instances of conflict and cooperation related to global water issues from 1948 to 2008 (Wei et al., 2022). Similarly, the Water-Related Intrastate Conflict and Cooperation (WARICC) database, developed by Bernauer et al. (2012), focuses on national water disputes occurring between 1997 and 2009 in 35 countries spanning the Mediterranean, the Middle East, and the Sahel regions (Wei et al., 2022). More recently, the Transboundary Freshwater Dispute Database (TFDD), proposed by Munia et al. (2016), provides a global and regional perspective on water conflicts and resolution processes.

For classification and measuring the extent of water conflict and cooperation Wolf et al. (2003) developed a 15-point Basins at Risk (BAR) scale. Similarly, Watson (2015) developed the

⁶ See water conflict chronology – a summary of the world's waters conflicts events (Gleick & Heberger 2014)
<http://ndl.ethernet.edu.et/bitstream>

⁷ International Waters dispute defined by (Fry & Chong, 2018) as disagreement between two or more states over law or interests about any aspects of international water law and because threats to the international peace and security.

Integrated Basin at Risk (iBAR) scale for consideration of inequalities and injustices *and* Conca (2006) projected core elements for measuring transboundary governance such as no-harm principle, equitable use, exchange of information and consultation among the riparian States, sovereignty, environmental protection, early notification and peaceful resolution of conflict and dispute (Turton et al., (2007).

These databases discuss & analyse the temporal and spatial characteristics of global water conflicts and cooperation across various transboundary river basins. However, their ability to identify the exact root causes remains limited due to an incomplete understanding of the underlying processes (Wei et al., 2022). In the following Section 2.3, three cooperation frameworks are reviewed and discussed in detail to address the research questions and explore the potential for establishing an effective cooperation mechanism between Iran and Afghanistan over the Helmand River.

2.3 Transboundary water conflict and cooperation Frameworks

2.3.1 Water conflict

Currently the world's supply of water due to overuse by people is under stress whereas almost half of the world population shares freshwaters that crossing their territorial borders (Rowland, 2005). According to Thomasson (2005), water physical⁸ scarcity causes water related conflicts while generally water distribution is the main common reason of conflicts among the nations. The neo-Malthusians stated by Thomasson (2005) which refers to overpopulation as major concern for conflict due to depletion of finite resources (Jarvis & Wolf 2013). The conceptual modes of the causes of conflict adapted by Jarvis (2008) which developed by Moore (2003) and Rothman (1997) as circle of conflict over shared water courses, see Figure 4 (Jarvis & Wolf 2013).

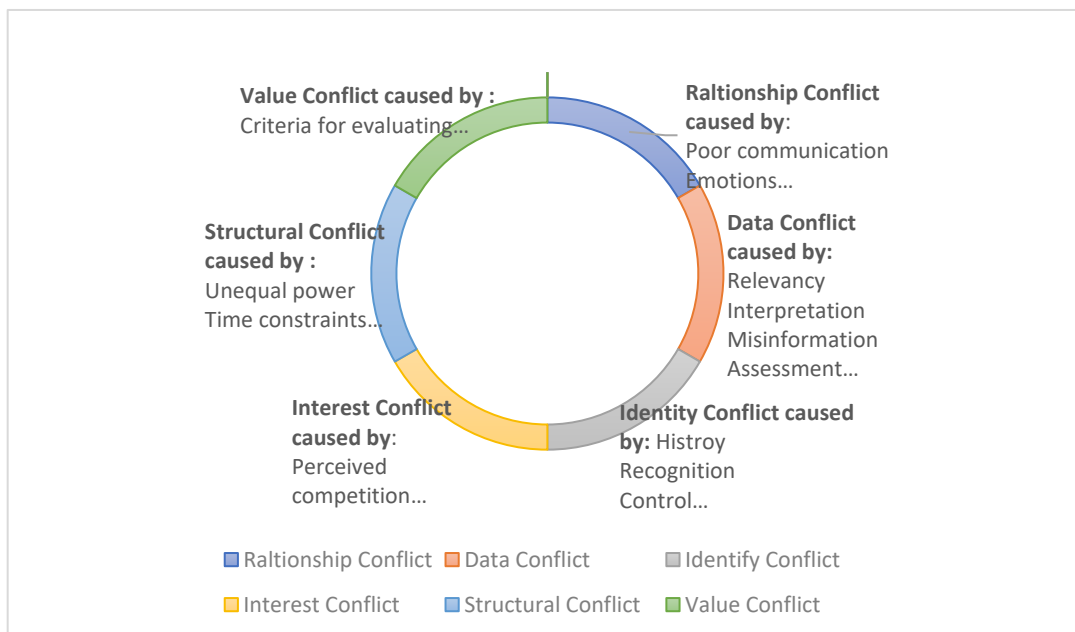


Figure 5: Circle of conflict (Source: retrieve from Jarvis (2008).

⁸ "Physical scarcity occurs when the demand of the population exceeds the available water resources of a region. Economic water scarcity occurs when water is adequate, but is unavailable due to a lack of significant investment in water infrastructure" (IWMI, 2000; Rijsberman, 2006)

This circle of conflict can be applicable for different groups such as clans, communities, cities and even disputes and conflicts between nations (Moore, 2003). For instance, structural conflicts discussed by (Cascão & Zeitoun, 2013) at the transboundary basin level for the assessment of “hydro-hegemony” in the Nile, Jordan, and Euphrates & Tigris rivers. Transboundary water is in high risk of disagreements, disputes, confrontations, and even armed conflicts between the riparian states (Ganoulis et al., 2018). In some river basins, conflicts refer to their historical events and fights over territory and sovereignty e.g. the Indus River basin can a typical example of such as conflict. Pakistan and India continue disputes and confrontations over the Kashmir region is a classic example of upstream and downstream conflict about the control and usage of water in the shared basin. The Kashmir region plays a role of upstream hub for the Indus River basin and both riparian countries are interested to have territorial domination aiming for water control.

The Nile River basin is another classic example of historical control and water rights conflicts among the upstream and downstream riparian states. The Nile River is formed of two main tributaries; the Blue Nile originates from the Ethiopia territory and the White Nile flows down from the Equatorial Lake region. Since last couple of decades, the Nile water rights conflict has become international particularly between the Eastern Nile countries (Egypt, Ethiopia, and Sudan) over construction of Great Ethiopia Renaissance Dam (GERD). Ethiopia claims its right in the Blue Nile River as its domestic natural resource whereas Egypt looks back to its interest and long historical control over the Nile Waters. It is not necessary that conflict is resource-based or interest-based, but it is important that identity is the foundational cause of all types of conflicts particularly for water (van Vugt, 2009).

According to Thomasson (1977) many conflicts are poorly studied and usually misrepresented identification of conflict over tangible resources. Whereas the identity-based disputes have foundations in people’s or nations need or interest for ‘dignity, recognition, safety, control, purpose, and efficacy’ (Jarvis & Wolf 2013). Conflict over shared water need an integrated approach to address multidisciplinary issues among the parties (Renevier and Henderson, 2002). Conflict defined in Oxford dictionary as (1) An encounter with arms; (2) A fight; (3) A conflict of interests; (4) An incompatibility between parties (Ganoulis et al., 2018). In the transboundary water conflict mainly interests and incompatibility are leading issues between the parties. Many people use conflict and dispute as identical terms but according to John Burton (1990) they are faintly different.

Dispute is negotiable and could be a short-term argument and parties could reach to a sort of solution while conflict is a long-term deeply rooted opposition and hardly negotiable (Mehrotra, 2023). Hard and unattended dispute will lead into conflict between the parties (Mehrotra, 2023). According to Timothy Keator (2011) researchers in their studies substituted conflict for dispute or vice-versa and mediators extracting meaning from both “conflict and dispute” to present their views but having expertise in both fields help mediation practices success for the high rate of settlement.

According to UNITAR (2017) disputes involve two or more parties that each of them tries to meet their own benefits or objectives and meanwhile each party consider each other as an obstacle to achieving their objectives (Ganoulis et al., 2018). The dispute even sometime grows between the parties and reach to the point that involved parties view each other as enemies. No one trust each other, communication becomes tough with aggressive approach, in such a situation every part tries to win without consideration of other parties to lose. This is a “win-lose” or called it “a zero-sum

game” meaning that whatever you gain e.g. power, right, money or authority, should be at cost of someone else (Ganoulis et al., 2018). This type of dispute worsening political, social, and economic relations with anger and stress between the riparian countries.

The intensity of conflict may have different inflection, and we summarize that the terms of conflict, dispute or armed conflict may be classified in ascending order depends to their severity level. Summarizing the different views of experts and factual definitions of conflict and dispute, Iran and Afghanistan have long-standing conflict over Helmand River waters due to its deep- roots of continuous confrontations from the time of demarcation to the water allocation. Water conflict has three main globes and classified into natural (hydrosphere), socioeconomic and political whereas the anthropogenic interventions influence both political and socioeconomic dimensions (Ganoulis et al., 2018). Water quality and quantity cause a strong potential conflict under natural (hydrosphere) between people and the ecosystem which has high impact on socioeconomic dimension, see Fig 6 (Ganoulis et al., 2018).

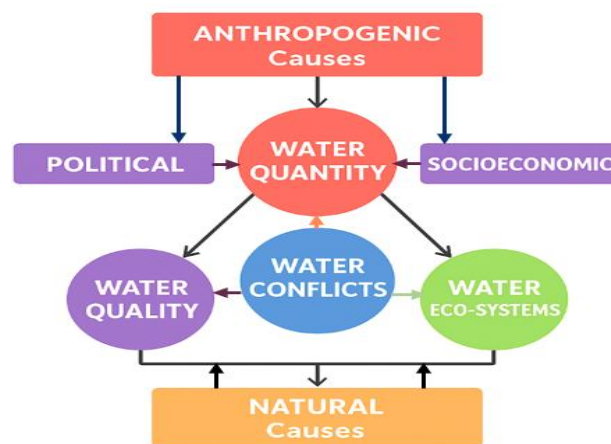


Figure 6: Classification of water conflict (Source: retrieve from Ganoulis et al., 2018)

Water conflict arises when water sphere affected by problems and disputes from the political and socioeconomic spheres which consequently causes water wars among the parties (Ganoulis et al., 2018 and Vinogradov, 2003). In fact, it is important to know how and why human being do conflict over international water? The common reason is when a new intervention in the basin or over usage of water takes place by one or more riparian states and available water could not meet the needs of all users in both qualitative and quantitative sense (Vinogradov, 2003). This causes conflict and even war over the shared water courses.

Since water is a scarce resource in the world and it has been for long time conflict causer between the nations, communities, and states. As we discussed that in addition of natural causes such climate change, another major cause is anthropogenic intervention when people or states competing their needs and interests. The follow domains further trigger water conflict among communities and states at different spatial levels such international, national and local (UNITAR, 2017; Wolf, 2022).

Water Quantity

This is very important domain specially when upstream country claims its sovereignty and control the source of water which impact the needs to others, resulting in conflict with downstream states. For instance, Ethiopia claims sovereignty over Blue Nile, faced with conflict with Egypt and Sudan

as downstream countries. Similarly, anthropogenic activities in the Helmand River by Afghanistan as upstream countries, resulting in conflict with Iran claiming squeezing flow down to Sistan region. Many other examples, in Euphrates and Tigris basin between Turkey, Iran and Syria and in the Indus basin by India resulting conflict with Pakistan as downstream countries.

Water Quality

Initiating of any man-made activities by the upstream country in the shared basin that impact on the quality of water and river flow could cause conflict with downstream countries. This conflict mostly happens between industrialized countries such Switzerland and Germany polluting Rhine water by chemical substances releasing from the industries, this imposes burden on the Netherlands whose uses Rhine water for drinking and irrigation purposes (Ganoulis et al., 2018).

Flooding

Human-made flooding in the upstream resulting conflict with downstream states. For example, river training, releasing of reservoir, building dikes, cutting vegetation or deforestation which decrease lead time and augments flow discharge in the river toward downstream countries.

Hydropower production

Construction of dams for hydropower, and other hydraulic infrastructure on the shared river basin is one of the major causes of conflict between upstream and downstream riparian states. This is because dam control and regulate the entire river flow system and only release a certain amount of water for required electricity production. The operating strategy of hydropower dams are usually not in line with water supply demand for irrigation, ecosystem, fishery requirements and hydropower production for downstream countries therefore it could potentially lead to conflict with upstream states (Jarvis & Wolf 2013 & Ganoulis et al., 2018).

In addition, diversion of water into large irrigation canals by upstream countries leads to potential conflict. The Eastern Nile countries conflict is over Ethiopia Renaissance Dam construction because Egypt and Sudan believe that Ethiopia control the Bule Nile flow system to downstream countries. Similar conflict example is between Iran and Afghanistan over Kamal Khan Dam construction by Afghanistan over the Helmand River. Many other identical conflict examples between countries in different shared water courses e.g. central Asian countries accused Afghanistan over construction of Qushtepa large irrigation canal in Amu Darya basin.

Environmental and Ecology

Water has a direct impact on environment ecosystem which can be also a source of conflict between the riparian states. Water pollution has potential health risk in many river basins for instance, in the Indus River water comes from various sources, including return flow from agriculture lands, which adds sodium nitrates, phosphates, and pesticides substances to the river. Many researchers stated that Indus River is the world second polluted river in terms of plastic concentration (Jabeen & Bukhari, 2023). In the lower reach of Helmand River, wetland degradation due to negative impacts of climate change on ecosystems and augmented by human induced devastating activities has been caused conflict between Iran and Afghanistan. The environmental and ecology issues of Helmand River discussed further in details in this chapter.

Economic Issue

Unilateral water infrastructure development and excess water usage in the shared river basin aiming economic development create ominous situation between the countries. This is because

economic development and national interest related to water is highly important for every riparian states. For example, the Aral Sea receives water from two main transboundary rivers, the Amu Darya and Syr Darya basins respectively in central Asia. The Aral Sea was the world's fourth largest natural lake but negatively affected after 1960 when the upstream countries started excessively use of water for irrigation. The Aral Sea water level shrunk almost to half of its former size, fishing industries disappeared, salinity and pollution levels increased, the river (Ganoulis et al., 2018, Alikhanov 2010). The Aral Sea water volume predicted that will further decrease from 98.1 Km³ to 75,4 Km³ by 2031 as result of climate change and excess use of water in the region (Gaybullaev et al., 2012, Alikhanov 2010).

Similar problem is in the Helmand River basin when Afghanistan resumed construction of Kamal Khan Dam in 2010 for its post-war economic development to provide irrigation water to 75000-hectare arable land in Helmand province. This economic development caused Iran reaction that accused Afghanistan of squeezing water flow to Sistan region. Though the main factor of squeezing flow is climate change but economic development plan for excess use of water increased anger of Iran against its neighbour country Afghanistan regarding the Helmand waters.

Hydro-governance through effective mode of cooperation between riparian states is the best practice for addressing such water conflicts in the shared basins (Ganoulis et al., 2018). For finding effective solution and settlement of conflicts and disputes, we look at that how international law and legal rules could help to provide a meaningful solution for effective cooperation. The existing legal rules and regulation for better governance of interstate relations in international river basin is the 1997 UN Convention on the Non-navigational Use of International Water Courses (IWC Convention, 1997). We discuss water cooperation before to review transformation of Potential Conflict to Cooperation Potential (PCCP) based on the role of international water and UNESECO technical study.

2.3.2 Water Cooperation

Cooperation⁹ over water refers to a voluntary process between two or more actors or entities that engage in benefit-sharing, pursue a common purpose, or undertake joint actions rather than competing with one another (Yıldız, 2015). While many view water as a potential source of conflict, scholars and experts increasingly emphasize its role as a catalyst for cooperation (Makengo et al., 2021; Wolf, 1998).

Cooperation is more likely when water resources are sufficiently available to all parties involved. However, when resources are scarce, particularly in international river basins, cooperation becomes significantly more difficult (Yıldız, 2015). In the water sector, it is crucial to clearly define what is meant by cooperation. The Strategic Foresight Group (2015) introduced the concept of “active cooperation”¹⁰ which means a commitment of riparian states to jointly manage their shared water resources”. In some cases, this commitment extends to the highest levels of political engagement, including heads of state (Philip et al., 2015).

Collaboration in the water sector still largely relies on hydrological analyses and technical studies, often grounded in modelling and mathematical principles for practical application. Numerical

⁹ In the Oxford languages, cooperation is the action or process of working together to the same end.

¹⁰ When countries engaged in “Active Water Cooperation”, they do not go to war for any other reason (Strategic Foresight Group, 2015).

calculations and data serve as a foundational basis for building mutual understanding among stakeholders. Researchers and experts have actively explored meaningful modes of cooperation to enhance collaborative efforts in shared water management (Yıldız, 2015). The following modes of cooperation listed by Yıldız (2015):

- Active water cooperation
- Intensive water cooperation
- Efficient water cooperation
- Improved water cooperation
- Meaningful water cooperation

Mere intentions for cooperation over shared water resources have not yielded significant results in recent decades. Therefore, implementing the above types of cooperation could make the overall process more effective. Identifying a specific water cooperation mechanism aligned with these modes of cooperation is essential. Among all, Active Water Cooperation (AWC) can help quantifying the level of cooperation between the parties especially when moving beyond traditional limited frameworks (Yıldız, 2015). The AWC mechanism has been discussed in detail in the following section.

2.3.2.1 Water Cooperation Quotient: Active Water Cooperation (AWC)

Water cooperation needs a mechanism to determine the extent of collaboration among the parties. The Strategic Foresight Group (2015) has formulated Water Cooperation Quotient (WCQ)¹¹ to quantify Active Water Cooperation (AWC) between the countries over a transboundary river basin. For quantifying the extent of AWC, the researcher set up ten indicators for WCQ including the level of scoring (Philip et al., 2015). These indicators have been listed based on the independent in-depth study and analysis of all cooperative mechanisms used for transboundary waters.

The score and ranking of each indicator or parameter define the commitment level of riparian state over shared water cooperation. The overall aim of WCQ exercise is to measure the intensity of cooperation over shared water (Yıldız, 2015). The lowest score is 1 starting from the agreement to treaty and the highest score is 10 ending with actual functioning of the treaty or agreement (Philip et al., 2015). The 10 indicators and scores presented in the table 2.

Table 3: WCQ indicators and scores for quantifying active Cooperation (Source: adapted from The Strategic Foresight Group (2015).

Indicator	Description	Score
Agreement/treaty	Agreement or treaty between the riparian states is a fundamental step over water cooperation to define their future provision and water rights and allocation in the basin.	1
Commission	Institutional set up is essential to govern, manage and discuss shared waters which can be River Basin Organization (RBO) that each riparian states should stable within their sovereign territory. The commission or institutional set can be very helpful for agreement/treaty implementation.	2

¹¹ The WCQ is a set of ten indicators that determine and quantify the extent of collaboration between two or more countries over shared watercourses (Yıldız, 2015, Strategic Foresight Group, 2015).

Ministerial Meetings	Ministerial engagement is a key requirement for cooperation between the countries that can take place annually/bi-annually or whenever needed. Facilitation and arrangement of such high rank political engagement is mandate of Commissioners.	3
Technical Projects	Joint technical projects such as irrigation canals, capacity building, livelihood, hydrological studies often bring the nations together for cooperation within the shared basin. These types of projects are basin wide and apart from those unilateral development project that each individual state does and usually implement by the RBOs.	4
Environmental Protection and Quality Control	Environmental issues are always crucial in the transboundary basins which can be water pollution, sedimentation, deforestation, soil erosion, etc. The environmental degradation mainly happens due to human intervention so countries should work holistically for environmental and ecosystem protection, prevent pollution, and mitigate climate change impacts.	5
Joint Monitoring of Water Flows	Joint monitoring of river flow by riparian countries helps actors and decision makers to cooperate with each other over water allocation. But often countries do not trust to share the flow data and it becomes a contentious issue among them. The RBOs play important role to promote joint monitoring of the river flow.	6
Floods, Dams and Reservoirs	Benefit sharing joint project such as construction of dams and reservoirs for economic development and flood control promote active cooperation among the riparian states. Countries keep informed and engaged each other through consultation and negotiation while planning such as infrastructure in consideration of mutual benefits.	7
High Political Commitment	High political commitment at Head of Governments can be a good sign of cooperation between the riparian countries. In some cases, high political commitment becomes part of institutional set up within RBOs to facilitate quarterly or annual summit for Head of the States to discuss shared water courses.	8
Integration into Economic Cooperation	Water has significant role in economic development for each nation and expansion of water cooperation scope throughout the region or basin helps the riparian states to integrate their economic development within the basin.	9
Actual Functioning of Mechanism	A real functioned institutional set up should ensure the following factors are taking into consideration: - The countries are actively engaged in execution of cooperation agreement that they have already agreed upon. - The plan and objectives are not only the face of paper, but they are implemented with given deadlines. - Make sure that all relevant riparian countries are actively engaged in governance and management of their shared basin.	10
Total		55

A centralized and functional integrated information management system can play a key role in ensuring efficient cooperation mechanisms between riparian countries within a shared river basin.

To quantify the effectiveness of active cooperation mechanisms, the Strategic Foresight Group proposed the following equation for calculating the Water Cooperation Quotient (WCQ) (Philip et al., 2015).

$$WCQ = (Total\ Score/55) \times 100$$

Active Water Cooperation

The Strategic Foresight Group (2015) identified Active Water Cooperation (AWC) using a formula that assigns weighted scores to four key indicators: i) agreements, ii) commissions, iii) ministerial meetings, and iv) technical projects implementation. These four elements represent the foundational level of Active Water Cooperation.

$$AWC = WCQ > (Agreement + Commission + Ministerial Meetings + Technical projects) / 55 \times 100 = 18.18^{12}$$

The Water Cooperation Quotient (WCQ) should be calculated using the equation proposed earlier. The resulting score is then compared against a benchmark value of 18.18 to determine whether the cooperation between countries can be considered active or non-active. Active cooperation is achieved when a country's cooperation arrangement score exceeds 18.18 and includes the presence of the remaining six indicators, as illustrated in Figure 6.

This is because the first four indicators alone; agreement, commission, ministerial meetings, and technical projects can only establish a basic level of cooperation. For instance, while the first indicator (such as an agreement or treaty) allows riparian countries to initiate cooperation over shared water resources, it does not in itself guarantee active cooperation.

In other words, the mere signing of treaties or agreements for water allocation, data exchange, or the establishment of River Basin Organizations (RBOs) does not fully constitute Active Water Cooperation unless it also involves joint management of the shared watercourses (Philip et al., 2015). For example, the following cooperation arrangements do not meet the criteria for Active Water Cooperation:

- Following the signing of the Indus River treaty in 1960 between India and Pakistan, they assigned a permanent commission for water allocation without commitment toward joint management of the Indus shared watercourse.
- The Helmand River treaty between Iran and Afghanistan signed in 1973 over water allocation but both governments failed to assign a joint management team for effective implementation of treaty and treaty itself has not been brought them into cooperation.
- Joint Water Committee (JWC) between Israel and Palestinian Liberation Organization (PLO) for aquifer management and implementation of 1995 interim agreement over water rights established but it never executed to govern and cooperate over shared watercourses.
- There are many other examples of water treaties around the world particularly in Asia and Africa that still do not meet the basic level of Active Water Cooperation, Fig 8.

¹² Active Water Cooperation (AWC) = $WCQ > (1+2+3+4)/55 \times 100 = 18.18$ (Philips et al., 2015).

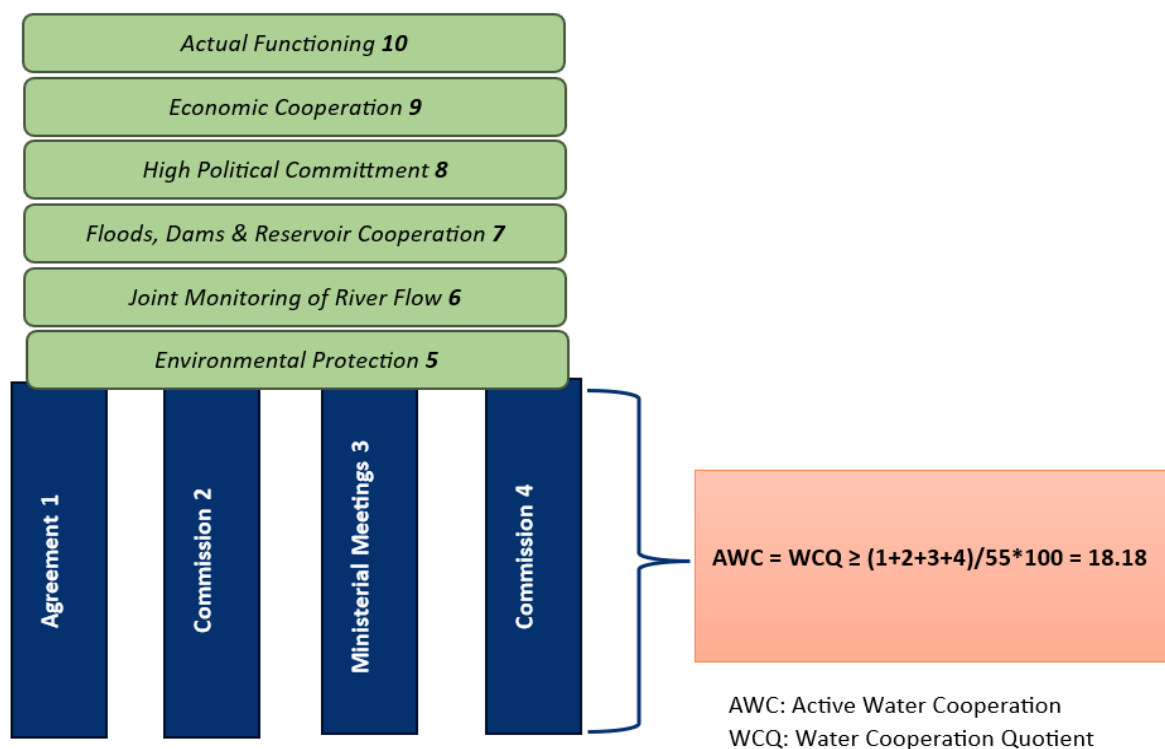


Figure 7: Active Water Cooperation Paradigm (Source; adapted from SFG by Philips et al., 2015).

In consideration of the indicators for Active Water Cooperation (AWC), several river basin cooperation mechanisms have been reviewed to assess which of them meet the established criteria. Table 3 presents examples of these river basins, illustrating which cooperation mechanisms fulfil at least the basic AWC benchmark score of 18.18. For each river basin, the Water Cooperation Quotient (WCQ) has been calculated based on the presence of relevant indicators.

Table 4: water cooperation Mechanisms and their corresponding WCQ (adapted from Philip et al., 2015)

Bilateral/multilateral Agreements/Treaties			
	Senegal River (Multilateral treaty, Senegal, Mali, Guinea, Mauritania)	Euphrates and Tigris River (Tripartite Joint Technical Committee: Iraq, Syrai, Turkey)	Helmand River (Bilateral treaty Iran, Afghanistan)
Indicators			
Agreement	1	1	1
Commission	2	-	2*
Ministerial Meetings	3	-	3*
Technical Projects	4	-	-
Environmental	5	-	-

Protection & Quality Harmonization			
Joint Monitoring Water flows	6	-	-
Flood, dam, Reservoir Cooperation	7	-	-
High political Commitment & HoGs	8	-	-
Integration into Economic Development	9	-	-
Actual Functioning of Mechanism	10	-	-
Total Scores	55	1	6
WCQ	100	1.81	10.91

*Commissions assigned in last few years from 2019 and Ministerial meetings not on regular basis (BRAAFG2, 2024)

Among the three river basins reviewed, only the Senegal River fully meets the Active Water Cooperation (AWC) criteria, with a WCQ score of 100. In contrast, the Helmand and Euphrates–Tigris basins do not even meet the basic benchmark score of 18.18, as established by the Strategic Foresight Group (2015). These two basins currently have only treaties or agreements in place. However, the mere existence of a treaty does not imply that riparian countries have achieved Active Water Cooperation over their shared watercourses.

However, some progress has been observed in the Helmand River basin. Since 2019, the riparian countries have appointed commissioners initially at the director level and, more recently, elevated to the Deputy Minister level to manage and discuss shared water issues but these are mostly event-based. In addition, some ministerial meetings have been held as needed not on a regular or agenda-based (BRAAFG2, July 2024)¹³.

Nevertheless, the risk of disputes, conflict, or even water-related violence remains high in river basins where the WCQ is below 18.18, such as the Helmand and Euphrates–Tigris basins, as shown in Table 5. This table presents a selected list of countries, detailing their cooperation mechanisms and WCQ scores, along with the associated risk of water-related conflict. It is adapted from the Strategic Foresight Group (Philip et al., 2015), with slight modifications to include this study's focus countries Afghanistan and Iran, as well as Pakistan and several Central Asian nations.

¹³ This recent development stated during interview with an Afghan WRM expert on July 2024 that meetings and discussions are not consistent it is just based on need when any concern raised by downstream country (BRAAFG2, July 2024).

Table 5: Cooperation mechanism and level of WCQ with associated risk of war (Philip et al.,2015)

Country	Cooperation Details	WCQ	War/Risk of War
Sweden	EUWFD ¹⁴ , Finish - Swedish Frontier River Commission (FRC)	94,54 EUWFD 74,54 FRC	NO NO
Denmark	EUWFD	94,54 EUWFD	NO
Netherlands	EUWFD, ICPR ¹⁵	94,54 EUWFD 100,00 ICPR	NO NO
Armenia		0,00 with Azerbaijan	YES
Georgia	JBWC Turkey & Georgia	80,00 with Turkey 0,00 with Russia	NO YES
Canada	International Joint Commission (IJC)	94,54 with USA	NO
USA	IJC with Canada IBWC with Mexico	94,54 with Canada 94,54 with Mexico	NO NO
Turkey	JBWC with Gorgia JTC ET with Syra and Iraq	80,00 with Gorgia 1,81 with Iraq-Syria	NO YES
Lebanon	Lebanese-Syra joint Committee For Shared Water	21,18 with Syria 0,00 with Israel	NO YES
Pakistan	Permanent Indus Commission	16,36 with India 0,00 Afghanistan	YES YES
Afghanistan	Helmand River Treaty With Iran	10,91 with Iran 0,00 with Pakistan 0,00 with CA	YES YES YES
Iran	Helmand River Treaty with Afghanistan, Agreement with Turkmenistan On Dostluk Water Reservoir, Treaty with Iraq on Frontier Relation	10,91 Afghanistan 49,09 Turkmenistan 1,81 with Iraq	YES NO YES
Tajikistan	ICWC ¹⁶	38,18 with ICWC 0,00 Afghanistan	NO YES
Turkmenistan	ICWC Agreement with Iran on Dostluk Water Reservoir	38,18 with ICWC 49,14 with Iran 0,00 Afghanistan	NO NO YES
Uzbekistan	ICWC	38,18 with ICWC 0,00 Afghanistan	NO YES

¹⁴ European Union Water Framework Directive (EUWFD)

¹⁵ International Commission for Protection of River (ICPR)

¹⁶ Interstate Commission for Water Coordination of Central Asia (ICWC)

The Strategic Foresight Group (2015) found that the risk of war over shared watercourses exists in several countries across Africa and Asia, as shown in Figure 8. In contrast, countries in the Americas, Europe, and Australia generally have stronger water cooperation mechanisms, reflected by a WCQ score of ≥ 18.18 , and show no significant risk of water-related conflict.

However, the study has some limitations due to incomplete data for certain countries. For instance, Central Asian countries were not fully represented, despite having a potential risk of conflict with Afghanistan, as there is no formal agreement or treaty in place over the Amu Darya River, not even meeting the first basic indicator of AWC.

Similarly, Iran and Afghanistan were listed as having no risk of war over the Helmand River in the SFG report. Yet, their cooperation is limited to a single treaty, lacking the three other foundational indicators of Active Water Cooperation—namely, a functioning commission, ministerial meetings, and technical projects. Consequently, their calculated WCQ score is only 10.91, which falls well below the minimum threshold of 18.18 for basic AWC.

This example illustrates why merely signing a treaty or agreement is insufficient to ensure meaningful and stable cooperation over shared watercourses. The absence of deeper collaborative mechanisms may increase the risk of armed clashes, as seen in the recent tensions between Iran and Afghanistan over the Helmand River.

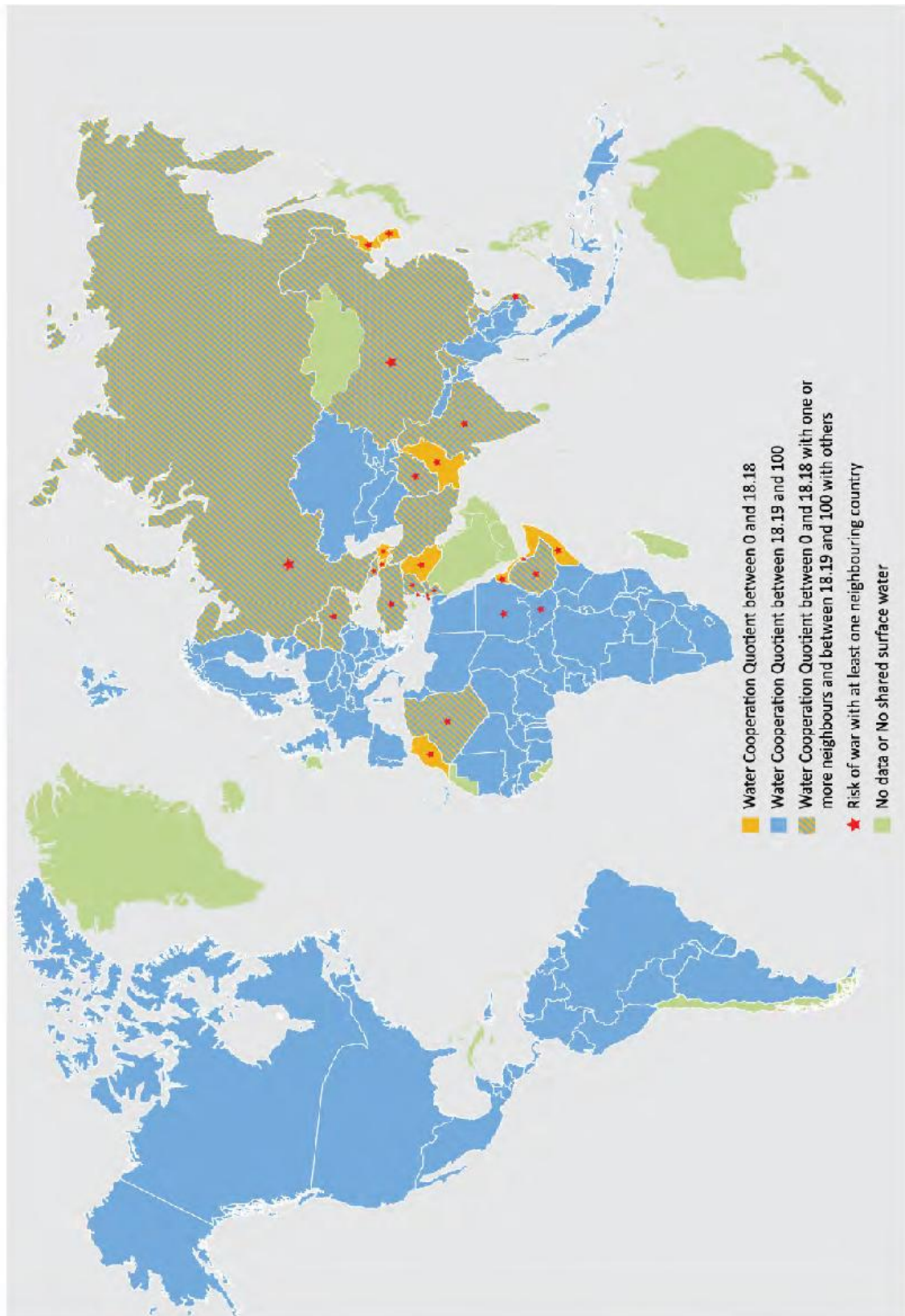


Figure 8: Water cooperation mechanism and risk of water war in different part of the world. (Source: SFG by Philip et al., 2015).

2.3.2.2 UNESCO PCCP Framework: Transforming Water Conflict to Cooperation Potential

Since it has been discussed in the SFG water cooperation concept that signing of agreement does not mean active cooperation. This second concept discusses the rules of international water law in promotion of effective and active cooperation between riparian countries over shared water courses. In this concept the effective mode of cooperation discussed considering the 1977 UN watercourse convention and best water cooperation practices that govern interstate relations over water cooperation (Vinogradov et al., 2003). It is mentioned by many water researchers that “water war” is imminent therefore it is crucial to transform water conflict into water cooperation.

To do this, the UNESCO legal study report presented the PCCP¹ cycle to unfold how potential conflict over shared water transforming to water cooperation potential between the parties. This concept in line with the case study Helmand River basin to present how the interstate conflicts between Iran and Afghanistan particularly the effective implementation of the signed treaty. The PCCP cycle has four interconnected phases (Vinogradov et al., 2003)

- Phase 1: The legal context: encompassing the rules of international water law for conflict resolution.
- Phase 2: Conflict to cooperation: this means transforming conflict to cooperation order between the states.
- Phase 3: Initiation of treaty or agreement: this phase means the legal framework between the riparian countries.
- Phase 4: Implementation of treat: the actual implementation of legal framework for engaging parties in effective cooperation and coping with new disputes and conflicts.

The PCCP cycle phases identified in light of the international water law in consideration of actual state practices. In this concept, we focus mainly on phase 3 and 4 to discuss the legal context and its full effective implementation for engaging parties into active cooperation and then follow the lessons learned and proposed best practices for riparian countries as result of Vinogradov et al., (2003) study and analysis. Fig 7 presents four phases of PCCP cycle how to transform water conflict into cooperation potential. Water conflict mainly arises when the use of water is increased in the basin by one or more states, or a new intervention e.g. unilateral development takes place particularly in the upstream countries. In such cases the conflict gets more consequential when there is insufficient water available to meet the needs of all, which could lead to an international dispute.

There could other reasons such as population density as benchmark for identification of water level availability per capita, climate change wet (flooding) and dry (drought) scenarios including political and economic policies differences between the riparian states. The set of rules and regulations in international water law presents a mechanism for cooperation and conflict prevention over shared watercourses (Vinogradov et al., 2003).

International water law proposes legal (arbitration and settlement) and diplomatic (joint institutional set up, negotiation, consultation, conciliation and mediation) means of relations for riparian countries over shared waters. The world’s most transboundary rivers are governed by agreements or treaties signed between two or more sovereign states but most of the treaties are not being effectively implemented due to lack of cooperation. On the other hand, while the treaty

established for initial water allocation in the basin and changed circumstances are not managed well during the treaty implementation through an effective cooperation approach then it may lead to a conflict (Vinogradov et al., 2003).

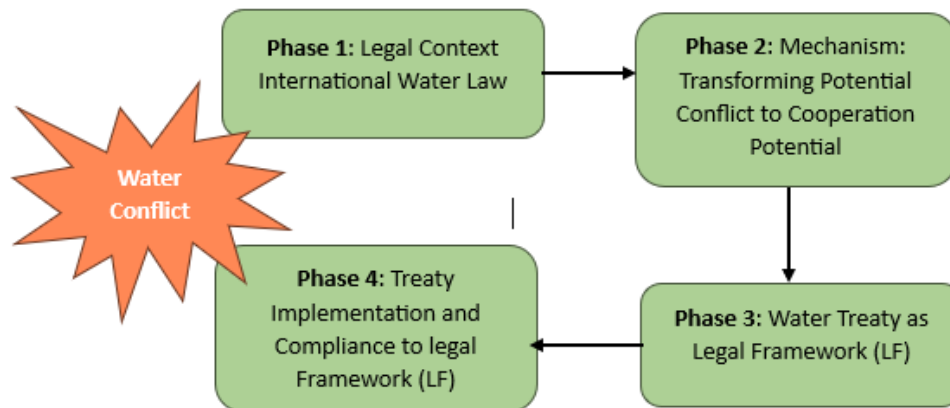


Figure 9: Phases of PCCP cycle as legal approach. Source: adopted from Vinogradov et al. (2003)

Thus, conflict over water mainly happens even in the presence of a signed agreement or treaty where there is no means of cooperation among the countries or not considering the international water law principles. But actors always should refer to the provisions of treaty through an effective cooperation mechanism and follow the provisions of the signed treaty. When a water treaty is present then the PCCP cycle as a legal tool for transforming the conflict to cooperation can be followed as seen in Fig 8 (Vinogradov et al., 2003). To elaborate the PCCP cycle phases through a pragmatic example here we briefly discussed the Lake Lanoux dispute settlement case between France and Spain.

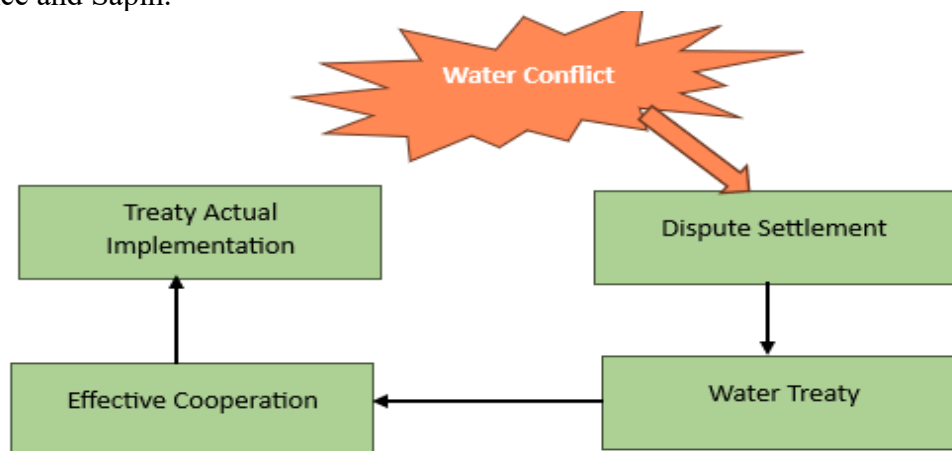


Figure 10: Transforming conflict to cooperation considering treaty through effective cooperation. Source: adapted from Vinogradov et al., (2003).

Phase 1: The legal Context and Nature of Conflict

Water conflict caused by France due to an intervention to divert Lake Lanoux waters into Ariège River for building a new Hydropower (HP) project. The Spain government reacted and opposed France HP project and feared of adverse impact on the Carol River flow where Spain used it mainly for irrigation (Bolla, 1957; Vinogradov et al., 2003; UNEP website, 2024). Spain insisted to stick on Bayonne 1866 treaty where Spain believed that its water right was secured, and unilateral development should not be taken place by any parties (UNEP Website, 2024). Also, Spain rejected France proposal for returning the same amount of water to the Carol River to secure the rights of

Spain. The Bayonne 1866 treaty had other additional acts and provisions e.g. both countries jointly enjoy the use of water for their common purposes, respect their territorial sovereignty, joint engineering commission and ensuring their actual need including conciliation and arbitral settlement (Vinogradov et al., 2003).

Phase 2: From Potential Conflict to Cooperation Potential.

Since 1917 French and Spanish governments had communicated and negotiated through their diplomatic missions regarding diversion of Lake Lanoux water. On September 21, 1950, French Energy authority proposed a concession to the French Ministry of Industry regarding diverting of Lake's waters toward the Ariège Rive (Bolla, 1957; UNEP, n.d.). Following negotiations both countries head of governments agreed on establishing a special Joint Commission of Engineers (JCE) in 1950 for reviewing France HP project and diversion of Lake Lanoux waters (Vinogradov et al., 2003). Spain asked JCE to evaluate the scheme though French government was accepted the principle to return the same quantity of drawn off water corresponding to the actual need of Spain.

In August 1955 the Joint Commission of Engineers meet in Pyrenees but they did not reach any consensus then in November 1955, the issue escalated to the International Commission of Pyrenees. France presented its HP project plan to the International Commission with commitment to consider rights of Spain, but this discussion also ended without any result and only France proposal accepted for establishing a Special Joint Commission. In December 1955 the Special Joint Commission met for the first time ((Vinogradov et al., 2003; Bolla, 1957).

Despite of France guarantee for an annual of 20 million m³ water regardless of water availability in the river flow system, insuring return of the same amount of water in the Carol River, Spain regular site inspection and respect of its rights, Spain rejected the proposal. Spain proposed and insisted on not diverting of water at all so the Special Joint Commission failed to sort the dispute out therefore they terminated their task in March 1956. In the same time France notified Spain about resuming construction of HP project while Spain was arguing that France's project is unlawful and violation to the Bayonne treaty and associated additional act. In November 1956 both countries agreed to submit their case to arbitration.

In November 1957 the Arbitration tribunal decided in favour of France in a statement that the HP project is not violating Bayonne 1866 treaty, nor the international water law principles so no need for prior confirmation of Spain (UNEP, n.d.; Vinogradov et al., 2003; Bolla, 1957). This is because France had fulfilled its international obligation to secure the rights of Spain by restoring the same quantity of waters to the Carol River and guaranteed the annual minimum flow in the river which may exceed the needs of Spain for irrigation purpose (Vinogradov et al., 2003). Thus, France endured fully committed to the right of Spain through effective cooperation and in consideration of international water law principles.

Phase 3: The new Water Treaty or Modification to the 1866 Treaty

In the 1958 right after the tribunal's decision both France and Spain agreed on a new water agreement over Lake Lanoux water resources incorporated to the 1866 treaty of Bayonne. This happened based on the French proposal to the joint commission in December 1955 and 1957 arbitral outcome that Electricité¹⁷ de France guaranteed provision of 20 million m³ annual water flow in the Carol River channel for Spain (Vinogradov et al., 2003). Following the signing of treaty

¹⁷ Electricité de France means France Energy Authority.

in 1958, a new six-member commission assigned to effectively implement the new/ or the modified treaty including overseeing and monitoring of the HP project construction and operation processes.

Phase 4: Full Functioning and Implementation of Treaty

The new water treaty implemented under full supervision of assigned commission by both countries France and Spain. Since 1958 the annual coordination meeting of commission regularly had been held over shared watercourses cooperation between both riparian countries until they decided to modify treaty once again in 1970 (Vinogradov et al., 2003). The ability of treaty is that keeps its functionality despite of political upheaval and regime alteration. The treaty provides a foundation for creation of institutional set up to deal with differences, disputes and conflicts through active cooperation. Even the treaty can be used as a legal tool or material for improving diplomatic relations of riparian countries over water discussion.

The contents and key elements of treaty play an important role in effective implementation of the treaty which should be done in a participatory approach among the riparian countries. The policy makers should be cautioned about their country national interests and work closely with technical and legal personnel for addressing all technical, socio-economic and legal elements in the treaty. When the treaty elements set up properly to cover all parties interest then the implementation will be easy for the assigned commission to cope and manage disputes and conflicts based on the legal documents. The relevance of this concept in relation to water cooperation, treaty implementation, and compliance is elaborated in Section 2.9, which outlines the proposed Active Water Cooperation Framework for the Helmand Basin.

2.3.2.3 Socio-hydrological Framework: Understanding TW Conflict and Cooperation

In the shared watercourses hydrological analysis provides a fundamental ground for understanding the water flow regime in the river basin in respect to the water quantity, water availability and climate change impact including infrastructure development (De Stefano et al., 2017). The hydrological studies have also made major impact on understanding the differences, disputes and cooperation over water allocation and distribution between the riparian countries (Wei et al., 2022). The hydrological studies and analysis provide good inputs for economic models which simulate social and human-behaviours regarding the tangible economic benefits particularly the national interests of riparian countries and help decision-making process (Schill et al., 2019).

According to Zeitoun and Mirumachi (2008) hydro-politic and hydro-diplomacy explore that transboundary river management reliant more on political process and both fields endorse that hydrology knowledge is must for the transboundary water management (Wei et al., 2022). Transboundary rivers conflict and cooperation knowledge spectrum discussed in table 5 by Wei et al. (2022). It is stated that due to limitation in the hydrology analytical capacity to present a mechanism that drives conflict and cooperation but still there is information to develop meta-theoretical socio-hydrological framework over water cooperation (Wei et al., 2022).

For water allocation people mentality and their cultural sociology play an important role in understanding of cooperative activities from the perspective of self-reflection, self-determination, and a mental model of the future (Schlüter et al., 2017). This is because human is the main actors of causing dispute or chose to cooperate among themselves. Social psychologists believe that people are quite different in terms of their social values and personal mentalities which are the main factors for inducing cooperation (Hoff and Stiglitz, 2016).

In this framework Wei et al (2022) have been used a meta-theoretical approach to discuss a mechanism that pushes dispute or cooperation among the actors regarding the transboundary water management. This framework developed based on the recent advancement in the coupled human-environment connections from the socio-ecological systems (Folke et al., 2005), the human and nature systems (Liu et al., 2007), and the socio-hydrological concept (Elshafei et al., 2014) which claims that the human-water relationship counted as an intricate adoptive system (Wei et al., 2022). Particularly, transboundary rivers as complex adaptive system encompassing other co-related subsystems such as hydrological (water resources), ecological, economics, political, institutional and cultural in the riparian countries (Wei et al., 2022).

The schematic diagram in Fig. 9 presents the connectivity of transboundary rivers with these subsystems that how interact with each other as natural outcome of human being understanding inducing cooperation over shared watercourse allocation and management (Wei et al., 2022). From the recent co-evolutionary process, it is predominantly noticed that hydrology and economics are moving on fast track while ecological and societal features are relatively moving slowly with time scale of decades or even longer (Sivapalan et al., 2012). This is why Wei et al. (2022) has divided the subsystems variabilities into fast and slow track processes as presented in Fig 11.

Table 6: Disciplinary and empirical understanding of water conflict and cooperation over Transboundary River Basin (Wei et al., 2022).

Disciplines	Contributions	Strengths and gaps
Empirical and assessment studies	Explain the phenomena of conflict and cooperation in the real systems	Description and assessment in the context of hydrological change but have not been integrated with hydrological models
Hydrology and its integration with ecology and geomorphology	Simulate the biophysical consequences of conflict and the biophysical conditions of cooperation with respect to transboundary rivers	Many numerical models developed in this context
Neoclassical and behavioural economics	Assess the institutional factors of cooperative behaviours	Economics models are well integrated with hydrological models without rationality of cooperative behaviours
Institutional economics	Explaining institutional factors of cooperative behaviours	Good theoretical and empirical development in this context it is lacking an explicit linkage with hydrological models and institutional incapacity
Cultural sociology and psychology	Describe social motives (values) of cooperative behaviours	Rich theoretical development but often integrated with hydrological models, resulting lacking an explicit linkage with hydrological changes and different social motives for cooperation
Political science	Describe international political factors of cooperative behaviours	Rich theoretical development regarding the hydrological changes but hydrological models do not encompass political science discipline

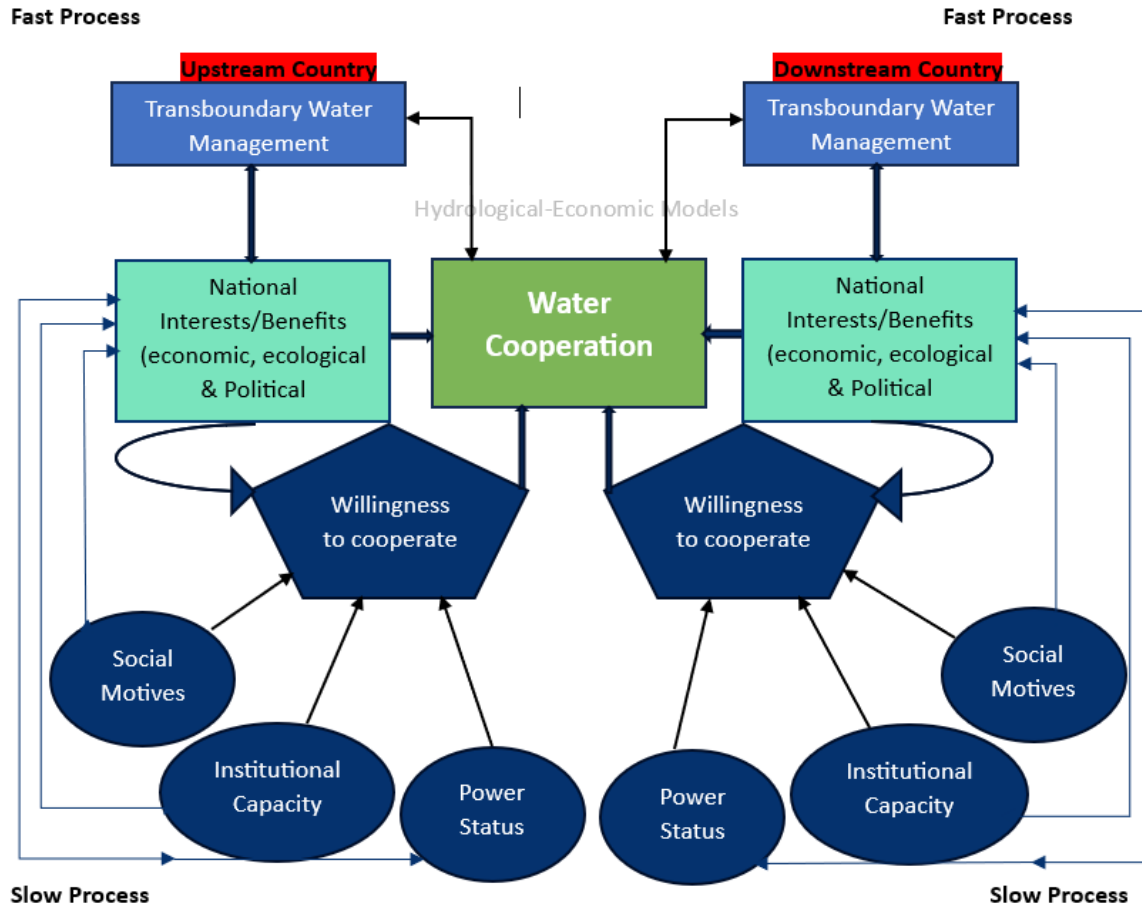


Figure 11: Socio-hydrological Framework for understanding conflict and cooperation concerning transboundary water management. (Source: adopted from Wei et al., 2022).

This framework further illustrates the dynamics of cooperation by incorporating insights from integrated hydro-economic models, which serve as fast-track mechanisms that lay the groundwork for initiating cooperation. In contrast, factors such as social motives, institutional capacity, and political power status function as slow-track variables that influence the willingness of riparian states to engage in cooperative efforts over shared water resources (Wei et al., 2022). Notably, slow variables can be shaped by both fast- and slow-track processes.

As depicted by the thin lines in Figure 11, feedback loops link these slow variables to demonstrate how cooperation impacts a country's economic, ecological, and political outcomes. A riparian country is influenced directly by tangible benefits such as short-term economic gains and long-term ecological improvements and indirectly through enhanced political standing in the region. These benefits often result from improvements or changes in water resources management, including modifications in dam storage capacity, river flow regimes, or the implementation of other infrastructure schemes designed to support benefit-sharing among basin countries.

Social motivation is a key driving force that encourages individuals and stakeholders to engage in cooperation, particularly when they feel secure in the protection of their rights and equitable access to water resources. Institutional capacity, including advancements in engineering, technology,

water infrastructure development, and the establishment of sound policies and regulatory frameworks, plays a critical role in fostering and sustaining cooperation among riparian countries.

Another influential but slower-moving factor is political power status, which significantly affects a country's willingness to cooperate (Wei et al., 2022). In practice, politically weaker riparian states often display indifference or reluctance to engage in cooperative efforts over shared watercourses. For example, despite multiple initiatives, efforts by Pakistan to initiate dialogue and cooperation with Afghanistan over the Kabul River Basin have largely failed. Even with active support from international organizations such as the World Bank and USAID, Afghanistan has shown limited willingness to engage in negotiations or cooperative arrangements with Pakistan over the past two decades (Thomas et al., 2016).

2.4 Case study-based literature reviews

The case study literature offers valuable insights into real-world phenomena, thereby bringing researchers closer to addressing key research questions (Öberg, 2016). This study has examined a range of shared watercourses to explore how transboundary water resources can serve as catalysts for cooperation between riparian states, enabling them to navigate and potentially resolve conflicts and disputes (Turgul et al., 2023).

The water-related tensions between Afghanistan and Iran are not unique in the global context. Similar conflicts have emerged in various regions, underscoring the growing geopolitical significance of water. For instance, the Tigris-Euphrates basin, shared by Turkey, Syria, Iraq, and Iran, has been a persistent source of tension. Likewise, a long-standing dispute continues between India and Pakistan over the Indus River (Sadat & Nasrat, 2019). These examples reflect a broader pattern of transboundary river basin disputes that are unfolding across multiple regions of the world.

The Columbia River originates in British Columbia, Canada, and flows through seven U.S. states before draining into the Pacific Ocean via Oregon. The river's highly seasonal flow variability and the significant downstream flood damage it causes have historically been sources of both conflict and cooperation between Canada and the United States. In 1948, catastrophic flooding combined with intense rainfall resulted in numerous fatalities and widespread property damage in both upstream (Canada) and downstream (United States) regions (Wei et al., 2022). This disaster prompted the United States, as the more vulnerable downstream country, to seek cooperative arrangements with Canada to mitigate future risks.

Between the 1960s and 1990s, both countries conducted a joint study aimed at improving water storage and flood control in Canada and explored benefit-sharing projects (Wei et al., 2022). The outcomes of this cooperative approach proved more effective and mutually advantageous than unilateral development and operation. As a result, the two nations ratified the Columbia River Treaty in 1964¹⁸ formalizing their commitment to cooperation on transboundary water management and benefit-sharing initiatives (Harrison, 2019).

¹⁸ The treaty was signed in January 1961 after nine diplomatic negotiating sessions and implemented on September 16, 1964, when President Johnson and Prime Minister Lester Pearson signed documents at Blaine, Washington, near the Canada-U.S. border (Harrison, 2019).

Under the treaty, the United States agreed to compensate Canada with USD 64.4 million for the right to utilize approximately 34,400 km² of Canadian territory for the construction of storage¹⁹ dams (Wei et al., 2022). This treaty stands as a prominent example of successful international cooperation over non-navigational uses of shared water resources (Wei et al., 2022).

The Columbia River Treaty primarily addressed hydropower generation and flood control, and it did not include an expiration date—remaining in effect indefinitely unless either party formally seeks termination. Both Canada and the United States have acknowledged the treaty's significant benefits in facilitating transboundary water management, with Canada receiving approximately half of the power produced by dams constructed in the United States as part of the agreement (Harrison, 2019).

However, over the past two decades, evolving socio-environmental conditions have prompted a re-evaluation of the treaty's scope and effectiveness. A growing number of stakeholders, including indigenous communities, fish²⁰ and wildlife conservation groups, and agricultural communities, have called for greater recognition of their interests within the basin (Wei et al., 2022; Harrison, 2019). These shifts underscore the need to modernize the treaty to reflect contemporary environmental, social, and ecological priorities in transboundary water governance.

Between 2011 and 2013, both Canada and the United States conducted joint studies to assess the integration of ecosystem considerations into the Columbia River Treaty framework. As a result, the United States proposed the adoption of ecosystem-based operations within the basin and highlighted an imbalance in the distribution of hydropower benefits, particularly to the disadvantage of the downstream party. The U.S. also emphasized the need for enhanced flood risk management through closer coordination with Canada (Harrison, 2019; Wei et al., 2022).

In contrast, in March 2014, Canada recommended maintaining the original structure of the 1964 treaty, with minor improvements, while upholding the treaty's primary objectives. Canada also stressed the importance of ensuring that compensation for all benefits derived by the United States including hydropower, flood control, and other advantages, be distributed equitably between both countries (Harrison, 2019; Wei et al., 2022). These divergent national interests have led to points of contention, highlighting the continued need for cooperative dialogue and negotiation to address and reconcile differing priorities in transboundary water governance.

The Lancang–Mekong River, spanning approximately 4,200 kilometres, flows through six Southeast Asian countries: China, Laos, Myanmar, Thailand, Vietnam, and Cambodia, and sustains the livelihoods of nearly 60 million people (Trang, 2016; Wei et al., 2022). As the longest and economically most significant river in the region, the Mekong plays a particularly vital role in fisheries, which are crucial to local food security and economies (MRC, 2018). Tensions and cooperation in the basin have evolved in response to the development of large-scale hydropower projects along the river (Wei et al., 2021). Between 1999 and 2003, only limited dam development took place, and as a result, conflict among the riparian states remained relatively low (Yorth, 2014).

¹⁹ The three large storage dams located in Canada territory (Keenleyside, Mica, and Duncan) and the Libby Dam on the USA side. Dams in Canada planned to harness water upstream and prevent flooding. In the treaty USA agreed to pay Canada 50% of its projected power generation as the “Canadian Entitlement” and as an exchange the controlled release of these three dams provided efficient hydropower generation in the USA. This treaty was a great example of international cooperation on non-navigational water uses (Wei et al., 2022).

²⁰ In the 1990s imposed stronger regulations on dam operators to release seasonal flow for fish migration.

In an effort to promote sustainable development and prevent potential disputes, Cambodia, Laos, Vietnam, and Thailand signed the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin in 1995 (Hirsch & Cheong, 1996; Trang, 1996). This agreement represented a pivotal step toward institutionalized cooperation among the lower Mekong countries, fostering a framework for collaborative transboundary water governance.

However, the alteration of the hydrological regime in the Mekong River during 2004–2005, primarily caused by severe drought conditions, triggered tensions among riparian states, as downstream countries experienced a significant decline in economic benefits (Wei et al., 2021). In response, China, as the upstream country, began sharing hydrological data to clarify the changes in river flow and increased cargo trade with downstream nations to support their economies between 2006 and 2009 (Yorth, 2014; Wei et al., 2022).

From 2010 to 2016, the rapid acceleration of large-scale dam construction, especially in China and Laos, led to major changes in the river's hydrology and ecological systems (Trang, 2016; Wei et al., 2022). These unilateral developments severely impacted the economic interests of downstream countries, with Vietnam accusing China of contributing to the degradation of the lower Mekong's ecological integrity (Yorth, 2014). Notably, severe droughts in 2015 and 2016 resulted in an estimated economic loss of USD 162 million in the downstream region, primarily from the fisheries and agricultural sectors (Wei et al., 2022).

Since 2017, all riparian countries have increasingly acknowledged the degradation of the basin's hydrological and ecological systems. Civil society organizations, including Thai NGOs, have raised alarms about the risks associated with dam construction, particularly the threat it poses to the river's natural floodplains (Trang, 2016; Wei et al., 2021). Nonetheless, driven by their respective national interests and recognition of mutual economic dependencies, the countries have shown a greater willingness to cooperate. As a result, most planned large hydropower projects have been completed, and several bilateral and multilateral cooperation agreements have been signed to strengthen regional coordination and governance (Lu et al., 2021; Wei et al., 2021).

The Nile River basin, recognized as the longest river in the world, spans approximately 6,800 kilometres and flows through 11 countries. Among the riparian states, Ethiopia, Sudan, and Egypt are considered the primary stakeholders, with significant interests in water use, while Uganda, Tanzania, Kenya, Burundi, Rwanda, Eritrea, South Sudan, and the Democratic Republic of Congo represent the secondary group of stakeholders (Wei et al., 2022).

Over time, numerous bilateral and multilateral agreements and cooperative initiatives have been developed among these countries regarding the utilization of the Nile's waters. From 1956 to 1989, Sudan and Egypt entered into a water-sharing agreement that allocated Nile waters exclusively between the two states. However, this arrangement excluded the upstream countries, effectively neglecting their water rights and hindering their socioeconomic development (Kameri-Mbote, 2007).

The consequences of this exclusion became more pronounced when severe droughts in 1973, 1984, and 1985 devastated Ethiopia, leading to the deaths of millions (Gebrehiwot et al., 2011). These humanitarian crises heightened Ethiopia's demand for transboundary water cooperation, which it began to advocate for starting in 1989. However, tangible progress toward cooperation remained ambiguous until 1998 (Wei et al., 2022). A key obstacle was the asymmetric power dynamic within

the basin, where Egypt, as a regional hegemon, benefited from a dominant hydro-political position and exerted significant influence over basin-wide water governance. In contrast, the other riparian states possessed relatively weak economic and political leverage (Cascão & Nicol, 2016).

Between 1999 and 2010, the riparian states made significant strides toward institutional cooperation through the establishment of the Nile Basin Initiative (NBI). This platform aimed to promote technical collaboration in transboundary water management and to facilitate dialogue, capacity-building, and policy coordination through the creation of a Cooperative Framework Agreement (CFA) (Cascão & Nicol, 2016). Furthermore, two Subsidiary Action Programs (SAPs) were launched: the Eastern Nile Subsidiary Action Program (ENSAP) and the Nile Equatorial Lakes Subsidiary Action Program (NELSAP). These initiatives focused on identifying, planning, and implementing water infrastructure projects deemed essential for the economic development of individual riparian states (Cascão & Nicol, 2016).

The efforts of the Nile Basin Initiative's subsidiary action programmes to promote joint development projects between 2005 and 2009 proved largely ineffective, primarily due to limited external funding and diminishing political commitment. Ethiopian policymakers increasingly perceived the anticipated economic benefits from cooperative projects as insufficient, which prompted a shift toward unilateral hydraulic development (Wei et al., 2022). This culminated in the launch of the Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile in 2011—a transformative infrastructure project aimed at advancing Ethiopia's energy security and economic growth.

During this period, Egypt's political stability also began to decline, weakening its capacity to sustain joint basin-wide initiatives. Consequently, multilateral cooperation efforts deteriorated further (Wei et al., 2022). The construction of GERD triggered heightened tensions among the Eastern Nile countries, particularly Ethiopia, Sudan, and Egypt, escalating at times to military threats and hostile rhetoric. In 2019, the United States, under President Donald Trump, attempted to mediate the conflict, yet no binding agreement was reached.

The divergent national interests of the riparian countries have been a persistent barrier to cooperation. Egypt maintains its position based on its historical hydro-hegemony and its over 95% dependency on the Nile waters for domestic and agricultural use. Conversely, Ethiopia prioritizes its economic development and energy generation through the construction of large-scale infrastructure such as GERD. Sudan²¹ for its part, has taken a pragmatic stance, aligning with the side that offers greater economic benefits at any given time. Meanwhile, the remaining upstream countries continue to pursue their own national water infrastructure projects, emphasizing sovereign water rights. The combined effect of competing interests and asymmetric benefits has led to a persistent reluctance to engage in equitable, basin-wide cooperation, thereby impeding the establishment of a sustainable water-sharing framework.

Indus River basin comprises several major tributaries originating in the Himalayan mountain range and the Tibet region of China (Bauer, 2023), flowing southward through India and Pakistan before ultimately draining into the Arabian Sea (Akhtar, 2019). The basin includes seven major rivers, covering an area of approximately 460,000 km² and spanning Afghanistan, China, India,

²¹ Sudan has 105 million hectares arable land potential and play an important role in food security of the Nilotic region, supply of water for irrigation is the most important focused area for Sudan (Cascão and Nicol, 216) <https://books.google.se/books>

and Pakistan. Among these, India (upstream) and Pakistan (downstream) are the principal riparian states, with both countries exhibiting high dependency on the Indus waters, particularly for irrigation and hydropower generation (Akhtar, 2019). The Indus River supports irrigation for 94% of Pakistan's agricultural land, while in India, it serves major agricultural states such as Rajasthan and Haryana.

Historically, the India - Pakistan relationship over the Indus River has been deeply intertwined with the Kashmir conflict, a dispute that has resulted in armed clashes notably in 1948 and 1960 and has brought both countries to the brink of military confrontation multiple times (Mirza, 2016). Although Kashmir is a contested territory, the primary focus for both states often centers on control over water resources rather than territorial sovereignty per se. The Kashmir region serves as a strategic hydrological hub of the Indus system, and for India, maintaining control over Kashmir ensures geopolitical leverage as the upstream nation (Bauer, 2023; Mirza, 2016).

Geographical positioning in shared river basins plays a vital role in influencing a state's ability to exercise autonomy over water usage. The origins of the Indus water dispute can be traced back to the British colonial period, during which treaties were signed with the ruler of Kashmir in the 1870s to support irrigation development in the Punjab region (Akhtar, 2019). These developments, however, sparked objections from Sindh, leading to inter-provincial disputes that the British government attempted to mediate in the 1940s (Akhtar, 2019). The conflict over Indus waters intensified with the partition of British India in 1947 and the subsequent creation of Pakistan, laying the foundation for one of the most enduring and geopolitically significant water disputes in the world.

Following the creation of Pakistan in 1947, the demarcation of borders posed significant challenges, particularly in the division of the Punjab province, where key irrigation headworks were located in India, while the canals extended into Pakistan (Bauer, 2023). According to Nijim, the British colonial administration failed to consider ethnic, cultural, and religious factors during the border demarcation process (Mirza, 2016), thereby complicating the emerging geopolitical landscape. In an effort to maintain the existing irrigation infrastructure, Sir Cyril Radcliffe proposed a "Standstill Agreement", which temporarily allowed India to continue releasing water flows to Pakistan until March 1948 (Akhtar, 2019).

However, upon the expiration of this short-term arrangement, India unilaterally halted water supplies to canals²² flowing into Pakistan, triggering a significant water crisis (Bauer, 2023). In response, and under U.S. mediation, both nations entered into the Inter-Dominion Agreement in May 1948, through which India agreed to resume water releases in exchange for an annual fee paid by Pakistan (Akhtar, 2019; Bauer, 2023). While this agreement temporarily alleviated tensions, it did not resolve the core issue. Negotiations continued in pursuit of a permanent resolution to the dispute, with both countries exchanging various proposals concerning the equitable distribution of the Indus waters. Despite these efforts, no consensus was reached during this period, and the conflict remained unresolved.

²² India cut flow of water to the Dipalpur canal & Upper Bari Doab irrigation Canals in Panjab (Akhter, 2019).

In 1951 David Lilienthal²³ proposed that India and Pakistan should collaborate in the joint administration of the Indus River waters, suggesting the involvement and potential financial support of the World Bank to facilitate the development of a treaty (Akhtar, 2019; Bauer, 2023). This proposal gained traction, and the president²⁴ of the World Bank endorsed the idea, encouraging both nations to engage in cooperative dialogue. Consequently, each country appointed a delegation of engineers and water experts to work under the guidance of a technical advisory team from the World Bank (Bauer, 2023). Despite the initial promise of this initiative, political tensions and mistrust between the two countries impeded progress, and the negotiations were unable to advance beyond the technical consultations (Bauer, 2023). As a result, this early attempt at treaty formulation stalled, underscoring the complex interplay of technical, political, and diplomatic factors in the management of transboundary water resources.

In 1954, experts from the World Bank submitted a formal proposal aimed at resolving the ongoing dispute over the Indus River waters (Akhtar, 2019; Bauer, 2023). Following extensive negotiations that spanned approximately six years, India and Pakistan signed the Indus Waters Treaty in September 1960, with the World Bank serving as mediator (Ganoulis et al., 2018). To support the implementation of the treaty, the World Bank and several of its member countries—including the United States, United Kingdom, West Germany, Japan, and Canada—pledged financial assistance to Pakistan. This included funding for the construction of two major dams, five barrages, and associated irrigation canals, while India committed to paying USD 174 million over a ten-year period (Akhtar, 2019).

As part of the treaty's institutional framework, both countries established a Permanent Indus Commission, tasked with overseeing the operationalization of the treaty and serving as a forum to address technical disputes at the commissioner level (Bauer, 2023). This mechanism proved effective in ensuring compliance and de-escalating potential conflicts without requiring direct intervention from national political leadership (Vinogradov, 2003). However, while the commission has contributed to the treaty's durability, it is primarily limited to water allocation and technical dispute resolution and does not fully meet the criteria for active water cooperation as outlined in Section 2.3 of this study.

Indus River Treaty Implementation Mechanism: The signed treaty provide ground for cooperation over water usage and its implementation have been started from 1960 with 10 years transitional period for Pakistan to develop its water infrastructures²⁵ (Akhtar, 2019).

- Both countries agreed to share daily hydrological data and daily release of water from dams
- Agreed on installation of new metrological and hydrometric stations for exchange of data in case of flooding, cyclones, intensive rainfall etc.

²³ David E. Lilienthal (born July 8, 1899, Morton, Ill., U.S.—died Jan. 15, 1981, New York) American businessman and government official, who was codirector (1933) and first chairman (1941) of the Tennessee Valley Authority (TVA) and first chairman of the Atomic Energy Commission (AEC) (Bauer, 2023).

²⁴ Eugene Robert Black (born May 1, 1898, Atlanta, Ga., U.S.—died Feb. 20, 1992, Southampton, N.Y.) was an American financier who, as the third president of the International Bank for Reconstruction and Development (World Bank) from 1949 to 1962

²⁵ Under the Treaty Pakistan built 2 dams (Mangla and Tarbela), 5 barrages (Chashma, Rasul, Marala, Qadirabad, & Mailsi) including 8 associated irrigation canals (Akhtar, 2019).

- The authorities agreed to share with each other plan of any new intervention or development in the basin.
- The most important mechanism is establishment of water commission with regular meetings and inspection of the works within the basin.
- Another important mechanism is resolving future water disputes and conflicts at the commissioners' level bilaterally, if not then refer to a neutral expert under the supervision of the World Bank, if not then escalate it to the International Court of Arbitration.

The above mechanisms have not been put into practice more effectively toward AWC to build trust and avoid disputes over shared water resources between India and Pakistan. In terms of context and governance situation the Indus River is almost the same with the Helmand River except the commission which is not established right after the signing of treaty. The comparative analysis of Helmand and Indus rivers discussed in detail in Section 4.8.1 under Chapter 4.

Euphrates and Tigris Rivers are two distinct river systems that converge only in their final 190 kilometres, forming the Shatt al-Arab near the confluence with the Persian Gulf. The Euphrates River Basin is the largest in the Middle East and the second largest in the region west of the Indus, with a total length of approximately 2,700 kilometres, flowing through three primary riparian states: Turkey, Syria, and Iraq (Faris et al., 2016). Turkey, as the upstream country, contributes approximately 90% of the Euphrates' flow and 45% of the Tigris' flow, granting it significant hydrological leverage in the basin (Kibaroglu, 1996).

Historically, the region of Mesopotamia, situated in modern-day Iraq, represents one of the earliest civilizations to utilize the Euphrates and Tigris rivers, with a history of water use dating back over 6,000 years (Faris et al., 2016). Prior to the 20th century, the entire basin was under the centralized control of the Ottoman Empire, which managed both rivers as a unified hydrological system. However, following the collapse of the Ottoman Empire after World War I, political fragmentation led to the division of the basin among newly established or colonially administered states, namely Turkey, Syria, and Iraq (Faris et al., 2016).

During the colonial period, international agreements began shaping the basin's governance. For example, France, during its mandate over Syria, negotiated with Turkey for the construction of a water supply system in Aleppo. Similarly, Britain, while administering Iraq in the 1930s, signed an agreement with Turkey aimed at preventing unilateral actions in the basin without prior consent from all parties (Faris et al., 2016). These early treaties and interventions by colonial powers laid the groundwork for future hydro-political dynamics in the Euphrates–Tigris basin.

In 1946, Turkey and Iraq signed a Friendship Agreement in which Turkey pledged not to construct any new water infrastructure on the Euphrates River without prior consultation with Iraq. However, this commitment began to unravel in the 1960s, as Turkey's rising demands for electricity and food production prompted the country to initiate large-scale dam and irrigation projects on the Euphrates (Faris et al., 2016). This unilateral development triggered increased competition and tensions among the three principal riparian states Turkey, Syria, and Iraq culminating in a near military confrontation in 1975 when Syria completed the Al-Thawra Dam (Faris et al., 2016). To de-escalate the situation, Syria and Iraq reached an agreement on the allocation of Euphrates waters, with 42% designated for Syria and 58% for Iraq (Kliot, 1994).

In an effort to institutionalize cooperation, the three countries established a Joint Technical Committee (JTC) in 1982 to negotiate water distribution and promote collaborative management of the basin. However, the committee was dissolved in 1993 due to persistent disagreements and the absence of a comprehensive legal framework grounded in international water law. Bilateral agreements continued to dominate, often excluding one of the key riparians. For example, although Turkey agreed in 1984 to release 500 m³/s to Iraq, Syria objected to this arrangement. Subsequently, in 1987, Turkey signed a bilateral agreement with Syria guaranteeing the same flow, effectively ignoring Iraq's prior agreement and water rights (Kolare, 1992; Faris et al., 2016).

Further tensions arose in 1990 during the construction of the Atatürk Dam, a cornerstone of Turkey's Southeastern Anatolia Project (GAP). In response, Iraq and Syria formed a coalition to protest Turkey's water policies. Nevertheless, Turkey proceeded and officially commissioned the dam in 1992 (Faris et al., 2016). The situation was exacerbated by Turkey's refusal to ratify the 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, which sought to establish equitable and reasonable water use among riparian states.

By 1998, tensions between Turkey and Syria once again escalated to the brink of military conflict over the Euphrates (Faris et al., 2016). Many scholars and analysts attribute Turkey's hydro-hegemonic position to its geographical advantage as the upstream state, as well as its military and economic dominance, which has discouraged basin-wide cooperation (Kibaroglu, 1996). In contrast, Iraq and Syria, positioned downstream and lacking comparable power, remain at a disadvantage. This asymmetry contributes to the region's high susceptibility to conflict and contention, making the Euphrates - Tigris Basin one of the most at-risk transboundary river systems globally, as identified by Wolf et al. (2003).

2.5 Afghanistan and Iran water policy and governance

Policymaking is a course of actions and processes whereby facts, laws, and strategies are developed and agreed by the policymakers and entered into force (Saikia et al, 2020). The leading role of water policy is to allocate water between two main categories of competing users and uses that their engagement either secure access to water or deny the access (Kibaroglu, 1996). Water plays a significant role in sustainable development in the presence of good water governance (Batchelor, 2007). Water governance refers to the social, political, economic, and administrative systems of a society which influence the use and management of domestic and shared water resources (Batchelor, 2007). Water governance covers the feature that regulatory actors and authorities practicing in the management of water and related natural resources. Politics plays an important role in water governance such as establishing water management system at the international, national, and local levels (Batchelor, 2007).

In fact, governance consists of the complex procedures, processes, system, and institutional set up that a country or society can discuss their difference, claim their interests, and practice their legal rights and entitlement (UNDP, 1997). The national interests, rapid economic development, demography, and climate change impacts augmenting more pressure on water and natural resources (Batchelor, 2007). Good water governance is an essential for better water resources management at international and local level (Saikia et al, 2020). In general, many researchers believed that water crisis is caused by unfavourable water governance (Ghafoori Kharanaq et al., 2019). Water governance appeared in the scientific literature that the current water crises is mainly

due to the evolution of the nature and the natural resource management approaches (Jimens et al., 2020). It is very important that governments strengthen their water policies and establish reasonable frameworks to catalyse better implementation of water governance as a tool to achieve sustainable development (Yousefian et al., 2022). The OECD²⁶ defines water governance as the “range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision makers are held accountable for water management” (OECD, 2015). The 12 principles of OECD for water governance clustered within three (Effectiveness, Efficiency and Trust and Engagement) dimensions as presented in Fig. 12 (OECD, 2015).

Politicians have an important role as policy maker whereas the political stream often complicated and hard to define. It is always combination of different factors such as national feeling, decision-makers and active elected officials, and many active interest parties and factions (Hoefer, 2022). Politicians should act for a defined problem along with an appropriate solution that is acceptable for all sides particularly while it is a national interest involved. In such a case, politicians must do something (propose a policy) which is called policy window (Hoefer, 2022). Politicians undertake efforts to define a solution for a problem through a policy and encourage majority of decision-makers to support policy package.

Then the new act or law for making decision is created. But it is important that policy makers should be knowledgeable to become skilful advocates of problem definitions and acceptable solutions (Hoefer, 2022). Policy makers should have a solution for the defined problem that they believe is suitable and useful in almost any situations. Since water is precious natural resources and water crisis is national problem so water policy should be feasible and useful for any situation to meet the country need and go through a filter system such as Multiple Streams Framework (MSF)²⁷ to be responsive for solving water crisis problem.

In this section Iran and Afghanistan water policies and water governance have been briefly reviewed to understand their water management system, water demand, institutional set up and their political and development priorities including water diplomacy practices. According to Nicholson (1939) “diplomacy as the art of conducting dialogue between and among states” and water diplomacy is part of diplomacy for bilateral and multilateral negotiations between the states and governments (Magdy 2011). Iran and Afghanistan constitutions do not explicitly recognize human rights to water, but they have included water as part of public interest and property (Mayar & Shapour, 2023).

²⁶ Organisation for Economic Cooperation Development (OECD) water governance indicator framework (OECD, 2015)

²⁷ “The multiple streams framework (MSF), developed by John Kingdon in 1984 (with a major update in 2010), is a well-respected approach for analyzing policymaking across a variety of policies and countries” (Hoefer, 2022).

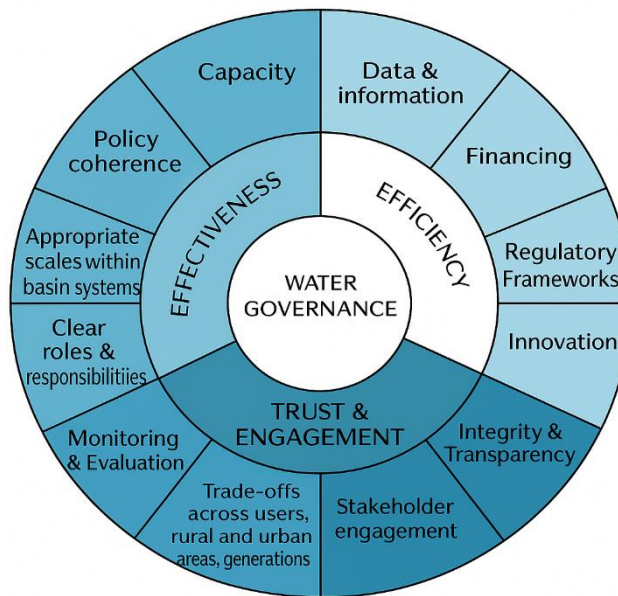


Figure 12: OECD principles on water governance (2015)

2.6 Afghanistan water policy and governance

Afghanistan has an estimated 57 MCM surface and 18 MCM underground annual renewal water resources potential (GoA, 1968), see Table 6. Afghanistan is a self-sufficient water country only on paper but in practical it has the lowest water storage capacity in the world (Sadat & Nasrat, 2020). Afghanistan has a capacity of only 33% of its annual surface water consumption (Thomas et al, 2016) and the rest flows down to the riparian countries. Water availability per capita/year is about 2700 m³ (Thomas et al, 2016) which is almost equal to Italy water resources (Sadat, 2013). Afghanistan has limited capacity to utilize its domestic annual renewable waters. Poor governance due to several years of war and inaccessibility because of geographical complexity has caused the loss of a 3rd of its surface water and just 33% is being exploited in the country. In addition, rapid snowmelt and seasonal flow cause flooding in spring and water shortage and scarcity for the rest of the seasons (Thomas et al., 2016).

Table 7: Estimated Surface and Groundwater Resources (BCM/Year). Source: Master plan (1986, GoA)

Type of water resources	Annual potential billion m ³	Present situation billion m ³		Potential situation billion m ³	
		Used	Unused	Future use	Unused
Surface Water	57	17	40	30	27
Groundwater	18	3	15	5	13
Total	75	20	55	35	40

For long time several water resources management policies have been developed and revised in Afghanistan due to political and institutional changes during different regimes. Since 1880 until early 1920 there was unrest in Afghanistan due to the Anglo war where, sovereignty of the country prevailed rather than a focus on water resources development. Later, between the 1960s and 1970s,

several institutional changes occurred e.g. the irrigation section shifted from the Ministry of Agriculture and Irrigation (MAI) to the new established Ministry of Water and Power (MWP). In the 1980s, the Soviet regime adopted a new principle combined with customary water law and practice. In 1988, in addition to MWP, the Ministry of Irrigation, Water Resources and Environment (MIWRE) was established. This time water policy revised again and shifted irrigation and water management responsibility to MIWRE, these changes created an institutional gap on water resources management in Afghanistan. Meanwhile, due to the considerable influence of the Soviet regime, water resources management policy issues were ignored, and the focus was on civil engineering aspects, while at the same time Afghan institutions faced conflict (Wegerich, 2009)

In addition, 1991 Water Law did not cover aspects of integrated river basin development approach with stakeholders' participation and decision-making process. Furthermore, due to several years of war the government autonomy became weak, and NGOs were leading the rehabilitation and development of small irrigation schemes in different river basins without any coordination with governmental entities. Later, in the mid-1990s the Taliban regime came to power which was another devastating period for the policies formulation and implementation in the history of Afghanistan. The change of regimes and revolution caused an institutional gap which seriously affected the water sector's efforts to promote the best practice toward transboundary water management and river basin development.

Finally, in 2002 after years of war the new western supported Afghan government focused on the construction of large infrastructures for irrigation and hydropower with financial support of international communities without any plan for transboundary water governance and management. In 2002, an international water conference was launched in Kabul, and the outcome was formulated in different policies in the water sector. In May 2004, the first draft of the "Strategic Policy and Framework for the Water Sector" was developed by the republican Afghan government. Later, in 2006 this was approved by the Supreme Council for Water Affairs Management (SCWAM) as a strategic policy framework. The aim was to address basic physical and institutional improvement for the process of water resources development and economic growth of the country (MIWRE, 2004).

Consequently, the 2004 water policy framework identified the need based on a holistic and integrated approach for the water resources management, ecosystem, infrastructure, institutional framework and regulation. However, the Ministry of Energy and Water (MEW) recognized that application of an integrated and holistic manner requires a considerable amount of time. For instance, the transformation of a centralized system to decentralized approach through River Basin Authorities (RBAs) and then enhancement of their capacity is a lengthy and challenging task for the MEW. This is because of various challenges stated by actors like political instability, inadequate capacity, poor stakeholders' coordination, and dependency of the Afghan government on foreign aid, all of which are influencing the implementation process (Sadat, 2012). This was the reason the integrated transboundary water management was not part of Afghanistan water policy agenda to engage, discuss, cooperate with riparian countries over four shared river basins.

2.6.1 Water Policy Formulation

The Afghan government has faced multiple political instability challenges for a long time in the water sector because of revolution and change of several regimes as stated in Section 2.6.

Moreover, technical and financial dependency on foreign support is also influencing the government autonomy in policy formulation and implementation. Therefore, the Afghan government after three decades of war and strife has introduced the application of Integrated Water Resource Management (IWRM) to address effective and efficient use of water resources. The establishment of River Basin Authorities (RBAs) will be the first task for implementation of IWRM.

Finally, by mid- 2011 the Ministry of Energy and Water developed river basin management approach and started the activation of RBAs and recruitment of staff. They hope to complete the process by the end of 2012 (Sadat, 2012). In addition, MIWRE which was merged with the Ministry of Energy and Water (MEW) introduced the policy key elements for the water sector to achieve IWRM principles.

MEW expects that by applying IWRM principles and activation of RBAs, water resources management and dam development will be improved. But from the interviews held with the actors, trans-boundary water management is a major challenge mainly for the dam development in international river basins. This is because, Afghanistan still does not have a clear Trans-boundary water policy framework which is an important issue that can affect IWRM three 'E's principles (Economy, Equity & Environment) defined by (Postel, 1992).

Furthermore, lack of international agreements on the share river basins except Helmand, pose threat and causing tension which could affect regional stability and economic development. This is one of the policy principles and a major obstacle for the dam development process in Afghanistan, in terms of international investor agencies policies as discussed by most of the actors. However, although, international donors supported the previous Government of Afghanistan (GoA) for several activities but did not financially support the physical dam construction on any of its four shared basins without formal notification of the riparian countries (Sadat, 2012).

Therefore, previous republican government included Ministry of Foreign Affair (MoFA) as a member of the Supreme Council of Water (SCoW) to facilitate formulation of trans-boundary water policy for international cooperation and agreements on water with the riparian states to promote donors' confidence and ensure sustainable river basin development. According to the Helsinki rule (international rivers water use guideline, 1966) stated that, trans-boundary agreements will entitle each riparian country to reasonable and equitable utilize water on an international and shared basin.

The unilateral water resources development such as dam and irrigation canals by Afghanistan on the shared basins have recently sparked reactions of riparian countries particularly the Kamal Khan dam in the Helmand basin by previous government of Afghanistan and current construction of 285 Km Qush Tepa canal by the Taliban de facto government in the Amu Darya basin. In Afghanistan most of large water resources development projects are part of water strategy from 1970s where transboundary water cooperation with neighbouring countries was not fully recognized nor in the recent decades water resources management policies. In 2008 the GoA decided to develop the Afghanistan National Development Strategy (ANDS) with generous contribution of national and international organizations. The Water Sector Strategy (WSS) was a part of the ANDS which was developed for integrated and holistic water resources management and development (GoA, 2008).

However, since the 1920s Afghan government had experienced the construction of large integrated irrigation schemes and hydropower projects. For example, the Helmand-Arghandab Valley Authority (HAVA) in the Helmand basin and Nangarhar Valley Development Authority (NVDA) in the Kabul basin were among the largest water resources infrastructures. The further development of these kind of projects was halted due to internal and external factors caused by war and unrest in the country. Water governance has been disrupted, maintenance and operation of existing infrastructures has deteriorated, and hydrological data recording has also ceased (GoA, 2008).

Therefore, since the 1990s while the concept of IWRM has been globally developed, the Afghan water strategy (2008) also had been further tailored to this new modern management approach and identified number of large water resources infrastructures to be developed through water resources Capital Investment Plan (CIP) (Sadat, 2012). Although, the strategy in developed in 2008 looks like investment plan, it is not practical because most of the planned projects' timeline had been over without any physical outputs. Similarly, it did not state that the identified major infrastructures are feasible or beneficial in terms of hydropower and irrigation development. Furthermore, there is nothing mentioned of what will be the effect of these water resources infrastructure development on the neighbouring countries or whether they will have any negative impacts (Wegerich, 2009). Neither discussed any future trajectory of transboundary water cooperation and negotiation with the neighbouring countries.

Since the Taliban assumed power in Afghanistan in August 2021, no new water policy frameworks or agendas for improved water governance have been introduced. Instead, the de facto authorities have focused on reviving large-scale water infrastructure projects that were either left incomplete by the previous republican government or originally planned in earlier decades, such as the Qosh Tepa Canal in the Amu Darya Basin and the Shah wa Arus multipurpose dam in the Kabul River Basin including Pashdan dam in the Harirud River basin.

Although the Taliban administration has made diplomatic overtures aimed at fostering political and socio-economic relations with neighbouring countries particularly Pakistan, Uzbekistan, and Iran significant concerns persist among these states. The main concern among them are apprehensions regarding Afghanistan's pursuit of unilateral water development projects within shared river basins.

The Taliban leadership has repeatedly expressed the view that Afghanistan has not historically benefited from its fair share of transboundary waters, claiming that neighbouring countries have fully utilized river flows for decades. They argue that it is now Afghanistan's turn to harness these resources. The neighbouring countries remain wary, while the Taliban maintain that their use of water resources will be responsible and will not infringe upon the rights of downstream states. They stress that any major diversions or alterations in water flow initiated by Afghanistan could significantly impact their own access to water and compromise existing water rights. Where Taliban senior leadership claim that their intervention would not impact the rights of neighbours.

2.7 Iran water policy and governance

Since long period water resources management is complex and a challenging issue in Iran mainly due to uneven political power system and limited authorization to the line departments (Yousefian, et al., 2022; Moridi, 2017). The power control by Head of Government influenced the autonomy of line ministries or authorized departments to make right and on time decisions regarding water resources governance at the country level (Moridi, 2017). Population growth and their uneven distribution including climate change impacts mainly prolong droughts can worsen availability and accessibility to water resources (Moridi, 2017). Particularly in the last two decades water crisis has become a major concern for people and government due to agriculture development to secure food demand, industrialization, and limited rainfall.

In addition, Iran has limited water resources and located in a dry and semi-dry region (Yousefian et al., 2022; Islami & Rahimi 2019). Despite, the current water crisis is not a priority for the policymakers and high rank authorities in Iran and lack of well-structured water resources governance at the national level including poor performance of the local entities further deteriorating water resources management in the country (Islami & Rahimi 2019).

Iran has many institutional set ups for policy making and execution for water governance and water resources development. But the policymakers have not presented yet a clear and effective policy to acknowledge and understand the water crisis nor a creative and genuine solution for the water crisis. The sectoral execution entities do not think for a fundamental solution of water scarceness, but the focus is, achieving their organizational objectives and spending their annual budget (Islami & Rahimi 2019). There are several gaps in policy formulation, water resources governance and development including operational activities that why country has been faced with insufficient integrated water supply management, water economy, water demand management, and participatory approach for a comprehensive planning toward a sustainable water resources development (Yousefian et al., 2022).

The United Nations (UN) has developed a percentage-based index to assess the severity of water crises in countries by measuring the proportion of renewable water resources withdrawn annually. According to this index, when a country withdraws more than 40% of its total renewable water resources, it is considered to be experiencing a severe water crisis. Withdrawals between 20% and 40% indicate a moderate crisis, while values between 10% and 20% reflect a low to moderate crisis. Countries with withdrawal rates below 10% are generally not considered to be facing a water crisis (Bazi et al., 2010, as cited by Islami & Rahimi, 2019).

In Iran, water consumption currently stands at 88% of its renewable water resources, as reported by Rahim Maidani, Deputy Minister of Water and Wastewater. Furthermore, approximately 63% of the nation's drinking water is sourced from underground aquifers (Maidani & Tejaratnews, 2016). This figure far exceeds the UN's threshold for a severe crisis, indicating that Iran is experiencing a critical and worsening water situation. The crisis is further exacerbated by the impacts of climate change and ongoing deficiencies in water governance (Islami & Rahimi, 2019).

The water crisis in different parts of Iran indicates an uncertain and challenging future. Although climate change inclusive prolongs drought and insufficient rainfall have had a great impact on water availability but most of the existing problems are related to water policy and governance issues (Yousefian et al., 2022). Iran as water resources scarce country has uneven, unpredictable

and limited precipitation throughout the year (Amiraslani & Dragovich 2023). Iran average rainfall²⁸ between 1994-2014 is 228 mm/year with 52 billion m³ annual run-off which is about 42% less than the long-term average (Moridi, 2017).

This shrinkage put pressure on underground water overexploitation. Agriculture sector is the major user (92%) of water in Iran where total amount of water from 44 billion m³ in 1961 increased to 80 billion m³ in 2001 where the usage of water is gradually increased to 86,5 billion m³ in 2011 (Moridi, 2017) and now it would be over 90 billion m³. On the other hand, the long-term rivers discharge in Iran was 89 billion m³ but this volume reduced to 53 billion m³ under the period of 2005-2013 based on the hydrometric stations data (Moridi, 2017).

The country economic policies are more focusing on land reform for agriculture expansion and economic development (Amiraslani & Dragovich 2023) in the desert. Also, increasing water prices in the last five decades without a sufficient attention to water scarcity and integrated water resources management, has intensified water crisis in Iran (Islami & Rahimi, 2019). In addition, it has reported as the study result that lack of communication and effective coordination among the governmental entities over water resources management, neglect implementation of laws and legal acts, lack of management stability, corruption, conflict of interest between various stakeholders are driving factors for poor water governance in Iran (Yousefian et al., 2022).

2.7.1 Iran Water Policy Formulation

From the legal perspective point of view Iran defined its water legislative foundation recently in 1968 (Amiraslani & Dragovich 2023). Until 1960, Iran had a traditional water system for water delivery and distribution (Ettehad, 2016) even water rights system in Iran was private based before 1968 where underground water resources were not part of the national water system scope (Islami & Rahimi, 2019). By the early twenty century Iran did not have water supply and delivery infrastructures for drinking and agriculture (Amiraslani & Dragovich, 2023). Over time by forming various legislations and laws such as Agrarian Reform in 1964, Underground Water Conservation and Protection law in 1966, and National Water Law in 1968, government took a leading role in water resources management at the national level (Islami & Rahimi, 2019).

Over the past two decades, Iran has formulated several strategic documents to guide water resources management, including the Water Resources General Strategy (2000), Water Resources Development Strategy (2003), Water Demand Management Strategy (2010), and most recently, the Iran Water Outlook 2025 developed in 2023 (Moridi, 2017). Collectively, these strategies present a comprehensive roadmap for the sustainable development and governance of water resources in the country. Despite the breadth and depth of these policy frameworks, the primary challenge remains the weak performance of executive institutions and local authorities, which hinders effective implementation. The lack of cross-sectoral coordination and institutional integration at the national level has significantly undermined the practical application of these strategies (Islami & Rahimi, 2019).

²⁸ Iran annual average rainfall reported 250 mm by (Najafi & Vatanfada 2013; Ettehad, 2010).

From the perspective of transboundary water management, Iran has established several treaties with its neighbouring countries. Notably, Iran is home to numerous wetlands and nine²⁹ significant transboundary rivers, encompassing both inflow and outflow basins. According to Najafi and Vatanfada (2013), Iran has signed treaties with riparian states for seven of these rivers; however, no formal agreements exist for the Harirud River shared with Afghanistan and the Nihing River shared with Pakistan. While the signing of treaties represents an important step toward fostering cooperation over shared watercourses, it does not necessarily imply that active or effective cooperation is occurring between the riparian states.

For effective and active cooperation, riparian countries must meet several essential criteria, including the establishment of a joint commission immediately after treaty signing, regular ministerial-level meetings, data sharing and joint monitoring mechanisms, collaborative technical projects, engagement at the highest political levels, and economic cooperation to ensure full implementation of the agreement (Philip et al., 2015). In the case of Iran and Afghanistan, active cooperation over the Helmand River remains absent, as the two countries have failed to meet any of these criteria aside from the existence of a treaty and a minimally functional commission. As a result, water-related tensions persist, with the most recent example being the armed clash in May 2023, which led to three casualties from both sides clearly demonstrating the consequences of the lack of active cooperation.

An active cooperation approach is vital for achieving integrated and sustainable transboundary water management. The three E-principles³⁰ (Economy, Equity, and Environment) of IWRM are particularly important in guiding such cooperation (Sadat, 2012). However, Iran still lacks a comprehensive transboundary water policy framework to support effective collaboration with its riparian neighbors and relevant stakeholders, a gap that requires urgent attention. According to Amiraslani and Dragovich (2023), despite the 1973 treaty serving as a legal instrument, the management of the Helmand River remains a persistent source of tension, exacerbated by climate change and population growth. These challenges suggest the need for revisiting and possibly revising the treaty. However, treaty revision alone is not a fundamental solution unless both countries commit to an active cooperation framework that ensures effective implementation at the basin level. This should be complemented by improved water governance and the development of local water delivery infrastructure (Philip et al., 2015).

Water scarcity represents a critical socio-ecological challenge (Ashraf et al., 2019), further exacerbated by multiple interrelated factors such as agricultural expansion, urbanization, climate change, population growth, land-use change, and most importantly ineffective water management systems (Madani, 2014; Barati et al., 2023). In response, Iran's Ministry of Power (MoP) has initiated significant efforts to address the growing crisis through dam construction and increased investment in transboundary water management. According to Nobakht (2019), Director of the Budget and Planning Organization, the Iranian government has allocated approximately USD 11.6 billion from the National Development Fund to support five major water-related projects aimed at mitigating the water crisis. These efforts have included the construction of 27 dams across various basins, with an additional 146 dams currently under construction. However, despite these large-scale investments of Iran, the Helmand River Basin particularly the Sistan region has received

²⁹ Iran nine important TW Rivers are Aras, Sari Su & Ghare Su, Harirud, Helmand/Hirmand rivers where Iran is downstream country and for Atrek, Nihing, Northern Khorasan and Western boundary rivers Iran is upstream country just Astarachai is a boundary river with Azerbaijan (Najafi & Vatanfada 2013).

³⁰ IWRM three E-principles (Economic efficiency, Equity and Environmental Sustainability) defined by Postel (1992).

disproportionately limited attention, with only USD 500 million allocated to its development (Islami & Rahimi, 2019). This highlights a regional imbalance in water infrastructure investment, despite the Helmand River plays a crucial role in eastern Iran's water security.

In contrast, many Iranian environmentalists have voiced strong criticism regarding the rapid pace and scale of dam construction in the country. According to Darwish (2019), extensive dam building has led to severe environmental consequences, including the drying of approximately one million palm trees in Khuzestan Province. Similarly, the construction of the Karkheh Dam contributed to the desiccation of large portions of the Hor al-Azim Wetland, resulting in the destruction of local livelihoods. In Menab, Hormozgan Desert, unsustainable groundwater extraction combined with dam-related impacts has caused significant land subsidence and the loss of nearly eight million palm trees (Islami & Rahimi, 2019).

Parviz Bavarsad, Dean of the Faculty of Marine Sciences and Arts at Persian Gulf University in Bushehr, stated in an interview with Iran Newspaper that widespread dam development has turned rivers into ecologically and socially degraded systems. He emphasized that flawed dam-building policies and mismanagement of water resources have triggered severe environmental and economic threats in Khuzestan and have had cascading negative effects across other regions of Iran (Iran Newspaper, 2017). The Ministry of Energy, as the principal authority over water infrastructure, is often held accountable for these adverse outcomes stemming from inadequate policy-making and poor transboundary water governance (Islami & Rahimi, 2019).

The Ministry of Agriculture is another key institution in Iran's water governance landscape, responsible for consuming approximately 90% of the country's water resources—primarily for agricultural use. As the dominant water consumer, the agricultural sector holds significant potential to contribute to resolving Iran's water crisis. However, in practice, it is often regarded as one of the primary contributors to the crisis due to unsustainable and contradictory policies (Madani, 2014; Islami & Rahimi, 2019). For instance, agricultural development strategies in water-scarce regions have largely ignored the limitations of water availability.

Poor cultivation practices, inefficient irrigation systems, outdated water delivery infrastructure, and improper water usage have created a substantial gap between water consumption and agricultural productivity, deviating sharply from international efficiency standards (Islami & Rahimi, 2019). Water scarcity has become one of the most pressing socio-environmental challenges in Iran, with prolonged droughts in recent years exacerbating water stress across the country. Yet, the problem extends beyond natural factors. As noted by Yousefian et al. (2022), deeply flawed governance and policy mismanagement have played a central role in the overexploitation and misuse of Iran's already scarce water resources.

Consequently, according to many studies and research papers as discussed in this section water crisis in Iran predominantly is the result of poor water resources management and improper policy (Yousefian et al., 2022; Islami & Rahimi, 2019; Majidyar, 2018; Iran Newspaper, 2017; Madani, 2014). It requires for the local actors and decision makers to bring a fundamental change in their water resources management policy, practices, and institutional set up for better coordination and good governance. According to Madani (2014), water crisis in Iran has the following three main driving factors:

- Demography: population growth and water distribution system
- Inefficient Irrigation system and agriculture pattern
- Poor water governance and thirst³¹ for dam development

Population Growth

Population growth is indeed a natural phenomenon mainly in most of the developing countries. For example, in the last two decades Iran population has been doubled mainly after the Islamic revolution took place in 1979. The renewable freshwater availability has been further reduced and stressed by the population increase. Misusing in some urban areas like Tehran such as daily water consumption is 400 L per capita which is almost double against the normal usage quantity (250 L) standard despite of its limited freshwater availability (Madani, 2014; Islami & Rahimi, 2019; Yousefian et al., 2022). Despite population growth further triggering water crisis in Iran, the government of Iran encourages for increasing the population and even the parliament passed a law that vasotomy surgery for prevention of male fertility is illegal act in Iran (Madani, 2014). This kind of laws and policies increase the burden in long term for the government to manage increase water demand with insufficient water resources and infrastructures in the country (Madani, 2014).

Inefficient Irrigation and Agriculture patterns

Iran agriculture predominantly relies in irrigation (Seyf, 2006) and the country has been always suffered from food insecurity since only 15% of the country areas is being cultivated (Madani, 2014). The agriculture sector consumes about 92% of the country water resources however this policy was helpful mainly during Iran-Iraq war but due to political reasons in recent decades Iran has lost its leading position in exporting its agriculture products (Madani, 2014). On the other hand, the crop patterns do not well match the country water resources availability and lack of proper cultivation management increase the water consumption demand (Seyf, 2006; Madani, 2014; Islami & Rahimi, 2019). Similarly, agriculture sector uses 90% of groundwater due to insufficient surface water availability and poor water delivery infrastructure system in the country (Madani, 2014; Yousefian, et al., 2022). The continuation of current water uses and inefficient irrigation system worsening water crisis in Iran therefore there is an urgent need for and advanced and efficient water delivery infrastructures and modernized agriculture system to address the current water crisis (Madani, 2014).

Poor water governance and thirst of development

Above all, Iran's water crisis is largely "the result of decades of bad water management" (Madani, 2014). A fundamental cause is the fragmented and poorly coordinated decision-making structure within the water sector. The country's water governance system involves numerous stakeholders operating within an inefficient and poorly defined hierarchy, leading to disjointed policies, institutional overlap, and ineffective implementation (Madani, 2014; Moridi, 2017; Yousefian et al., 2022). The presence of multiple actors has intensified organizational competition and internal conflicts, often diverting focus from the overarching goals of sustainable water governance (Islami & Rahimi, 2019).

One key example of institutional disruption was the structural reform initiated during President Ahmadinejad's administration. As highlighted by Zarezadeh et al. (2013), this reform shifted water resource management from a watershed-based model to a province-based model. This transition

³¹ Madani (2014) stated that the thirst for development motivates "nature control" rather than "nature management.

significantly weakened the integrated management framework and created confusion and inefficiencies among responsible entities (Madani, 2014).

Additionally, political incentives have fuelled unsustainable development. Politicians frequently advocate for rapid water infrastructure projects such as dams and irrigation systems to gain local popularity and electoral support. Members of parliament often pressure local authorities to initiate such projects under the pretense of boosting local economies and supporting farmers. In return, local communities may re-elect these politicians, reinforcing a cycle of short-term gains at the expense of long-term sustainability (Madani, 2014). These populist-driven initiatives, while politically advantageous, often ignore environmental impacts and threaten the durability and resilience of water infrastructure. Similar trends have been observed in Afghanistan, both during the former republican government and under the current *de facto* administration, where political leaders similarly prioritize visible development projects to gain legitimacy and public favour, often overlooking the broader implications for water governance and environmental sustainability.

2.8 Overview of 1973 treaty

The Helmand River Water Treaty remains the only formal agreement between Afghanistan and Iran that addresses the distribution of shared water resources between the two countries. Signed in 1973, the treaty serves as a legal framework for the utilization of the Helmand River, which originates in Afghanistan and flows into Iran, providing a critical water source for both countries—particularly the Sistan region.

The Helmand basin, including Sistan, has been a longstanding source of contention dating back to the late 1800s (Hearns, 2015). Multiple efforts were made to resolve the water allocation disputes: Britain attempted mediation in the early 1900s, Turkey intervened in 1938, and in 1948, the United States initiated a three-member commission in Washington, D.C. After three years of negotiations, the commission issued a recommendation on 28 February 1951, proposing a temporary arrangement in which Iran would receive 22 m³/s of water in a normal water year (Treaty, 1973; Abidi, 1977; Hearns, 2015; Aman, 2016). While Afghanistan accepted the recommendation, Iran rejected it, demanding a greater share of the water (Abidi, 1977; Aman, 2016). By 1953, tensions between the two countries escalated further—exacerbated not only by water-related disagreements but also by diverging foreign policy orientations, which visibly strained bilateral relations (Abidi, 1977).

When Sardar Mohammad Daud Khan became Prime Minister of Afghanistan, he pursued an ambitious national development agenda, which raised concerns among neighbouring countries particularly over Afghanistan's plans for water infrastructure and dam development. Among these concerns, Iran voiced strong objections, accusing Afghanistan of neglecting the downstream rights of Iran regarding the Helmand River. In response, the United States proposed a dialogue to find common ground between the two countries, leading to two consecutive meetings held in Washington in 1956 and 1957 (Abidi, 1977).

A severe drought in 1971 reignited tensions when Afghanistan failed to release the agreed volume of water to Iran. This event underscored the hydrological uncertainties in the basin and served as a valuable lesson for the negotiating parties. Consequently, when the Helmand River Treaty was

finally signed in 1973, the term “normal water year” was formally included in the agreement to reflect these climatic variabilities.

During the early stages of the political rift between Iran’s royal family and nationalist factions, the United States seized the opportunity to expand its regional influence, stepping into the role previously occupied by Britain in mediating disputes between Iran and Afghanistan (Abidi, 1977). Notably, in 1969, Iran’s Court Minister Asadollah Alam recorded in his diary that Afghanistan had expressed willingness to offer more than 22 m³/s of water in exchange for access to Iran’s Chabahar and Bandar Abbas ports (Aman, 2016). Some researchers refer to this as a “package deal”—a form of benefit-sharing that linked water allocations with port access and broader economic cooperation (Nagheeb & Warner, 2022).

Three years later, in 1973, Afghan Prime Minister Mohammad Musa Shafiq and Iranian Prime Minister Amir Abbas Hoveyda reached a formal agreement on the distribution of the Helmand River waters, accepting the same recommendation originally proposed by the U.S. Commission in 1951. According to the treaty, Afghanistan committed to releasing an average flow of 22 m³/sec during a “normal water year”, or above³² the “normal water year” and an additional 4 m³/sec extra³³ as an expression of “goodwill and neighbourhood” (Treaty, 1973; Hearn, 2015; Aman, 2016).

The term “normal water year” is defined in the treaty as the annual total flow of the river from October 1 to September 30 of the following year, with a baseline value of 5,661.715 million m³, measured at the Dehrawud hydrometric station, upstream of the Kajaki Hydropower reservoir (Article II). Article III of the treaty further outlines the average monthly distribution of water to Iran based on this allocation, following the River Delta Commission’s recommendations from February 28, 1951. This monthly allocation is designed to provide proportional water releases throughout the year, with a built-in flexibility clause allowing reductions in Iran’s allocation during years when the flow falls below the normal threshold (Hearn, 2015). The treaty also specifies three delivery points for the water supply to Iran: i) the Rud-e Sistan, where the river crosses the Afghan–Iranian border, and ii) two points between border pillars 51 and 52 along the bed of the Helmand River (Article III).

2.8.1 The main points of the 1973 treaty at glance:

- The establishment of a Joint Commission³⁴ was the primary objective of the 1973 Helmand River Treaty. This Commission, composed of representatives from both Iran and Afghanistan, was intended to oversee the implementation of the treaty and to address any disputes or operational issues that might arise concerning the allocation of the Helmand River's waters. However, the Commission was not actively formed or operationalized in the early years following the treaty’s signing, and it failed to carry out its intended administrative and monitoring responsibilities.

³² Above the water year means when the river annual flow discharge is more than 5661 million m³.

³³ According to Aman (2016) Iran had an option to purchase 4 m³ additional flow and in return Iran shall give access to Afghanistan to Chabahar and Bandar Abbas ports, but this option was not ratified.

³⁴ Article VIII and Protocol No.1 article II of the 1973 treaty.

For decades, both governments relied on ad hoc “Commissioners”, appointed intermittently mostly in response to water-related grievances raised by Iran. Since 2019, there has been a renewed recognition by both parties of the need for a functioning Commission to facilitate the governance of the Helmand River (BRAAFG2, July 2024). Nevertheless, several Afghan interviewees have emphasized that the Commission has remained inactive and reactive, convening only in response to specific concerns from Iran, rather than operating under a consistent, institutionalized framework (AQKAFG1, July 2024; WAAFG4, July 2024).

One of the key duties of the Commission under the treaty was to identify the three official water delivery points one at Rud-e Sistan where the Helmand River crosses into Iran, and two others between boundary pillars 51 and 52. This task, however, was never fully implemented, primarily due to the lack of an active, functional Commission and commitment from both parties.

This institutional failure can be largely attributed to the political upheavals and prolonged instability in both countries. In particular, Afghanistan’s decades-long conflict, beginning with the Soviet invasion in 1979, severely undermined its governance capacity. Similarly, Iran’s 1979 revolution and subsequent shifts in political priorities diverted attention from bilateral water cooperation. Moreover, during much of the 20th century, water scarcity was not perceived as a critical issue, which likely contributed to the institutional negligence and lack of urgency in activating the treaty mechanisms.

- The 1973 Helmand River Treaty also included provisions for the exchange of hydrological data and information between Iran and Afghanistan to support improved water management and informed decision-making. However, this critical clause has never been effectively implemented by either country. Several factors have contributed to this failure, including the inability to consistently compile and manage hydrological data (Abidi, 1977), a persistent lack of trust between the parties, the absence or deterioration of gauging and hydrometric infrastructure, and overarching political instability and security challenges. These limitations have not only undermined data transparency but have also weakened the potential for coordinated responses to water scarcity and climate variability in the Helmand Basin.
- The 1973 Helmand River Treaty reaffirmed the sovereignty of both Iran and Afghanistan over their respective territories and water resources, while emphasizing the principles of good neighbourliness and mutual cooperation. However, this foundational aspect of the treaty has largely deteriorated over time, particularly due to major political upheavals and social disruptions. Key developments such as the 1973 coup in Afghanistan, followed by the Soviet invasion in 1979, and the Islamic Revolution in Iran the same year, significantly strained bilateral relations (Aman, 2016). These events eroded political trust and weakened social ties between the two nations. As a result, the spirit of mutual respect and cooperation

envisioned in the treaty was replaced by recurring tensions, and the issue of water rights has persisted as a major source of contention and diplomatic friction for decades.

- Another significant aim of the 1973 Helmand River Treaty was the commitment of both Afghanistan and Iran to collaborate on the construction of dams, reservoirs, and water management infrastructure along the Helmand River (Article VII). This cooperation was intended to improve irrigation systems, flood control, and water storage capacity for agricultural and socio-economic development. However, this objective has not been realized, as both countries have pursued unilateral development agendas, rather than coordinated planning. Since the 1980s, Iran has continued to develop the Chahnimeh reservoirs to expand water storage for the Sistan region reportedly at nearly double the allocation stipulated in the treaty (Thomas et al., 2016). Yet, despite increased storage capacity, the water needs of the Sistan population remain unmet due to inefficient water resource management and insufficient irrigation and water delivery infrastructure (Ettehad, 2010; Sadat & Nasrat, 2020).

Furthermore, Iran has unilaterally constructed approximately 30 storage dams on various rivers originating in Afghanistan (Glinski, 2020), a move that underscores the absence of collaborative planning. On the Afghan side, upstream dam-building particularly the Kamal Khan Dam has drawn strong objections from Tehran, which argues that such infrastructure could cause significant environmental harm, especially to transboundary wetlands and the Sistan region (Glinski, 2020; Sadat & Nasrat, 2020). Notably, the 1973 Treaty did not account for environmental flows, leaving no legal mechanism to ensure the ecological health of critical areas such as the Hamoun Wetlands (Sadat & Sayed, 2020).

Afghan officials have asserted that Tehran's objection³⁵ and complaints regarding the construction of the Kamal Khan Dam are unfounded (Ghanizada, 2011). From a hydrological perspective, the Kamal Khan Dam is estimated to reduce river flow by approximately 52 Mm³ (Jahanmal, 2020), which constitutes less than 1% of the Helmand River's total annual flow during a normal water year. As such, this minimal reduction is unlikely to significantly affect Iran's 14% allocation under the 1973 Helmand River Treaty.

Interestingly, during the 1970s, Iran had expressed interest in financing the construction of the Kamal Khan Dam as a means to secure access to surplus water from Afghanistan. However, this proposal did not materialize, and Iran ultimately failed to incorporate provisions in the treaty for the purchase of excess water beyond its agreed allocation (Wasefi & Rashid, 2012). This historical context adds further complexity to the current disputes, as Iran's earlier willingness to support the dam contrasts with its present opposition.

³⁵ According to Khama Press, "The officials in Ministry of Foreign Affairs and Ministry of Water and Energy of Afghanistan said, concerns and views of Iran regarding the construction of Kamal Khan is baseless and emphasized, the construction of the dam is the right of Afghanistan" (Ghanizada, 08 September 2011).

- One of the prickliest clauses for Iran within the Helmand River Treaty is outlined in Articles IV and V, which stipulate that in years of water abundance—when the river's flow exceeds the volume defined as a “normal water year”—Iran is not entitled to claim more water than the fixed amount specified in Column 4 of Article III. This restriction has been a source of dissatisfaction for Iran, especially during wet years when excess flow is available but not legally accessible to the downstream state.

The 1973 Helmand River Treaty marked a significant milestone in the bilateral relations between Iran and Afghanistan, particularly in the realm of transboundary water governance. However, the implementation and long-term efficacy of the treaty have been shaped by a range of political, environmental, and hydrological challenges. Water allocation under the treaty is based on the concept of a "normal water year," with flow distribution heavily influenced by seasonal variability. Typically, the Helmand River experiences reduced discharge from August to December, meaning that water deliveries to Iran are directly tied to the river's natural flow regime. Consequently, the treaty does not fully guarantee consistent water supply to Iran's downstream wetlands, nor does it explicitly incorporate provisions for environmental flows—an omission that has become increasingly problematic given the ecological importance of the Sistan region.

In response to these limitations and growing water demand, Iran has pursued unilateral measures to expand its storage capacity. Since the 1980s, it has constructed a series of Chahnimeh reservoirs aimed at regulating and storing Helmand River water. Notably, the construction of the fourth Chahnimeh reservoir in 2006 increased the total storage capacity to approximately 1,400 million cubic meters—nearly double Iran's annual allocation of 820 million cubic meters as per the treaty (Thomas et al., 2016). Nevertheless, the benefits of these storage expansions have been undermined by inefficient water management practices and a lack of modern irrigation infrastructure, resulting in continued water shortages for local populations despite the enlarged capacity (Ettehad, 2010).

On the other hand, intensive evaporation is another factor for water loss in Sistan arid region (Ettehad, 2010) and getting worst by climate change impacts. This is because the Chahnimeh designs are not accurately estimated reservoir evaporation which is essential for efficient water resource management. The interior design of water infrastructures and inadequate water resources management cause that wetlands remain dry and local people may face with water shortfall even in the normal water year. In 2011 Mr. Kaikha, Iranian parliament member objected Iranian authorities for having no strategy for the Sistan water issue. Iran's Foreign Ministry said water flow to Iran has been reduced by Afghanistan and adversely impacted Sistan environment and the local people where they have rights to use Helmand waters (Ghanizada, 2011).

- Article X of the 1973 Helmand River Treaty declares the agreement as a permanent arrangement between Iran and Afghanistan, immune to present or future doctrines or reinterpretations. This clause poses a particular challenge for Iran in pursuing treaty revisions, especially if Afghanistan remains unwilling or unprepared to renegotiate its terms. Furthermore, as stipulated in Article IV, Iran's water entitlement is conditional upon the river's hydrological performance. This means that in the absence of a "normal water year," Iran's share may be reduced accordingly. Conversely, even in years of surplus flow, Iran's entitlement is capped at a maximum of 26 m³/Sec, as specified in Article III. These legal limitations may constrain Iran's position should it choose to escalate the matter to international arbitration.

Protocol No. 1 Article 5 addresses scenarios of extreme drought or force majeure, instructing the Commissioners of both parties to coordinate and devise urgent plans for mitigating the crisis and reporting to their respective governments (Article XI). However, implementation of this clause has been undermined by the long-standing failure of both governments to appoint active Commissioners and establish permanent institutional offices for the treaty's enforcement. This administrative gap has hindered systematic monitoring and delivery of water allocations to Iran, as envisioned in the treaty.

Despite these challenges, some progress has been observed in recent years. Since 2019, bilateral meetings between the designated Commissioners have taken place with greater frequency. Nonetheless, interview data and responses with Iranian and Afghan experts has illustrated that effective cooperation remains limited between both countries and is often reactive rather than sustained or strategic (BRAAFG2, July 2024; AWBAFG10, September 2024).

- The Helmand River dispute intensified during the recent severe droughts particularly during 2000 - 2001, when extreme hydrological conditions led to the complete desiccation of the Hamun wetlands and Iran's artificial reservoirs (Chahnimeh). During this period, Afghanistan was unable to supply sufficient water to meet Iran's allocated share due to minimal river flow. Although the Helmand River Treaty explicitly outlines in Article III that Iran's water rights are contingent upon the river's flow regime and further clarifies in Articles IV and V that Iran's entitlement shall not exceed 26 m³/s as an average even in high-flow years Iran nevertheless lodged a formal complaint. In 2001, Iran submitted an official letter to the Afghan Embassy alleging that Afghanistan was deliberately withholding water in violation of the treaty (Thomas et al., 2016). This complaint was subsequently included as an agenda item in the United Nations General Assembly Security Council on 21 September 2001.

Afghan officials refuted Iran's allegations, arguing that the claims were unsubstantiated. At the time, Afghanistan lacked the infrastructure such as large-scale reservoirs or significant diversion systems that could enable upstream water retention. Afghan

authorities attributed the reduced flows to the ongoing extreme drought, which they linked to broader climatic variability (Aman, 2016). Despite these clarifications, Iranian concerns about insufficient water deliveries have persisted over the years. These tensions culminated in a violent border clash on 27 May 2023 between Iranian forces and Taliban border guards, resulting in the deaths of two Iranian and one Afghan personnel (Pannier, 2023). Following the incident, both parties initially exchanged blame but later de-escalated the situation through diplomatic engagement.

The Taliban administration has repeatedly emphasized its commitment to upholding the terms of the 1973 Helmand River Treaty. In a televised interview on 29 February 2024 with TOLONews, Taliban Acting Foreign Minister Amir Khan Muttaqi stated that “the water issue has been discussed with Iranian counterparts, and we even invited community elders from the Sistan region to visit the Helmand River and Dehrawud areas.” According to Muttaqi, local Iranian representatives acknowledged that upstream hydrological changes mainly driven by climate change were the primary cause of reduced flows, rather than deliberate water withholding by Afghanistan.

2.9 Visualization of Conceptual Frameworks for improving TW Cooperation toward collaboration

Transboundary water management paradigm should change from a traditional cooperation to effective collaboration (Yildiz, 2015) toward a shared objective, outcome and vision. This is because collaboration³⁶ encourages a sense of meaningful contributions between the actors toward a large effort to achieve the mutual goal and vision. In this chapter, three different cooperative approaches have been discussed to see in which ways both countries Iran and Afghanistan could cooperate over usage of the Helmand waters.

The Active Water Cooperation (AWC) framework developed by the Strategic Foresight Group (Philip et al., 2015) outlines ten key indicators that serve as foundational conditions for fostering effective transboundary water cooperation. These indicators are designed to move riparian relations beyond a narrow focus on water quantity and allocation, toward a more holistic model of shared objectives and benefit-sharing within transboundary river basins. From a practical perspective, the presence of these criteria can significantly enhance cooperation by promoting institutional trust, long-term dialogue, and joint development initiatives. Among the ten indicators, the first four (i) existence of a formal agreement, (ii) establishment of a joint commission, (iii) regular ministerial-level meetings, and (iv) implementation of technical or infrastructure projects, are considered foundational. When these core elements are operational, they create the institutional and political environment necessary to support sustained and active cooperation between riparian states.

³⁶ “Certainly, cooperation and collaboration are related concepts with different meanings; collaboration means that actors work together for achieving a shared objective, outcome and vision with their efforts and ideas emphasizing interdependence, flexibility, innovation, and collective ownership of outcomes while cooperation means that actors work together to get done a specific task without sharing vision or shared authorship” (Moseley, 2024).

The remaining six criteria outlined in the Strategic Foresight Group's Active Water Cooperation (AWC) framework; (v) environmental protection, (vi) joint monitoring of river flow, (vii) cooperative dam building for flood control and water storage, (viii) high-level political commitment, (ix) integration of water management into broader economic development strategies, and (x) actual functioning of implementation mechanisms and treaty provisions are essential for enabling effective and sustained collaboration. These elements foster an enabling environment for achieving shared objectives, mutual benefits, and national interests through the practical execution of agreements and cooperative water resource management in transboundary basins. In light of emerging challenges such as climate change, the food-water-energy nexus, and increasing concerns over environmental degradation and ecosystem sustainability, a more reform-oriented and adaptive approach to transboundary water governance is imperative (Yildiz, 2015). These criteria collectively support a shift toward more resilient, inclusive, and benefit-driven frameworks for water diplomacy.

An essential step toward effective transboundary water governance is the adaptation of international treaty principles to the local context, ensuring the incorporation of customary practices and community-based norms within shared basins (Yildiz, 2015). Establishment of trust is equally vital between riparian states, which serves as a foundation for cultivating political will and institutional readiness to engage in cooperative water management based on mutual benefits. Building trust requires that officials and technical experts from both Iran and Afghanistan to develop a comprehensive understanding of the river flow regime, grounded in hydrological monitoring and technical assessments.

To further stimulate cooperative behaviour, the socio-hydrological framework (Fig.11) provides an integrated lens for interpreting water-related conflicts and cooperation, emphasizing on hydro-economic models that illustrate the economic, ecological, and political advantages of collaboration for all parties involved. According to Wei et al. (2022), three supportive drivers i) social motives, ii) institutional capacity, and iii) relative power dynamics play a significant role in shaping the willingness of states to cooperate. While these are considered part of a slow-track process (as indicated in the conceptual model (Fig. 11), they are crucial in providing iterative feedback that enhances understanding of the long-term impacts of cooperation. This feedback loop is vital for building sustained trust and aligning national interests around shared water resources.

Adapted AWC Framework for the Helmand River Basin

As illustrated in the proposed conceptual framework (Fig. 13), the foundational step toward establishing AWC between Iran and Afghanistan involves operationalizing four core criteria: a treaty, a joint commission, regular ministerial meetings, and collaborative technical projects. These criteria are critical for transforming a historically contentious relationship into a cooperative and benefit-sharing arrangement, thereby mitigating the risk of conflict and war³⁷ for promoting long-term stability in the Helmand River basin.

At present, only the treaty is established which is not operationalized yet, while the remaining three criteria: functioning joint commission, periodic ministerial-level dialogues, and joint technical initiatives remain either underdeveloped or inconsistently implemented on event basis.

³⁷ Water war equation presented Strategic Foresight Group (Philip et al., 2015) that Water & Water Equation} Any two countries engaged in Active Water Cooperation (AWC) = They do not go to War for any other reason.

Yet, these elements are not only essential to achieving AWC but are also explicitly embedded in the 1973 Treaty itself: the establishment of a Joint Commission (Article VIII), the convening of high-level meetings (Article X; Protocol No. 1), and the execution of technical cooperation projects (Article III, Para b). For Iran and Afghanistan to move beyond periodic tensions and toward sustainable and institutionalized cooperation, it is imperative that these three criteria as treaty provisions are systematically activated and strengthened. Their full realization will lay the groundwork for building trust, enhancing transparency, and aligning both countries' strategic interests in the shared management of transboundary water resources.

In step two of the proposed conceptual framework (Fig. 13), the realization of national benefits economic, ecological, and political can be achieved through improved transboundary water management and strategic collaboration around shared objectives. To move toward these outcomes, the involved parties must adopt a governance model based on flexibility, innovation, and collective ownership of both outcomes and benefits. This transition requires a shift from traditional, transactional forms of cooperation to a collaborative governance model that prioritizes long-term sustainability and mutual gain.

This transformation is addressed in step three of the framework, which emphasizes the importance of implementing the six additional AWC criteria as listed in the schematic diagram (Fig. 13). These elements must be aligned with the core principles of IWRM and IWL namely, equitable and reasonable utilization, prevention of significant harm, and ecosystem protection while being contextualized to the local socio-political and hydrological realities of the Helmand River basin.

This conceptual framework, as illustrated in Fig. 13, represents a new, adaptive model for Iran and Afghanistan to establish a robust collaboration mechanism. It provides a structured approach to operationalize the 1973 Helmand River Treaty and foster its effective implementation. The framework is the product of a synthesis of three existing conceptual models, tailored specifically to the Helmand River context, and aims to promote not only compliance with legal provisions but also the realization of mutual benefits and resilience in the face of emerging environmental and political challenges.

Analysis of Current Situation Toward AWC

As discussed in Section 2.3.2.1, the Helmand River basin currently fails to meet the fundamental criteria required for AWC, as evidenced by a low WCQ score of 18.18, calculated using the prescribed equation. This score clearly indicates that neither active nor even traditional forms of cooperation are in place between Iran and Afghanistan. The absence of sustained cooperation has led to recurring disputes, culminating in several "water conflicts" and even violent confrontations over the past few decades with the most recent one occurring on 23 May 2023. While the 1973 Treaty provides a legal foundation for transboundary cooperation recognized as the first critical AWC criterion (as illustrated in Fig. 13) the mere existence of a treaty is insufficient to ensure genuine water cooperation between riparian states. Institutional and operational mechanisms must complement legal instruments to translate commitments into action.

To move toward AWC, both countries must urgently fulfil the remaining three other foundational indicators: Joint Commission, Ministerial-level meetings, and the implementation of joint technical projects. These are essential for transitioning from symbolic legal frameworks to substantive cooperation.

In parallel, step two of the framework emphasizes the need to cultivate willingness to cooperate, which is instrumental in achieving and aligning national interests (economic, ecological, and political benefits). Without this mutual willingness, cooperation efforts are unlikely to gain traction. When national interests are visibly secured through collaboration on shared water resources, trust-building between officials, institutions, and communities becomes more feasible, laying the groundwork for long-term and sustainable cooperation.

Currently, a significant trust deficit exists between Iran and Afghanistan, posing a major obstacle to effective cooperation over their shared water resources. As emphasized by Loodin et al. (2023), trust-building is a foundational prerequisite for fostering collaborative transboundary water governance. To create an enabling environment for generating willingness to cooperate, both countries must engage and practice the three slow-track trust-building processes: strengthening social motives, enhancing institutional capacity, and addressing asymmetries in political power as presented in the AWC framework (Fig. 13).

For decades, the social and institutional relationships between the two riparian states have been shaped by a complex interplay of factors, most notably, the historical legacy of the 1973 Treaty, evolving geopolitical dynamics, and accelerating environmental changes. The influence of political power asymmetries including geographical positioning, material and technical resources, bargaining leverage, and ideational narratives must be carefully navigated to support a cooperative rather than competitive paradigm. Ensuring mutual respect, equitable treatment, and reciprocal engagement is vital for transitioning from formal legal arrangements to sustainable and inclusive water-sharing and cooperative frameworks. Despite the treaty being in place, its implementation has encountered persistent disputes over water allocation and infrastructure development, highlighting the gap between legal commitments and operational realities.

However, trust cannot be achieved merely through formal diplomatic relations. As Yildiz (2015) underscores, trust-building extends beyond political engagement and must include genuine socio-economic cooperation and mutual benefit-sharing. Iran's relationship with the previous Afghan government remained largely diplomatic and polarized, lacking substantial collaboration in economic, development, and political domains. This fragility persists and has even intensified under the current *de facto* Taliban administration, evidenced by heightened tensions and violent border clashes, such as the confrontation in May 2023 regardless of the current conservative diplomatic approach currently being practiced between Kabul and Tehran. Therefore, for both countries to effectively address shared water challenges, they must commit to a long-term strategy of trust-building—grounded in social connectivity, institutional reliability, and balanced power relations alongside technical cooperation and legal adherence.

In practical terms, the first and most critical step toward building trust between riparian states lies in fostering institutional unity among government agencies, regulatory authorities, and bilateral commissions, particularly through a basin-wide trust-building approach. These institutional actors most notably the Helmand River Commissioners must engage in sustained dialogue grounded in mutual trust, respect, and empathy, thereby creating the foundation for implementing the trust-building indicators outlined in Figure 13 for advancing treaty formalization.

A unified and transparent institutional front enables constructive engagement on key disputes, particularly around water allocation and environmental degradation, and supports the development

of mutually beneficial solutions. Through such cooperation, both Iran and Afghanistan can work to align the use of Helmand River waters with their economic, ecological, and political interests, enhancing the legitimacy and effectiveness of the 1973 Treaty.

Sustainable transboundary trust is most likely to emerge when states begin to prioritize shared basin interests over narrowly defined national security or domestic priorities (Loodin et al., 2023). When riparian countries embrace transboundary objectives as part of their strategic outlook, they reinforce their commitment to active and sustained cooperation. However, as observed in water-stressed basins such as the Nile, Indus, Mekong, and Helmand, riparian states often pursue unilateral or national agendas, which impedes progress toward long-term trust and collective conviction.

A foundational mechanism for building trust in such contexts is the transparent and reciprocal exchange of data, particularly through the establishment of a joint water monitoring system at the border, as stipulated under Article IIIa³⁸ of the 1973 Helmand River Treaty. Such mechanisms ensure the availability of real-time, credible hydrological data, which is essential for informed decision-making, dispute resolution, and accountability (Loodin et al., 2023). Establishing this system would be a tangible demonstration of political will and an important step toward institutionalizing trust across the basin.

In step three of the conceptual framework (Fig. 13), once trust is established, institutional actors are better positioned to collaborate effectively over shared water resources. This cooperation should be grounded in the principles of IWL and obligation to cooperate to ensure the realization of shared objectives and equitable benefit sharing. An essential element of this phase is the exchange of knowledge, data, and scientific research, which serves to enhance institutional capacity and foster academic collaboration across political boundaries. Such transboundary academic engagement helps deepen mutual understanding of treaty provisions and supports evidence-based water governance. Strengthened institutional collaboration significantly reduces the likelihood of hydro-political conflicts, as demonstrated in other transboundary contexts (Turgul et al., 2023). When institutional capacity and cooperation are present, transboundary water cooperation can act as a catalyst for regional stability and sustainable development (Earle et al., 2013).

Three primary groups of actors play a crucial role in transboundary water management (TWM): i) Government officials and water managers, including private sector stakeholders; ii) Academics and research professionals, along with International Financial Institutions (IFIs); iii) Politicians and decision-makers. These groups continuously interact, influence, and learn from each other. However, as noted by Earle et al. (2013), the ultimate authority and responsibility for advancing cooperation often lies with political leaders. Political will is, therefore, the decisive factor in translating institutional potential and technical collaboration into sustained cooperative action across the basin.

When the key actors; government officials, academics, private stakeholders, and political leaders adopt IWRM and IWL principles as overarching frameworks, they are more likely to shape cooperative and inclusive strategies for water resources governance. These principles offer a “soft

³⁸ The 1973 Treaty (Article IIIa) specifies three locations for installing a water monitoring system, i) where the boundary line crosses the Rud-e-Sistan and ii) two additional locations between border pillars 51 and 52.

path” approach, emphasizing sustainability, equity, and participation rather than unilateral development. By applying these standards, consensus-building becomes more feasible. For example, water infrastructure development such as dam construction and water storage reservoir expansion should be proportional to actual water availability and reflect the rights of riparian states, as defined in existing agreements and informed by the basin’s hydrology. This necessitates transparent sharing of development plans, close coordination, data exchange, and joint water monitoring mechanisms.

Moreover, it is essential to revise national water consumption patterns in line with the natural flow regime, promoting more reasonable and adaptive water use (Ettehad, 2010). Such revisions are critical to minimizing harm to both people and ecosystems, thereby advancing the core IWL principle of “no significant harm.” By aligning institutional strategies with these foundational principles, actors in both countries can establish AWC in the Helmand River basin. This process entails building trust by enhancing social, institutional, and political relationships, while ensuring that national interests economic, ecological, and political are respected. At this stage, the basin management will shift from fragmented or conflict-prone dynamics to a collaborative model. Both Iran and Afghanistan will be positioned to jointly pursue their shared objectives, focusing on the effective implementation of the 1973 Treaty. This includes operationalizing the following six criteria necessary for sustainable cooperation as outline in the AWC framework in Fig.13.

1. Environmental and ecosystem protection and quality control to avoid harm.
2. Joint monitoring of river flow by both countries helps decision makers to collaborate.
3. Dam building for flood control and economic development as benefits sharing projects.
4. High political commitment at Head of Governments level can be good sign of cooperation.
5. Integration into economic cooperation to integrate their development within the basin.
6. Actual functioning of collaboration mechanism for effective implementation of treaty.

Since the Helmand River basin has historically been a source of both cooperation and conflict, the proposed conceptual framework (Fig. 13) offers a practical and analytical tool to advance transboundary water cooperation between Iran and Afghanistan. Building on International Water Law, political science, and environmental governance. The framework also integrates IWRM principles which promote the coordinated development and management of water, land, and related resources in the entire basin. This holistic approach aims to maximize economic and social welfare without compromising the sustainability of critical environmental and ecosystems. Articulating IWRM alongside IWL³⁹ provides a cross-cutting foundation for collaboration, guiding actors toward effective treaty implementation, equitable water use, and conflict avoidance in the basin.

³⁹ IWRM three E-principles are Equity: i) Ensuring fair distribution of water resources, ii) Efficiency: Promoting the efficient use of water resources, and iii) Sustainability: Protecting and enhancing the environment.

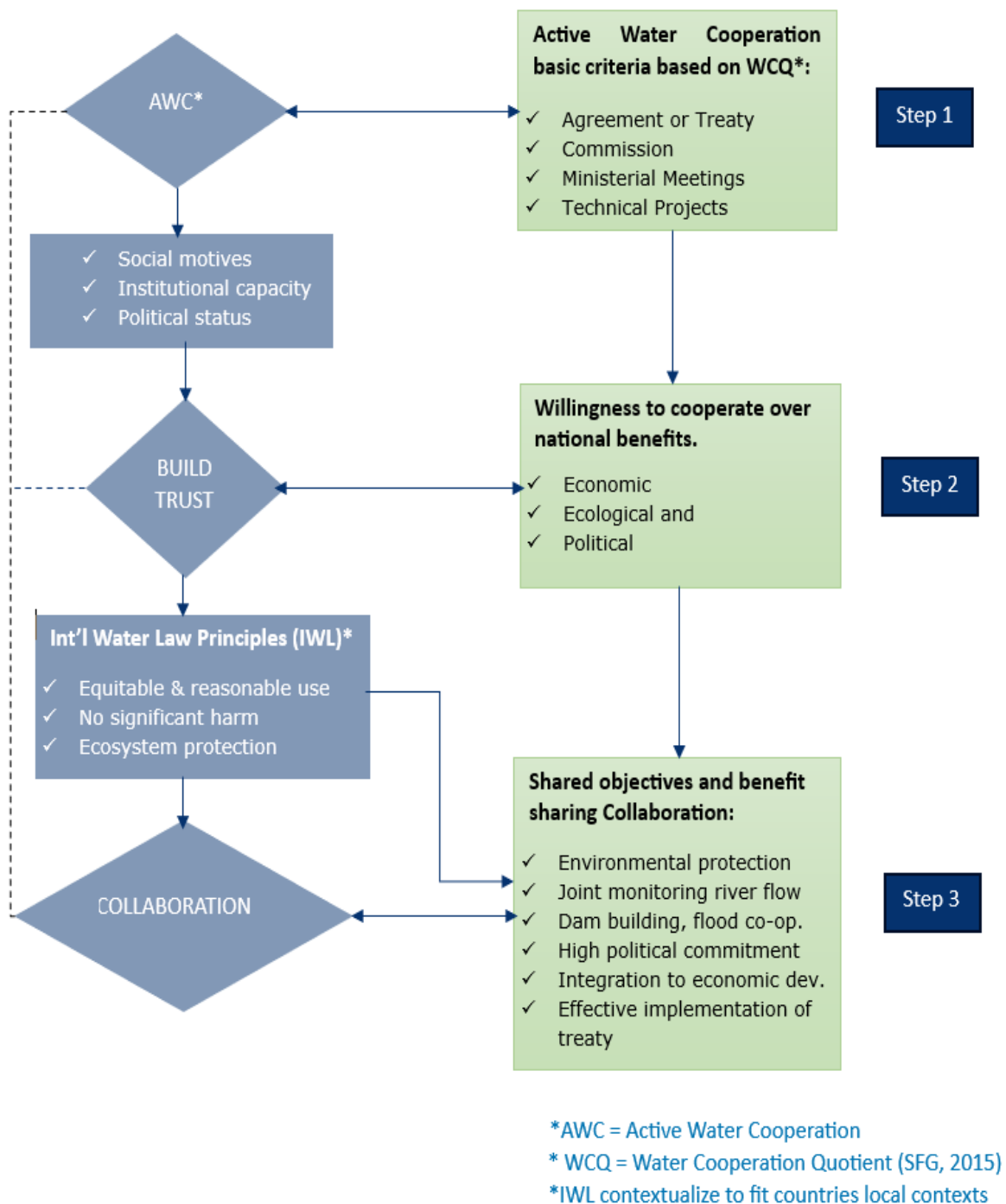


Figure 13: Proposed AWC Framework toward collaboration between Iran and Afghanistan

2.10 Environmental Flows and Wetlands Preservation in the River Delta

In the realm of water resources management, environmental considerations play a pivotal role, particularly in the context of transboundary water cooperation. Two primary drivers are pushing riparian states closer to the brink of water-related disputes: (i) anthropogenic interventions, and (ii) environmental pressures. The increasing impacts of climate change further intensify these risks, undermining social and political stability. According to the United Nations (2024), tensions over water are emerging as a significant threat to global peace, exacerbating existing conflicts in many regions. Freshwater resources are becoming progressively strained due to unsustainable water management practices, rapid population growth, and climate-induced changes (Heijden & Stinson, 2019). Environmental challenges especially those affecting water systems transcend political boundaries and must be addressed at multiple governance levels through integrated and cooperative frameworks (Turgul, 2023).

Environmental Flow (EF) is very important to be considered for the maintenance of ecosystem and environmental protection in the river basin (Brown & King, 2013). This important issue was missed to be discussed and embed it in the Helmand water treaty in 1973. This is because environmental aspect was not a focused subject in early decades. It means environmental protection was not part of water resources management practices in 1970s. EF is and instream flow in the riverbed which is developed over the last four decades to protect river ecosystem (Brown & King, 2013) particularly in the basin reaches. Some expert says that EF can be a minimum stream flow as a specific amount of flow to protect basin targeted ecosystem. But this is not a good approach because water flow in the riverbed should be according to the required amount of water for maintenance of wetlands, estuaries and aquifers. In most cases human being controls environmental flow for their development purposes specially in the dry seasons which cause to cut supply of water to the wetlands, estuaries, and ecosystem (Brown & King, 2013).

A similar issue is observed in the Helmand River delta, where wetlands frequently fail to receive adequate water due to the compounded impacts of climate change and the absence of environmental flow considerations by the riparian states. Notably, environmental flow provisions were not integrated into the Helmand River Treaty. According to an interview with a former Helmand basin Commissioner, the return flow from Hamun-e-Helmand located in Iran territory to the Godzare area in Afghanistan was classified as part of the environmental flow (AWBAFG10, 2024). This classification, endorsed by three independent consultants from Chile and Canada, was documented in the Delta Commission's report, 1951.

The report underscored that the return flow from the Hamuns plays a vital ecological role in preserving the fragile ecosystem of the Helmand delta, despite the fact that it is not explicitly addressed in the treaty. This case highlights the inherently transboundary nature of environmental water management and underscores the necessity for both Afghanistan and Iran to incorporate environmental considerations into their water governance frameworks. As ecosystems become increasingly vulnerable due to climate variability, the recognition and formal integration of environmental flows are essential to achieving sustainable and cooperative transboundary water management (AWBAFG10, 2024).

The average annual flow rate of 26 m³/sec was estimated to be sufficient for the 50, 000 – 100, 000 hectares agriculture land and about 200,000 grazeland in the Helmand delta in Iran territory (Wasefi & Rashid, 2012). Iran as an agrarian country keep expanding agriculture area in Sistan

region without considering climate change impacts on water resources and its proportional rights in the shared basin. Even Iran did not have water view foundation until 1968 (Amiraslani & Dragovich 2023) and reliant on a traditional water system for water delivery and distribution (Ettehad, 2016). In addition, water rights system in Iran was private based before 1968 where underground water resources were not part of the national water system scope (Islami & Rahimi, 2019). Therefore, environmental aspect was not part of water governance subject in the region to discuss it in the Treaty.

The Afghan side delayed the ratification of the 1973 Helmand River Treaty until June 1977, largely due to opposition from influential political factions within the Afghan government. Initially, the treaty was regarded as highly sensitive; its ratification was not publicized domestically, and following the 1978 political revolution, the new regime declared the treaty unrecognized (Wasefi & Rashid, 2012). This opposition stemmed from nationalist sentiments and a prevailing mindset among Afghan political groups and the public, emphasizing sovereign control over the country's natural resources often referred to as “Afghan precious water” for national development purposes (Wasefi & Rashid, 2012). At the time, critical concepts such as environmental flow, ecosystem protection, international water law, and IWRM principles were absent from the discourse on transboundary water governance and not institutionally embedded in the region’s water management frameworks.

Tensions escalated particularly in recent decades as the Hamun wetlands began to dry up, a situation exacerbated by the impacts of climate change. Iran’s strong reaction to the declining wetland conditions has become a focal point of bilateral water disputes. Moreover, some water experts have argued that the construction and expansion of the Chahnimeh reservoirs in Iran may have largely contributed to the degradation of the wetlands, adding another layer of complexity to the transboundary environmental concerns (WAAFG4, 2024; AWBAFG10, 2024).

Overall, water scarcity in the Helmand River basin has been significantly exacerbated by climate change, which has led to widespread environmental degradation. Simultaneously, rapid population growth and increasing food and water demands particularly in Iran’s Sistan region and the river delta have further intensified tensions over Helmand water allocation. The geographical positioning of the wetlands along the border, coupled with the complex hydrological system, adds to the challenges. Approximately 96% of Sistan’s surface water originates in Afghanistan, making the region highly vulnerable due to its near-total dependence on an upstream country (Thomas et al., 2016).

Under normal hydrological conditions, water flows from Afghanistan’s wetlands—specifically Puzak and Saberi—support the Iranian side of the ecosystem, maintaining wetland function and ecological balance. However, during dry years, river flow significantly declines, leading to sub-minimal water levels and the desiccation of many wetlands in Iran. The 1973 Helmand River Treaty outlines water allocation based on a “normal water year,” but it does not adequately account for variations in flow during drought periods. Typically, river discharge is particularly low from August to December, a period that coincides with heightened stress on wetlands and ecosystems. Consequently, the treaty does not provide a guaranteed or sufficient supply of water to sustain the wetlands in Iran, especially during times of environmental stress.

On the other hand, since 1980, Iran has been constructing *Chahnimah* (reservoir) to store more water in the delta intended to improve reliability of irrigation in the Sistan area (Thomas et al.,

2016) which is not a practical remedy to quench the thirst of Sistan people Fig 14. In 2006, Iran commenced construction of the fourth large *Chahnimah* with the total storage capacity of 819 Mm³ which is equal to Iran rights in the basin based on the 1973 treaty. The total storage capacity of four constructed *Chahnimah* estimated around 1,400 million m³ to satisfy Iran's water demand which is equal to the current storage capacity of Kajki and Arghandab reservoirs in Afghanistan.

These interconnected Chanimah direct water to be stored in a controlled artificial reservoirs adversely impacted water supply to wetlands (WAAFG4, July 2024). Despite of increasing storage capacity in the last decades by Iran the local people of Sistan continuously suffer from lack of water availability due to poor water delivery and inefficient irrigation infrastructure system including poor water resources management in the region (Ettehad, 2010). Lack of good water resources management and insufficient water delivery system in Iran constantly deteriorating wetlands, depression areas like Godzari, agriculture, and socioeconomic development in the basin. In addition, dry climate of Sistan delta with over 50°C temperatures in summer, sandy soil and strong wind cause high rate of evaporation from 3200 -5000 mm/year (Beek et al., 2008). Similarly, according to Thomas et al., (2016) water users and evaporation presented in table 8.

Table 8: Water usage and evaporation in the Sistan delta (Thomas et al., 2016).

Description of water user	Annual average water use Mm ³	Contribution as % of total
Agriculture area (120 000 hectare)	1 161	20%
Public water supply	34	1%
Hamun (wetlands) evaporation	4 378	74%
Chahnimah evaporation	124	2%
Outflow to Shelarud & Gaud-e-Zirreh	238	4%
Total surface water	5 935	100%

The Hamuns (wetlands) are the primary water consumers in the Helmand River basin, with evaporation losses accounting for approximately 74% of the total river flow (Thomas et al., 2016). This exceptionally high evaporation rate exceeds the environmental flow capacity of the Helmand River, making it extremely difficult to ensure a consistent and reliable water supply to sustain the wetlands in Iran's Sistan region. Although the wetlands are critical for supporting local livelihoods and biodiversity (Thomas et al., 2016), the volume of water required to maintain these ecosystems presents a significant challenge, particularly during periods of drought or low-flow years.

However, according to Iran the Chahnimah reservoirs, intended for wetland conservation, have shown minimal effectiveness in preserving the ecological integrity of the Hamuns. In addition, the utilization of Chahnimah water infrastructure to support the expansion of irrigated arable land from the existing 120,000 hectares to an additional 1,450,000 hectares has been criticized. According to model simulations and studies conducted by Beek et al. (2008), such large-scale agricultural expansion is neither advisable nor sustainable under current hydrological and climatic constraints, posing additional risks to the basin's fragile water balance.

The ecological and socioeconomic sustainability is very important for the people of Sistan which is fully depending on supply of water. Further expansion of agriculture area for socioeconomic development is limited due to inadequate capacity of natural system and lack of water supply. Prolong drought from 2000 – 2005, poor management of natural system particularly destroying reed field in Hamuns (wetlands) areas, overuse of natural resources, augmented cattle grazing

caused to collapse the natural system in Sistan and made it now complicated to restore the wetlands (Beek et al., 2008). This is even difficult by ensuring the environmental flow to regenerate the capacity of wetlands and natural system in Sistan area.



Figure 14: Four artificial reservoirs (Chahnimah) built by Iran in the Helmand Delta (Google Map, n.d.)

CHAPTER THREE

3 Data and Methodology

3.1 Introduction

This chapter outlines the methodology and analytical approach adopted for the research project. The introductory section (1.1) presents the research aim, key questions, problem statement, and the selected case study to provide a clear structure and direction for the study. In order to gain a deeper understanding of the problem and to explore its relevance to other transboundary basins, an extensive literature review has been conducted in Chapter 2. This review informed the development of a conceptual framework aimed at fostering collaboration over shared water resources. The feasibility and relevance of the proposed framework were discussed with stakeholders, including experts, officials, and actors from both Iran and Afghanistan, to incorporate diverse perspectives on transboundary water usage. The methodology Chapter 3 then details the research trajectory, outlining a step-by-step explanation of the analytical approach and methods employed throughout the study.

3.2 Choice of Case Study

The case study forms the core of the research design and analytical trajectory in this study. As defined by Gerring (2004), a case study constitutes an in-depth examination of a single unit with the intent of generating insights that can be generalized to a broader set of cases or replicated across a wider sector in this case, the water resources sector. The case study approach is particularly well-suited for addressing "what" questions and exploring complex dynamics in context-specific settings.

This research adopts the Helmand River basin as a representative and multifaceted case of a transboundary watercourse shared between Iran and Afghanistan. Despite the existence of a formal agreement the 1973 Helmand River Treaty the basin has remained a persistent source of tension, including armed clashes, especially in recent decades. The Helmand River holds significant geographic and hydrological importance, as it is one of the largest river basins in the region, covering approximately 40% of Afghanistan's territory (Thomas et al., 2016).

The rationale for selecting the Helmand River basin is grounded in the potential for broader applicability of the research findings. Insights derived from this case may offer valuable guidance for transboundary water governance in other contested basins, particularly for Afghanistan's interactions with neighbouring states. In this regard, the findings may be replicated to address disputes in the Harirod River basin Afghanistan's second major transboundary river shared with Iran and Turkmenistan where no formal treaty exist between the countries. Notably, beyond its traditional use for irrigation, Iran has recently begun utilizing the Harirod River for domestic and industrial purposes in Mashhad city (Thomas et al., 2016), further highlighting the basin's strategic importance.

The contextual conditions of the Helmand River basin are markedly distinct from Afghanistan's other three transboundary river basins. This distinction primarily stems from the fact that the Helmand is the only basin governed by a formal bilateral treaty between Afghanistan and Iran. Furthermore, the intensity and persistence of water-related disputes and conflicts in the Helmand basin are significantly higher compared to other transboundary basins in the region. Historically, both countries have demonstrated a long-standing demand for water infrastructure development within the basin. As early as ancient times, the Helmand basin was recognized for its fertile lands and was referred to as the breadbasket of Central Asia, underscoring its agronomic importance.

Numerous historical dams and canals were constructed in the basin. Notable among these were the Khosh Dam, built approximately 2,000 years ago; the Hawang Dam, dating back 1,400 to 1,700 years; and the Rustam Dam, constructed around 1,200 years ago. These early hydraulic structures were primarily located near the present site of the Kamal Khan Dam and were eventually destroyed during the invasion of Timur (Tamerlane) in the early 14th century (Sadat, 2012).

In the contemporary context, the impacts of climate change are profoundly affecting the Helmand River basin, particularly due to its agrarian character and the ecological sensitivity of its downstream delta, which includes critical wetland (Hamun) areas. The growing demand for water, especially for irrigation and domestic consumption, exacerbates the pressure on available resources, making cooperative transboundary water management increasingly urgent.

3.3 Research Approach and Strategy

This section explains the system of the research work, application of the procedure, and analysis of the case study in order to accomplish the overall objective of the given thesis topic. This research has been conducted qualitatively through a literature review, secondary and primary data through interview and discussion with experts and local officials. For the data collection different academic sources and websites e.g. Britannica ACADEMIC database library, Science Direct, Google Scholar, relevant books, UN-Water, and scientific literatures have been used to complete the research for the given topic.

In addition, a research strategy has been developed for finding effective source of information and data for this thesis in 4 main areas: Transboundary water disputes and conflicts, conceptual cooperation and collaboration frameworks, practical reports on conflict resolution, Afghanistan and Iran water policy and governance, case study-based examples from different river basins across the world, see Annex I.

3.3.1 Research Methodology

This research adopts a constructivist epistemology and a contingent ontology, grounded in a qualitative methodological approach, utilizing a single-case study design to facilitate an in-depth and context-specific analysis of the Helmand River Basin (Creswell, 2009). To bridge the domains of water policy and transboundary water cooperation, particularly in relation to treaty operationalization and implementation, the study applies the Multiple Streams Framework (MSF). MSF is recognized as a robust analytical tool for examining policymaking processes and agenda-setting in complex governance environments and is especially relevant for assessing water governance in Iran and Afghanistan within the framework of Integrated Transboundary Water Management (ITWM) (Hoefler, 2022).

The research draws upon a comprehensive review of academic literature, including peer-reviewed journals and books, as well as grey literature such as government policy documents, technical reports, and institutional studies. For primary data collection, semi-structured interviews were conducted with key stakeholders, including policymakers, practitioners, and water experts in Afghanistan. In addition to national actors, the study incorporates insights from international experts and researchers affiliated with universities, development organizations, and institutions, ensuring a broader and more diverse perspective on the challenges and opportunities in Helmand River transboundary water governance.

Similarly, content analysis of water policy documents in Iran including interview with Iranian experts and academics figures including Iranian diaspora abroad conducted. It involved interviews with key policymakers, experts, lawyers, academia, and government officials. The research and analysis work involved snowball sampling literature reviews, benefiting from the researcher's and water experts long-term research work and experience in Afghanistan, Iran and across the globe including other transboundary basins.

In addition, the literature review part included review of transboundary water cooperation good and bad practices with upstream and downstream counties in other five basins such as Columbia, Mekong, Nile, Indus, and Euphrates and Tigris Rivers. I have reviewed three excellent conceptual cooperation frameworks; i) Water Cooperation Quotient developed by SFG in 2015, ii) Potential Conflict to Cooperation Potential (PCCP) developed by UNESCO in 2013, and iii) Socio-hydrological Cooperation Framework developed by Wei et al. (2022). After in-depth analysis of all the key elements of these three frameworks, I developed Helmand River waters cooperation framework in consideration of trust building and international water law principles, see Fig.13 in Section 2.9.

3.3.2 Method of Data Collection and Analysis

For data collection, multiple methods have been applied. The process began with an in-depth review of relevant literature, including books, scientific articles, journals, government policy documents and reports, technical reports from UN agencies, and legal documents related to water law. Due to security concerns and the sensitive nature of the research theme, the original fieldwork plan was adjusted to online interaction and video calls. Primary data were collected qualitatively through online and video call interviews with Afghan and Iranian actors, experts, diaspora members, and international specialists. Interviewees were selected based on a review of their expertise, background, and roles or responsibilities, particularly focusing on former government officials in Afghanistan.

I conducted interviews with 13 experts and former officials from Afghanistan's Ministry of Energy and Water, including officers from River Basin Organizations (RBOs) and academia from Kabul and Polytechnic Universities. Engaging relevant authorities from Iran's Water Resources Ministry posed significant challenges, as multiple contact attempts went unanswered. However, I successfully interviewed 10 Iranian experts, and university professors including individual diasporas, climate activists, freelance researchers, and water specialists both within Iran and abroad. In section 3.8, table 9 states the interviewees number, professions and background, locations, and their position.

To understand the transboundary water management and cooperation context and look at the practicality of proposed Conceptual Framework in line with the IWL and IWRM principles, I have also interviewed 5 key non-Afghan and non-Iranian origin experts in this field. I developed a questionnaire (see Annex VII) to structure my interview and similar questions to everyone for better comparison of ideas and opinions. During the interviews, I took handwritten notes with consent of interviewee. Since Transboundary Water issue is politically sensitive therefor recording did not allow by interviewees. I scanned and stored all information (written scripts) in a secure folder on my laptop (if any), to which only I and my PhD supervisor(s) have access.

In addition, to the interviews, I used GIS mapping as remote sensing and hydrological data or general information from different sources (FAO and google map) to visualize past and current situation (e.g., main water infrastructure's locations and numbers in both countries, land use, wetlands situation, agricultural patterns) in the basin and delta reaches of the Helmand River. These types of data further helped me to understand the characteristics of environmental aspect and flow regime including water usage infrastructure within the basin to provide practical information from both countries and see which type of technical project shall motivate both countries to collaborate over.

Right after the interviews, I read carefully all the notes and transcripts and conducted some preliminary review and analysis including using both inductive and deductive coding system. Inductive coding helps to determine new themes that may be particular to Transboundary Water Management (TWM) are thus yet unknown in the TWM related literatures and deductive coding helps to look for topics that have been identified by the water dispute resolution and cooperation over shared watercourse literature as being important. Upon identifying themes and topics, I double checked the interview notes and transcripts to identify the forms in which these themes could reflect.

The initial stage of analysis involved an in-depth reading of interview transcripts and field notes, followed by systematic coding in accordance with the ethical and security considerations outlined earlier. This process allowed me to deepen my understanding and interpretation of the insights shared by interviewees, helping to extract key perspectives and themes from their narratives. I initially experimented with NVivo software for coding and thematic analysis to identify major and sub-themes emerging from the data. However, due to limitations in software accessibility, I conducted the analysis manually using Microsoft Excel spreadsheets to organize, categorize, and interpret the responses.

All stages of the research adhered strictly to the academic and ethical guidelines set forth by Selinus University. The findings of this study aim to provide a valuable knowledge base for policymakers and practitioners, particularly in Afghanistan and Iran, offering practical pathways for transforming long-standing disputes into active cooperation and collaboration for the operationalization and effective implementation of the 1973 Helmand River Treaty.

3.4 International Water Law Role in Cooperation Over Transboundary Water Resources

International Water Law (IWL) as a legal instrument developed over the second half of the 20th century and then its legitimacy increased in recent years (Litke & Rieu-Clarke, 2015). In 1966 Helsinki rules established to guide states on the non-navigational uses of transboundary watercourse. In 1992 Helsinki convention developed for sustainable use of transboundary watercourses in the UNECE region and later in 1977 UN Watercourses Convention adopted by the UN General Assembly and entered into force in 2014. This is the only universal treaty governing transboundary watercourses and provides governance framework (Litke & Rieu-Clarke, 2015). It helps states to communicate over their shared watercourses and avoid potential conflict and encourage cooperation for sustainable and integrated transboundary water resources management (Schmeier, 2024).

International water law has been playing an important role in preventing conflicts and fostering cooperation over transboundary water resources worldwide. Nevertheless, several driving factors such as climate change, unilateral development and national interest of individual states, population growth and economic competition have been causing challenges for applying international water law principles (Schmeier, 2024). This is because implementation of these principles such equitable and reasonable usage of water in the shared basin, no significant harm policy and ecosystem protection initiating new confrontations and disagreements between riparian states.

Therefore, it is important that international water law principles should be more adaptive to change and consider local and regional practices including expediency of riparian countries to ensure sustainable water management and long-term collaboration over shared water resources (Schmeier, 2024). Most of previously signed treaties did not consider environmental flow for ecosystem protection and most often water distribution was not equally⁴⁰ or fairly divided between upstream and downstream riparian countries. For example, environmental flow and wetlands water supply were not fully guaranteed in the 1973 treaty in normal or below normal water years. Obviously lack of cooperation over shared water resources ecosystem and environment can be negatively affected (Schmeier, 2024).

In the early stage the important focused issues of international water law were to govern the riparian states international relations over transboundary water resources and secondly guiding principle of international law was based on the concept of sovereignty. Recently it has been recognized that these two principles cannot only be resolved but even initiating confrontations and clashes between the countries over shared watercourses (Schmeier, 2024). The upstream countries argued that each country had full rights to water resources originate in its territory without constraint based on the concept of sovereignty. While the downstream countries claimed for getting instream water supply without squeezing the river flow into their territory (Schmeier, 2024).

This situation has been getting more complicated and difficult over time when each sovereign country tries to secure water for its food and economic development activities. The riparian

⁴⁰ Equally or equitable use of TW is not an absolute equal shares but it means fair shares on the context of ; i) cooperation that riparian states to negotiate, share data, and resolve disputes peacefully and ii) prevent harm that countries should not use water in a way that causes significant damage to others (UN Convention on the Law of the Non-Navigational Uses of International Watercourses, 1997)

countries water demand and consumption dramatically rises to meet the needs of their sovereign countries for food production and manufacturing. In the meanwhile, poor water governance, over exploitation of water resources and adverse impact of climate change put extra pressure on water resources and negatively affect environment and ecosystem which triggering confrontations between riparian states (Heijden & Stinson 2019).

However, the principle of reasonable and equitable use governs transboundary water resources as an international judicial practice. But disputes and disagreements over allocated water amount in the previously signed treaties or new allocations are a matter of question to see whether the proposed amount is reasonable and equitable, requires discussions to ensure all relevant factors are holistically considered by the riparian countries (Wouters, 2013 P. 117-118). In such cases dispute between riparian states is inevitable due to increasing demand for growing number of users and development that each country argues for.

Thus, disputes could be resolved through cooperation practice between the riparian countries usually in presence of agreement or treaty (Wouters, 2013). The best practice of dispute resolution and cooperation over Lake Lanoux waters between France and Spain was based on the existing treaty as discussed in section 2.3.2.2 under PCCP cooperation framework (Vinogradov et al., 2003). As discussed in the water cooperation quotient (SFG, 2015) in section 2.3.2.1 that agreement or treaty is the first important criteria to initiate cooperation between the riparian countries and this has been discussed in the proposed conceptual cooperation framework for the Helmand River basin. Since

Since mid-20 century environmental protection and no significant harm principles have been forming foundation of the international water law legal regime (Schmeier, 2024). In the recent decades, environmental law has become more important as fundamental part of water resources management. For stance, since 1970s the environmental matter received more focus such as Stockholm Conference and Declaration of the United Nations (UN) in 1972 was a major step forward in including environmental protection principle as an integral part of international water law (Schmeier, 2024). Then Stockholm Declaration item 21 stated that it is responsibility of each state to avoid significant harm to the environment while doing any activities within its territory. Later in 1992, environmental instruments further strengthened during the Rio Declaration on Environment and Development which became a crucial principle of international water law (Schmeier, 2024).

According to Salman (2007b) despite of these rules and principles there are still limited commitments by actors to the 1977 UN Water Convention regarding equitable and reasonable usage of water and no significant harm and ecosystem protection principles. In other word, the UN Convention is non-enforceable (Wouters, 2013 P. 19) and could not reduce pressure between the riparian countries over applying these principles as universal legal instrument. Upstream countries perceive them in favour of downstream countries while downstream countries keep criticizing the upstream countries for not considering the equitable and reasonable usage principles (Schmeier, 2024). The riparian countries disputes and disagreements only can be resolved through establishing of a cooperation framework in presence of criteria as discussed in the proposed cooperation framework and consideration of international water law.

Nowadays most of the countries try to prevail cooperations over confrontations though number of clashes and disputed incidents relatively increased compared to the decades before 2000 (TFDD,

n.d.). These less intensity conflicts have negative implication on political, socio-economic relations of riparian countries. Similarly institutional cooperation and establishing of river basin organization over a shared river basins has substantially slowed down since the last couple of decades except a few basins (TFDD, n.d.; Schmeier, 2024). But cooperation between riparian countries over transboundary water resources in the light of international water law principles is divided into two main attributes, i) to acknowledge that shared watercourses should be managed in an integrated and a holistic manner across the sectors and actors and ii) to allocate water resources in a balanced manner for different users to be equitable and reasonable without any significant harm and balance between human and environment and balance between current and future uses (Schmeier, 2024). For an integrated transboundary water resources management IWRM principles should be implemented. Where IWRM three pillars (equity, environmental sustainability and economic efficiency) as an adaptive approach of water management can further uphold execution of IWL (Ettehad, 2010). Thus, IWL and IWRM work simultaneously by integrating legal framework, principles, and cooperation mechanism to ensure effective and integrated and sustainable transboundary water resources management in the basin (IWRM AH, n.d.)

Therefore, the proposed cooperative framework for the Helmnad River basin in section 2.9 comprises of three main steps in the light of socio-hydrological framework and IWL principles enables countries to collaborate over shared watercourses. The 4 criteria of AWC in step 1 and 6 criteria in step 3 reflect IWRM⁴¹ principles and approach for brining different stakeholders and actors to work together and facilitate collaboration over shared watercourses and dispute resolution. In the transboundary river basin, IWRM process required getting involved policymakers and actors should establish close coordination for different sectors at different levels (Ettehad, 2010).

Since water particularly transboundary water is a politicized natural resource (Elhance, 2000) thus IWRM policies required engagement of high political officials to prepare a road map for the key players to get involved from riparian states for decision-making and cooperation process. That is why in the first step of framework, ministerial meeting is one of essential criteria for ensuring cooperation over water. In the third step, high political commitment criteria are recommended for further fostering the collaboration between riparian states. At the local and basin levels technical project criteria as states in step 1 pave the ground for application of IWRM principles and get the countries closer for active cooperation over basin wide water infrastructure management and development projects.

It obviously climate change and national interest factors negatively affect the balance approaches that countries may follow due to hydrological and river flow change perspective. But the international water law principles and IWRM policies and practices can be resilient to help riparian countries to cooperate with each other and adapt climate change and development challenges. The proposed conceptual cooperative framework as an inclusive tool covers all discussed principles, practices and perspectives and can be an effective tool for successfully implementation of the 1973 treaty. The most important issue is actors' commitment to multilateral approaches, building trust and willingness discussed in the second step of the conceptual framework to actively cooperate for effective implementation of treaty and reasonable, fair, sustainable, and integrated cross-sectors

⁴¹ IWRM is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic social and welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP, 2000).

sharing of transboundary water resources will settle both countries disagreements and disputes over Helmand/Hirmand waters (Schmeier, 2024).

3.5 Research Ethics

As a PhD candidate at Selinus University in Italy, I adhere to the university's ethical guidelines for qualitative research. This includes strict compliance with protocols for obtaining informed consent prior to interviews or distributing questionnaires. The study ensures confidentiality, anonymity, and accurate coding of participant responses. All references are properly cited using numbered format, including full details such as authors' names, article titles, journals, and publishers. The ethical policy of Selinus University emphasizes the responsible handling of primary data collected through human research, ensuring it is used solely for academic and scientific purposes.

I introduced myself to each interviewees conducting physically or virtually to create a trustful environment and codify the interview and information provided during the interview. In addition, I also presented an official letter from Selinus University to interviewees to make sure them information they provide, will be used exclusively for scientific purposes, and is treated with strict confidentiality. This means that anything they said during the interview and any comments they made, will not be linked to their names. I requested permission to record the interview (recording will be optional to the interviewee permission) but due to sensitivity majority did not allow it. The interview scripts filed in a secure platform and will only share with my professor and mentor if needed to ensure that interviewees views presented accurately.

A pre-identified list of interviewees was developed to ensure a diverse and representative sample of perspectives. The selection included former Afghan government officials (both inside and outside Afghanistan), academics, representatives from relevant NGOs, members of the Afghan diaspora, as well as non-Afghan and Iranian-origin experts in transboundary water governance. Due to the research design and ethical considerations, officials from the current *de facto*⁴² (unrecognized) government of Afghanistan were excluded from the interview process. Virtual interviews were conducted with Iranian experts and academics, including members of the Iranian diaspora; however, access to current Iranian government officials posed a significant challenge and remained a limitation in the data collection phase.

3.6 Research Timelines

Year 1:	Literature review, conceptual cooperative framework, policy research, draft methodology, finale methods, ethics approval.
Year 2:	Data collection (12 weeks online interviews with Afghan and Iranian experts and academia), policy analysis, data analysis, and findings.
Year 3:	Final thesis with recommendations, and conclusion for review committee

⁴² "Interviewing *de facto* government officials for PhD research can be challenging due to several reasons: Theory-Practice Divide: Government officials often emphasize the theory-practice divide. They may doubt that academics fully grasp policy-related aspects of a problem or fail to understand the "political sensitivity of the moment. Self-Image Promotion: Officials tend to promote the self-image of central actors in an issue, and ear of Misrepresentation: Government and intergovernmental organization (IGO) representatives worry that their statements could be distorted or misused, affecting their "evaluative meaning" or "truth value" in academic research" (Wu & Savić, 2010, P N.A).

3.7 Research Limitations

Since this study is based on qualitative research and literature review so finding of right information and data was a challenge even by using different key words. It is also time-consuming process to review plenty of articles to pursue right information and conceptions. It is difficult to investigate connection or establish causal relationships between variables and the analysis process extremely difficult to make it in line with the context.

On one hand technological limitation was a major challenge. For instance, using NVivo software has a complex interface with many features, and it is relatively expensive especially for individuals with limited budget. It was challenging to be installed in the company computer. It was resource-heavy and caused lag computer during the process. The software real-time collaboration was limited, and it was required to use NVivo collaboration cloud which required additional cost. Alternatively, I used Excell spreadsheet for summarizing and analysing of interview responses which was really time consuming.

3.8 Questionnaire Revision

The interview sessions commenced in early July 2024 to evaluate how interviewees responded to the research questions. Although the interviews were generally successful, the initial set of 25 questions proved excessive, as participants often became fatigued. After conducting 5-6 interviews, I reviewed the process and reduced the number of questions to 10, eliminating redundancies. This reduction did not compromise the quality of data collection, or the diversity of perspectives gathered. On the contrary, it enhanced the interview process, quality and providing interviewees with more time to articulate their thoughts without exhaustion. The interviewees, comprising individuals from both countries and external participants, are categorized in Table 9.

Table 9: Interviewees professional background and location

No. of Interviewees	Professional background	Position	Location
2	Government official	Former Minister	Kabul, Afghanistan
2	Government official	Former D. Minister	Kabul, Afghanistan
3	Academia	University Professor	Kabul, Afghanistan
			Tehran, Iran & Texas, USA
1	Climate change	Specialist	Kabul, Paris, France
1	Irrigation/water resources	Specialist	Manila, Philippine
			Delhi, India
1	Environmental	Specialist	Dhaka, Bangladesh
8	TWM/Water Resources	Iran Experts	Tehran, Iran
			Canberra, Australia
			London, UK
9	TWM/Water Resources	Afghan Experts	Kabul, Afghanistan
			DC, USA & Germany
			Toronto, Canada
Total 27			

CHAPTER FOUR

4 Contents and Results

4.1 Introduction

This chapter discusses contents and results of research project. The focus of this chapter comprises of geopolitical and environmental context, legal and institutional framework, challenges and opportunities, findings, main source of disputes, comparative analysis, future prospect, and conclusion including interviews results. The contents and results chapter provides a comprehensive analysis of the cooperation mechanism over the Helmand River waters between Iran and Afghanistan, offering valuable insights and recommendations for future collaboration. Water should be used for a peaceful and sustainable future. The interview results have analysed through the Nvivo software excel spreadsheet and result has been discussed in the relevant sections of this chapter with full reflection responses in chapter six.

Since 1973, Helmand River basin has been the only single basin of Afghanistan which has a formal bilateral treaty with its neighbouring country Iran. Helmand river basin is the largest basin in Afghanistan in terms of area size. The basin average annual flow is estimated 9.30 BCM which shared with Iran and a small portion with Pakistan. The Helmand River has provided irrigation water for agriculture over 5000 years and played an important role in sustaining the natural life and livelihood of the local people (Shirani & Afshari 2020). The Helmand River is the longest river in Afghanistan which supplies water for agriculture and domestic use for millions of people in both countries. Helmand river feeds three wetlands (Hamuns) which lies down around the border areas between Iran and Afghanistan.

The current hydraulic infrastructures, water storage and hydropower dams and irrigation schemes (HAVA) in the Helmand basin holds significant economic and ecological importance for Afghanistan. Similarly, Hamuns wetlands and artificial reservoirs for irrigation such as Chahnimah in the delta of the river are equally essential for the domestic and agriculture water needs of the Sistan people in Iran. Though construction of Chahnimah by Iran, has caused degradation of wetlands according to the water experts (WAAFG4, July 2024; FHMAFG8, September 2024). This region is arid and water scarce, and the Helmand River is a critical source of water supply for drinking, agriculture, and domestic needs.

From a regional stability perspective, access to water from the Helmand River is a critical factor. Disputes over water rights and usage have the potential to escalate tensions between Afghanistan and Iran, highlighting the geopolitical significance of effective management and equitable sharing of this vital resource. Historical disputes between Iran and Afghanistan over the allocation and usage of the Helmand River's water have long strained relations between the two countries. The 1973 Helmand River Water Treaty represented a significant effort to resolve these conflicts by establishing water-sharing agreements and promoting cooperation in water distribution. However, tensions have persisted, particularly during periods of drought, even after the treaty was signed.

Climate change has been further exacerbated water scarcity issues in the region, making the river even more critical as a shared resource. This has underscored the critical importance of the Helmand River as a shared resource. Reduced water flow and increased demand have heightened the need for cooperative management between the two countries. In summary, the Helmand River is a lifeline for both Afghanistan and Iran, essential for their agriculture, water supply, electricity production, domestic use and livelihood including overall regional stability. The effective, integrated, and reasonable water resource management of this transboundary basin remains a critical issue for both nations.

The main objective of this study is to explore the root causes of everlasting disputes between Iran and Afghanistan over the Helmand River waters despite of 1973 treaty and propose a conceptual framework for active cooperation for full functioning and effective implementation of treaty to understand how TWM serves induce economic, social, and political collaboration between the riparian states. In the 19th century, there was an attempt by British to engaged in water right issue and mediate the dispute between both countries. For instance, The Goldsmid Arbitration of 1872 attempted to delineate the water-sharing arrangements between Iran and Afghanistan but remained inconclusive. There were some intermittent negotiations during early to mid-20th century. For example, in 1938 Turkish involvement to settle water sharing dispute as third party and the agreement stated that Afghanistan should not hamper water flow down to Iran and equally share the river flow below the Kamal Khan dam (Abidi, 1977).

In 1951, the USA intervened to address the water-sharing conflict between Afghanistan and Iran by establishing the Helmand River Delta Commission. The commission proposed solutions and facilitated the signing of an agreement; however, the terms were not fully implemented. After years of prolonged negotiations, the efforts culminated in the most significant formal agreement to date the 1973 Helmand River Treaty, which sought to define and regulate water-sharing arrangements between the two nations. Despite the signed treaty, disputes between both countries have been persisted inclusive several armed clashes.

Afghanistan has sometimes struggled to meet and release the agreed flow down to Iran due to different types of droughts⁴³, domestic water needs and infrastructure issues. Low river flows and recurring droughts have caused significant water scarcity for downstream communities in the Sistan region, leading to widespread hardship. These conditions often fuel suspicions among downstream residents that Afghanistan is intentionally restricting the river's flow. Such perceptions have been a primary source of water-related disputes, occasionally escalating into violent confrontations. A notable example occurred in May 2023, when tensions over water access resulted in an armed clash at the border. This incident led to three fatalities, multiple injuries, and substantial damage on both sides (Al Jazeera, 27 May 2023).

In connection with the water rights issue and the recent incident, Iran's late President Raisi strongly asserted Iran's water rights to the Taliban. Over the past three decades, drought has been a significant challenge in the region, affecting local populations in both countries. Following a recent clash, the Taliban's Acting Foreign Minister, Amir Khan Muttaqi, met with Iran's envoy to Afghanistan on 27 May 2023 to discuss the Helmand waters issue (Aljazeera, 2023). The Taliban

⁴³ FAO (2019) defined the types of droughts such Meteorological drought (deviation from average rainfall/snowfall), Hydrological drought (deviation from the average level of surface and groundwater), Agriculture drought (deviation in vegetation health and crop produce) and Socio-economical drought which is induced by a combination of meteorological, agricultural, and hydrological drought).

officials have continued diplomatic discussions and bilateral talks to resolve ongoing disputes and reduce the concerns of Iranian people and officials.

According to TOLONews on February 29, 2024, Muttaqi stated that the water issue was a theme of our discussion with Iranian officials. As part of these discussions, community elders from the Sistan region were invited to visit upstream areas of the Helmand River, extending as far as Dehrawud⁴⁴. The local people of Iran's Sistan region acknowledged that the primary challenge lies in climate change, droughts, and the alteration of the river flow regime in the upstream areas. The Taliban officials reiterated their commitment to the 1973 treaty and emphasized their respect for all its provisions, assuring that they have not forgotten their neighbouring country's rights. However, they stressed that the main problem is drought and climate change. On May 22, 2023, the Taliban's Deputy Prime Minister, Mullah Abdul Ghani Baradar, stated, "The pain of the people of Sistan-Baluchistan is our pain," but also noted that Afghanistan is equally suffering from a water shortage (Scollon, 2023).

4.2 Geopolitical and Environmental Context

The Helmand River basin is a critical area of concern for both Afghanistan and Iran due to its importance for agriculture water supply, and ecology including domestic use. Geopolitical tensions over water rights, paired with environmental challenges like climate change and degradation of wetlands, complicate the management of this vital resource. The dubious political relationship between Afghanistan and Iran influences water sharing. Political instability in Afghanistan was a good opportunity for Iran to influence and secure its water interests (FAZAFG3 & WAAFG4, July 2024). Over time bilateral talks and negotiations continue intermittently, reflecting the broader geopolitical relationship between the two countries. Helmand river 1973 treaty is result of historical negotiations and political relations between both countries and international community engagement. Political tensions and upheaval in Afghanistan for the last four decades has negatively impacted diplomatic relations of both countries and effective implementation of the signed treaty.

In general, political relations of both countries have been inconsistent over the time with different political parties particularly in the recent couple of decades. For instance, in 2001 Iran took side of the United States against the Taliban to stopple the previous regime of Taliban (Mayar & Shapour, 2023). This could be as a revenge from the Taliban when they were at the verge of armed conflict with Iran in 1997 over the deaths of eight Iranian diplomats in Mazar city (Siddique & Radio Azadi, January 2022).

Then during the presence of United States in Afghanistan as Western-backed Afghan government, Iran chosen to have a competitive mode against the Afghan government with some differences and confrontations mainly over water infrastructure development. There were many claims that Iran developed a strong tie with the Taliban and militant groups (Majidyar, 2018; Siddique & Radio Azadi, January 2022) against the republic government of Afghanistan for the purpose of disturbing water infrastructure development in the Helmand and Harirud basins. For instance, in 2011 one of the Taliban battler commanders reported that Iran offered him USD 50, 000 to blow up the Kamal Khan dam (Glinski, 2020).

⁴⁴ Dehrawod is an area just upstream of the Kajaki hydropower dam reservoir where hydrometric station is located for measuring the Helmand River flow and a place where specifies the hydrological year for proportional releasing of water to Iran.

In contrast when Taliban took the power on 15 August 2021, they started to practice hydro-hegemonic approach as an upstream country claiming that they should harness and manage their domestic waters without considering transboundary hydro-politics. But in the same time Taliban leaders try to maintain their ties and political relations with neighbouring countries. According to Siddique & Radia Azadi (2022), Taliban released water from the Kamal Khan reservoir to show their cooperation to Iran officials, but the Taliban Water and Energy Ministry refused releasing of water from the Kamal Khan dam. The denial might have some social perspective because many Afghans criticized Taliban for releasing of water to Iran. In summer 2022 signs of disputes initiated again between Tehran and Kabul despite of their close diplomatic tie, Iran Foreign Minister⁴⁵ warned Kabul over a telephonic conversation for an immediate solution and removing of artificial obstacles from the riverbed (Mayar & Shapour, 2023).

Previously, on 24 March 2021 President Ghani, during the inauguration of Kamal Khan dam emphasized on effective implementation of 1973 treaty with Iran and pointed out that “Afghanistan would no longer give away free water to anyone and Iran should provide fuel to Afghans in return of water” (Askari & Bashardost, 2021). President Ghani also added that “the economy of Iran and Afghanistan is supplementary to each other, and they are not opposing each other” (Askari & Bashardost, 2021).

Thus, the result of political inconsistency over the time between Iran Afghanistan reveals that authorities have not been trusting each other to cooperate over the shared water resources to effectively implement 1973 Treaty. Whereas effective cooperation and sustainable water resources management practices are essential to address these issues and ensure the long-term viability of the Helmand River basin for both nations, environment, and ecosystem protection.

On other hand environmental degradation is another major concern while Iran as downstream country continuously argues for its rights and allegedly claim that one of the largest wetlands (Hamoun) is substantially dried up due to squeezing of water flow by Afghanistan. Though Taliban officials consistently have been denying squeezing water supply to their neighbouring countries and strictly respect the substances of 1973 treaty (Scollon, 2023). Iran and Pakistan⁴⁶ accused Afghanistan that water infrastructure projects will cause humanitarian turmoil in the region. In general, from one hand water scarcity becomes exacerbated due to climate change which caused degradation of environment and from other hand population growth and increasing food and water demand in Sistan region mainly in the river delta areas further stimulus disputes over Helmand waters.

Meanwhile, geographical location of wetlands along the border and hydrological system of these wetlands are very complex that 96% of surface water in Sistan originate in Afghanistan (Thomas et al., 2016). This is a high risk of wetland vulnerability while fully dependable to upstream country instream flow. During the normal water year, the flow of water from the Afghanistan’s wetlands (Puzak and Saberi) continues to supply water to all other wetlands located in Iran but in the dry

⁴⁵ Iran’s MoFA press 29 July 2022: “Providing Iran with its water share is an important index for assessing the caretaker Afghan government’s adherence to its international commitments to Iran,” the foreign minister said. He added, if the issue of Iran’s share of Helmand River’s water is not resolved swiftly and seriously, it will negatively impact other areas of cooperation between the two countries,” the foreign minister said (Mayar & Shapour, 2023). According to ToloNews Iran special envoy confirmed release of water by Taliban <https://tolonews.com/afghanistan-179303>

⁴⁶ Since Helmand River basin located only 2% in Pakistan territory therefore Pakistan is not part of the 1973 treaty.

years, river flow doesn't reach to wetlands and most of them remain dry mostly in Iran side. The flow and distribution of water in the river has been indicated in the 1973 treaty based on the normal water year and usually river has low flow from August to December where wetlands and ecosystem negatively get affected. Thus, supply of water to the wetlands in Iran was not fully guaranteed in the 1973 treaty.

Article V of the treaty stated that Iran has no right to claim for excess water more than allocated amount specified in the treaty even in case of additional water available in the riverbed. Many experts mainly Iranians believe that this is one of the toughest conditions that both countries agreed upon and has a negative impact on the ecosystem and environment. But if we look at the real live down in the delta area during the wet years, sufficient water flows down to the delta areas since Afghanistan does not have water harnessing and storage capacity to control excess water. However, in the dry years not only lower reaches and delta area suffer but even upstream reaches equally suffer from the water shortage. One of experts during the interview said, situation would be further tensed and problematic in next 20-30 years' time when the Hindukush maintain lost glacier and Helmand River flow gets diminished (VCE1, July 2024). Climate change and global warming put environment in danger.

A sustainable TWM is essential which can contribute important role in protection of environment and ecosystem. Afghanistan should avoid water pollution. Afghanistan and Iran water infrastructure design should be based on environmental impact assessment to avoid environmental impairment in the basin. Both countries actors should analysis the impact of water reduction downstream to protect the environment (VCE1, July 2024). It is important to consider a fundamental environmental study of delta areas (Hamuns) and first action should be to diminish the Chahnimah constructed by Iran because Hamuns are badly impacted by them (WAAFG4, July 2024).

Similarly, Godzari and Hamun should be equally treated and restored for ecosystem and marsh land protection. Iranian water expert said, we expect to quench thirst of Sistan people and avoid further degradation of Hamuns but the current authority of Afghanistan released about 5 billion m³ water in two turns to Godzari, the expert added that satellite images are a clear evidence (BNMIRN2, August 2024) whereas Afghan side refused this claim. The Acting Minister of Water and Power of the Taliban government also called the transfer of water from the Kamal Khan dam to the Godzare desert against the interests of Afghanistan and Iran (BBC, 26 July 2024). Thus, a balanced approach should be applied when Iran emphasizes on wetlands restoration and protection, the same approach should apply for Godzari restoration in Afghanistan (WAAFG2, July 2024).

4.3 Current Water Sharing Agreements

Helmand 1973 treaty aimed to regulate distribution of water resources from the Helmand River basin which originates in Afghanistan and flows down to Iran. Helmand basin accommodated 7 million inhabitants (Adelphi, n.d.)⁴⁷ of which 6.5 million lives in Afghanistan and 0,5 million lives around the river delta located in Iran (Aquapedia, n.d.). Since more than 6000 years, the Helmand

⁴⁷ Climate diplomacy – Adelphi website from Germany Foreign Federal Office [Transboundary Water Disputes between Afghanistan and Iran | Climate-Diplomacy](#)

River is a vital source of water for both countries' farmers for irrigated agriculture to secure their food and livelihood and equally important for the domestic use of people in Sistan (Adelphi, n.d.; Loodin et al., 2023). The Helmand River basin including the Sistan territory have been source of contentious since late 1800s (Hearns, 2015).

The dispute started between Iran and Afghanistan from time territorial border demarcation by Fredric Goldsmid along the Helmand basin in 1872 (Loodin et al., 2023). The several attempts undertook to resolve the causes of controversy over water allocation with involving the Britain early 1900s and then Turkey in 1938. In the start of emergent breach between Iran's royal family and the nationalists, the US took this as an opportunity to step in the toes of Britain and continued to mediate the water disputes resolution between Iran and Afghanistan (Abidi, 1977). Then US initiated three-person⁴⁸ commission in Washington in 1948 and after three years negotiation, US developed a recommendation for temporary arrangement on 28 February 1951 that Iran shall receive 22 m³/sec in the "normal water year" (Treaty, 1973; Abidi, 1977; Hearns, 2015; Aman, 2016).

Though Iran was not happy with the Helmand Delta Commission report and insisted to claim for more share whereas Afghanistan accepted the report (Abidi, 1977; Aman, 2016). In 1953 the countries relation became even tense over the water when both countries perceptibly parted because of their foreign policies (Abidi, 1977). Then US suggested to call a meeting for finding a common ground between both countries, which two consecutive meetings held in Washington in 1956 and 1957 (Abidi, 1977).

Over time both countries hesitantly followed US Helmand River Delta Commission recommendation (22 m³/sec)⁴⁹ over water distribution until a severe drought occurred in 1971 which augmented both countries dispute over Helmand waters. This situation was a good experience for negotiating parties to realize the hydrological uncertainties in the basin and added the terms "normal water year" for water allocation. When agreement signed off later in 1973 by both countries, Afghanistan offered 4 m³/sec additional flow for goodwill to Iran. In return Iran granted Bandar Abbas port for Afghanistan free of charge for trading purpose. These two major conditions formed the basis for the 1973 treaty and both countries ratified the treaty. Iran ratified it immediately in July 1973 and Afghanistan ratified it four years later in June 1977 (Loodin et al., 2023). Despite of this internationally recognized treaty both countries has been experiencing disputes and clashes over water due to lack of active cooperation and effective implementation of the signed treaty.

Political upheavals and institutional changes during almost a half century have been caused loss of social, institutional, and political trusts between both countries. Despite of an immense socioeconomic dependency politicians, actors and even civilians from both countries have not been practicing a good neighbourhood behaviour. Both countries governments and nations looking to

⁴⁸ The commission's recommendations were advisory and helped lay the groundwork for future negotiations. However, its efforts did not immediately resolve the dispute, leading to prolonged negotiations that eventually culminated in the 1973 Helmand River Water Treaty. Commission had three main objectives: to investigate historical and current usage of water, study of irrigation systems and recommend technical solutions for water sharing ([Ranjan, 2023](#)).

⁴⁹ According to the Helmand Delta Commission findings, Iran's water share from the Helmand River has been calculated at 22 m³/second in a normal water year (Helmand River Delta Commission Report, 1951, p95). Iran's total annual right is 820 Mm³ (Treaty, 1973; Thomas, 2016; Loodin et al., 2023).

each other in a criticism and grievance eye. The current social relation of both nations is not like how it was during the kingdom. The grievance and criticism in Sistan amplified with adverse impact of climate change and population growth associated with increasing demands for water and food availability. An Afghan expert said that climate change caused drying out majority of the Helmand River tributaries which has resulted further squeezing the river flow (BRAAFG2, July 2024). While the article IV of the treaty stated that Iran rights could be adjusted according to the instream flow. This means Afghanistan shall not be criticised by the Sistan people while there is no sufficient flow in the riverbed since water flow doesn't reach to lower reach (BRAAFG2, July 2024).

In last four decades, Afghanistan database shows Iran has received water 3 times more than its rights while Iranian calculation shows they have received water 5 times more than their rights (BRAAFG2, July 2024). In addition, Iran has been building artificial storages, canals, and dams in competition with Afghanistan without a clear strategy for an efficient and sustainable water delivery system. According to Hoominfar and Radel (2020) Iran has built about 1300 hydraulic infrastructures including small and large size dams throughout the country. Iran's dam development process has been criticized by Iranian scholars from environmental and economic point of views which has been stated in section 2.7 of the Thesis.

Many other scholars claim that damming activity has caused several socio-environmental concerns in Iran (Hoominfar and Radel, 2020); Loodin et al., 2023). Only in the Helmand delta, Iran has built 4 reservoirs (Chahnimah) with the capacity of 1,400 Mm³ and high rate of evaporation (124 Mm³). According to Thomas et al., (2016) capacity of these Chahnimah is two times more than Iran rights in the Helmand basin. An Afghan water expert said during the interviewee that according to their technical studies, construction of Chahnimah caused to dry up wetlands (WAAFG4, July 2024). On the other hand, dry climate of Sistan delta with over 50°C temperatures in summer, sandy soil and strong wind cause high rate of evaporation from 3200 -5000 mm/year (Beek et al., 2008). The Hamuns (wetlands) are the main water user with high rate of evaporation (4 378 Mm³) which is equal to 74% of the total Helmand River flow (Thomas et al., 2016). These are root causes of continual and persistent disputes that both countries could not realize, never trust, and nor cooperate with each other.

Lack of trust and trend of unilateral development and competition further hampered effective implementation of 1973 treaty (WAAFG4, July 2024). Both countries are thirst of dams and water infrastructure development rather than to cooperate over implementation of signed treaty and sustainable management of shared water resources. During the interview with an international expert, she added unreasonable water usage causes problem between both countries (VCE1, July 2024). Afghanistan water infrastructure planning and development has made its neighbour worried however "in my view Afghanistan complies regarding water release to Iran", but Iran insecurity and instability specially in Sistan region is a crucial issue which gets compounded by drought and climate change (VCE1, July 2024). It is obvious that security and development concepts are interrelated in current century (Swain, 2024).

The interviewee added that I do not see any major intervention by Afghanistan now to threatening Iran on Helmand waters however I am worried in 20-30 years' time when the Hindukush maintain lost its glacier and river flow gets diminished (VCE1, July 2024). As matter of fact both nations should understand the reality on the ground and analysis different factors such as climate changes impact, population growth and continuous increasing water demand including their unilateral

development while discussing shared waters distribution in the Helmand basin in light of signed treaty as a legal script. For improving regional socio-economic aspects building trust and having an effective mode of cooperation are essential to avoid potential conflict.

In addition, the interviewee has added that both countries should settle water dispute in a sustainable manner otherwise from social point of view, water dispute puts security of the border community and rural people in danger. It is also impacting water scarcity because upstream may control water in case of disputing and use water as much as wants then livelihood of downstream people will be negatively impacted. This will also cause reduction of livestock and agriculture which resulting lack of job opportunity and push rural people for migration and displacement (VCE1, July 2024; AKQAFG1, July 2024). The disputed situation not in benefit of any countries rather than induce social, economic, and political chaos. Therefore, effective implementation of current signed treaty is essential to be used as base for distribution of water and establish active cooperation framework for sustainable transboundary water management in the Helmand basin.

In recent years since 2019 both countries have been tried to nominate their commissioners first at the Directors level and couple of years back escalated to the Deputy Ministers level (BRAAFG2, July 2024). However, commission is not active, and demand based just discuss water issues when Iran suggests or raise any concern (WAAFG4, July 2024). They do not have a regular agenda and plan for governing and implementation of the treaty provisions. The same interviewee said, Ministerial meetings also take place in case of need. He added that a few times river flow data have been also shared (BRAAFG2, July 2024). While other interviewee from the Ministry of Energy and Water said unreliable data was shared between both countries due to lack of trust (WAAFG4, July 2024). When I discussed these new developments with other Afghan expert from University of Kabul, he said, these are just concerns and issues get raised by Iran, not for the treaty effectively implementation and use of treaty provisions which has stated in the 1973 treaty (AKQAFG1, July 2024).

4.4 Water Management Challenges and Stakeholders Analysis

The conflict between Afghanistan and Iran has historically been tied to their international border dispute, but over time, the focus has shifted to contentions over the Helmand River's water resources. Attempts to resolve the water conflict have taken place in 1872, 1905, 1938, 1950, and 1973, often triggered by recurring droughts within the basin. The current conflict follows this pattern, with tensions escalating after a severe drought between 1999 and 2009 (Houk 2011; Dehgan et al. 2014). While drought has exacerbated the dispute over shared water resources, other factors beyond the typical climatic and hydrological variability in the basin are also contributing to the conflict.

Following the withdrawal of USA and foreign troops from Afghanistan, the Afghan authorities have shifted their focus to stabilization and reconstruction efforts. These initiatives are primarily centred on developing agricultural and water-related projects, particularly in the middle and lower reaches of the Helmand River, which involve water withdrawal, diversion, and storage (Dehgan et al. 2014). These planned developments align with the projected population growth, which will increase demand for domestic water supplies, business expansion, agriculture, and food production further triggering the disputes over shared watercourses.

Agriculture sector is the main user of surface and underground water in Iran and Afghanistan. From 1961 to 2001 agriculture water use in Iran increased from 44 billion m³ to 80 billion m³ and reached to 86,5 billion m³ until 2011 (Moridi, 2017). The second major water user is Hamuns (wetlands) with high rate of evaporation (4 378 Mm³/annually) which is equal to 74% of the total Helmand River flow (Beek et al., 2008; Thomas et al., 2016). In recent years most of the tributaries are completely dried which adversely impacting the main river flow (BRAAFG2, July 2024) and resulting water stress in the basin. Lack of coordination between institutions, ministries, overlapping responsibilities between government entities further worsening water management in the basin (VCE1, July 2024). Inadequate institutional for good water governance, contributing to unregulated and unsustainable consumption.

At the state, regional, and local levels, governments on individual basis are focused on ensuring a steady water supply to communities in the Sistan Delta and the lower and middle reaches of the Helmand Basin. From Afghanistan's perspective, Iran's opposition to Afghan water projects may be seen as an attempt to curtail their growth and development potential. On the other hand, Iran's position is that more water is needed to meet the domestic and agricultural demands of the Sistan Delta's population, as well as to sustain the Hamoun ecosystem. However, Sistan area is not economically important for Iran, but main objective of Iran is security stability (MRJIRN5; SGRIRN4, August 2024). Iran views Afghanistan's development efforts as a threat to local livelihoods and agricultural production in Sistan, with potential repercussions for the country. While most water in the basin is currently used for agriculture, future infrastructure projects aimed at expanding irrigation and supporting economic growth present both risks and opportunities for water users within the basin.

Drought, political dynamics, rising water demand, and climate change have all diminished the water flow into the Hamoun ecosystem. The Iranian government, local authorities, communities, and environmental groups are advocating for increased water flow to sustain the ecosystem, not only to preserve the wildlife and habitat but also to support the people whose livelihoods depend on the delta. The degradation of the ecosystem is attributed to multiple factors, and there is ongoing conflict over which factors are primarily responsible.

The institutional frameworks in both Iran and Afghanistan are highly centralized, which hampers the autonomy of different sectors and line ministries (Yousefian et al., 2022; Ahmadzai, 2021; Moridi, 2017). In both countries, power is concentrated in the hands of the Head of Government, which significantly influences the ability of line ministries and authorized departments to make timely and effective decisions regarding water resources governance (Ahmadzai, 2021; Moridi, 2017). Effective water resources management requires an integrated and holistic approach, which is best achieved through decentralized and participatory processes. Integrated Water Resources Management (IWRM) advocates for the equitable and sustainable integration of water, land, and other related resources. IWRM required solid political commitment at all levels (Ahmadzai, 2021). However, in Afghanistan, water and land continue to be managed as separate sectors due to the country's institutional setup (VCEI, July 2024).

Over the past decade, Afghanistan previous government established the Supreme Council of Water (SCoW), with representation from eight sectoral ministries and national institutions, to serve as the national entity for coordination and policy formulation in water governance. Additionally, the High Council of Land and Water (HCLW) was formed as a coordination body led by the President's office. However, the HCLW has not been effective in pragmatically integrating land

and water management at the national level. At the community level, line ministries initiated the creation of Water User Associations (WUAs) and Irrigation Associations (IAs), particularly in the Panj Amu, Northern, Kabul, and Harirod-Murghab river basins. However, the number of these associations was insufficient, and their establishment was not often feasible in the Helmand basin due to ongoing security challenges.

At the basin level, River-basin Authorities (RAs) were established, but their activities in the Helmand basin were also limited due to security concerns. These local institutional setups faced significant challenges to be part of water governance due to lack of central government political commitment for decentralization of water governance in the country (Ahmadzai, 2021). The SCoW and HCLW, being highly politicized and led by the President or Vice President, often interfered with the responsibilities of line ministries. This centralization of power created an additional layer of authority between the line ministries and the President's office, impacting the effectiveness and neutrality of sectoral ministries.

However, under the current Taliban-led government, the situation is uncertain. Many administrative structures, including those related to water management, have experienced disruptions, and the continuity of the river-basin Authority's operations in the Helmand basin is unclear. The level of functionality and effectiveness of the RA under the new government likely depends on the broader political and administrative stability in the region.

Similarly, the Iranian government exhibits a high degree of centralization in water governance, which has often led to inefficiencies and undermined the autonomy of line ministries, resulting in poor coordination among them. The Ministry of Energy is the primary authority responsible for national and transboundary water management, but it has been criticized for its poor management practices and significant engineering mistakes⁵⁰ (Madani, 2021). Iran's water issues largely originate from flawed management and a misguided belief held by both the Shah and current government officials that technological advancements and dam construction could effectively address water shortages. This approach led to the Ministry of Energy being assigned responsibility for water governance, with a primary focus on dam development rather than a more holistic and sustainable water management strategy.

Since 1979, Iran has constructed numerous large dams, becoming the world's third-largest dam builder after China and Japan. However, this focus on dam construction, often touted as a symbol of development and economic growth, has largely ignored the environmental and social impacts. Consequently, many people have been displaced, and valuable wetlands and ecosystems have suffered serious damage (Madani, 2021). Despite awareness of the negative consequences of dam-building, particularly in the Khuzestan and Hamadan provinces, policymakers continued to prioritize ideology over science and succumbed to corruption (Madani, 2021). In addition, Iran has constructed four large artificial reservoirs, known as Chahnimeh, in the Sistan region, which have had a detrimental impact on the Delta has become a source of contention (WAAFG4, July 2024).

⁵⁰ "We made these mistakes in the 1980s," Issa Kalantari, the head of Iran's Environment Department and a former Minister of Agriculture, admitted in 2018. "Then we came to realize that in places that we'd built dams, we shouldn't have built any, and in places where we should have built dams, we didn't build any" (Madani, 2021)

4.5 Legal and Institutional Framework Role in TW Cooperation

The institutional frameworks of water resources management in both Iran and Afghanistan are highly centralized, which hampers the autonomy of different sectors and line ministries (Yousefian et al., 2022; Ahmadzai, 2021; Moridi, 2017). However, Afghanistan had tried in the last recent years before Taliban took over to establish River Basin Authorities and Water User Associations (WUAs) at the basin and community levels, but the major challenge was security which hampered their effectiveness.

Historically, water resources management in Afghanistan was governed by customary laws and community-based practices particularly the Mirab⁵¹ system was widely used, especially in rural areas. For the first time Afghanistan formal water law introduced in 1921 but due to the dominance of traditional practices, the water law enforcement was sub-minimal. In 1981 the soviet-backed government developed a comprehensive water law to regulate water for industry, irrigation, and domestic use. However, due to civil conflicts still the Mirab system remained dominant as local customary practices.

In 2009 after several decades of war and resentment Afghanistan developed a new water law toward modernization of water governance in the country. This new law clearly stated the role and responsibility of relevant line ministries and stakeholders at the national level. The key feature of this new water law was TWM, IWRM, River Basin Management and water permit for reasonable allocation and equal distribution specially for irrigation. In 2019 the water law further modified with more emphasized on IWRM application and environmental sustainability. This time again re-identified the role and responsibility of line ministries and assigned Ministry of Energy and Water as sole responsible for the management and use of water resources at the national level.

Similarly, Iran water law was based on the customary practices for several decades and followed traditional ways of water distribution and sharing. In 1929 Iran first water law was introduced marking centralized water resources management (Moridi, 2017). Despite of formal law introduction, the local practices were dominant like Qanats system and local diversion of river water through intake similar in Afghanistan until late 60s. In 1967 Iran developed a national water resources law which cover all surface and underground water resources. This was the start of centralized and modern water resources management in Iran (Yousefian et al., 2022). In 1982 and then in 1993 Iran amended its water law aiming to further strengthen state control over water resources and embedded new regulations for the irrigation and public water distribution projects in the country. Iran continues to evolve its water law and legislation in response to the environmental crises and climate changes impacts and combating with water scarcity and crisis.

Despite of evolving water laws toward modernization of water resources management over time, both countries have been experiencing water crisis and ongoing water disputes. Since both countries water law is centralized and controlled by the state governments. However, in recent years both countries have been tried to promote IWRM practices which needs participatory approach. But participatory approach is not still a common practice in both countries. Policy change is required to address increasing water demand, climate changes and regional conflict over water resources. Afghanistan Ministry of Energy and Water (MEW) expects that by applying

⁵¹ A Mirab terms mean water master was chosen by the community to distribute water equitably for irrigation from rivers to intakes and along the canal's length.

IWRM principles and activation of RBAs, water resources management will be improved. But from the interviews held with the actors, trans-boundary water management is a major challenge mainly for the dam development in international river basins. This is because, Afghanistan still does not have a clear Trans-boundary water policy framework which is an important issue that can affect IWRM three 'E's principles (Economy, Equity & Environment) which defined by (Postel, 1992).

Iran has many institutional set ups for policy making and execution for water governance and water resources development. But the policymakers have not presented yet a clear and effective policy to acknowledge and understand the water crisis nor a creative and genuine solution for the water crisis. The sectoral execution entities do not think for a fundamental solution of water scarceness, but the focus is, achieving their organizational objectives and spending their annual budget (Islami & Rahimi 2019). There are several gaps in the Iran policy formulation, water resources governance and development including operational activities that why country has been faced with insufficient integrated water supply management, water economy, water demand management, and participatory approach for a comprehensive planning toward a sustainable water resources development (Yousefian et al., 2022).

However, officials from both countries have often neglected the crucial link between climate change and the region's water crisis. To address the growing impacts of climate change, significant transboundary water policy changes are urgently needed. Rather than focusing on developing mitigation or adaptation measures, legal institutions from both sides have fallen into a cycle of blame. Iran accuses Afghanistan of diverting water, while Afghanistan argues that Iran is demanding far more water than it is entitled to under the existing treaty.

From the interviews, it became evident that most Iranian water experts do not believe that climate change significantly impacts water availability in the Helmand River (ZRGIRN7, October 2024; MRJINR5, August 2024; MDJIRN, September 2024). From Iran's perspective, infrastructure developments such as the Kamal Khan Dam and the Qala-e-Afzal canal on the Helmand River, and Bakhshabad Dam on the Harirud River, are seen as the primary factors affecting water supply to Iran.

These projects, aimed at water diversion and storage, are perceived by Iran as direct threats to its water resources (MDJIRN8, September 2024). The root of this escalating tension lies in the lack of communication between officials and responsible institutions, the absence of a clear policy, coordinated strategy, and a fundamental lack of trust and understanding about the true causes of water reduction in the Helmand River and its tributaries. Without addressing these underlying issues, particularly the role of climate change, future cooperation will remain difficult, and the water crisis is likely to worsen.

4.6 Challenges and Opportunities

Afghanistan has been severely affected by four decades of war and instability, which have hindered its ability to manage its domestic water resources, including those of the Helmand River. Over the past two decades, Afghanistan received financial support from the U.S. and the international community for post-conflict reconstruction, particularly in developing water infrastructure for irrigated agriculture. However, this financial support was often aligned with the donors' own

missions and objectives in Afghanistan and the region, rather than focusing on sustainable and fundamental development. Nevertheless, it presented an opportunity for Afghanistan to pursue its ambitious goals.

Afghanistan invested in the construction of dams and irrigation projects across various basins to increase its water storage capacity and improve irrigation efficiency in the agricultural sector. One of these infrastructure projects was the Kamal Khan Dam in the Helmand basin which was initially designed for construction in 1970 during the presidency of Sardar Daud Khan as part of an effort to improve water management in Nimroz province. However, the Soviet occupation of Afghanistan and the ensuing civil war halted its progress, leaving the dam's construction congested for decades until 1996 (Aman, 2016; KI, 2024). Then its construction was resumed for the first time in nearly 35 years under President Karzai and its first phase completed in July 2012 then finally on 24 March 2021, in celebration of Afghanistan's National Water Day, President Ghani inaugurated the dam project in Nimroz province (KI, 2024). While such projects are critical for Afghanistan's socio-economic development, they have also sparked concern in Iran (Adelphi, N.d.).

Iran is anxious about Afghanistan's dam construction activities as the upstream country, fearing that these developments could negatively impact Iran's water rights in the Helmand River (BNMIRN2, 17 August 2024; MDJIRN, 5 September 2024). Additionally, Iran is concerned that Afghanistan's increasing water storage capacity could destabilize its eastern province of Sistan and Baluchistan, where the Helmand River is the sole water source for the region's inhabitants and ecosystem, a water-scarce area (MRJIRN5, 22 August 2024; Adelphi, N.d.). This situation presents a significant challenge, as the lack of cooperation between the riparian countries means that the socio-economic development of the upstream country is perceived as a threat by the downstream riparian country. This dynamic could adversely affect the social, economic, and political relations between the riparian nations, potentially leading to disputes and conflicts.

At the same time, projects like the Kamal Khan Dam and other dam developments in Afghanistan, as an upstream country, could serve as valuable opportunities for flood control and the regulation of water flow to the deltas in Iran. By harnessing water during the wet season in spring and releasing it during the dry season, these projects could help manage water resources more effectively. One of the interviewees from Iran mentioned that Iran has the technical and financial capacity to assist Afghanistan in developing hydraulic infrastructure, not only in the Helmand basin but also in other basins like the Amu Darya. By providing financial support for these projects, Iran could strengthen its relationship with Afghanistan and potentially secure more water from the Helmand basin (MHEIRN6, 26 August 2024).

Additionally, the same interviewee suggested that Iran shall engage through the Shanghai Cooperation Organization (SCO) to support Afghanistan's water resource development programme, demonstrating a genuine commitment to cooperation. This strategy could encourage a more positive response from Afghanistan and help mitigate ongoing water disputes over the Helmand basin (MHEIRN6, 26 August 2024).

Since the stability of the Sistan-Baluchistan region is critically important for Iran, effective cooperation with Afghanistan is necessary to address this challenge. While Sistan may not hold significant economic value for Iran, from a security perspective, it is a priority for the Iranian government (MRJIRN5, 22 August 2024). This presents an opportunity for Iran to cooperate with

Afghanistan, even in the context of Afghanistan's water infrastructure development, as long as it does not pose significant harm to Iran's water rights. By engaging in such cooperation, Iran can help maintain the security of the Sistan region and prevent issues like migration and displacement. This approach would enable Iran to balance its security concerns with fostering collaboration over shared water resources.

Iran's political relationship with the previous government of Afghanistan was volatile, particularly over the construction of dams in Afghanistan. However, now Iran should focus on improving its political and diplomatic relations with the Taliban to build mutual trust. A key challenge for Afghanistan is the lack of international recognition of the Taliban government, which complicates meaningful dialogue and reaching consensus on critical issues (MHEIRN6, 26 August 2024).

This situation presents a great opportunity for the Taliban to take significant steps toward establishing an inclusive and elected government, respecting human rights, and lifting restrictions on education and employment for girls and women. Such reforms could help the Taliban gain national and international recognition, fostering stronger diplomatic relations with neighbouring countries, including Iran. Improved relations would also contribute to water infrastructure development, benefiting both countries and promoting economic development and regional stability.

While climate change is a global threat that adversely affects the ecological health of the Helmand basin, it also presents an opportunity for Afghanistan and Iran to collaborate on mitigation and adaptation measures. This could involve the planning and execution of joint technical projects focused on environmental and ecosystem sustainability. One of the key shortcomings of the Helmand Treaty is the lack of provisions addressing environmental concerns. With the increasing impacts of global warming and climate change, particularly in vulnerable regions like ours, an environmental amendment to the treaty is essential. This amendment should prioritize ecosystem preservation and sustainable water management practices. To facilitate this process, UN agencies and international organizations like the World Bank should engage with both countries, providing resources and support to help incorporate environmental considerations into the treaty and related policies (MHEIRN6, 26 August 2024).

However, according to a water expert from Afghanistan, the return flow from the Hirmand wetland to Godzare was previously considered an environmental flow by three independent consultants in the Delta Commissions report (AWBAFG10, 11 September 2024). Unfortunately, climate change has severely impacted this flow, and Godzare is now dry. A collaborative effort between Afghanistan and Iran, supported by international agencies, will be crucial in ensuring the long-term sustainability of water resources in the Helmand basin, adapting to climate change, and protecting the region's ecosystems.

The lack of a water measurement infrastructure and joint monitoring system has been a significant challenge in the Helmand River basin since the signing of the Helmand Treaty. This system is a crucial element for the treaty's effective implementation, but war and instability in Afghanistan, coupled with a lack of interest from Iran, have hindered progress (AWBAFG10, 11 September 2024). In 2020, when Afghanistan initiated the construction of water-receiving points at border areas between pillars 51 and 52 including Rude Sistan in accordance with Article III of the treaty, the insurgent groups disrupted the activities, preventing the project's completion. An interviewee

even stated that Iran played a role in provoking insurgent militants to interfere with the construction of water receiving infrastructure (AWBAFG10, 11 September 2024).

Now Iran and the Taliban Administration expressing good political relation, this presents an opportunity for both riparian countries to collaborate on building these water-receiving points at the border. Establishing such infrastructure for water measurement and monitoring could significantly improve the implementation of the treaty, ensure more transparent water management, and help reduce disputes over water allocation.

Since the 1980s, Iran has hosted Afghan refugees for several decades, beginning with the war against the Soviet Union and continuing through the recent developments following the Taliban's takeover in August 2021. However, this recent influx of Afghan refugees has shifted Iranian public sentiment more negatively due to the numerous challenges the country faces (Rezaei Zadeh, 2023). Afghan refugees face enormous challenges in Iran due to restrictive government policies and negative public attitudes. They have limited access to essential services such as education, healthcare, and other public services. In addition, many refugees experience mass deportations, further compounding their difficulties and uncertainty.

This combination of societal and governmental restrictions significantly impacts their quality of life and opportunities for integration (Rezaei Zadeh, 2023). One major factor contributing to this negative societal mindset is the lack of social and political trust between the two nations, particularly regarding the Helmand waters. Many Iranians believe Afghanistan is deliberately limiting water flow to Iran, exacerbating tensions (BNMIRN2, August 2024). The second issue is Iran's struggling economy, worsened by international sanctions and the additional pressure from hosting refugees.

Despite this, the presence of Afghan refugees presents an opportunity for Iran's economy. Through humanitarian support from international organizations like the EU, UNHCR, and IOM, Iran could benefit from direct financial assistance. Furthermore, Afghan refugees serve as human capital, supporting Iran's secondary labour markets. This situation also offers Iran a chance to draw global attention for funding and could be a catalyst for improving its relations with the international community. By leveraging the refugee crisis to engage with international bodies, Iran can position itself for economic support and diplomatic progress with regional countries and Afghanistan.

4.7 Findings

The 1973 signed treaty between Afghanistan and Iran, primarily focuses on the allocation of water from the Helmand River. However, several aspects and issues related to this treaty and the management of Helmand water resources are often not fully covered or addressed in recent literatures. The following points have been outlined for discussion as findings in the thesis. The detailed discussion of each finding is outlined in chapter 5, section 5.2.

Geopolitical complexity: The Helmand River basin is a critical area of concern for both Afghanistan and Iran due to its nature and importance for agriculture water supply, and ecology including domestic use. Geopolitical tensions over water rights, paired with environmental challenges like climate change and degradation of wetlands, complicate the management of this vital resource. The dubious political relationship between Afghanistan and Iran influences water

sharing. Geopolitical engagement, often mediated by third parties (e.g., in 1950s the United States in the Helmand River case), helps to mitigate tensions by fostering dialogue and negotiation through creating dispute-resolution mechanisms.

Over time, Iran's foreign policy has been continually shaped by international and regional events, such as the Cold War, the Islamic Revolution, the Soviet invasion of Afghanistan, the Afghan civil war, the rise of the Taliban in 1995, the event of September 11, the U.S. intervention in Afghanistan, and the Taliban's return to power in August 2021. Initially, Iran's policy toward Afghanistan was pragmatic, but following the Islamic Revolution, it shifted toward Ayatollah Khomeini's ideological approach (Tarhan, 2019). This inconsistent and reactive foreign policy has not only contributed to disputes over shared water resources but has also exacerbated issues related to territorial conflicts, resource management, trade routes, and security concerns. Iran's sense of regional superiority and efforts to assert political hegemony in Afghanistan have further strained relations. However, Afghanistan has resisted falling entirely under Iran's political influence, leading to mutual distrust and grievances on social and political levels (ENZAFG7, August 2024).

This dynamic has fostered emotional and adversarial narratives on both sides over the time, undermining opportunities for active cooperation and hindering the effective implementation of the 1973 Helmand River Treaty. As a result, tensions persist, complicating efforts to resolve critical issues in shared resource management and regional stability. Effective geopolitical strategies aim to create frameworks that respect both nations' needs while addressing resource limitations and regional stability. But unfortunately, both countries Iran and Afghanistan have not been undertaken a fundamental step to navigate shared water disputes by balancing interests, fostering cooperation, and ensuring sustainable and integrated transboundary water management.

Poor water governance and water management policy: Water governance and policy in the Helmand River Basin, which spans parts of Afghanistan and Iran, are influenced by historical agreements, national water policies, and the geopolitical context. Afghanistan's water governance is formally guided by its Water Law 2009 and, which emphasizes integrated water resources management (IWRM), equitable distribution, and sustainability. However, these principles largely remain theoretical and have not been effectively implemented in the water and land sectors. As an interviewee pointed out, water and land management in Afghanistan are still treated as separate sectors, despite IWRM principles recognizing their interconnectedness (VCE1, July 2024).

Similarly, excessive groundwater extraction in Iran and poor water management practices have led to significant environmental degradation, including the drying up of the Hamun wetlands. This issue is critical, as the drying of these wetlands severely impacts biodiversity and local livelihoods. Although both Afghanistan and Iran have expressed interest in addressing this problem, practical cooperation between the two countries remains limited (BRAAFG2, July 2024; WAAFG4, July 2024). The water governance frameworks and policies of both countries have been criticized by most interviewees from both sides (SBMIRN3; BNMIRAN2, August 2024; WAAFG4; FZAAFG3, July 2024).

The control exerted by the Head of Government in Iran has significantly influenced the autonomy of line ministries and authorized departments, limiting their ability to make timely and effective decisions regarding water resources governance at the national level (Moridi, 2017). Similarly, in Afghanistan, local authorities prioritize maintaining their political power over implementing an effective and comprehensive water governance policy.

Environmental and Ecological Considerations: The Helmand Waters Treaty primarily addresses the quantity of water to be delivered to Iran but often lacks comprehensive considerations regarding the environmental and ecological health of the Helmand River basin (SBMIRN3, August 2024). Recent literature may not fully explore the impacts of water allocation on the entire basin ecosystem and basin's biodiversity but most focus on environmental issues only related to the Hamuns in Iran, but the environmental aspects should be considered cross-national and treated equally throughout the basin. Helmand water is crucial for ecological survival of deltas (Hamuns) and Godzari depression lake. Iranian Environmental Affairs Director, Mojtaba Zuljodi said that water disputes caused environmental disaster in Sistan region (Khan, 2023). Saying that, while the Hamuns are crucial for Iran, the Godzari Lake which is now completely dried, is equally important for Afghanistan from an environmental and ecological perspective (BRAAFG2, July 2024).

It is crucial that water treaties remain flexible and incorporate environmental considerations for the entire basin. During the last meeting of the Commissioners from both countries on July 26, 2024, Iran's Water and Energy Deputy Minister, Muhammad Jawanbakht, emphasized the need to rectify the design of the Kamal Khan Dam (BBC, 26 July 2024). An Afghan expert and former Manager at the Ministry of Energy and Water explained that, from Iran's perspective, the rectification involves changing the spillway drainage direction from Godzari toward Iran. This suggestion never be acceptable for Afghanistan because Godzari is equally important to be restored (WAAFG4, July 2024).

Both riparian countries, Iran and Afghanistan, tend to focus on their own national interests and raise concerns about their individual environmental issues without having a shared vision and objectives for the environmental and ecological management of the Helmand basin that would benefit both nations (SBMIRN3, August 2024). Iran's primary concern is the degradation of wetlands (Hamuns) in the river delta, while Afghanistan is more focused on the drying of Godzari, a significant environmental loss that, despite its importance, does not seem to be a priority for Afghan authorities.

According to a BBC report, during the last Commission meeting, Afghan authorities stated that diverting water to Godzari is against the interests of both Afghanistan and Iran (BBC, 26 July). Despite recent developments where Commission meetings are held as needed, both countries lack the willingness to cooperate on issues that transcend national interests. Therefore, establishing a cooperative framework is essential to bring both countries closer together, enabling them to collaborate on a joint vision and objectives that mutually respect their economic, ecological, and political interests.

Climate Change Impacts: The effects of climate change in recent decades, including altered precipitation patterns, increased temperatures, and more frequent droughts, on water availability and flow in the Helmand River basin have not been comprehensively discussed in many research paper. There is a need for more detailed analysis of how climate change might impact water-sharing agreements and the sustainability of water resources. The majority of international interviewees and Afghan water experts indicated that the Helmand River's flow has been severely affected by climate change (VCE1; AQKAFG1; BRKAFG2; WAAFGH3; WAAFG4, July 2024; DND2, August 2024).

Meanwhile, some Iranian-led research paper assessed the long-term hydrological conditions of the Upper Helmand River from 1940 to 2012 tried to find out climate change impact on the river flow.

The study aimed to identify any non-stationary processes in the river flow across different hydrological time windows to determine if there were changes in the river's annual mean flow since the 1973 treaty, which reported 5661.7 Mm³/year in a normal water year. The research concluded that while there has not been a significant decline in the river's annual mean⁵² flow, the flow time series has shifted. For instance, there has been an increase in flow during early winter (November to February) and a decrease during the summer months (June to July) and the average remind slightly the same as indicated in the treaty (Hajihoseini et al., 2016). Similarly another Iranian research paper released in January 2025 indicated that the average annual precipitation in the Helmand basin 70% found as normal climatic condition over the period from 1986 – 2022 (Arfa et al., 2025).

In contrast, during an interview, an Afghan researcher studies at ZEF in Germany stated that the river flow regime in the Helmand basin has been altered due to climate change, severely impacting water availability in the upper and lower reaches (FZAAFG3, July 2024). This issue was corroborated by another Afghan water expert and former officer at MEW under the previous government, who noted that water no longer reaches to the distribution points due to reduced flow caused by climate change particularly during the low flow season (BRAAFG2, July 2024). Similarly, a former water expert from ADB and MEW emphasized that climate change, particularly over the last two decades, has led to global threats like El Niño and La Niña, resulting in floods, droughts, cold, and heat which caused severe environmental problem (DND2, August 2024).

However, an Iranian water expert criticized the study conducted by Hajihoseini et al. (2016), arguing that there has been no significant change in the Helmand River's flow due to climate factors (BNHIRN2, August 2024). In the meantime, water experts do not believe that climate change significantly impacts water availability in the Helmand River (ZRGIRN7, October 2024; MRJINR5, August 2024; MDJIRN, September 2024). While most of international water experts and research papers argue that climate change has altered the regular snow cycle in Afghanistan and the surrounding mountains. Extreme weather, such as increased snowfall, leads to more snowmelt and disastrous floods in spring (March to June), which is detrimental to farmers, followed by water shortages in the summer. A moderate level of snow at the right time is crucial for maintaining the flow cycle during the summer and autumn, which is when water supply is most needed for crops in both countries (DND2, August 2024). Additionally, population growth and the expansion of agricultural areas in the Sistan region have increased water demand, posing a challenge in adapting to the water allocation stipulated in the treaty (DND2, August 2024).

Exploitation of Groundwater Resources: The focus of the treaty and much of the literature is on surface water flows. However, groundwater resources and their connection to surface water are less studied and often overlooked, particularly in terms of how they are managed, extracted, and their role in the overall hydrology of the basin. In both countries, groundwater exploitation is uncontrolled. Farmers and local communities over-exploit groundwater for agricultural irrigation without any clear policy or monitoring system from local authorities (VCE1, July 2024). This over-pumping of groundwater by communities is leading to severe water level depletion, especially during periods of low rainfall and insufficient runoff to recharge groundwater. A recent Terrestrial

⁵² “The Helmand River long term data analyses for streamflow comparison from 1940 to 2012 revealed that there has been no significant change in annual mean flows in the Upper Helmand River basin. For example, the annual mean volumes for the period 1983 to 2012 that is more affected by the recent droughts is estimated to be 5858.9 MCM/yr., while it is indicated as 5661.7 MCM/year in the treaty” (Hajihoseini et al., 2016).

Water Storage (TWS) study in Afghanistan's five river basins indicated that the groundwater table in the Helmand River basin has depleted by 6.4% (Do et al., 2024).

Local authorities focus primarily on surface water flows, often neglecting the governance of groundwater within the basin. Sistan is a water-scarce region, and deforestation, along with the over-exploitation of groundwater, is further degrading the environment. Without vegetation and forests, transpiration and evaporation are reduced, leading to less moisture in the air, which in turn results in lower rainfall and reduced runoff. When the treaty was signed, environmental concerns were not a major issue, but they have since become increasingly important. As one expert noted during an interview, addressing environmental concerns requires education and public awareness. For instance, the lack of forestation contributes to the degradation of riverbanks, making tree planting crucial for farmers to protect their agricultural land from floods.

Unfortunately, land reclamation efforts are not supported by local authorities, the community, or even international organizations, which is negatively impacting valuable agricultural land (DND2, August 2024). The lack of environmental protection and sustainability is further affecting both surface and groundwater availability in the basin. It is essential to mitigate the impacts on surface waters by enhancing environmental sustainability and protecting groundwater resources.

Water Quality Issues: While the Helmand Treaty addresses water quantity monthly in Article III, water quality issues such as pollution from agricultural runoff, urban wastewater, and industrial discharges are equally important, as outlined in Article VI. The treaty obligates Afghanistan to ensure water quality by preventing agricultural pesticide contamination and industrial chemical effluents from polluting the river. Although Afghanistan is not heavily industrialized, which lessens concerns over industrial pollution, the use of agricultural pesticides and solid waste management in Lashkarkah city pose significant challenges to water quality, particularly for domestic use. Water pH is a critical parameter, and according to the WHO, the acceptable range is between 6.5 and 8.5. Studies have shown that the Helmand River's pH is between 7.95 and 8.31, indicating slightly alkaline conditions (Ansari et al., 2021).

The high pH and alkalinity are attributed to anthropogenic activities, such as waste disposal into the river, and the river's reliance on rainwater, which causes soil erosion of limestone and minerals, contributing to alkalinity (Ansari et al., 2021). In general, water quality assessment indicates that Helmand River water does not require significant treatment and is suitable for domestic use (Ansari et al., 2021). However, it is essential for Afghan authorities to improve solid waste and wastewater management to prevent significant pollution and ensure that downstream users in Sistan are not adversely affected. Addressing these issues will help secure water quality, benefiting both Afghanistan and Iran.

Socioeconomic Impacts: The socioeconomic implications of water allocation and usage, particularly along the Helmand River, are often overlooked in analyses, despite the significant impact of water scarcity and disputes on local communities. The literature could explore deeper into how agriculture, livelihoods, and local economies are affected by changing water availability. The Helmand River is predominantly used for irrigation, serving as the primary source of income and livelihood for people in both Afghanistan and Iran.

The ongoing water dispute has significantly strained social relations between Iran and Afghanistan. Iranian claim that the failure of former President Ghani to fulfil his promises regarding equitable

water distribution worsened the situation, leading to increased displacement, particularly in regions reliant on the Helmand River (MDJIRAN8, September 2024). Iran Sistan region has been most adversely impacted by displacement, as water shortages have disrupted livelihoods and intensified migration across the border. Politically, Iran is now seeking to strengthen ties with the Taliban, primarily to secure its strategic interests and ensure stability in its southeastern provinces. However, during President Ghani's tenure, relations between the two countries deteriorated, as both distanced themselves from meaningful dialogue and cooperation, further aggravating the water-related tensions. This political disconnect has only deepened the mistrust and strained their broader relationship.

In recent years, climate change has altered the river's flow regime, which has negatively impacted the agricultural sector and the environment. The Hamuns and Godzare lakes, located around the border, have been severely affected. Once known for their rich plant life, diverse animals, and bird species, these lakes have now become dry and barren. The ecological health of these lakes and deltas was essential to the prosperity of local communities, who relied on the area's biodiversity for their livelihoods (Khalid & Zahra, 2019).

The environmental degradation of the Helmand River basin has become a major concern, contributing to significant socioeconomic problems. Despite the lack of conservation or restoration plans by the riparian countries, the situation has recently garnered international attention. Further research is needed to explore the socioeconomic impacts of these recent developments and to assess potential solutions for sustainable water management in the region.

Infrastructural Development and Upgrades: The state of water infrastructure, such as dams, irrigation systems, and canals, remains underexplored, especially regarding their efficiency in meeting both current and future water demands. Unilateral development by riparian countries often does not align with their water rights or the river's natural flow regime.

The Helmand River Treaty's Article VI recommends joint projects, such as riverbank protection and land reclamation in border areas, but these projects have never been thoroughly assessed or executed. There is a lack of research on the type of infrastructure required, as well as how Afghanistan and Iran could jointly plan and implement these projects to foster cooperation. Instead, both countries continue to build water storage and diversion infrastructure without comprehensive environmental impact assessments, ignoring risks such as water loss due to evaporation and future climate-related challenges. Iran, for example, depletes its groundwater by relying on a vast number of borewells, with the number of wells estimated to have reached 600,000. Furthermore, Iran is the third-largest dam-building country in the world (Khalid & Zahra, 2019), a strategy that has been widely criticized by Iranian water experts (Darwis, 2019; Islami & Rahimi, 2019; Iran Newspaper, 2017).

Similarly, Afghanistan has recently begun to follow the same path as Iran, pursuing large-scale water infrastructure projects without conducting fundamental studies or impact assessments. This approach mirrors Iran's previous actions, where infrastructure developments, such as dam construction and water diversion systems, were implemented without fully understanding their long-term environmental and socioeconomic impacts. Afghanistan's recent steps raise concerns about the potential environmental degradation, and disruption to the flow regime of the Helmand River, further complicating bilateral water management and cooperation efforts. The literature could benefit from more detailed assessments of infrastructure needs, potential upgrades, and how

these could be approached through bilateral cooperation. Additionally, evaluating the long-term environmental and social impacts of large-scale infrastructure development would provide valuable insights for sustainable water management across the region.

Political Conflict and Cooperation Dynamics: The geopolitical and security dimensions of water sharing, including how broader political relations between Afghanistan and Iran impact water cooperation or conflict, are sometimes underexplored. The literature might not fully address how water issues are tangled with other bilateral issues, such as border security and socioeconomic aspect. If we look at the dynamic of conflict and cooperation between both countries over the 100 years several attempts undergone to resolve this complex water issue.

For instance, since 1872, Iran and Afghanistan disputed their shared political borders and water rights along the Helmand River delta, first drawn by British officer Goldsmid. His decision designated "Sistan proper" to Iran and "Outer Sistan" to Afghanistan, granting water rights to both nations. Following a severe drought in 1902 that dried the Hamun wetlands, Britain intervened again, assigning Sir Henry McMahon in 1905 to mediate. McMahon's award allocated one-third of the water to Iran and two-thirds to Afghanistan, including dam autonomy. This sparked protests in Iran, which rejected the decision.

Between 1905 and 1933, a joint Irano-Afghan protocol regulated water distribution. In 1933, Afghanistan's King Nadir Shah proposed a half-share of water for Iran in the delta region, but the Afghan parliament rejected the 1936 temporary agreement. Another severe drought in 1946–47 prompted U.S. mediation, culminating in the 1951 Helmand River Delta Commission report, which allocated 22 m³/sec to Iran. Despite another severe drought in 1971, Iran and Afghanistan negotiated internally and used delta commission report to conclusively resolve the water rights issue and penned 1973 treaty (Mayar & Shapour, 2023).

Data Availability and Transparency: Issues related to the availability, reliability, and transparency of data on water flow, usage, and hydrological assessments are not always covered. Discrepancies or gaps in data sharing and monitoring can significantly impact the management of the water resources. Filling these gaps in the literature could provide a more comprehensive understanding of the challenges and opportunities in managing the Helmand River's water resources, especially in the face of environmental changes and geopolitical complexities.

The treaty includes provisions for the joint measurement and monitoring of water flow, but these provisions have never been fully applied, and implementation has been inconsistent. According to the treaty, Afghanistan is obliged to share hydrological data from the Dehrawod station and convince Iran of the data's accuracy. If Iran is not satisfied with the data's accuracy, Afghanistan is required to allow Iranian representatives to visit the Dehrawod station to verify the data and river flow. For the first time in 2023, Iran was invited to the Dehrawod hydrometric station to cross-check and confirm water availability in the river (BRAAFG2, July 2024). The main challenge between both countries is the lack of reliable and scientific data exchange, leading to a lack of clear understanding regarding the river flow regime (FZAAFG3, July 2024).

4.8 Case Studies and Best Practices of Shared Watercourses

This research has examined various shared watercourses to understand how transboundary water resources can facilitate cooperation between riparian states and help them overcome conflicts and disputes (Turgul et al., 2023). The water-related dilemma between Afghanistan and Iran is not unique in today's world. Since shared water resources susceptible to disputes and contentions at different levels. For centuries there are several real stories that water resources used as weapon of conflict and water system can be a source of conflict (Gleick & Shimabuku, 2023).

There are many transboundary rivers in the world specially in Asia experiencing conflict and complex situation that world is witness of incidence and water war at national and international levels. There is enough evidence that water resources and water infrastructure intentionally has been weaponized, poisoned or cut the supply either to civilians or flood areas (Gleick & Shimabuku, 2023).

Water Brief highlights four severe water conflict incident categories as detailed by Gleick & Heberger (2013). The authors categorize water conflicts into four main areas:

- i) Military tool: the weaponization of water systems or resources by a state or nation
- ii) Military target – when a state or nation targets water resources or systems
- iii) Terrorism or domestic violence – non-state actions where water systems become the target of terrorism or national violence
- iv) Development disputes – these can involve both state and non-state actors, where water resources become a point of contention in socioeconomic development.

The water chronology traces famous ancient water-related events, including the six-day Sumerian flood storm and Noah's flood around 3000 BC (Spar, 2009), as well as the miraculous parting of the Red Sea by Moses in 1200 BC, which led to the destruction of Pharaoh's army. It also documents numerous water-related incidents up to 2012 (Gleick & Heberger, 2013). Several key examples of shared water resource disputes stand out. In 1804, a development dispute between France and Holland over the construction of a canal connecting the Rhine and Meuse Rivers led to military tensions, as the canal was ordered by Napoleon (Israel, 1997).

In 1841, a reservoir in Ops, Ontario, Canada, was destroyed in a terrorism and development dispute by local neighbours (Forkey, 1998). Similarly, in 1887, a canal reservoir in Ohio, USA, was dynamited by a mob in another development dispute (Walters, 1948). During World War II, the Soviet Union used water as a military tool by releasing the Istra reservoir near Moscow to disrupt German advances, and the Germans later employed a similar tactic (Malik, 2005). A more recent example involves discussions between the United Nations and Turkey regarding the use of the Atatürk Dam to restrict Euphrates River flow to Iraq as a military tool (Gleick, 1993).

Water conflicts have escalated in recent decades for various reasons, including political instability in the Middle East, climate change impacts, and severe droughts, particularly in Iran, Afghanistan, the rest of regional countries. Additionally, tensions between local and nomadic populations over natural resources in sub-Saharan Africa, and north Africa including water scarcity and many other inter-state tensions in different basins have also contributed to water conflicts (Gleick & Shimabuku, 2023). Similarly, between Iran and Afghanistan despite the 1973 water treaty, several

water-related conflicts have occurred over the Helmand River, a basin over which they have disputed for decades (Al Jazeera, May 2023). For example, in 2007, the Taliban engaged in armed clashes to halt NATO's reconstruction of the Kajaki Dam, a military target in a terrorism-related action (Friel, 2007). There have been claims that Iran supported the Taliban to disrupt dam development projects in Afghanistan (Khan, 2023; Radio Free Europe, 2011).

In the 1990s, during the Taliban's first rule in Afghanistan, they restricted the river flow to Iran by lowering the spillway gates of the Kajaki Dam. Iran continuously have been accusing Afghanistan of failing to supply its water rights as stipulated in the treaty (Abbasian, June 2023). This grievance between the two countries may have been further fuelled by the Taliban's killing of eight Iranian diplomats in northern Afghanistan in August 1998 (UNHCR, n.d.).

The most recent incident was a deadly clash between Iranian border police and Taliban fighters on 23 May 2023 over water resulted in three casualties and several injuries on both sides (New York Times, May 2023). According to Al Jazeera, this conflict was sparked by Iranian President Ebrahim Raisi's accusations that the Taliban government was restricting the flow of the Helmand River to Iran's Sistan-Baluchistan province (Al Jazeera, May 2023). In 2012 Islamist insurgent militant killed Afghan government appointed guards who was defending construction of Machalgho dam in one of the Helmand River tributaries in southeast of Afghanistan (Mashal, 2012).

Despite the clashes and incidents, there are also positive examples of cooperation in other river basins. The Columbia River between the USA and Canada is a notable example, as is the Senegal River in West Africa, where Senegal, Mauritania, and Mali have maintained their active cooperation. The Rhine River in Europe also serves as a model of successful transboundary water management, along with many other river basins around the world. The Indus River basin is somewhat similar to the Helmand River basin in many aspects has been considered for comparative analysis. Despite mutual distrust and historical infringement between Pakistan and India, the 1960 Indus Water Treaty has been effectively implemented. Section 4.8.1 discusses a comparative analysis of the Indus and Helmand rivers in terms of cooperation best practices.

4.8.1 Comparative Analysis of the Helmand River Basin with Indus Basin

There are several transboundary water basins in the region governed by bilateral⁵³ agreements, such as the Indus River Basin Treaty between Pakistan and India. The bilateral agreement governing the Indus Basin is comparable to the Helmand Basin treaty in terms of cooperation, social and political interactions, and the level of trust between the parties involved. In both cases, the most critical challenge is building trust among the riparian countries. However, neither India

⁵³ Jordan and Israel: The 1994 Israel-Jordan Peace Treaty includes provisions for water sharing from the Jordan and Yarmouk rivers.

Turkey and Iraq: They have agreements concerning the Tigris and Euphrates rivers, although there are ongoing disputes and negotiations.

Syria and Iraq: There are agreements regarding the use of the Euphrates and Tigris rivers.

Afghanistan and Iran: The 1973 treaty on the Helmand River sets the water-sharing terms between the two countries.

India and Pakistan: Although not part of Central Asia, the Indus Waters Treaty of 1960 is a key bilateral treaty that affects the region.

Armenia and Azerbaijan: They have agreements related to the Kura and Aras rivers, although political tensions can complicate water sharing.

and Pakistan over the Indus nor Iran and Afghanistan over the Helmand River Basin have established a solid foundation of trust.

Sustainable trust can only be achieved when riparian states prioritize transboundary interests over national security or domestic concerns. When countries place greater importance on shared water resources, they are more likely to commit to active cooperation. Unfortunately, in water-scarce basins like the Nile, Indus, Mekong, and Helmand, riparian nations often prioritize their individual or domestic interests over transboundary cooperation. This tendency is a major reason why these nations struggle to build sustainable trust and achieve long-term cooperation (Loodin et al., 2023).

Another key issue is the sharing of unrealistic data and development plans, which highlights the unwillingness, distrust, and poor cooperation between riparian countries. The exchange of accurate data and development plans over the Indus River Basin between India and Pakistan has been a complex and contentious matter, shaped by a combination of historical, political, and strategic factors. The deep-rooted mistrust and historical conflicts between the two nations, including wars and ongoing military tensions, have led to a reluctance to share detailed data and development plans. These are often viewed as sensitive and strategic information by both Pakistan and India, as there is a fear that sharing such data could be used to their disadvantage in international forums, negotiations, or potential future conflicts.

Similarly, Iran and Afghanistan exhibit a reluctance to share realistic data and water infrastructure development plans. Although both countries lack a comprehensive water flow monitoring system, they have, in recent years, exchanged some manually estimated data (BRKAFG2, July 2024). However, several interviewees have labelled this data as unreliable (WAAFG4 & AKQAFG, July 2024) and noted that it remains difficult for both countries to trust each other when it comes to sharing accurate data and information (WAAFG, July 2024). Water resources are critically important for both countries, not only for drinking water and agriculture but also for energy generation, particularly in Afghanistan as an urgent demand. Control over water is therefore seen as a strategic advantage, making both nations cautious about sharing detailed information.

One of the critical gaps in the Helmand basin is the lack of a well-established water measurement and monitoring system. This deficiency significantly complicates the decision-making process for both Afghanistan and Iran, as they struggle to agree on the reasonable distribution of water resources. The Dehrawod station, which serves as the primary source for measuring water flow in the basin, is an outdated system with limited capabilities. Its antiquated setup provides neither the accuracy nor the consistency needed to effectively monitor water flow, further fuelling disagreements between the two countries. In contrast, the Indus basin boasts a much more advanced water measurement and monitoring system.

With modern infrastructure and technology in place, the Indus River Basin offers real-time data and accurate assessments of water flow, allowing for more informed decision-making between India and Pakistan. The absence of such modern systems in the Helmand basin puts Afghanistan and Iran at a significant disadvantage, as they lack the precise data needed to support their negotiations and manage the water supply efficiently. Without updated infrastructure, both countries remain vulnerable to disputes over water allocation, especially as climate change continues to impact water availability in the region. The installation of advanced monitoring technologies would not only improve transparency but also facilitate cooperation by providing a reliable foundation for discussions on water-sharing agreements.

The provisions of the Helmand Treaty have not been effectively implemented since its signing. A notable comparison can be made with the Indus River Treaty between India and Pakistan, which has been much more successfully enforced. Following the signing of the Indus Treaty in 1960, both countries promptly established permanent commissions to oversee its implementation. The treaty included a 10-year transitional period to allow Pakistan to develop its water infrastructure (Akhter, 2019), and since then, the Indus River Treaty has been consistently upheld.

In contrast, the Helmand Treaty has faced significant challenges in its implementation, primarily due to Afghanistan's four decades of instability and conflict. For Afghan authorities, the treaty and its execution were not a priority during these turbulent years. However, beginning in 2004, President Karzai initiated efforts to implement the treaty. While some bilateral meetings were held, they were irregular and driven by immediate needs, lacking a clear agenda or consistent schedule.

Initially, both countries assigned officers, rather than specific Commissioners, to discuss the treaty's provisions, with meetings generally taking place at the Director General level. It wasn't until 2019 that the discussions were elevated to the Deputy Minister level. By 26 July 2024, a total of 28 meetings had been held, with the most recent one involving Mohamad Jawanbakht, Iran's Deputy Minister of Energy (BRKAFG2, July 2024). Despite this progress, the implementation of the Helmand Treaty remains inconsistent, particularly when compared to the more structured and continuous enforcement of the Indus River Treaty, which has continued effectively despite the longstanding mistrust, environmental challenges, and historical tensions between India and Pakistan.

One of the key reasons the Indus Treaty has been successfully enforced is the involvement of the World Bank, which has played a crucial role as an observer and mediator from the very beginning of the treaty's negotiation process. The World Bank's participation brought an external, neutral authority into the discussions, helping to facilitate dialogue between India and Pakistan—two countries with a history of deep-rooted mistrust and conflict. As an impartial mediator, the World Bank provided technical expertise, financial resources, and, most importantly, a platform for both parties to address disputes in a structured manner. This external involvement helped reduce tensions and fostered a more cooperative atmosphere, ensuring that the focus remained on equitable water sharing rather than political differences.

Furthermore, the World Bank continues to play an active role in the treaty's implementation, helping to resolve conflicts, oversee compliance, and ensure that both countries adhere to the agreed-upon terms. Its long-term engagement has been instrumental in maintaining the treaty's effectiveness, even during periods of heightened political tension between India and Pakistan. This sustained involvement has been a key factor in the treaty's success, offering an international layer of accountability and ensuring that both sides have a reliable mechanism to address disagreements, thus preventing the escalation of conflicts. Thus, a similar arrangement involving an international organization like the World Bank is necessary for the effective implementation of the Helmand Basin Treaty. Such an organization could mediate and provide support, helping both countries collaborate on shared water governance and environmental preservation (MHEIRN6, August 2024).

Table 10: Summary of comparative analysis between Helmand and Indus River Basins

Helmand River Treaty (Afghanistan and Iran) 1973	Indus River Treaty (India and Pakistan) 1960
Bilateral Treaty with the USA mediation.	Bilateral Treaty with the World bank mediation.
Lack of Trust between nations and actors	Lack of trust between nations and actors
The provisions of the Helmand Treaty have not been effectively implemented since its signing.	The provisions of the Indus Treaty have been much more successfully enforced and implemented compared to Helmand.
The riparian countries failed to assign Commissioners as per treaty since its signing until 2004.	The riparian countries succeeded to assign Commissioners as per treaty
Environmental challenges, and historical tensions between both riparian countries particularly the Hamuns and Godzare ecological health in the river deltas	Environmental challenges, and historical tensions between both riparian countries particularly over environmental degradation at both sides of the river in Kashmir areas.
Iran and Afghanistan exhibit a reluctance to share realistic data and water infrastructure development plans	The exchange of accurate data and development plans over the Indus River Basin has been always a complex and contentious matter between India and Pakistan
Riparian countries are in competitive mindset to each other	Riparian countries are in competitive mindset to each other
Lack of modern water measurement and flow monitoring system	Over time Indus basin boasts a much more advanced water measurement and monitoring system
Intermittent border armed clashes and conflicts over water (e.g. recent border clash on 23 May 2023) and hydraulic infrastructure development. For example, Kamal khan dam sparked reaction of Iran, Chahnimahs perceive as contributing factor impacting Hamuns and amplify expectations at lower reach.	Intermittent conflicts and arbitration ⁵⁴ over water infrastructure development. For example, in 2010 Pakistan and India went to arbitration over the Kishanganga Hydroelectric Project at the International Court of Arbitration.

Iran and Afghanistan could initiate a similar approach to the Indus River and work towards improving their cooperation over time. Both countries might consider the involvement of a mediator or facilitator to help bring them closer, offering training and capacity building for better water diplomacy and transboundary water cooperation. If both nations agree that a third party could be beneficial, they could formally engage one. The third party could also assist with environmental studies of the deltas, providing technical recommendations.

One Afghan interviewee mentioned that in 2017, there were discussions with Iran about involving an experienced consultancy firm for environmental studies on the Hamuns (IDMAFG11, October 2024). However, there is hesitancy from the Iranian side when it comes to trusting third parties. They argue that past experiences with external mediators in Helmand water disputes have not been favourable (ZRGIRAN7, October 2024; MDJIRAN8, September 2024). Iranian experts remain critical of previous interventions, such as those by Goldsmid (1872), McMahon (1905), and the Helmand Delta Commissions Report (1951), which led to the 1973 treaty and were perceived as being unfavourable to Iran.

⁵⁴ The 2010 dispute between India and Pakistan centred around the construction of a dam on the Kishanganga River. Pakistan took the case to the Hague's Permanent Court of Arbitration (PCA), arguing that the dam would negatively impact downstream water flow. In 2013, the PCA ruled in favour of India but imposed strict conditions, requiring India to amend the dam's design to limit the water diversion to 9 m³/second rather than a full diversion of the river (Iqbal, 2018; Khan, 2013).

4.9 Primary Sources of Disputes and Conflicts

The primary sources of contention and disputes differ between the two countries Iran and Afghanistan respectively. From Iran's standpoint, the three main highlighted sources of conflict over the Helmand waters are water quantity, dissatisfaction with the 1973 treaty, and historical border disputes. Iranians argue that the water allocated in the treaty is insufficient to meet their needs, while Afghans assert that the Helmand River's water is theirs, questioning why they should share it with their neighbours, despite acknowledging Iran's rights under the 1973 treaty. These issues lay the foundation for the ongoing tensions between the two nations.

Water Quantity and Treaty Provisions: The first issue revolves around the water quantity (820 Mm³) outlined in the Helmand Treaty. Iran contends that the current water allocation specified in the treaty is insufficient, especially in light of the reduced water flow caused by climate change. Most Iranian experts, including MDJIRN8, have pointed out that water discharge has decreased significantly—from 4 million m³ to 1.4 million m³ in the border areas. This reduction has led to accusations against Afghanistan for restricting water flow, which violates Article V of the treaty, stating that Afghanistan should not deprive Iran of its fair share of Helmand water.

Iranians are dissatisfied with the treaty's provisions, believing that they no longer adequately address their water needs, contributing to ongoing disputes (MDJIRN8, September 2024). In contrast Afghan experts' authorities emphasized on the rights of Iran but consistently trying to highlight climate change impact has been caused water reduction in the river entire flow. Similarly, several water experts from Iran said that climate change has further complicated the situation in the Helmand basin and increased of water demand in both sides which amplified by climate change impacting water availability and make it complex its distribution (MHEIRN6, August 2024).

Treaty Dissatisfaction: Iran is dissatisfied with several provisions of the Helmand Treaty, viewing them as insufficient to meet its growing water needs, especially in light of environmental pressures. A particularly contentious point is Article V, which states that Iran has no right to claim excess water even when additional water is available in the lower reaches of the river. This has heightened tensions between the two countries, as Iran believes the treaty no longer reflects current realities or ensures an equitable water supply, while Afghanistan maintains that the existing treaty is a binding legal document (MDJIRN8, September 2024). Iran's primary concern is that the 14% water allocation specified in the treaty is inadequate, especially since McMahon did not account for the water needs of the wetlands, which are crucial for Iran (BNMIRAN2, July 2024). This discrepancy has further fuelled Iran's frustration over the treaty.

Border Disputes: The third issue concerns long-standing border problems, a legacy of disputes that date back centuries. These unresolved territorial disagreements add another layer of complexity to the water-sharing issue, as the countries' political and geographical tensions further complicate cooperation over shared resources through nowadays focus has shifted toward water (MDJIRN8, September 2024; WAAFG4, July 2024). Iran's transboundary water policy states that river alignment should not cross its borders. This means not to lose any small piece of its territory. In the late 1990s, Iran altered the alignment of the Helmand River by 30 Km leading to a significant loss of trust between the two nations (WAAFG4, July 2024). In addition to the above primary concerns from the Iranian perspective, the following significant factors also further trigger disputes between both countries as discussed during the data collection and interviews with experts.

Geopolitics: The Helmand River itself is a central factor contributing to the ongoing conflict between Afghanistan and Iran (WAAFG4, July 2024; MHEIRN6, August 2024). This river originating from the Hindu Kush mountains and flowing southeast about 95% throughout Afghanistan and small portion of the river constitutes 55 km of the Afghan - Iranian border and drains in the Sistan Delta reaching Iran (Khan 2023). The river's unpredictable nature and uneven flow patterns have long been a source of tension. The river's waters are vital for domestic consumption, agricultural activities, and environmental preservation in both countries. Afghanistan and Iran, as the two primary users, rely heavily on the Helmand's resources, yet the river's variability complicates its management and equitable distribution (MHEIRN6, August 2024).

Geographical and geopolitical factors further exacerbate the conflict. The Sistan region in southern Iran is particularly susceptible to water scarcity and the impacts of climate change, making water from the Helmand River an essential resource for the area (WAAFG4, July 2024; MHEIRN6, August 2024). The strategic importance of this region has made water access a politically sensitive issue for Iran, heightening tensions with Afghanistan, especially during periods of drought or reduced river flow (MHEIRN6, August 2024). The history of the Helmand River's water distribution between Afghanistan and Iran is marked by significant diplomatic efforts. Notable among these was the work of Mahmoud Foroghi and Mr. Alam⁵⁵ Prime Minister of Iran and Musa Shafiq, Prime Minister of Afghanistan, played crucial roles in the negotiation and they were instrumental in signing of the treaty. Mahmoud Foroghi contributions were significant in formalizing a framework for water sharing, though challenges have persisted, stated by an interviewee from Iran (MHEIRN6, August 2024).

Despite these efforts, there has historically been insufficient political will and investment from authorities in both countries to fully address the complexities of the Helmand River's management. This lack of sustained attention and resources has allowed the conflict to persist, with both nations struggling to find a long-term, mutually beneficial solution (MHEIRN6, August 2024). On the other hand, Iran argues that the treaty is no longer fair or just, with many Iranians expressing dissatisfaction because they believe it does not adequately serve Iran's interests. Another point of contention is the issue of Afghan refugees in Iran. From the Iranian perspective, they feel they are bearing the burden of supporting Afghan refugees, while Afghans maintain that the water is theirs, leaving Iran to deal with the associated challenges (SBMIRN3, August 2024).

Climate change: Climate change has further complicated the situation in the Helmand basin. Continuous population growth in Afghanistan and Iran, combined with increased irrigation and agriculture for food security, along with infrastructure development, has intensified the complexities surrounding the Helmand water issue between the two countries. The rising water demand on both sides, exacerbated by climate change, is straining water availability, and complicating its distribution (MHEIRN6, August 2024). From Iran's perspective, the country does not accept that climate change has significantly reduced water flow or affected its water rights. Instead, Iran views Afghanistan's infrastructure projects, such as the Kamal Khan Dam and the Qala-e-Afzal Canal on the Helmand River, as well as the Bakhshabad Dam on the Harirud River, as the primary factors impacting water availability. These projects, which focus on water

⁵⁵ Asadollah Alam, the Prime Minister of Iran (1962–64) and previously he worked as Governor of Sistan, Minister of Court and many other senior positions during the Shah Pahlave era.

diversion and storage, are perceived by Iran as direct threats to its water supply (MDJIRN8, September 2024).

Afghanistan emphasized that the reduction in water flow in the riverbed is a result of climate change. In an interview on 19 May 2023 with BBC Pashto, the Taliban's Acting Minister of Water and Energy, Abdul Latif Mansour, responded to recent remarks made by the President of Iran. He stated, "Currently, the drought has impacted the entire region, and we are facing a water shortage as well as an upstream country. The people of Nimroz in Afghanistan are also in need of water, but the situation is not as dire as it's being portrayed. This issue shouldn't be blown out of proportion" ((BBC, 19 May 2023). However, Iran's Foreign Ministry declared the Taliban government's stance on water as "unacceptable and illegal" until Iranian experts can verify the claim as "true" (BBC, 19 May 2023). These types of confrontations are a clear sign of mistrust between politicians in both riparian countries.

Environment: One of the major shortcomings of the Helmand Treaty is its failure to address environmental concerns, which have become increasingly critical due to global warming and climate change. The treaty, originally designed to focus on water allocation between Afghanistan and Iran, lacks provisions for the protection and sustainable management of the Helmand River Basin's ecosystems. This omission is especially concerning given the region's vulnerability to environmental changes, which are likely to exacerbate existing water conflicts and lead to further degradation of natural resources such as Hamuns (MHEIRN6, August 2024) and Godzari depression area at the delta of river (WAAFG4, July 2024).

Climate change presents a global threat, driving environmental degradation, floods, droughts, irregular rainfall, and rising temperatures, all of which undermine the ecological balance of the Helmand Basin. Two opposing climate phenomena, El Niño and La Niña, intensify these disruptions. El Niño typically brings heat and drought to northern regions while increasing rainfall in southern areas, whereas La Niña results in colder conditions in the north and drier, flood-prone conditions in the south, often leading to severe floods and hurricanes (NOAA, 2024). This year, Afghanistan has experienced extreme weather events, including floods, storms, and hurricanes across multiple regions. Without an active cooperative framework for water governance, the preservation of the Helmand deltas (Hamuns), including Godzari in Afghanistan, remains a critical challenge. The current treaty lacks the provisions necessary to ensure the long-term sustainability of the Helmand Basin's natural resources and water systems, underscoring the need for its effective implementation and active collaboration between both nations.

Additionally, according to Afghan water experts, the Chahnimah reservoirs cause considerable environmental harm to the deltas (Hamuns), with Iran's violations in this area being more extensive than Afghanistan's infrastructure developments (WAAFG4, July 2024; FHMAFG8, August 2024). An Iranian Iran's excessive use of groundwater further jeopardizes the future of the region's water resources (MDJIRN8, September 2024), particularly as they divert of water to Zahedan ((FHMAFG8, August 2024). Iran tends to focus discussions only on issues that are unfavourable to them, often neglecting broader environmental concerns (FHMAFG8, August 2024). Moreover, Iran's negative stance toward Godzari Lake is concerning, especially given the lake's critical role in the provinces of Farah and Herat, where it helps mitigate hot winds, reduces dust, and moderates' temperatures (FHMAFG8, August 2024).

Economic: However, the economies of Iran and Afghanistan have been interdependent for centuries. As a landlocked country, Afghanistan has sought to strengthen its economic ties with Iran, offering an additional 4 m³/sec of water—beyond the 22 m³/sec specified in the 1951 Helmand River Delta Commission and articulated in the 1973 treaty—in exchange for access to the Bandar Abbas seaports (Ghoreishi et al., 2024). Over time, however, a lack of shared interests between the two countries has hindered their cooperation and strained neighbourly relations (MRJIRN5, August 2024). Each nation prioritizes its own national interests differently. Economically, Iran is more stable compared to Afghanistan (WAAFG4, July 2024).

While security and economic welfare are priorities for many nations, Afghanistan lacks a clear definition of its national interests and has an unclear approach to foreign policy, particularly regarding its diplomatic relations with neighbouring countries over shared water resources (EHZAFG7, August 2024). Meanwhile, Iran perceives itself as superior and seeks to exert political dominance over Afghanistan, attempting to gain the upper hand. However, Afghanistan resists and never falling under Iran's political influence. The changing river flow due to climate change, coupled with a lack of climate impact mitigation and adaptation practices, exacerbates the conflict, with minimal cooperation between the two countries. (EHZAFG7, August 2024).

Development: Afghanistan is a country still in the early stages of development. It lacks industrialization and a strong economy, and ongoing security and stability issues have hindered its progress (BHNIRN2, August 2024). These challenges have led Afghanistan to prioritize development efforts to improve its economic situation and achieve greater stability. For instance, construction of the Kamal Khan dam on the Helmand River and Salma Dam on the Harirod River which sparked reaction of Iran. In 1990s Iran underwent a similar phase when its dam development projects led to significant environmental degradation and displacement of community.

Now, as Afghanistan embarks on its own water infrastructure projects, these efforts have become a central point of contention between the two countries. Iran perceives Afghanistan's development initiatives as a potential threat to its own water resources and environmental stability. Moreover, Iran struggles with effective communication and diplomatic engagement with Afghanistan, which exacerbates the dispute. There is also a broader issue within Iranian society, where there is a tendency to underestimate Afghanistan and view it through a lens of condescension. This lack of mutual understanding and respect further complicates efforts to resolve the water disputes between the two nations (BHNIRN2, August 2024). Relations between Iran and the Taliban Government could further deteriorate over Helmand River water sharing due to increasing domestic pressures in both countries (Khan, 2023).

National Security: One of the important reasons of dispute is that the Sistan-Baluchistan region does not hold a significant value for Iran from the economic standpoint, due to its limited resources and underdeveloped infrastructure (MDJIRAN8, September 2024; MRJINR5, August 2024; Khan, 2023). However, from a security perspective, Sistan is a high priority for the Iranian government. The region's strategic location near the Afghan border and its susceptibility to water scarcity and related social unrest make it crucial for maintaining stability and national security in the region. Ensuring security in Sistan-Baluchistan is vital for Iran to prevent cross-border issues, avoid displacement and manage potential refugee flows, and address any insurgent activities that could destabilize the broader region (MDJIRAN8, September 2024; MRJINR5, August 2024).

Mistrust: The lack of trust between Iran and Afghanistan, particularly regarding the sharing of data from the Dehrawod station, has exacerbated tensions over water distribution. The Afghan side claims they are releasing sufficient water, while the Iranians argue that they are not receiving the agreed-upon amounts. This discrepancy has fuelled distrust between the two nations, making cooperation difficult (FHMAFG8, August 2024). To address this issue, Afghan officials suggested a visit to the Sistan region in Iran to observe the situation firsthand and verify the water flow and availability. However, Iran refused to allow Afghan officials to conduct such a visit, further deepening the mistrust.

Adding to the complexity, a couple of Interviewees stated that Iran has established a pipe manufacturing facility in Zabul, where large pipes are produced to conveyance water over long distances up to 400 kilometres to Zahidan and surrounding areas (FHMAFG8, August 2024; WAAFGH4, July 2024). This infrastructure development underscores Iran's determination to secure water supplies for its arid regions, but it also raises concerns on the Afghan side, as it may signal Iran's intent to divert significant amounts of water, potentially at Afghanistan's expense. This lack of transparency and open communication between the two countries hinder efforts to reach a mutually beneficial agreement on water sharing and effective implementation of the 1973 treaty.

4.10 Future Prospect

The outlook for both countries, as expressed by interviewees from both sides, remains unpromising from various perspectives. The heads of government seem to lack commitment to effective water governance and an integrated transboundary water management approach with a shared vision of responsibility. Despite the signed treaty and the stipulated monthly water allocation for Iran, both nations continue to experience disputes and conflicts over water resources. The treaty, intended primarily to resolve conflicts and improve political relations between the two countries, has seen little progress in terms of effective implementation.

Over the past 50 years, both countries have failed to establish the necessary distribution points or install joint advanced measuring devices, as required by paragraph b, article III of the treaty. Additionally, no efforts have been made to implement digital monitoring systems (WAAFG4, July 2024). While Afghanistan made several attempts in the last decade to install new hydrometric stations along various rivers, security issues posed significant challenges for the previous government. The current de facto government in Afghanistan faces financial and technical constraints, further complicating efforts. On the other hand, Iran has shown little interest in establishing monitoring stations at water-receiving distribution points, seemingly to keep the actual water amounts unclear (BRAAFG2, July 2024). To achieve better transparency in water flow and usage, it is essential to build distribution points as per the treaty and install advanced digital monitoring systems. This is a critical step for the effective implementation of the treaty to let decision-makers know about the water flow status (Eckstein4, September 2024). Effectively implementation of Treaty could make the relation better in the future and avoid disputes.

The next point addresses the barren and dry Hamuns and Godzare, which have become significant sources of disputes between Afghanistan and Iran. While these environmental challenges contribute to rising tensions, they also offer opportunities for cooperation. The basin's deteriorating conditions urgently require attention, necessitating a technical study to develop a comprehensive

restoration plan. Currently, neither Afghanistan nor Iran has the capacity to conduct the in-depth environmental assessments needed or to propose a joint restoration and maintenance program for these wetlands. Therefore, it is crucial to involve an international organization to lead these critical studies and seek financial support from global institutions.

However, the dire environmental situation of the Hamuns has already captured the attention of global entities. For example, during the World Water Week held on 26 August 2024, the Stockholm International Water Institute (SIWI) presented a short film highlighting the devastation of the Helmand River deltas to an international audience. This indicates a growing global awareness and support for addressing the environmental challenges in the basin. A collaborative approach, with international expertise and leadership, can help restore these ecologically important wetlands and promote cooperation between the two nations.

Additionally, water rights and distribution should be re-evaluated in the long term based on water availability and the flow regime in the basin. While amending the treaty is possible, the basis for such amendments and the implementation process are critical considerations, particularly since both countries lack a strategic consensus (WAAFG4, July 2024). Afghanistan insists that the treaty is permanent and fears that Iran may appeal for an increased water allocation (FHMAFG8, September 2024; AWBAFG10, September 2024). Conversely, Iran is concerned about a potential reduction in its current water rights due to climate change impacts and reduced temporal flow in the river.

The social and political relations between Afghanistan and Iran remain inconsistent, with both countries prioritizing their own national interests without fostering a shared sense of responsibility over the basin. An interviewee from Iran remarked that if the current trajectory continues, no significant changes or improvements are expected in the near future (MDJIRN8, September 2024). He also mentioned that while Iran is working to strengthen its relationship with the Taliban—mainly to secure stability in its southeastern region—there appears to be little focus on developing a long-term, sustainable solution to the ongoing water disputes and conflicts (MDJIRN8, September 2024). Another Iranian interviewee highlighted that for Iranian officials, security, diplomatic relations, and political power take precedence over water-related issues (ZRGIRAN7, October 2024).

A water expert further expressed doubts that relations between Iran and Afghanistan will improve in the next decade or even longer, especially considering the worsening impacts of climate change (MHRIRN1, July 2024). Water scarcity is becoming a critical driver of interstate tensions and grievances, placing increased pressure on political leaders to take meaningful action. Addressing these challenges demands a comprehensive hydrological study that considers recent climate variability and the growing risks of prolonged droughts and flash floods. Looking forward, without immediate collaborative efforts and international support, the situation could worsen, exacerbating both the environmental crisis and regional instability. However, if both nations can shift their focus toward shared management of the basin, leveraging scientific research and international support, there is potential to transform this challenge into an opportunity for sustainable water resource management, fostering long-term cooperation.

4.11 Conclusion

The Helmand River basin dispute captures complex and enduring issues rooted in historical, geopolitical, environmental, and socio-economic factors. Despite the 1973 treaty, which aimed to define and allocate water rights, the lack of effective implementation, coupled with the absence of mutual trust and coordination, has led to recurring tensions. Key contributing factors include unilateral infrastructure development, such as dam construction, climate change-induced water scarcity, and a lack of transparent water flow monitoring. These challenges are further compounded by regional instability and inconsistent policy enforcement in both Afghanistan and Iran.

For sustainable and active cooperation, the chapter emphasizes the need for a joint and basin-wide sustainable management framework, improved water measurement infrastructure, and active engagement of international entities to foster dialogue. By prioritizing mutual water needs over nationalistic agendas and addressing environmental sustainability, both nations could work toward a shared vision and responsibility that upholds the basin's ecological health and serves the socio-economic interests of the border communities in Sistan-Baluchistan region. It is also crucial to establish a framework for the sustainable and integrated transboundary water management.

This chapter's findings highlight the following critical themes that how transboundary water management can foster water-sharing collaboration between Iran and Afghanistan.

Historical and Geopolitical Context: The Helmand River has long been a lifeline for both Afghan and Iranian communities, supporting agriculture, domestic use, and biodiversity. The basin's water flow, governed by an unstable flow regime influenced by both natural variability and human interventions, is increasingly strained by climate change and regional population growth nation. The 1973 treaty, designed to allocate water to Iran and prevent Afghanistan from obstructing flow, has faced significant implementation challenges. Afghanistan's political instability, Iran's 1979 revolution followed by detached political circumstances, combined with institutional and technical barriers, has limited the treaty's effectiveness and its implementation. While Afghanistan has made recent efforts to address compliance, the lack of regular updates and trust between the two nations has hindered progress.

Environment: Climate change has intensified drought conditions in the Helmand basin, altering seasonal water availability and threatening both countries' agriculture and livelihoods. The basin's wetlands in both countries, particularly Hamuns, face severe ecological degradation due to fluctuating water supply. Further, groundwater over-extraction in Iran Sistan-Baluchistan exacerbates water scarcity, as both nations rely on surface and groundwater to meet agricultural needs. Infrastructure development and water governance policy and strategy are pursuing unilateral water infrastructure development projects, including dams and diversion canals in both countries.

For example, construction of four Chahnimah in river delta area by Iran and construction of dams by Afghanistan. These projects, while intended to secure domestic water needs, increase tensions by altering river flow patterns and reducing water availability at the lower reach of the river. As discussed by several interviewees that one of the major reasons caused drying of Hamuns is construction of Chahnimah by Iran. Similarly, Afghanistan's newly constructed Kamal Khan Dam, is seen by Iran as a threat to its water rights and Hamuns. This study emphasizes the need for joint

environmental and hydrological impact assessments to restore and maintain wetlands and Godzare lake to equally treat environmental interests of both countries.

Data Transparency and Monitoring: The absence of a reliable water monitoring and measuring system complicates data transparency and accountability. While the treaty mandates hydrological monitoring, limited technological capability has prevented accurate tracking of river flow, leading to further mistrust between the parties. Establishing a modern monitoring system is crucial for informed decision-making and equitable water distribution between both riparian countries and effective implementation of treaty. The Helmand River Basin dispute exemplifies the challenges of managing shared resources in a climate-stressed region. Addressing this issue requires a collaborative framework that includes modern water measurement systems, transparent data sharing, and coordinated infrastructure planning. Without cooperative strategies and support from international entities, Afghanistan and Iran risk exacerbating socio-economic strain and environmental degradation in the region. This chapter underscores that an active cooperation framework is essential for sustaining peace and stability through equitable water management in the Helmand River basin.

Sustainable and Integrated Water Resources Management: lack of sustainable water resources management in both countries augment challenges and disputes surrounding the Helmand basin. In the absence of integrated water management system, both countries over exploit river waters unilaterally with consideration of a long-term sustainability. Abandoned agriculture runoff, pollution and sedimentation further affecting water quality and amplified water scarcity in the basin. Absence of an effective IWRM framework also creates mistrust between the two nations. For instance, disputes arise over compliance with the 1973 Helmand River Treaty, which allocates a fixed volume of water to Iran. The geopolitical conflicts stem from the perception in Iran that unfair water distribution can lead to political strain, thereby undermining regional stability.

Unsustainable water management practices contribute to wetlands and environmental degradation, desertification which make both countries more vulnerable to dust storms and habitat loss. Local communities' livelihood is threatening due to lack of sustainable water management since both countries reliant on agriculture, fishing, and wetland resources. Water scarcity often drives migration and fuels socio-economic tensions, potentially spilling over into political unrest. This is crucial for both countries to practice integrated water management to address the current challenges and ensure environmental resilience in the basin. This approach could allow both nations to optimize agricultural productivity, manage floods, and enhance hydropower generation to mitigate loss of economic and environmental opportunities. Without a cooperative approach, both countries are less prepared to handle environmental degradation, drought and other water crises aggravated by climate change.

The active cooperation framework proposed in this research helps both countries to secure their national interests, build trust, promote IWRM values and contextualize international water law principles for better collaboration over shared watercourses and contribute to effective implementation of the treaty. Practicing good water governance and cooperation over water, support peace and stabilization in the region and avoid displacement and migration of rural people. by effective implementation of the treaty, socio-economic development and diplomatic relations can be improved between both countries.

CHAPTER FIVE

5 Discussion

5.1 Introduction

The discussion chapter has synthesized Helmand River waters dispute findings and cooperation mechanism between Iran and Afghanistan and linked them to the broader context, interpret their significances, and explore implications for policy and recommended practices. The discussion chapter provides a comprehensive analysis of the research findings, offer valuable insights for policymakers and stakeholders, and suggests practical steps for improving cooperation over the Helmand River waters.

Many scholars and research studies have examined water disputes, water stress, hydrological analysis, and infrastructure development in the Helmand River basin. However, none have specifically addressed the need for an active cooperative framework grounded in trust from social, institutional, and political perspectives. Furthermore, there is a lack of analysis considering International Water Law and IWRM principles from the local context lens to explore how such a cooperative framework could enable both states to collaborate on the implementation of the signed treaty and the sustainable use of shared watercourses.

The main objective of this study is to thoroughly assess the enduring disputes between Iran and Afghanistan over the Helmand River basin, despite the signing of the 1973 water-sharing treaty. By identifying the root causes of these unresolved conflicts, the research seeks to understand the factors that hinder the treaty's effective implementation and sustained cooperation. The study emphasizes developing a framework for active collaboration between the two nations to ensure the treaty's full functionality. This framework (section 2.9) is aimed promoting transparent and reasonable water management practices, addressing both legal and practical challenges in treaty enforcement. Additionally, the research highlights the broader implications of transboundary water management in fostering economic, social, and political collaboration between the riparian states. By doing so, it demonstrates how such cooperation can enhance regional stability, mitigate tensions, and create mutual benefits for both countries including a balanced and equitable approach for the environmental and ecological preservation and restoration in the basin.

This chapter builds on prior analyses and investigation to propose actionable solutions and strategies to bridge the gaps in current water management practices, paving the way for a sustainable and cooperative approach to shared and transboundary water resources.

5.2 Interpretation of Findings

The 1973 treaty is the culmination of over a century of disputes, negotiations, and mediations involving both internal and external actors. These efforts began to an international level with the

1872 border and water disputes resolution by the British General, Frederic Goldsmid⁵⁶ and extended to U.S. mediation in 1950s that ultimately led to the Helmand River treaty in 1973. The geopolitical complexities and the fluctuating nature and flow alignment of the Helmand River were major obstacles to reaching a consensus on water distribution and border demarcation. The border disputes discussed in many other research studies which was continued between Tehran and Kabul until the 1930s (Tarhan, 2019; Aman, 2016; Hearn, 2015) while negotiation over water continued until 1970s.

5.2.1 Geopolitical Complexity

Historical records show that the river's irregular flow, exacerbated by frequent droughts, fuelled tensions throughout centuries. The severe drought of 1902 (Delta Commission Report, 1951), for example, resulted in disputes mediated again by the British Commissioner, McMahon⁵⁷ in 1905, who proposed allocating two-thirds of the river's flow to Afghanistan and one-third to Iran an arrangement rejected by Iran. Afghans were generally satisfied with the outcome of the arbitration, but it sparked negative reactions abroad, particularly in Iranian and Russian media ((Nagheeb, 2022)). These outlets published letters criticizing McMahon's award and alleging that it undermined the water rights of the Sistan people. Some also framed the arbitration as a British political tactic and part of a larger geopolitical conspiracy by Britain and Russia to manipulate regional water rights and exert influence in the area (Nagheeb, 2022).

However, McMahon's engineering data recognized by both countries' local officials. When for 30 years water distribution issues remained unanswered, in subsequent decades, joint commissions from both countries skillful local officials addressed water issues. In 1931-1932, both Afghan-Irano joint teams reached to a consensus to divide the river lower flow reaching the head of Delta below the Band-e-Kamal Khan (Delta Commission Report, 1951). This joint protocol was ratified by Iran's parliament in 1937 but was ultimately rejected by Afghanistan's national assembly, as it was perceived to favor Iran.

The severe drought of 1947 prompted U.S. intervention to mediate the water disputes between Iran and Afghanistan, leading to the establishment of the Helmand River Delta Advisory Commission in 1950. The commission reviewed the longstanding disputes using prior assessments, including the McMahon reports. As part of its mandate, the commission engaged in discussions with senior Iranian and Afghan officials⁵⁸ and collected available data from both sides. According to the Delta Commission Report (1951), Iran and Afghanistan established a permanent Helmand River Commission to collaborate with the U.S. Advisory Commission in addressing water-related conflicts and disputes toward finding a resolution which ended up to 1973 treaty, signed by both countries. Treaty was a product of mutual consensus between the heads of government of

⁵⁶ Goldsmid acknowledged water disputes between Iran Afghanistan in terms such "It is moreover to be well understood that no works are to be carried out on either side calculated to interfere with the requisite supply of water for irrigation on the banks of the Helmand" (Delta Commission Report, 1951).

⁵⁷ "The Mission (hereinafter referred to as the McMahon Mission) conducted field investigations in the Helmand River Delta from February 1903 to May 1905" (Delta Commission Report, 1951).

⁵⁸ The U.S. Commission met with several Iranian officials, including Mr. Alam, the Deputy of Iran's Majlis in Sistan, Ebrahim Mahdavi, the Minister of Agriculture, Mr. Tashakkori, Mr. Behnia (Managing Director of Irrigation), and other interested Iranian officials in Tehran. Afghan officials engaged during the field investigation included Mohammad Akram Khan, Acting Minister of Public Works, Amir-Uddin Khan, President of Agriculture in Kabul, Abdul Majid Khan, and Najib Ullah Khan (Delta Commission Report, 1951).

Afghanistan and Iran, who expressed their consent and willingly signed the agreement. Iranian researchers also acknowledge that the interactions and negotiations between the two nations ultimately concluded in the signing of this joint treaty to allocate the Helmand River's waters (Amini et al., 2021). According to an Iranian water expert, the 1973 treaty was a strong and valid document for its time (MHEIRN6, August 2024). However, numerous factors have since hindered the treaty's effective implementation, with geopolitical complexities being one of the primary challenges. These complexities include shifting political dynamics, regional tensions, and the broader influence of global powers in the region.

Nonetheless, effective geopolitics provide tools to navigate shared water disputes by balancing interests, fostering cooperation, and ensuring sustainable resource management. But Afghanistan and Iran have not been succeeded to establish a ground for cooperation even failed to develop and institute a joint water monitoring system and data sharing platform for unravelling the ambiguity of water delivery volume to Iran.

During the interview, Afghanistan's ex-Commissioner for the Helmand River stated that teams from both countries had multiple discussions about establishing water receiving points along Rude Sistan, specifically where the border crosses and between pillars 51 and 52. However, these efforts were unsuccessful. In 2020, Afghanistan initiated the construction of water receiving points, but the project was disrupted by insurgent groups. Afghanistan claims that Iran played a direct role in sabotaging this critical project through its support of insurgent groups, as Iran is alleged to oppose river flow measurements (AWBAFG10, September 2024). This resistance is attributed to Iran reportedly receiving more than its allocated share of water (26 m³/sec) under the 1973 Helmand River Treaty (BRAAFG2, July 2024; WAAFG4, July 2024; ENZAFG7, August 2024).

Iran's political trajectory toward Afghanistan has been notably inconsistent, particularly over the past five decades. Initially, following the signing of the 1973 Helmand River Treaty, both nations exhibited mutual trust at senior governmental levels. One notable positive outcome of the treaty was Afghanistan gaining access to Iran's Bandar-e-Abbas port, enhancing its connectivity as a landlocked country (Khan, 2023; Aman, 2016). However, this trust proved unsustainable due to political upheavals on both sides, which adversely impacted the treaty's implementation. Over time, Iran's political and social relations with Afghanistan have evolved dynamically, influenced by key events such as the Soviet invasion, the Afghan civil war, the republican era, and the current Taliban regime.

During the US-backed republican government, Iran strengthened its ties with the Taliban, reportedly to disturb⁵⁹ Afghanistan's water resource development projects in the Harirud and Helmand River basins (Khan, 2023; Express Web Desk, 2017). This fluctuating relationship underscores the geopolitical complexities that continue to affect bilateral cooperation over shared water resources and implementation of the signed treaty.

⁵⁹ In 2017, Taliban insurgents attempted to blow up the Salma dam in the Harrirod basin and Kamal Khan and Kajaki dams in the Helmand basin. The arrested Taliban gang leader Mullah Dadullah said "I was trained in Iran for three months. Our trainers were a mix of Pakistanis, Iranians, and Arabs and added that Ali Talibi and Hussein Rezai were two of my Iranian instructors. They taught me to fire rockets and to plant mines" the article reported that "He said that recently Iranian officials offered him \$50,000 in return for destroying the Kamal Khan Dam in Nimroz" (Khan, 2023; Express Web Desk (2017, June 25; Radio Free Europe (2011, August 23). https://www.rferl.org/a/captured_taliban_commander_claims_trained_in_iran/24305674.html

Iran and Afghanistan are currently working to strengthen their bilateral relations. On January 27, 2025, Iran's Foreign Minister, Sayed Abbas Araghchi, visited Kabul to enhance political and economic ties with the Taliban government. During the visit, Taliban Prime Minister Mullah Muhammad Hassan assured Iran that Afghanistan has no harmful intentions regarding the Helmand River waters and river flow would not be restricted to Iran. He emphasized that Afghanistan would respect Iran's water rights, even in the absence of a formal treaty (Fahim, 2025).

Araghchi underscored the importance of cooperation on water management and Afghan migrants, urging both sides to prioritize the full implementation of the 1973 water treaty (Jalali, January 2025). Despite Iran's ongoing political manoeuvring and concerns over resource management, the Taliban government continues to show a commitment to fostering stronger relations. However, tensions persist, with reports highlighting that Afghan refugees are caught in the political power play between Iran and the Taliban (Kawusi, 2024).

The meeting between Iran's Foreign Minister and the Taliban leadership highlights efforts to strengthen ties, with water management and Afghan migrants positioned as key areas for cooperation. While the Taliban assured Iran of no harmful intentions regarding Helmand waters (Fahim, 2025). Iran Foreign Minister confirmed during his press on 27 January 2025 that the current authority of Afghanistan has good intention about Iran and emphasized on Iran rights to be prioritized through the implementation of the 1973 treaty (Fahim, 2025). This indicates cautious diplomacy but underscores unresolved tensions over water rights and resource management, which remain critical to future relations. It suggests that while both sides seek cooperation, trust and effective treaty enforcement will be pivotal in mitigating disputes and fostering stable relations.

5.2.2 Poor water governance and water management policy in Iran and Afghanistan

As stated in Chapter Four, water governance and policy in the Helmand River Basin which spans parts of Afghanistan and Iran are shaped by a combination of historical agreements, national water laws and policies, and the broader geopolitical context. These factors collectively influence how water resources are managed, shared, and contested between the two nations. The leading role of water policy is to allocate water between two main categories of competing users and uses that their engagement either secure access to water or denial the access (Kibaroglu, 1996).

Water plays a significant role in sustainable development in the presence of good water governance (Batchelor, 2007). Water governance refers to the social, political, economic, and administrative systems of a society which influence the use and management of domestic and shared water resources (Batchelor, 2007). Water governance covers the feature that regulatory actors and authorities practicing in the management of water and related natural resources. Politics plays important role in water governance such as establishing water management system at the international, national, and local levels (Batchelor, 2007).

Since long period Iran water resources management challenging and complex issue mainly due to uneven political power system and limited authorization to the line departments (Yousefian, et al., 2022; Moridi, 2017). The power control by Head of Government influenced the autonomy of line ministries or authorized departments to make right and on time decisions regarding water resources governance at the country level (Moridi, 2017). The UN's index says when amount of water withdrawal for a country is more than 40% of its total domestic renewable water resources, this

country faces a severe water crisis. According to Rahim Maidani, Deputy Minister of Water and Wastewater, Iran current water consumption is 88% of its renewable water resources and 63% of the country's drinking water comes from the underground sources (Midani and Tejaratnews, 2016). The same issue reported by Bozorg-Haddad et al. (2024) that Iran water current consumption is 80% higher than the water scarcity threshold. It is also added that ground water and surface water badly impacted by mismanagement and climate change with 58% rainfall reduction in last years. This means Iran has a severe water crisis and the country water crisis has almost reached to chronic situation, and it is getting worsen day by day due to climate changes impact and poor water governance (Islami & Rahimi, 2019).

Moreover, numerous Iranian studies have identified several key factors contributing to poor water governance in Iran. These include a lack of communication and effective coordination among governmental entities responsible for water resource management, failure to implement existing laws and regulations, instability in management, widespread corruption, and conflicts of interest among various stakeholders and actors (Yousefian et al., 2022; Moridi, 2017). The country economic policies are more focusing on land reform for agriculture expansion and economic development (Amiraslani & Dragovich 2023) in the desert. For example, Agriculture sector is the major user (92%) of water in Iran where total amount of water from 44 billion m³ in 1961 increased to 80 billion m³ in 2001 where the usage of water is gradually increased to 86,5 billion m³ in 2011 (Moridi, 2017) and now it would be over 90 billion m³.

An Iranian professor stated during the interview that he noticed during his duty in Kabul, Helmand basin's commissioners from both Iran and Afghanistan were frequently changed, leading to inconsistency in their meeting agendas and a lack of productive, result-based discussions, hindered their decision-making process (MHEIRN6, August 2024). Many Iranian environmentalists criticize the pace of dams' development in Iran. According to Darwish (2019) construction of many dams caused to dry one million of Palm trees in Khusistan province. Similarly, construction of Kurkha dam caused drying up a large part of the Horul Azim wetland and resulted the destruction of people's livelihoods and over exploitation of groundwater caused land subsidence and loss of eight million palm trees in the Menab Harmazgan desert (Islami & Rahimi, 2019).

Iran newspaper reported that the consequences of improper dam building policy and poor water resources management have been caused many environmental and economic threats to Khusistan and adverse effect in other parts of the country (Iran Newspaper, 2017). Iran Ministry of Energy as a main actor is responsible for all the negative impacts of wrong policies and poor transboundary water management in Iran (Islami & Rahimi, 2019). Consequently, according to many studies and research papers as discussed in this section water crisis in Iran predominantly is the result of poor water resources management and improper policy (Yousefian et al., 2022; Islami & Rahimi, 2019; Majidyar, 2018; Iran Newspaper, 2017; Madani, 2014).

The Afghan government has long faced significant challenges in the water sector due to political instability stemming from revolutions and frequent regime changes, as highlighted in section 2.7. Additionally, the Afghan government's reliance on foreign technical and financial support has constrained its autonomy in policy formulation and implementation. After enduring four decades of war and conflict, the previous Afghan government introduced Integrated Water Resource Management (IWRM) as a strategy to ensure the effective and efficient utilization of water resources. Establishing River Basin Authorities (RBAs) was identified as the first step in implementing IWRM. By mid-2011, the Ministry of Energy and Water had developed a river basin

management framework and initiated the activation of RBAs alongside staff recruitment (Sadat, 2012). Local institutionalization requires strong political will and commitment for successful implementation. Unfortunately, in Afghanistan, such commitment has remained inconsistent due to political instability and frequent alternations in leadership (Madema et al., 2008). Moreover, the lack of cross-sectoral coordination among line ministries and departments has been another significant challenge, hindering the integration of stakeholders in policy and governance formulation (Ahmadzai, 2021).

The Afghan Ministry of Energy and Water (MEW) anticipated that applying Integrated Water Resource Management (IWRM) principles and activating River Basin Authorities (RBAs) would lead to improved water resources management and dam development. However, interviews with key stakeholders reveal that transboundary water management poses a significant challenge, particularly for dam development in international river basins. This issue is compounded by Afghanistan's lack of a clear transboundary water policy framework, a critical gap that directly impacts the three IWRM principles; Economy, Equity, and Environment as defined by Postel (1992). Furthermore, the absence of international agreements on shared river basins apart from the Helmand River, poses significant threats and contributes to tensions that could undermine regional stability and economic development.

This issue represents a critical policy challenge and a major obstacle to dam development in Afghanistan, particularly in light of the policies of international investor agencies, as highlighted by many stakeholders. The primary reason for Iran's opposition to Afghanistan's dam development projects lies in the developments on the Helmand and Harirud River basins. Iranian authorities argue that these water infrastructure projects have reduced water flow to Iran, particularly affecting the Hamuns (BNMIRN2, August 2024; ZRGIRAN7, October 2024; MDJIRAN8, September 2024). This issue stems from the absence of clear water governance and policy frameworks at both national and transboundary levels in Afghanistan.

The Water Law of Afghanistan was first enacted in 1991 and has undergone several revisions and updates since then. The last revision was made in 2009 to align with Afghanistan's evolving conditions and the need for sustainable water resource management. The most recent revision was made in 2019 which emphasize on IWRM, to improve the utilization of water resources and enhance coordination among relevant institutions (GoA, 2017). Also to establish management entities like River Basin Authorities (RBAs) for better regional oversight including transboundary waters and environmental protection (MEW, 2009). The aim of RBAs was to decentralize water governance in the country but limited technical and financial capacity in key institutions like the Ministry of Energy and Water (MEW) has hindered effective policy execution (Sadat, 2012). Weak coordination between the line ministries and decades of political instability, institutional upheaval and regime alterations have disrupted long-term strategic planning and policy consistency (Ahmadzai, 2021).

In addition, Afghanistan shares four transboundary rivers with its neighbours, including the Helmand River (Iran), Harirud-Murghab (Iran and Turkmenistan), Kabul River (Pakistan), and Amu Darya (Tajikistan, Uzbekistan, Turkmenistan). Except for the Helmand River Treaty (1973) with Iran, no binding water agreements govern transboundary water sharing (Rahimi, 2014). Afghanistan lacks a clear and actionable transboundary water policy. While the Water Law encourages cooperation, it does not provide practical mechanisms for negotiations with neighbouring countries (MEW, 2009; ENZAFG7, August 2024). Afghanistan struggles with

inadequate water monitoring systems, making it difficult to assess water availability and negotiate effectively with neighbours (ICRC, 2020). Limited internal capacity forces Afghanistan to rely on international organizations for technical assessments (UNDP, 2018). Increased variability in water availability due to climate change has exacerbated water scarcity issues, intensifying disputes with neighbours (Rahimi, 2014). Environmental degradation, such as the drying of wetlands (e.g., the Hamouns shared with Iran), has heightened tensions (World Bank, 2021).

While the Water Law of Afghanistan provides a robust legal framework for water governance which focuses on participatory approach to engage all stakeholders in decision-making (Nabavi, 2024), still significant gaps in its implementation, good governance, and transboundary water management persist. Addressing these challenges requires a combination of political will, institutional reform, and regional active cooperation framework to ensure sustainable and equitable water management for Afghanistan and its neighbours particularly Iran and Pakistan. The current regime of Taliban political and governance trajectory looks uncertain particularly regarding shared and transboundary waters with Iran, Pakistan and Central Asian countries. Lack of transboundary water management agreements with most of its neighbouring countries intensifies political tensions. Even the effective implementation of 1973 treaty required improved political relations and establishing an active cooperative framework with Iran.

5.2.3 Environmental and Ecological Considerations

In transboundary water governance programs, in addition to hydrological, climatological, political, social, and legal factors, environmental and ecological aspects play a crucial role and should be carefully considered by all stakeholders (Najafi & Vatanfada, 2011). The 1973 treaty addresses climatic factors, specifying that when the river flow falls below a “normal water year,” the amount of water allocated to Iran, as stipulated in Article III, should be adjusted accordingly (Article IV). However, the treaty does not address environmental concerns or the ecological health of the river delta, particularly the river wetlands nor the entire basin.

Several research studies highlight that the treaty lacks provisions for environmental flow and wetland sustainability, as these concepts were not widely recognized in the 1970s. On the other hand, some Afghan experts argue that the return flow from Hamun-i-Helmand to Godezari was implicitly considered by the three neutral experts⁶⁰ as an environmental flow (AWBAFG10, September 2024). Nonetheless, this remains a point of contention, particularly for Iranians, who emphasize the need to improve the treaty to address contemporary environmental priorities. However, the Delta Commission Report provided a more detailed discussion of wetlands and sub-wetlands spanning from Taraku as called sub-wetland to Puzak Hamun and extending toward Hamun-i-Helmand. The report examined their hydrological status and outlined the flow directions into the Hamuns from various tributaries, such as Rud-i-Sistan and the flood overflow from Sabri Hamun to Hamun-i-Halmand. During periods of high flooding, the report highlighted that return flows through the Sar-i-Shela channel reach the Godezari depression, located in Afghanistan (Delta Commission Report, 1951).

⁶⁰ The Helmand Delta Commission three neutral experts composed of Professor Francisco J. Dominguez from Chile, Engineer Robert L. Lowry from USA, and Engineer Christopher E. Webb from Canada (Delta Commission Report, 1951). The purpose of mission was to recommend an engineering-based agreement of water distribution for Iran and Afghanistan at or below the Kamal Khan dam (Delta Commission Report, 1951).

The 1973 treaty was signed based on the findings and recommendations outlined in the Delta Commission Report. This report provided a detailed analysis of the hydrology, wetlands, and flow directions of the Helmand River Basin, including key areas such as the Hamuns. Today, climate change has significantly deteriorated wetlands such as the Hamuns, leaving them mostly dried up. However, many Iranians do not believe the impact of climate change, arguing instead that Afghanistan's actions specifically restricting water flow (Hajihosseini et al, 2016). They claim that Afghanistan's actions violate the provisions of the 1973 treaty, particularly Article V, which stipulates that Afghanistan must not deprive Iran of its lawful rights to the Helmand River (MDJIRAN8, September 2024).

At the same time, Iranians are dissatisfied with the treaty itself, claim that the water quantity allocated under its provisions is no longer sufficient to meet their needs ((MDJIRAN8, September 2024). On the other hand, Iranian claims that reduction in water flow attributed to Afghanistan's upstream development activities, creating ongoing tensions between the two countries. From the Iranian perspective, infrastructure projects such as the Kamal Khan Dam and the Qala-e-Afzal Canal on the Helmand River, as well as the Bakhshabad Dam on the Harirud River, are viewed as primary factors impacting water availability in the wetlands (Arfa et al., 2025). These projects, designed for water diversion and storage, are perceived by Iran as a direct threat to its water supply and further deterioration of the Hamun wetlands, further intensifying tensions between the two nations over transboundary water management (Arfa et al., 2025; MDJIRAN8, September 2024; ZRGIRAN7, October 2024).

Afghan experts and researchers emphasize that the drying of wetlands and environmental deterioration of the river delta are primarily due to climate change, which has significantly affected river flow. They also point to the construction of artificial reservoirs (Chahnimahs) by Iran near the Hamuns (wetlands) as a major contributing factor (WAAFG4, July 2024; IDMAFG11, October 2024). Afghanistan advocates for an equitable approach to managing the basin's environment, including the Hamuns and Godezari wetlands. Afghanistan asserts that the Hamuns are not solely for Iran but are valuable historical and natural resources that play a crucial role in supporting the livelihoods of rural communities and maintaining ecological balance in both countries.

In the active cooperative framework outlined in Section 2.9, the focus on ecological and environmental benefits highlights the importance of fostering active cooperation between Iran and Afghanistan. Both parties should prioritize flexibility, innovation, collective ownership of outcomes, and equitable sharing of ecological resources.

To transition from traditional cooperation to an active cooperation and a collaborative mode, it is essential for the engaged institutions of both countries to implement the recommended AWC criteria outlined in Figure 11. These criteria should be aligned with Integrated Water Resources Management (IWRM) and key international water law principles, such as equitable and reasonable utilization, the prevention of significant harm, and ecosystem protection, all tailored to the local context as recommended by the PCCP conceptual framework and discussed this in the following section 5.3. In this proposed conceptual framework for the Helmand River Basin, Iran and Afghanistan should establish a robust collaboration mechanism to ensure the actual and effective implementation of the 1973 treaty. This would serve as a vital step toward sustainable transboundary water governance ensuring environmental sustainability and ecological restoration in the wetlands.

5.2.4 Climate change impacts

Climate change, as a global threat, has not been comprehensively addressed in many research studies concerning water allocation and environmental issues in transboundary basins. However, its impacts have emerged as a significant factor exacerbating tensions between Iran and Afghanistan over Helmand River waters (Majidiyar, 2018). According to Shokory et al. (2023) since 1950, temperature raised from 0.6 to 1.8 C in Afghanistan. Researchers emphasize that climate change has disrupted river flow patterns, increased water demand, altered cropping systems, and diversified agricultural practices. Climate change is one of the main driving factors of global water scarcity (Bozorg-Haddad et al., 2024). Rising temperatures have extended harvesting periods, further intensifying the need for water resources (ENZAFG7, August 2024). The evolving climate conditions highlight the urgent need for adaptive water management strategies and cross-border cooperation to mitigate the effects on agricultural livelihoods and environmental sustainability. The effective implementation of the 1973 treaty could help both countries to cooperate over water rather than go for conflict.

According to Afghan researchers, climate change should not be a source of tension between countries, as the issue has already been addressed in the 1973 treaty's Article IV (IDMAFG11, October 2024; FHMAFG8, September 2024). This article of treaty, outlines a cooperative roadmap stating climatic factors, that Iran's rights under Article III should be adjusted when the river flow is below a "normal water year." Furthermore, it specifies that Afghanistan should cooperate with Iran by delivering the agreed water rights when the flow equals or exceeds a "normal water year." As stated in the treaty. An active cooperative approach can make it easier for both nations to manage environmental challenges and support each other during critical times.

Failure to adhere to this clause stated in the treaty and cooperative mechanism may instead amplify tensions between Iran and Afghanistan. Hashemi (2024) reported that Shokory et al. (2023) has reviewed 131 scientific papers and indicated that Afghanistan water resources negatively impacted by climate change. For example, according to Bromand (2017) the Helmand River flow from 10.4 BCM in 1969 -1980 has decreased to 8.4 BCM during 2007- 2016 which shows 19% reduction in total annual flow and further reduction projected to 7.1 BCM by 2030 (Hashemi, 2024).

Nevertheless, many Iranians remain sceptical about the extent to which climate change has impacted water availability and assert that it has not significantly reduced water flow or affected Iran's water rights. Despite this belief, Iran's economy has been adversely impacted by drought and climate change in recent years (Sadat & Sayed, 2024) and face with severe water scarcity (Kawusi, 2024). According to the Iran Islamic Republic News Agency, more than 800,000 people were displaced from southern to northern parts of the country during 2022 and 2023 due to severe water shortages particularly in Sistan – Balochistan region (Sadat & Sayed, 2024). The same claim recurrent by Iran Foreign Minister during his recent trip to Afghanistan in January 2025, stated that climate is a global challenge, but we are not sure at what extend the Helmand River flows has been impacted and what is water availability in the basin (Fahim, 2025).

This shows a unity of Iran and their understanding level that all public, academia and politicians are in the same page of believe. While Iran government forget that in 2023 thousands of people from Sistan region protested and threatened Iran government about water shortage in the region as a result of climate change impacts (Tayebi, 2023). A recent research paper reported that Iran water current consumption is 80% higher than the water scarcity threshold. It is also added that both

surface water and groundwater badly impacted by mismanagement and climate change with 58% rainfall reduction in the last years in Iran (Bozorg-Haddad et al., 2024).

Several Iranian researchers indicate that rainfall data for example from 1986 to 2022 shows that approximately 70% of the recorded years experienced normal climate conditions (Arfa et al., 2025). Another group of Iranian experts analysed hydrological data from 1940 to 2012 and argues that climate change has not significantly impacted the Helmand River's annual mean flow (Hajihosseini et al., 2016). They claim that Afghanistan's recent actions, particularly dam construction and water infrastructure development are the main cause of water flow attenuation to Iran's Sistan region. This is violating the provisions of the 1973 treaty, especially Article V, which stipulates that Afghanistan must not deprive Iran of its lawful rights to Helmand River water (Hajihosseini et al., 2016; MDJIRAN8, September 2024). One of Iran's primary concerns is the Kamal Khan Dam, which the Iranian Minister of Energy, Ali Akbar Mehrabian, has labelled it as a "grievous" project built by Afghanistan (Fahim, 2025).

In contrast, an Iranian expert interviewed in August 2024 who criticized the findings of Hajihosseini et al. (2016), suggesting that the study is questionable due to the use of incorrect parameters in their model simulations. He also emphasized that while Iran blames Afghanistan for the construction of Kamal Khan Dam, no one questions Iran's water management performance or its efforts to find creative solutions for the water crisis challenges faced the Sistan people (BNMIRN2, August 2024). He also emphasized that anyone with even a basic understanding should recognize the significant impact of climate change on water resource availability.

It is evident that climate change has further intensified transboundary water challenges between riparian countries. Addressing these challenges requires active cooperation, transparent data sharing, trust building, consistent dialogue between actors, and integrated water resource management. Moreover, prioritizing transboundary interests over national interests is essential to minimize tensions related to water disputes (Sadat & Sayed, 2024). Though climate change has become a source of contention between upstream and downstream riparian countries. However, it can be an opportunity to enhance cooperation and get closer both countries for collaboration that could transform this threat into an opportunity to engage in dialogue, explore creative solutions, and develop effective mitigation strategies (HSNIRN10, August 2024).

5.2.5 Exploitation of Groundwater Resources

The natural complexity of the groundwater aquifer is a major challenge to set up a clear standard method or approach to delineate the shared hydrological boundaries between the riparian countries (Sanchez et al., 2020). Groundwater is still missing and not part of the transboundary water discussions nor part of many research and studies in the Helmand basin despite transboundary water is a major contributor of water storage in the basin (Do et al., 2024). Local authorities tend to prioritize surface water flow management, often overlooking the critical governance of groundwater within the basin (Smith & Kumar, 2018). This neglect poses severe challenges, particularly in water-scarce regions, arid and semi-arid climate like Iran and Afghanistan particularly the Sistan region.

The region faces environmental degradation exacerbated by deforestation and the over-extraction of groundwater (Bozorg-Haddad et al., 2024). Deforestation significantly impacts the hydrological cycle, as the absence of vegetation reduces transpiration and evaporation, leading to decreased

atmospheric moisture, lower rainfall, diminished runoff and negatively impact groundwater recharge (Boyle, 2024). A recent research paper by Bozorg-Haddad et al. (2024) reported that Iran's current water consumption is 80% higher than the water scarcity threshold. The study further highlighted severe impacts on both groundwater and surface water due to mismanagement and climate change, including a significant 58% reduction in rainfall.

Environmental concerns were not a central focus when the 1973 treaty governing water distribution was initially signed between both countries; however, they have now become increasingly critical. As highlighted by an expert in a recent interview, addressing these concerns necessitates education and public awareness. The lack of forestation, for example, accelerates the degradation of riverbanks in both sides, further deteriorate Hamuns and the entire environment. Tree planting is thus essential for farmers to protect their agricultural land from flood risks and maintain soil integrity (Ahmed, 2023).

Groundwater exploitation remains unregulated in both countries, as farmers and local communities excessively extract water through solar energy for agricultural irrigation without any comprehensive policy or monitoring framework from local authorities (VCE1, July 2024). This unchecked over-pumping has led to significant groundwater depletion, particularly during periods of low rainfall and inadequate runoff for natural recharge. A recent Terrestrial Water Storage (TWS)⁶¹ study across Afghanistan's five river basins revealed a concerning 6.4% decline in the groundwater table within the Helmand River basin (Do et al., 2024).

A recent study by Do et al. (2024) highlight that substantial groundwater extraction increased during dry periods, particularly during the severe drought from 2008 to 2018 across five basins in Afghanistan, including the Helmand basin. This over-extraction led to a drastic groundwater table loss from 2019 to 2022, attributed to "human-induced impacts." Over the past two decades, prolonged droughts, compounded by climate change and human-induced activities such as excessive groundwater extraction, have made groundwater storage loss a critical issue in the Helmand and other basins of Afghanistan (Do et al., 2024). Between 2002 and 2023, another study by Azizi et al. (2025) reported that groundwater depletion in Afghanistan was 49.1% primarily influenced by glacier retreat due to climate change and 36.7% due to excessive water extraction. Among the five basins studied in Afghanistan, the Helmand basin groundwater level experienced the most severe depletion which is due to uncontrolled and unsustainable water extraction by local communities (Azizi et al., 2025).

Similarly, Bozorg-Haddad et al. (2024) highlighted severe impacts on groundwater in Iran due to mismanagement and climate change, including a significant 58% reduction in rainfall. Notably, the 1973 treaty between Iran and Afghanistan did not account for groundwater management and both countries national water policies have also neglected this aspect. However, establishing a cooperative mechanism between the two countries could help develop a control framework for groundwater utilization. As proposed in the cooperative framework in section 2.9, technical projects and joint monitoring criteria could focus on controlling groundwater over-extraction. Additionally, environmental preservation efforts such as afforestation and vegetation expansion could support the hydrological cycle, enhancing surface runoff and groundwater recharge.

⁶¹ "Terrestrial water storage (TWS) refers to the total amount of water present within the Earth's landmass. This includes water stored in the soil, groundwater, snowpack, and glaciers, and surface water bodies (e.g., lakes, rivers, and reservoirs). Due to the high spatiotemporal variations of water storage, it is difficult to measure and analyse regional water storage using point-scale measurements" (Frappart et al., 2013; Swenson et al., 2006).

Meanwhile, IWRM and sustainable water resources management is an urgent need to be considered by both countries to avoid further decline in the long-term.

5.2.6 Water Quality Issues

While the Helmand Treaty primarily addresses water quantity in Article III, water quality issues such as pollution from agricultural runoff, urban wastewater, and industrial discharges are equally significant and are emphasized in Article VI. The treaty obligates Afghanistan to maintain water quality by preventing agricultural pesticide contamination and industrial chemical effluents from polluting the river. Although Afghanistan is not heavily industrialized, reducing concerns over industrial pollution, the use of agricultural pesticides and inadequate solid waste management in Lashkargah city present significant threats to water quality, particularly for domestic use. One key parameter is water pH, which, according to WHO (2008) guidelines, should range between 6.5 and 8.5 values. Studies have shown that the Helmand River's pH ranges from 7.95 to 8.31, indicating slightly alkaline conditions but still good for domestic use (Ansari et al., 2021).

The Potential of Hydrogen (pH) is a key parameter for assessing water quality for drinking and other purposes. A pH of 7 is considered standard for pure water, with values below 7 indicating acidic conditions and values above 7 indicating alkaline conditions. A physico-chemical study of the Helmand River water conducted at the National University of Malaysia Lab found slightly elevated pH levels. This increase was attributed to a predominant reliance on rainwater, mineral dissolution from soil erosion along the riverbanks, and human activities. But the groundwater in the Old Karta-e-Lagan pH, EC, salinity, TDS, sulphate are beyond the recommended threshold of WHO due to dumping waste and percolation of septic tanks in that area of the city (Ansari et al., 2021).

Despite waste management concerns, the study found no significant point sources of human or industrial effluent pollution impacting the Helmand River in Afghanistan. Overall, collaborative research conducted by academic institutions⁶² in Afghanistan, Turkey, and Malaysia concluded that the Helmand River water is potable and suitable for domestic use. The Water Quality Index assessment also indicated that the river does not contain harmful concentrations of chemical elements (Ansari et al., 2021). This is what Afghanistan fulfils its obligation based on the treaty provision (Article VI) not to pollute and contaminant river water flows down to Iran and must be responsible and avoid it in the future.

5.2.7 Socioeconomic Impacts

Since more than 6000 years, the Helmand River is a vital source of water for both countries' farmers for irrigated agriculture to secure their food and livelihood and equally important for the domestic use of people in Sistan (Adelphi, n.d.; Loodin et al., 2023). Since 1946 Afghanistan agriculture system evolving through construction of dams and irrigation canals (Hashemi, 2024). The similar strategy and agenda have been using by Iran, constructing diversion and storage dams, and using non-climate resilience crops in the region (Aman, 2016). For example, Afghanistan

⁶² Collaborative study of the Helmand River water quality conducted in Helmand Higher Education Institute, Afghanistan, National University of Malaysia, Izmir Institute of Technology, Turkey, School of Ocean Engineering, and University Malaysia Terengganu, Malaysia; the groundwater sample collected from three areas and analysed water pH, EC, salinity, TDS, sulphate, and concentrations of nitrate, chloride, TH, Mg, and Ca where only groundwater quality in Old Karta-e-Lagan area was beyond permissible values due to septic tanks and waste effluent (Ansari et al., 2021).

keeps building dams and water infrastructure and Iran pushing for expanding agriculture lands and water storage to ensure food security and socioeconomic development for the rural people (Hashemi, 2024; Aman, 2016).

Many Afghan experts argue that Iran's construction of the Chahnimah reservoirs has significantly disrupted the natural flow of water to the Hamun wetlands, leading to their drying up. These wetlands were once a vital source of income and livelihood for local communities, supporting agriculture, fishing, and biodiversity. The loss of this critical ecosystem has had severe socio-economic and environmental consequences, further exacerbating regional water disputes (FHMAFG8, September 2024; WAAFG4, July 2024). An assessment based on field data from the Natural Resources Management Project and the socio-economic development of the Sistan region revealed significant challenges to biodiversity and natural resource quality. The study recommended that enhancing the region's socio-economic resilience should be a top priority to mitigate these challenges effectively (Hashemi, 2024).

Since both Iran and Afghanistan, particularly the Sistan region, rely heavily on agriculture, their socioeconomic conditions will be further strained by the impacts of climate change and global warming. Bromand (2017) reported that by 2030, the Helmand River's flow is expected to decrease from 8.4 BMC to 7.1 BMC, marking a 32% reduction compared to its flow in the 1970s (Hashemi, 2024). This decline is a clear evidence of climate change which will exacerbate water scarcity in the region, intensifying existing challenges both countries.

A fieldwork assessment by DoE, EU, and UNDP (2022) highlighted national security concerns over the transboundary water dispute between Afghanistan and Iran (Hashemi, 2024). The impacts of climate change and increasing water scarcity continue to threaten local livelihoods and sources of income (HSNIRN10, August 2024). Iran claims that Afghanistan has restricted the river flow to Iran by constructing the Kamal Khan Dam in 2021, thereby impacting Iran's water rights and violating the 1973 treaty (Sadat & Sayed, 2024).

However, Afghanistan insists that the project is essential for boosting agriculture and developing irrigation schemes to support its socioeconomic growth. Nagheeby (2004) argued that the legal and equity principles of the 1973 treaty were overlooked due to external actors' security interests. As a result, security concerns led to the demarcation of a border line, a move contested by local communities. According to DoE, EU, and UNDP (2022), local people do not recognize or accept this political boundary (Hashemi, 2024).

In the Helmand River basin, rural communities in Afghanistan and Iran have been largely excluded from water resources planning and management, and collaboration between the two countries has not materialized. Both nations have failed to establish strong community engagement. While diplomatic relations play a crucial role, the governments of Afghanistan and Iran lack mutual trust to work toward common interests. Iran expects its concerns to be acknowledged, and its regional influence to be recognized while Afghanistan overshadowed Iran's expectations (ENZAFG7, August 2024). Narratives from politicians, social media, and inconsistent political relations have created a significant divide between the people of Iran and Afghanistan, developed a negative mindset between the nations. This negative outlook is a major obstacle to promoting cooperation over water resources. This is why the active cooperation framework in Section 2.9 highlights the slow-track process, emphasizing social motives, institutional capacity, and political power dynamics as essential factors in building trust among the public, politicians, and academia.

5.2.8 Infrastructural Development and Upgrades

In the Helmand basin the state of water infrastructure, including dams, irrigation systems, and canals, remains underexplored, particularly in terms of their efficiency in meeting both current and future water demands. For local economy development both countries focused on development as part of their strategic goals. But unilateral development by both riparian countries in the upstream and downstream often fails to align with established water rights or in proportional to the river's natural flow regime.

Afghanistan is a water-rich country with an estimated 75 MBC of annual freshwater resources. However, due to inadequate water infrastructure, it ranks among the lowest in water storage capacity in the world (Sadat & Sayed, 2020). The Helmand River, one of Afghanistan's largest basins by area, has been a key focus for dam construction over the past two decades. While Afghanistan prioritizes water resource development, Iran argues that upstream dam projects negatively impact its water rights and cause environmental degradation in the arid Sistan region. The Helmand River has become a growing source of conflict between the two nations, with the construction of the Kamal Khan Dam particularly triggering strong reactions from Iran (Sadat & Sayed, 2020). Iran claims that by construction of the Kamal Khan dam, Afghanistan increased its control over the Helmand River flow (Kamil, 2023).

This stems from a 1933 decision by Afghanistan's King Nadir Shah, who offered Iran half of the Helmand River's water an increase from the one-third allocation listed in the McMahon Award for areas downstream of the Band-i-Kamal Khan (Mayar, 2023). This means the Kamal Khan dam was already a planned structure by Afghanistan in 1960s. In the 1970s, Iran had initially expressed interest in financing the construction of the Kamal Khan Dam to secure the purchase of excess water from Afghanistan, as it had failed to include provisions for additional water rights during treaty negotiations (Wasefi & Rashid, 2012). Thus, Afghan officials have dismissed Tehran's objections to the construction of the Kamal Khan Dam as baseless (Ghanizada, 2011). However, even from a hydrological perspective, the dam could reduce the river flow by 52 MCM, equivalent to 1% of the total annual flow in a normal water year (Jahanmal, 2020).

This relatively small amount of water storage in the Kamal Khan dam reservoir is unlikely to significantly impact Iran's 14% water share from the Helmand River except to regulate river flow. The idea for the Kamla Khan dam emerged when Afghanistan realized that the Kajaki Dam which financed by USAID in 1954, was insufficient in controlling devastating floods in the lower reaches of the river (Wasefi & Rashid, 2012). Recognizing the need for a more effective flood control solution, Afghanistan identified Band-e-Kamal Khan as the optimal location for the lower reaches.

Initially, the Afghan government sought funding and technical expertise from the United States, but these efforts proved unsuccessful. In the 1960s, the Soviet Union offered to finance the dam's construction, but Afghan authorities rejected the proposal (Wasefi & Rashid, 2012). Meanwhile, Afghanistan pursued a complementary flood management strategy through the Chakhansur Project, which aimed to control floods and support irrigation in the country. The primary goal was to mitigate flood risks in Iran's Sistan⁶³ region. The McMahon commission survey report indicated

⁶³ The Sistan region of Iran had population of 175,000 people including 30,000 in the Zabol city in 1960s. For utilization of the Helmand River waters, in addition of the diversion weirs, Iran installed about 80 water pumps at the border area for lifting water to agriculture lands in Iran (Wasefi & Rashid, 2012, *this paper originally published on 16-12-1981 but a sanitized copy approved on 06-09-2012: CAI-RDP08C01297R000100130002-7*)

that Sistan suffered more from excess flow rather than water deficiency (Abidi, 1977). Although Iran had constructed, water control and diversion weirs but lack of storage capacity, leading to expectations that Afghanistan would manage floodwaters upstream.

In 1972, Afghanistan developed the Chakhansur Project plan through the International Engineering Co. (IECO), with financial support from the Asian Development Bank (Wasefi & Rashid, 2012). The initial design for the Kamal Khan Dam included two earth-filled dams and a concrete control structure, intended to connect with the Qala Afzal Dam to channel water into Godezare. These interconnected infrastructures were designed to mitigate flood risks for Iran, regulate water flow, and ensure Iran's allocated water share of 26 m³/sec, as specified in the 1973 treaty. Following the treaty's ratification in June 1977, construction of the Kamal Khan Dam began, and Iran even offered financial support for the dam's construction aiming to secure future water purchases from Afghanistan (Wasefi & Rashid, 2012).

Water infrastructure development has been an integral part of discussions and disputes between Iran and Afghanistan in various events. In 1938, Iran declared that it would not oppose Afghanistan's use the Helmand River waters upstream of the Band-i-Kamal Khan for irrigation and agricultural development. Meanwhile, the Royal Government of Afghanistan asserted its right to use the Helmand River's waters upstream of Band-i-Kamal Khan while agreeing not to interfere with Iran's water use downstream, as specified in Section I of the 1938 agreement (NEAOIR, 2012).

According to Abidi (1977), the purpose of the 1938 agreement and the 1937 Saadabad Pact on non-aggression was to foster cooperation over the use of Helmand's waters and to dispel mutual doubts and suspicions. This interchange reflected the willingness of both countries to forget past old grievances and disputes, focusing instead on cooperation in trade, economic development, transit, and the improvement of bilateral relations (Abidi, 1977).

Since the signing of the 1973 treaty, Iran has received a free flow of river water (Wasefi & Rashid, 2012), exceeding its lawful entitlement (26 m³/sec) by approximately 40% as specified in Article III of the treaty (BRAAFG2, July 2024). This overuse was largely due to Afghanistan's limited capacity to utilize the water effectively. However, with the increasing impact of climate change on the river flow regime, Iran has raised concerns over construction of the Kamal Khan dam. However, Afghanistan has confirmed that the Kamal Khan Dam has not impacted Iran's water rights. Instead, the reduction in river flow over time is attributed to natural changes in the flow regime. According to Bromand (2017) the Helmand River flow from 10.4 BCM in 1969 -1980 has decreased to 8.4 BCM during 2007- 2016 which shows 19% reduction in total annual flow and further reduction projected to 7.1 BCM by 2030 (Hashemi, 2024).

Despite global awareness of climate change as a serious threat, neither country has taken significant steps toward adaptation or mitigation measures (BNMIRN2, August 2024), particularly Iran as a downstream nation, faces a high risk of water crises. Instead, both countries continue to focus on dam construction and artificial reservoirs that lack climate resilience. This neglect of climate change threats and the negative consequences of water infrastructure development has drawn criticism. Many water experts argue that the construction of Chahnimah in the river delta has directly contributed to the drying up of the Hamun wetlands (FHMAFG8, September 2024).

The total storage capacity of the four constructed Chahnimah reservoirs is estimated at approximately 1,400 Mm³ nearly equal to the current storage capacity of Afghanistan's Kajaki reservoir and two times of Iran rights in the Helmand waters. These interconnected reservoirs (Chahnimah) divert water into controlled storage, significantly reducing the natural flow to wetlands and adversely impacting ecosystems (WAAFG4, July 2024). Water and environmental experts warn that Chahnimahs pose a severe environmental threat to the deltas Hamuns (FHMAFG8, September 2024).

The unilateral water infrastructure development by both sides in a competitive manner have further hindered cooperation on the effective implementation of the 1973 treaty. In earlier times, based on previous declarations and agreements, political relations and narratives between the two countries were more inclined toward mutual benefits. However, over the past two to three decades, a growing lack of trust, coupled with negative social and political interactions, has intensified tensions over Helmand waters despite advancements in scientific knowledge and climate change awareness.

The proposed conceptual Active Water Cooperative (AWC) framework in Section 2.9 outlines key criteria for fostering cooperation, emphasizing mutual economic, political, and ecological benefits while incorporating IWL principles within the local context. To strengthen collaboration, both parties should begin by implementing the first four criteria of the AWC framework, which lay the groundwork for implementation of technical projects as specified in the treaty. One of the most urgent infrastructure developments is the construction of water receiving points in the designated locations outlined in the 1973 treaty. These points are crucial for trust building and ensuring accurate river flow and discharge measurement, as well as for regularly monitoring Iran's water rights (Loodin et al., 2023; AWBAFG10, September 2024; WABAFG12, October 2024).

5.2.9 Political Conflict and Cooperation Dynamics

The geopolitical and security dimensions of water sharing particularly how broader political relations between Afghanistan and Iran influence water cooperation or conflict are often underexplored. Most of academic research and studies focus is more on environmental, water flow and water allocation. Majority of existing literatures may not fully capture the intricate links between water disputes and other bilateral issues, such as border security and socioeconomic factors. Looking at the dynamics of conflict and cooperation between the two countries over the past century, multiple attempts have been made to resolve this complex water issue, yet challenges persist.

In 1872, British official Sir Frederic John Goldsmid mediated border demarcation between Iran and Afghanistan, including water allocation issues in the border areas. However, the Goldsmid Award was vague and unclear in resolving disputes, as its interpretation suggested a form of shared water rights between both countries. Since the borderline followed the riverbank, a major flood in 1896 caused the river to burst its banks and shift westward, altering its alignment and escalating water rights tensions between the two nations (Mayar, 2023).

Over the decades, both countries have made efforts to regulate the waters of the Helmand River and resolve their disputes (Bolduc, 2025). Following a severe drought in 1902, British officer Sir Henry McMahon intervened from 1903 to 1905 to mediate the water conflict. While Afghanistan accepted McMahon's ruling, Iran rejected it, as the decision allocated two-thirds of the water to Afghanistan and one-third to Iran. Additionally, the McMahon Commission's detailed survey

report in 1096 indicated that Sistan suffered more from excessive water flow than from water scarcity (Abidi, 1977).

In 1921, as Reza Khan was manoeuvring to take power from Ziya-ul-Din Tabatabai, he sought to establish good relations with Iran's neighbours, particularly Afghanistan. In June 1921, Iran signed a friendship agreement with Afghanistan, even before Reza Khan had fully assumed control to announced royalty (Abidi, 1977). Although Reza Khan emphasized Islamic unity and fostering strong ties with Afghanistan, Turkey, and Iraq, aiming to influence and expand regional cooperation while struggling for Iran's independence from Russian and British. Iran and Afghanistan agreed to uphold all clauses of the 1921 friendship agreement.

This agreement was reiterated on November 27, 1927⁶⁴, as Reza Khan sought to convince Afghanistan of Iran's sincere intentions and bona fides in resolving border and water rights disputes (Abidi, 1977). In March 1934, both countries agreed to involve Turkey as a neutral mediator, under the terms of the 1927 agreement, to assist in resolving their border issue of Musa⁶⁵ Abad (Abidi, 1977). In 1933, Irano-Afghan joint protocol established where Afghanistan's King Mohammad Nadir Shah offered Iran a half-share of Helmand waters at Band-e-Kamal Khan. However, this temporary agreement was tentatively signed in 1936 by both sides but later rejected by the Afghanistan National Assembly (Mayar, 2023).

In 1938, both countries reached a non-aggression consensus, committing to cooperation. According to the agreement, Iran was entitled to use water below Band-i-Kamal Khan, while Afghanistan retained full rights to utilize the river's flow upstream (NEAOIR, 2012). Similarly, Abidi (1977) highlights that the 1938 agreement⁶⁶ and the 1937 Saadabad Pact between Iran, Turkey, Iran and Afghanistan aimed to strengthen cooperation over Helmand's waters while dispelling mutual doubts and suspicions. This shift in relations reflected the willingness of both nations to move past historical grievances and focus on trade, economic development, transit, and overall bilateral relations (Abidi, 1977).

During the interim period, while both countries had reached a level of cooperation through the 1938 agreement, a severe drought struck again in 1946–47, prompting U.S. mediation efforts between Iran and Afghanistan in 1948. As a result, the United States established the Helmand Water Delta Commission, engaging three independent experts from the U.S., Canada, and Chile to conduct an engineering study and recommend water distribution at or below Band-e-Kamal Khan for Iran's Sistan region and Afghanistan's Chakhansur region (Delta Commission Report, 1951). Afghanistan accepted the Delta Commission's recommendation to allocate 22 m³/sec of water to Iran, but Iran had expected a larger share than what was proposed in the report (Mayar, 2023). Additionally, the Commission permitted plans for the development of water infrastructure in Afghanistan, including the construction of dams and canals in the upstream reaches (Delta Commission Report, 1951).

⁶⁴ Text in League of Nations Treaty Series, vol. 107, pp. 445-51 (Abidi, 1977).

⁶⁵ According to Ramazani (n. 15, p. 268), Turkey's involvement was related to disputes over the Musa Abad area, a border region between Iran and Afghanistan that had not been demarcated at the time (Abidi, 1977).

⁶⁶ In section 8 of agreement stated that "the contracting parties agreed that no action will be decided upon and taken from the Band-e-Kamal Kahn to Deh Dost Mohammad Khan Sikh Sar which may reduce the share of water, or cause damage to, either party". In Section 12 stated if anybody violate from the agreement provisions, they shall be prosecuted and legally punished (NEAOIR, 2012).

The Delta Commission Report served as a roadmap for Afghanistan, guiding the development of dam and irrigation projects, including the construction of the Kajaki Dam, which was completed in 1954. Upstream dam development was intended to mitigate flood risks in the Sistan region, aligning with the McMahon Award, which stated that Sistan suffered more from excessive water flow than from water scarcity (Abidi, 1977). This may explain why Iran's water rights issue remained largely dormant for nearly two decades until a severe drought occurred in 1971. At that point, both countries recognized the need for a lasting solution and initiated bilateral negotiations based on the Delta Commission Report (1951). To address Iran's concerns, Afghanistan agreed to allocate an additional 4 m³/sec of water, leading to the signing of the 1973 treaty (Mayar, 2023). Iran ratified the treaty immediately in July 1973, while Afghanistan, due to political upheaval, delayed ratification until June 1977 (Loodin et al., 2023).

The signing of the 1973 treaty was a significant step toward cooperation between Iran and Afghanistan, but it did not mark the end of disputes over the Helmand River's waters. The issue of water distribution has been an ongoing challenge between the two countries for centuries. Over time, these disputes have led to both closer cooperation resulting in agreements on water utilization and sometime conflicts which drew steps of external mediators as stated above. The dynamics of cooperation and conflict surrounding the Helmand River can be attributed to two main factors:

- Drought due to climate change impact and environmental degradation
- Political upheavals and interpretation of national interests

The Iran-Afghanistan water dispute has been shaped by decades of both cooperation and conflict. During Afghanistan's 1980 civil war, Iran supported the Mujahideen, particularly Shia groups, against the Afghan government. When the Taliban took power in 1996, Iran's relations with the regime deteriorated drastically, culminating in the Taliban's assassination of 8–10 Iranian diplomats, nearly leading to war (Khan, 2023). Rumors circulated that the Taliban threatened Iran with water restrictions, further straining ties. This hostility drove Iran to welcoming the U.S. in removing the Taliban after 9/11.

Despite volatile Iran-Afghanistan relations under the U.S.-backed Afghan government, Iran and the Taliban found common ground in their opposition to the U.S. (Boone & Kamali, 2016). However, some Taliban factions remained wary of Iran, and Tehran hesitated to formalize ties with the group. When the Taliban regained power in August 2021, Iran strengthened its relations with them to further shared interests. However, tensions resurfaced when the Taliban pursued water hegemony by expanding water infrastructure, angering Iran. President Ebrahim Raisi visited Sistan on May 18, 2023, warning the Taliban against violating Iran's water rights over the Helmand River. This led to a deadly border clash on May 27, 2023 (Al Jazeera, 2023).

Despite strained ties, the Taliban, facing political isolation, expressed a desire for better relations with Tehran and neighbouring countries. In a symbolic gesture, they released water from the Kamal Khan reservoir (Tasnim, 2022), though Afghanistan's Water and Energy Ministry later denied it to avoid domestic backlash (Siddique & Radia Azadi, 2022). Diplomatic visits, such as Iran's Energy Minister Ali Akbar Mehrabian visit in August 2022 (Tasnim, 2022) and Iran's Foreign Minister Araghchi's trip to Kabul in February 2025, signalled efforts to mend relations and pressing the Taliban government to commit over Iran's water rights. However, some evidence suggests that water cooperation fosters political and strategic collaboration. Despite inconsistent

political relations, some Iranian experts emphasize that strengthening ties with Afghanistan benefits Iran, given its upstream position and control over water flow (Fahim, 2025).

5.2.10 Data Availability and Transparency

Accurate data sharing is crucial for fostering cooperation and informed decision-making in transboundary river basins (Loodin et al., 2024). However, the lack of a reliable water monitoring system hampers transparency and accountability. The 1973 treaty emphasizes the construction of joint water receiving points at three specified locations, one at the border line crossing Rude Sistan and two between pillars 51 and 52 (Article III). Yet, for decades, Iran and Afghanistan have failed to implement these measures due to various challenges, as discussed in Section 5.2.1. While for sustainable transboundary water management data sharing is essential (Loodin, et al., 2024).

However, Afghanistan's Commissioner for the Helmand River Basin stated that both countries had multiple discussions on establishing water receiving points, but efforts remained unsuccessful (AWBAFG10, September 2024). In 2020, Afghanistan unilaterally initiated construction of water receiving points to help Iran, but insurgent groups disrupted the project. Afghan officials allege that Iran, opposing river flow measurements and directly contributed to these disruptions by supporting insurgents (AWBAFG10, September 2024). Several interviewees argued that Iran resists monitoring efforts because it reportedly receives more than its allocated (26 m³/sec) rights under the 1973 Helmand River Treaty (BRAAFG2, July 2024; WAAFG4, July 2024; ENZAFG7, August 2024).

This could explain why Iran is not interested in establishing water receiving and monitoring infrastructure, while Afghanistan may feel negligent about setting up joint monitoring and measurement systems. However, it is crucial for Afghanistan to implement a joint water measurement and data-sharing system to prevent accusations of non-compliance with the treaty regarding Iran's water rights. Many stakeholders support regular data sharing, though opinions vary on the frequency, ranging from annual and semi-annual reports to event-triggered data sharing during droughts and floods (Loodin et al., 2024).

Given the Helmand River basin's highly fluctuating flow regime, a daily or real-time data recording system is essential to monitor Iran's water rights as specified in the treaty (WAAFG4, July 2024). Such a system would enhance trust among actors and officials and facilitate efficient decision-making for both parties. However, accurate data collection can only be ensured if water receiving points are constructed at the designated locations, as mandated by Article III, paragraph "a" of the 1973 treaty.

Although current officials from both countries try to maintain close relations, there is still minimal interest in establishing water receiving points and a joint data-sharing mechanism, as required by the treaty. Both sides appear uncommitted to a fundamental solution through full treaty implementation. Lack of trust and competition over their economic and national interest remain major obstacles, leading to water data being treated as a state secret, restricting information sharing. The proposed active cooperation framework in section 2.9 could foster synergy, enhance trust-building, and promote institutional capacity exchange, paving the way for joint data measurement and sharing. Data sharing will not only ensure treaty implementation but also foster sustainable trust and help prevent water conflicts and disputes over water allocation. According to a former Afghan minister, Iran's misperception of Afghanistan stems from a persistent sense of supremacy and an attempt to exert political hegemony (ENZAFG7, August 2024).

Meanwhile, Afghanistan not only resists falling under Iran's political influence but also remains indifferent to Iran's water crisis and water rights concerns (AQKAFG1, July 2024; ENZAFG7, August 2024). This mutual stance negatively impacts political and social relations, leading to a lack of willingness for data sharing and treaty implementation. Additionally, it disregards the application of International Water Law (IWL) principles, which emphasize the reasonable use of water while preventing negative impacts on other water users and the basin's ecosystem health.

5.3 Cooperative Framework and Interpretation of IWL Principles

As discussed in the cooperative framework in Chapter 2, Section 2.9, building trust between nations and actors requires a gradual development of social motives, institutional capacity, and economic/political power status through a slow-track process, as outlined in the following equation (Hofbauer & Sigmund, 2003).

$$S_i(t) = a + k/1 + e^{-t}$$

In this context, $S_i(t)$ represents the social variable over time, where includes social motives, institutional capacity, and economic/political power status. In the equation, a and k denote the constant values that represent the development of these three areas, and e is Euler's number (Wei et al., 2022). This means that stronger social relations and institutional capacity improve the willingness to cooperate over shared water resources. Meanwhile, the strength of a nation's economic or political power status can influence the willingness of riparian countries to cooperate, either positively or negatively, and this is closely tied to social motives (Wei et al., 2022).

A riparian country's economic and political power status play a significant role in shaping its willingness to cooperate. This argument is applicable to many river basins around the world. For instance, in the Ganga River basin, India, and in the Mekong River basin, China, both upstream riparian countries wield strong economic and political power, influencing cooperation based on their own terms. Geographical power status also plays a crucial role in shaping cooperation willingness. For example, Afghanistan in the Helmand River basin holds geographical power but despite of its weak economic and political power, its geographical power plays important role.

The geographical power situation has contributed to its lack of willingness to cooperate with Iran. On the other hand, Iran, with stronger economic and political power, has tried to exert its influence over Afghanistan to secure cooperation over water resources. However, Afghanistan has resisted Iran's political dominance due to its historical and geographical strength. As a result, Afghanistan has remained passive over the decades, showing little interest in practical cooperation over water until President Karzai initiated the implementation of the treaty in 2004 (BRAAFG2, July 2024; AWBAFG10, September 2024).

The recent willingness for cooperation between both countries appears to be driven more by securing individual benefits rather than fulfilling their shared responsibilities. The core issue is a lack of trust between the parties and their nations. Building trust is essential and must occur at different levels in the transboundary water management context particularly where treaty exist. During an interview in September 2024, Professor Gabriel Eckstein, Chair and Executive Council International Association for Water Law recommends two types of trust that need to be developed between Iran and Afghanistan.

1. Within the treaty, where parties respect and accept the treaty's provisions and both countries should have a consensus of interpretation.
2. Outside the treaty, where trust is fostered through the creation of a transparent environment, promoting the exchange of information, data and knowledge sharing between institutions and the public.

The ongoing disputes over water resources arise from both nations focusing on securing less than what they perceive as their rightful share. Instead of fixating solely on the treaty, it is essential to look beyond and assess how much water Afghanistan is sharing with Iran. This can then be compared with the amounts stipulated in the treaty to gain a clearer understanding of the situation. This assessment can be achieved through the construction of water monitoring and measurement infrastructure at the border, specifically at the water receiving points outlined in the treaty. The most important point for effective implementation is to develop the specified water receiving and monitoring stations at the border and establish measuring system to be acceptable for both parties otherwise they will continue to dispute forever (Eckstein, September 2024).

In the third step of cooperative framework, after building trust, both countries must define the principles of IWL subjectively, rather than objectively. While the treaty recognizes the IWL principles and the parties have agreed on its clauses, customary laws unwritten and local practices are equally important which is not yet explicitly included in the treaty. Both nations should come together to document these customary practices in light of IWL principles. Riparian countries need to define and contextualize the broad international water law principles to fit their specific contexts. For instance, terms like "significant harm" lack a precise, universal definition. Therefore, both countries should break down and identify what constitutes harm or risk for their specific circumstances. This localized interpretation will make it easier to apply IWL principles effectively (Eckstein, 2024).

Rather than applying these principles in an abstract way, Iran and Afghanistan should develop their own definitions of terms like "harm" or "risk" in a way that reflects their unique environmental or socioeconomic challenges. Achieving consensus on these definitions won't be easy and will require active negotiation and contextualization by local actors and governments.

5.3.1 Contextualizing International Water Law (IWL) for Afghanistan and Iran

Once trust is established, Afghanistan and Iran must take the crucial step of interpreting and applying IWL principles in a way that fits their specific and local circumstances, not merely in an abstract or universal sense which is vague and doesn't give any an explicit definition. While the 1973 Helmand River water treaty recognizes certain IWL principles such as water distribution according to flow river flow regime on monthly basis, water monitoring and measurement, avoid river water pollution not to be harmful for the Iran agriculture sector and both parties have agreed on these clauses, the treaty overlooks a critical aspect: the role of local and customary water management practices in the basin that have been in place for both centuries.

These customary laws, though unwritten, are central to managing transboundary water resources effectively and are equally binding in practice. Afghanistan and Iran need to convene and formally document these local practices in alignment with IWL principles. This process involves recognizing that the law, while international in scope, needs to be tailored to the specific cultural, geographic, and hydrological realities of the Helmand River basin.

The Importance of Customary Law

Local and customary water-sharing practices whether based on centuries-old tribal agreements, irrigation rights, or seasonal patterns of river flow are deeply rooted in the livelihoods of communities on both sides of the border. By codifying these practices alongside formal IWL provisions, Afghanistan and Iran can ensure that water management decisions are more holistic, culturally sensitive, and contextually relevant. The absence of written agreements on such local practices can cause friction, as the treaty does not account for these nuances.

Defining Key IWL Principles Locally

Riparian countries like Afghanistan and Iran must not only agree to general IWL principles but also they should define the principles in a way that reflects their local needs and concerns. A core principle of IWL is the "no significant harm" rule, which requires upstream countries not to harm downstream countries through their use of shared water resources. However, "significant harm" lacks a universal definition, making it essential for Afghanistan and Iran to collaboratively determine what constitutes harm in the Helmand basin context, stated by (Eckstein, September 2024) during the interview.

For example, Afghanistan's dam-building projects and increased irrigation could be seen by Iran as causing environmental or economic harm downstream, reducing water availability for Iran's agricultural regions like Sistan-Baluchistan. To move beyond this vague term, the two nations should break down specific categories of harm whether they relate to water quantity, ecosystem degradation, or disruption of livelihoods and negotiate what is acceptable and unacceptable for each (Eckstein, September 2024). This effort would allow for clearer and more enforceable guidelines for cooperation.

Subjective Application of IWL

By subjectively applying IWL principles rather than treating them as rigid, abstract norms, Afghanistan and Iran can better align water-sharing agreements with local realities. For example, while IWL emphasizes equitable and reasonable use of water, the two countries may have different interpretations of what "equitable" means in practice. For Iran, equitable use might mean a guaranteed volume of water to sustain agriculture and local ecosystems, while for Afghanistan, it could involve prioritizing its own irrigation projects for food security and economic development including energy production.

Instead of relying on external legal interpretations, Afghanistan and Iran should define what equitable use means in their unique geopolitical and hydrological context as already considered hydrological regime in the article III of the treaty. The Helmand River, after all, is more than just a water source it is a lifeline for millions of people who depend on its waters. Afghanistan, being the upstream country, holds significant control over the river's flow, while Iran, as the downstream riparian, has pressing needs for water security. Both nations must therefore balance their respective interests in a way that reflects both legal obligations and practical realities (Eckstein, September 2024).

Local Definitions of Cooperation and Harm

This subjective interpretation of IWL principles will be vital in fostering real cooperation. Iran and Afghanistan must sit down and develop a shared understanding of key terms like "harm," "benefit," and "cooperation." For instance, environmental issues such as droughts or wetland degradation in

Iran due to reduced water flow could be framed as “significant harm” under IWL, while Afghanistan might prioritize its own developmental needs as “reasonable use” of its water resources. These differences can only be reconciled through dialogue and negotiation that recognizes both countries' unique priorities and challenges.

The complexity of these negotiations makes it clear that merely agreeing to international norms is insufficient. Without context-specific definitions, both countries will struggle to move beyond symbolic cooperation and into the realm of practical, implementable solutions. Afghanistan and Iran should engage local actors—farmers, water experts, and community leaders in these discussions to ensure that any agreements made at the government level are grounded in the lived realities of the people most affected by the river’s flow.

5.3.2 Moving Beyond the Treaty

Iran and Afghanistan need to focus not only on the text and provisions of the 1973 treaty but also on developing a broader framework for cooperation. The treaty should be viewed as a starting point rather than the final word in their water-sharing relationship. Building trust is critical for officials from both countries and is essential for fostering water cooperation. Trust is not limited to political and diplomatic relations (Yildiz, 2015). Several measures can help establish sustainable trust, including joint water monitoring, transparent sharing of realistic data (Loodin et al., 2024), and collaboration on development plans from both sides. Institutional collaboration plays a crucial role in mitigating hydro-political tensions and conflicts (Turgul et al., 2023).

Consistent diplomatic relations foster institutional cooperation, requiring both nations to take an active role in defining international water law (IWL) principles and reaching a consensus on their implementation. The success of their cooperation will depend on how well they adapt the general principles of international law to the specific, practical, and often contentious realities of the Helmand River basin. Clearly defining these principles will encourage both countries to share development plans in a way that respects their rights and minimizes environmental impacts.

For example, Iran's unilateral development of Chahnimah has affected the river's counterclockwise flow direction, leading to the drying up of the Godzari lake and the rest of delta wetlands. Similarly, the construction of the Kamal Khan Dam has allegedly reduced water flow to Iran (ZRGIRAN7, October 2024; MDJIRAN8, September 2024). Iran has objected to the dam’s spillway, claiming it diverts water to Godzari (MDJIRAN8, September 2024). Iran’s Deputy Minister of Energy, during his visit to Kabul in July 2024, stated that Iran had repeatedly asked Afghanistan to modify the dam’s design (BBC, 26 July 2024).

This is obvious that without trust, riparian countries will hesitate to share development plans and data which hampering the cooperation process. To maintain long-term collaboration, the trust level between Iran and Afghanistan must reach an appropriate threshold, supported by a structured system for exchanging data and development plans (Loodin et al., 2023).

In summary, for Afghanistan and Iran to achieve sustainable, long-term cooperation over the Helmand River waters and treaty implementation, they must focus on three key areas: building trust, codifying customary laws and practices alongside international norms, and clearly defining key International Water Law (IWL) principles such as “significant harm,” “equitable use,” and “ecosystem protection.” This tailored approach will create a more adaptable and locally relevant framework for managing their shared waters, ensuring that both nations' needs are addressed fairly and mutually beneficially.

The codification of IWL principles in alignment with local customary practices will also secure socioeconomic and environmental benefits for both countries, as outlined in the proposed cooperative framework. Specifically, applying the six listed criteria in Step 3 of the framework (Chapter 2, Fig. 13) will help to establish shared objectives and promote benefit-sharing collaboration. This, in turn, will pave the way for the effective implementation of the 1973 treaty. A well-implemented treaty could significantly improve relations between Afghanistan and Iran, fostering long-term stability and sustainable cooperation over their shared water resources.

5.4 Comparative Analysis

Comparison with Other Transboundary Water Cooperation: Compare the Helmand River cooperation with similar cases globally. Identify common challenges and successful strategies that could be applied.

Lessons from Case Studies: Discuss the lessons learned from specific incidents or case studies presented in the results chapter. Explain how these lessons can inform future policy and cooperation efforts.

The Helmand River basin shares similarities with many other rivers. It is similar to the Columbia River as both involve two countries in their management and water-sharing agreements. While from a flow regime and water control perspective, it resembles the Nile River and the Tigris-Euphrates basin. In Chapter 2, Section 2.4, we discussed the Nile River basin, highlighting that Egypt is focused on maintaining its historical hydro-hegemony and its 95% dependence on Nile waters. Ethiopia, on the other hand, is prioritizing its economic growth through the construction of large dams, while Sudan aligns itself based on whichever side offers the greatest economic benefit. The remaining upstream countries are primarily interested in developing their own water infrastructure and securing their water rights. As a result, the national interests and economic benefits of each country have led to a lack of cooperation over the equitable distribution of the shared waters.

Indus River basin shares water between Pakistan and India through a bilateral agreement. Indus is a great source of irrigation in the basin particularly for Pakistan as an agrarian country. India is an upstream country with a strong socio-economic power while Pakistan suffers from water hegemony approach of India. Let's compare the key subsystem of these three rivers based on the socio-hydrological framework proposed by (Wei et al, 2021) to understanding the conflict preventing cooperation in the basin. These three river basins are imbalance in power status with dominative for hydro-hegemon. As we can see Afghanistan, India and Egypt are the hydro-hegemons either use their geographical power or political and material powers. Afghanistan reliant more on its geographical power while India and Egypt have dominant political power in their regions.

Table 11: Subsystem comparison of Nile, Indus and & Helmand Basins

Subsystem	Helmand River	Indus River	Nile River
Water Management	Dam development and water supply. Water demand	Water supply (dam storage) Water demand	Dam storage development
Benefits	Economic benefits: irrigation and power	Economic benefits: irrigation and power	Economic benefits: irrigation and power

	Ecological benefits: Hamoun and wetlands protection: Political benefits: security and stability in the region		
Cooperation	Treaty exists but not effectively implemented. Distrust and disputes	Treaty exists and implements. Distrust and dispute	No formal treaty at the basin level. Bilateral agreement exists but not functional
Willingness to Cooperate	Lower end of the range between 0-1	Lower end of the range between 0-1	Lower end of the range between 0-1
Social Motives	Homogeneous with same culture, religion, and language but against each other	Homogeneous with different religion and same language but against each other	Homogeneous with little difference
Power Status	Downstream with strong socio-economic and political power status	Upstream country with strong socio-economic power	Downstream countries with strong socio-economic power
Institutional Capacity	Very weak in both countries- downstream country relatively better	Very high in both countries- upstream country slightly better	Very weak in all riparian countries- Egypt slightly better

All these three basins have almost similar water supply and demand challenges and dam development is a key priority for each riparian country. Obviously powerful party could influence water distribution for its favour (Zeitoun & Warner, 2005). In transboundary water management apart from military and economic strength, other features such as territory value and size have its affect monopolize water distribution (Zeitoun & Warner, 2005). However, Afghanistan is not political and economically powerful in the region compared to Egypt and India in Indus and Nile basins but downstream countries like Pakistan and Iran perceive Afghanistan's theoretical water control power as a major threat. Despite of Afghanistan upriver power, Iran receives 3-4 times water more than its right to suffice its people demand for expanded arable areas (BRAAFG2, July 2024; WAAFG4, July 2024).

For Iran, security and stability in the Sistan region is considered a higher priority than water availability alone (MRJINR5, August 2024). This closely mirrors India's approach to Kashmir, the upstream catchment of the Indus Basin and its theoretical control, where strategic and political concerns shape water policies. However, a major distinction lies in the level of cooperation. Despite deep-rooted political hostility, India and Pakistan have consistently implemented the 1960 Indus Waters Treaty, with the World Bank engagement as a neutral mediator. In contrast, Iran and Afghanistan have never meaningfully cooperated to enforce the 1973 Helmand River Treaty since its signing.

According to Afghan officials, Iran fears that strict enforcement of the treaty would limit it to 820 million cubic meters (Mm³) of water annually, as outlined in the agreement (BRAAFG2, July 2024). Instead of focusing on efficient use and equitable distribution of the allocated volume, Iran has allegedly argued that the actual upstream flow is insufficient, often without verified data. This perception may be a key reason why Iran is reluctant to engage in structured and active cooperation to fully implement the treaty.

There are several important lessons highlighted in table 12 from the Indus and Nile River basins that Iran and Afghanistan should review and consider helping resolve their water disputes, support effective implementation of the Helmand River Treaty, and guide future policy and cooperation efforts. The effective implementation of treaty reduces diplomatic relation and constraints over water distribution.

Table 12: Key lessons learned from Indus and Nile Basins relevance to the Helmand Basin

Key lessons	Indus Basin	Nile Basin	Relevance to Helmand Basin
Neutral mediation works	The 1960 treaty mediated & brokered by the World Bank	The only binding agreement exists between Egypt and Sudan exclusive upstream countries, and Ethiopia has shown low confidence in involving a mediator over GERD and water discussion	A similar approach requires for Afghanistan and Iran to benefit from international mediation or involvement of neutral organizations like the UN or World Bank for effective implementation of the treaty.
Dispute Resolution Mechanism	Pakistan and India established Permanent Indus Commission and ascertained multiple levels of legal escalation (neutral expert, court of arbitration, etc) to settle disputes.	Nile Basin Initiative (NBI) established in 1999, but Egypt is indifference over the cooperative framework agreement and believes it is a threaten to its historical water rights.	Iran and Afghanistan should establish a permanent joint Helmand Commission to actively handle disputes and water distribution and monitoring issues with transparency and data sharing which foster cooperation between both countries.
Upstream vs. Downstream Tensions:	Pakistan and India compete on development due to lack of trust and worse political relation; it is hard to share their development plans and agenda.	Ethiopia aims economic development (e.g. Grand Ethiopian Renaissance Dam) and Egypt fears of water squeezing, and Sudan main concern is flood risk and irrigation disruption.	A similar position and concerns are between Iran and Afghanistan. Infrastructure development (e.g. Kamal Khan dam) by Afghanistan perceives as a major threat by Iran. Climate change worsen water scarcity and causes wetlands deterioration in Sistan while Iran accuses upstream for squeezing water
Data Sharing is Critical for riparian countries	However, the exchange of accurate data and development plan is always a complex and challenge for both countries due to mistrust, Indus basin has water monitoring system in the northernmost monitoring stations	Mistrust grew due to lack of transparency about the Ethiopia dam filling timelines and drought impact scenarios.	Afghanistan and Iran should learn from the Indus basin that water measuring system, transparent data sharing on flows, dam development, wetlands preservation at both sides and drought scenarios can reduce tension and pave the way for result-based negotiation.

The lessons learned from the Indus and Nile River basins, along with practices from other international watercourses are essential for Iran and Afghanistan to review as they shape their bilateral discussions and work toward strengthening cooperation. The tensions surrounding the Helmand River are emblematic of broader border-related disputes that have amplified mutual mistrust and further complicated the already fragile Iran-Afghanistan political relationship, contributing to regional instability, including increased migration (Boltuc, 2025). In particular, the

absence of cooperation and lack of effective implementation of the 1973 treaty have had serious repercussions in border areas like Sistan, where water scarcity and climate change have triggered local unrest, economic decline, and migration. These issues have directly impacted Iran's internal stability, fuel nationalist sentiments and further undermining regional diplomacy (Boltuc, 2025).

In contrast, the effective implementation of the 1960 Indus Waters Treaty between India and Pakistan has endured wars and diplomatic tensions largely because it treats water as a technical issue rather than a political one. Similarly, Iran and Afghanistan must depoliticize water negotiations by focusing on treaty implementation, establishing technical cooperation, and creating data-sharing mechanisms, including an independent joint water monitoring body as Indus. Additionally, Iran and Afghanistan could benefit from third-party mediation, similar to the role the World Bank has played in maintaining the Indus Waters Treaty implementation, helping both Pakistan and India remain accountable and promoting continued technical dialogue.

One of the major challenges in the Helmand Basin is the lack of water-receiving infrastructure at the border where specified by the 1973 treaty and the absence of a joint hydrological data monitoring system. A shared data system is crucial for ensuring transparency and building sustainable trust between the two countries which has positive impact on social sentiments. Experience from the Nile Basin demonstrates that withholding data and refusing to share information can escalate tensions. As noted by LTS International (2015), the Nile Basin Initiative (NBI) successfully established a joint data monitoring system that has significantly enhanced transparency and trust among participating countries however Egypt fears of its historical water rights since it is not part of NBI.

Consequently, lessons from the Indus and Nile River basins such as technical cooperation, third-party mediation, and addressing mistrust and data-sharing gaps are crucial for Iran and Afghanistan to enhance their transboundary water management and develop a climate-resilient, cooperative water policy framework. Infographic summarizing the river basin lessons into applied policy.

River Basins	Applied policy
Indus River: Indus Treaty (1960) Nile River: Key issues over GERD Helmand River: Treaty (1973)	- Effective implementation of treaties using third-party for active engaging riparian countries into the dialogue and cooperation - Establishing joint water monitoring mechanism - Establishing joint commission and real-time data sharing - Focus on climate change impact and adaptation and shared risk promote joint management drought strategies - Leverage development incentives, link water cooperation to trade, aid, energy and livelihood projects for better relations - Define IWL principles into local context and establish institutional capacity and knowledge sharing practices - Building trust to enhance cooperation willingness over national and transboundary interests (political, economic & ecological)

5.5 Implications for Policy and Practice

The Helmand River basin has long been a source of disputes and contentions between Afghanistan and Iran, particularly over water allocation⁶⁷, usage, and the impacts of climate change on wetlands. Here are specific, evidence-based recommendations for policymakers in both countries to improve active cooperation, building trust and sustainably manage the river basin.

5.5.1 Strengthen and modernize the 1973 Helmand River Treaty

The 1973 treaty between Afghanistan and Iran allocates 820 Mm³ of water annually to Iran. The treaty outlines key aspects such as monthly water distribution schedules, hydrological flow benchmarks “normal water year”, designated water delivery points, and provisions for water quality and seasonal variations in river discharge due to climatic factors.

However, the treaty falls short in several critical areas. It lacks a comprehensive environmental management framework, does not adequately address the long-term impacts of climate change, and provides no clear mechanism for dispute resolution. Some researchers have criticized the treaty, arguing that it is not adequately projected for sustainable transboundary water resources management and development (Thomas & Varzi, 2015). To ensure sustainable and equitable management of the Helmand River basin, both riparian states must realign their transboundary water policies with the principles of Active Cooperation Framework as discussed in section 2.9. Incorporating the following best practices can strengthen the treaty, improve its implementation, and help address current and emerging challenges more effectively:

Recommendations

- Establish a Joint Technical Commission as discussed in section 5.4 with a modern hydrological equipment and data-sharing mechanisms to monitor flows and usage transparently. This urgently required construction of water receiving points as specified in the treaty.
- Improve the treaty with an annex⁶⁸ to reflect climate change impacts and environmental aspect and impact of population growth and increasing agricultural and industrial demands.
- Establish regular and agenda-oriented ministerial meeting to promote willingness for cooperation, improve political and diplomatic relations and foster trust building. Facilitation and arrangement of such high rank political engagement is mandate of Commissioners.
- Plan Joint Technical Projects as specified in the treaty such as bank protection, irrigation canals, livelihood, hydrological studies and knowledge sharing which could often bring the nations together for cooperation within the shared basin. These types of projects are basin

⁶⁷ “In 1973, the two countries signed the Helmand River Water Treaty, which allotted 22 cubic meters per second to Iran, with the option to buy an additional 4 cubic meters per second in normal water years” (Daghan et al., 2014: Hanasz, 2012).

⁶⁸ The environmental issue can be discussed as an annex to the treaty not the entire treaty revision since 1973 treaty is a permanent ratified treaty and Afghanistan never want to discuss the entire treaty with Iran (Afghanistan Former Minister of Interior, October 2024)

wide and apart from those unilateral development project that each individual state does and usually implement by the RBOs

5.5.2 Develop a Helmand Basin IWRM Framework

Lack of basin-wide planning has led to inefficient water use and ecological degradation, especially in the Hamoun wetlands in Sistan region. Numerous scholars and research studies have explored water disputes, hydrological analysis, water stress, and infrastructure development within the Helmand River basin. However, none have specifically addressed the critical need for an active cooperative framework rooted in trust across social, institutional, and political dimensions. Additionally, there is a noticeable gap in the analysis of International Water Law (IWL) and Integrated Water Resources Management (IWRM) principles, particularly from the perspective of local contexts in both countries. Such an analysis is essential to understanding how a cooperative framework, underpinned by IWRM, could enable both countries to collaborate effectively in implementing the terms of the signed treaty and ensuring the sustainable use of their shared water resources. The following recommendations deem necessary to be considered by the countries:

Recommendations

- Promote IWRM and IWL principles and define them in the local context to coordinate upstream and downstream water needs (e.g., agriculture, environment, and domestic) within the treaty provisions
- Develop and enhance River Basin Organization (RBOs) capacity to involve local water user associations and communities to ensure buy-in and sustainable implementation of IWRM principles
- Collaborate with international organizations (e.g., World Bank, UNEP, FAO, GEF, etc) to provide technical support fund and facilitate basin-wide environmental assessments and capacity building

5.5.3 Invest in Climate-Resilient Infrastructure and Conservation

As discussed in Chapter 2, Iran's agriculture sector is heavily dependent on irrigation (Seyf, 2006), yet the country has consistently faced food insecurity, with only about 15% of its land suitable for cultivation (Madani, 2014). Moreover, there is a significant mismatch between crop patterns and the availability of water resources. This combined with poor cultivation management and the impacts of climate change, has led to increasing water demand (Madani, 2014; Islami & Rahimi, 2019). Climate variability, coupled with an inefficient irrigation system, continues to worsen Iran's water crisis. This underscores the urgent need for policies that promote advanced, efficient, and climate-resilient water delivery infrastructure, alongside a modernized and sustainable agricultural system (Madani, 2014).

A similar situation exists in Afghanistan, where agriculture also plays a central role in the country economy. However, weak water management policies, inadequate infrastructure, and outdated agricultural practices have intensified both water scarcity and food insecurity. In both countries, the lack of sustainable water governance and inefficient irrigation systems contributes to growing tensions over water resources. To address these shared challenges and foster a sense of mutual responsibility, the following recommendations are essential for both Iran and Afghanistan to implement. These measures aim to improve water management, promote agricultural sustainability, invest in climate-resilient infrastructure and reduce conflict over water allocation.

Recommendation

- Implement modern and efficient irrigation system and technologies (drip, sprinkler and pivot) and shift cultivation strategy toward less water-intensive crops through incentives.
- Rehabilitate and maintain Hamoun wetlands including Godzari which are crucial for local livelihoods, biodiversity, and dust storm mitigation in Iran's Sistan region and Afghanistan.
- Build joint early warning systems within the basin for droughts and floods using advanced technological devices, satellite data (e.g., from NASA's GRACE mission).

5.5.4 Establish a Formal Dispute Resolution Mechanism

The Helmand River Basin, shared between Afghanistan and Iran, has been a source of ongoing political tensions for decades. The primary issues stem from disputes over water rights and usage, which have been exacerbated by several factors such as historical grievances, political tensions, environmental and social impacts, and economical pressures. These challenges have largely persisted due to the absence of a neutral and effective forum for dispute resolution. Although several third-party mediators have attempted to facilitate dialogue, their efforts have often been perceived by the parties as biased or unbalanced. Additionally, the complex political landscapes in both countries have further compounded the difficulty of reaching a sustainable resolution.

Afghanistan's efforts to develop its water infrastructure for agricultural and hydroelectric purposes have intensified concerns in Iran about water security. From the outset, trust and cooperation between the two countries have been limited particularly during the prolonged drought period from 1998 to 2002, when the Sistan region received insufficient water flows, further deepening mistrust between the parties (Houk, 2011). As a result, political tensions combined with the absence of a trusted, neutral platform for managing such contentious issues have significantly hindered effective conflict resolution. To move toward a more cooperative and sustainable framework, the following recommendations are proposed to support both parties in resolving disputes through an impartial and mutually accepted dispute resolution mechanism.

Recommendations

- Include third-party mediation options (e.g., via the United Nations or neutral countries or international financial institutes such as World Bank, Asian Development Bank, or might be academic institutes) in treaty annexes or side agreement.
- Explore regional water diplomacy platforms, possibly under ECO (Economic Cooperation Organization) or Think Thank Institutes to facilitate de-escalation and resolve disputes in consideration of IWL principles and the signed treaty provisions.

5.5.5 Promote Cross-Border Environmental Cooperation

The Helmand River basin, spanning a vast area in Afghanistan and part of Iran, faces significant environmental challenges that impact both countries particularly the wetlands and Godzari lake. These challenges include environmental degradation, desertification, and loss of biodiversity, all of which have profound effects on the region's ecosystems and human populations including economic pressure. Iranian experts claims that environmental degradation in the Helmand Basin is predominantly driven by man-made activities such as upstream water consumption,

deforestation, agriculture land expansion and unsustainable agricultural patterns. These human activities have caused to a decline water availability in the lower reaches and has been disrupting ecosystem (Afzali et al., 2022). While according to Mansfield & Alcis (2025) the main and primary cause is climate change impacts by altering precipitation patterns and increasing temperatures, further stressing the already fragile environment.

Another major concern in the Helmand River basin is the accelerating desertification. The region's arid climate, compounded by the overexploitation of freshwater resources and poor land management practices, has led to the progressive expansion of desert areas (Whitney, 2006). Intense winds and high temperatures further contribute to soil erosion and the formation of sand dunes across both Afghanistan and Iran, rendering vast areas increasingly unsuitable for agriculture and other livelihood activities. This poses a severe threat not only to the sustainability of local ecosystems but also to the well-being of communities that rely on the basin's resources for their survival (Whitney, 2006).

Despite these shared environmental threats, Afghanistan and Iran have yet to establish a coordinated and effective response. Political tensions, divergent national priorities, and a lack of active cross-border cooperation have significantly undermined efforts to manage water resources and mitigate environmental degradation. Furthermore, both countries have pursued unilateral development projects driven by national interests, which often exacerbate existing problems rather than offering innovative or collaborative solutions (Mansfield & Alcis, 2025).

In light of these challenges, it is imperative that Afghanistan and Iran develop a joint crossed-border environmental and ecosystem conservation policy. This framework should include the appointment of qualified environmental experts to provide technical guidance for the restoration of critical ecosystems, including the Hamoun wetlands, and to prevent further degradation. The following recommendations are proposed to help both countries fulfil their shared responsibilities and promote the sustainable management of the Helmand River basin.

Recommendations:

- Both countries should collaborate with experienced environmental experts and reputable research institutions to conduct comprehensive environmental assessments across the Helmand River basin. These assessments should focus on evaluating the current state of land degradation, water quality, biodiversity loss, and ecosystem vulnerability.
- Initiate joint environmental monitoring and crossed-border conservation projects for shared ecosystems (Hamoun wetlands, Godzari, and the entire basin) and ensuring environmental sustainability.
- Collaborate on transboundary impact assessments for any new water infrastructure such as dams, canals, reservoirs or water transfer projects, ensuring transparency and trust-building.

5.5.6 Engage in Track II Diplomacy and Public Dialogue

While many bilateral treaties and accords exist globally for the management of shared watercourses, in numerous cases including that of the Helmand River basin, States have yet to establish even a foundational Track I diplomatic framework for sustained cooperation (Yasuda et al., 2020). In the context of the Helmand River, Track I water diplomacy would entail formal,

state-to-state engagement between Afghanistan and Iran. This could include operationalizing the 1973 treaty, instituting water measurement systems and data-sharing mechanisms, ensuring equitable water allocation, and jointly addressing pressing transboundary challenges such as climate change impacts, food security, livelihood impacts, and population growth.

Although both countries have, in recent years, appointed commissioners to engage in discussions on Helmand water issues, these interactions remain largely event-driven and ad hoc, lacking the structure, frequency, and continuity needed for a meaningful and sustained dialogue. In recent years (2022-2025), a limited number of ministerial visits have taken place between Afghan and Iranian authorities; however, these engagements have been largely politically driven, border tension and migration issues, with minimal focus on substantive water-related discussions or cooperation.

At the same time, Track II diplomacy plays a vital complementary role. It involves the participation of non-governmental actors, including international organizations, NGOs, academic institutions, research centres, and civil society stakeholders. This informal, yet strategic level of engagement fosters trust-building, facilitates the exchange of knowledge, and creates a collaborative space that can inform and influence official negotiations (Yıldız, 2025). Such an approach aligns with the "slow-track process" outlined in the Active Cooperation Framework (Section 2.9), which emphasizes the importance of social drivers, institutional capacities, and power asymmetries.

In the Helmand River basin, Track II diplomacy could support joint research projects, cross-border academic collaboration, and community-based initiatives, all aimed at deepening mutual understanding and reinforcing trust between stakeholders in both countries (Nagheeby, 2023). Water can be used as leverage to foster improved political relations and water diplomacy between Iran and Afghanistan (Sadat & Sayed, 2024). The following recommendations are proposed to help foster civil society engagement, enhance hydro-diplomatic channels, and strengthen regional cooperation for more sustainable and peaceful transboundary water governance.

Recommendations

- Facilitate academic and civil society exchanges to promote civil diplomacy, communicate climate adaptation strategies and public awareness to ensure sustainable water resources management and foster mutual understanding and cooperation.
- Support media awareness campaigns (e.g. workshops, TV talks, journalists' capacity building) highlighting shared cultural, religious and ecological heritage to reduce politicization of water issues.
- By integrating Track I and II even adding Track III diplomacy which is involvement of local Water User Associations (WUAs) and local communities would be a plus point to establish a comprehensive and multi-layered approach to address the complex water issues in the Helmand River basin, promoting long-term active cooperation and integrity.

5.6 Political and Socioeconomical Challenges and Limitations

Political

One of the primary political challenges in the Helmand River basin stems from decades of historical tensions between Afghanistan and Iran. The limited attention given to the effective implementation of the 1973 Helmand River Treaty has frequently transformed it from a potential

framework for cooperation into a source of contention and dispute (Nagheeby & Rieu-Clarke, 2020). Persistent regional instability especially in Afghanistan and shifting political dynamics in both countries have further undermined the consistency and coherence of transboundary water governance and sustainable water resource management.

A deep-rooted lack of mutual social and political trust, compounded by political rhetoric and accusations, has continued to fuel the discord. Iran frequently accuses Afghanistan of withholding water through upstream dam construction, while Afghanistan counters by accusing Iran of poor domestic water governance and excessive water use (Nagheeby & Rieu-Clarke, 2020). This ongoing blame game prevents constructive dialogue and the evolution of a cooperative water-sharing arrangement. This ongoing political atmosphere of distrust has consistently had a direct negative impact on Afghan migrants, as Iran has been accused of politicizing migration issues to exert pressure on Afghan authorities in pursuit of securing additional water for the Sistan region (Khalid & Zahra, 2019; Sadat & Sayed, 2024).

From Iranian experts' perspective, the 14% water allocation stipulated in the 1973 treaty is inadequate for the current users, particularly given that the agreement based on the McMahon mission's assessment which did not account for the environmental and ecological needs of the Hamoun wetlands. As water demand continues to rise in both countries, the available resources either remain static or are in decline, creating a growing mismatch between supply and demand. Agricultural expansion, especially in Iran, has further intensified this issue. Critics within Iran question the rationale behind developing new agricultural lands without securing a proportional increase in water supply to support the farmers and local communities.

The geopolitical context has also influenced the dynamics around the Helmand River. The 1973 treaty itself was shaped, in part, by the geopolitical interests of global powers such as the United States and the Soviet Union, with the Helmand basin once referred to as a "small New York" in the 1950s due to its development potential (Sadat, 2012). In the last two decades, India has emerged as a key player in Afghanistan's water infrastructure sector, financing major projects such as the Salma Dam on the Harirud River. However, India's involvement in the Kabul River basin has been constrained by political pressure from Pakistan. In contrast, India faces fewer geopolitical barriers in the Helmand and Harirud basins, where Iranian resistance has been limited (BNMIRAN2, July 2024).

Iran's political stance toward Afghanistan has been notably inconsistent, particularly over the past five decades. Following the signing of the 1973 Helmand River Treaty, there was a period of mutual trust at the senior governmental level. A significant positive outcome of this agreement was Afghanistan's access to Iran's Bandar-e-Abbas port, which enhanced trade and regional connectivity for the landlocked country (Khan, 2023; Aman, 2016).

However, this initial trust proved unsustainable due to political upheavals in both countries, which ultimately hindered the treaty's implementation. Iran's political and social relationship with Afghanistan has continued to evolve in response to key historical events, including the Soviet invasion, the Afghan civil war, the U.S-backed republican era, and the emergence of the Taliban regime. During the republican government, Iran reportedly cultivated relations with the Taliban allegedly as a strategic move to undermine Afghanistan's efforts in developing water infrastructure in the Harirud and Helmand River basins (Khan, 2023; Express Web Desk, 2017). This fluctuating

relationship highlights the complex geopolitical landscape that continues to impede bilateral cooperation and the effective implementation of the 1973 treaty.

Although Iran and Afghanistan current actors are making efforts to strengthen their bilateral relations, this engagement reflects a form of cautious diplomacy, underscoring the persistent tensions surrounding water rights and resource management. These unresolved issues remain central to the trajectory of future political relations. While both nations express a willingness to cooperate, the establishment of mutual trust and the effective enforcement of existing treaties, particularly the 1973 Helmand River Treaty, will be crucial in mitigating disputes and fostering long-term stability and collaboration

Socioeconomic

While these political issues remain unresolved, the situation could escalate into a socioeconomic and ecological crisis, with local populations potentially abandoning the region due to declining agricultural productivity, migration and worsening environmental conditions. Lack of livelihood caused people to leave their home villages e.g. according to Islamic Republic News in 2022 and 20023 about 800 000 people migrated from southern and central parts of Iran to northern areas as result of climate change and water crisis (Sadat & Sayed, 2024).

To address this critical gap (Environmental issue), it is important to modify the Helmand Treaty with an annex to include specific provision for environmental protection and integrated water resources management practices. This adjustment should aim to preserve the basin's ecosystems in both countries, including wetlands, grazeland, the Godzari depression area, and wildlife habitats, while promoting environmental sustainability practices that ensure the equitable and sustainable use of water resources. However, the Afghan side has a major concern and never interested to any type of modification that Iran may claim additional water rights as stated by the former Interior Minister of Afghanistan and several MEW officers during the interview (FHMAFG8, August 2024; WABAFG12, October 2024; WAAFG4, July 2024).

Water infrastructure development is one of the major challenge and obstacle and seen as threats by Iran. For an instance, several Iranian experts has observed and criticized that the primary objective of Afghanistan's Kamal Khan Dam is not water storage, it is a diversion dam to the Godzari lake deliberately squeezing water to Iran (BNMIRAN2, July 2024; MDJIRAN8, September 2024). The Iranian experts also stated that Iran itself has experienced adverse socioeconomic and environmental outcomes from its own dam development initiatives and expressed their concern that Afghanistan may now be repeating similar patterns without sufficient environmental or ecological considerations (BNMIRAN2, July 2024).

The economic inequality between the Iran and Afghanistan influences both countries water resources management priorities. Sine Afghanistan is being less developed, interested to prioritizes water infrastructure development for its economic growth, while Iran focuses on maintaining its existing water-dependent agricultural activities for food security and livelihood to avoid destabilization in the region. Furthermore, the expert highlighted that Afghanistan lacks the domestic financial capacity to execute such large-scale water infrastructure projects independently, historically relying on foreign aid and external technical assistance to support its water development agenda (BNMIRAN2, July 2024).

To resolve these challenges, international organizations like the World Bank, UN agencies and academic institutions should be actively engaged with both Afghanistan and Iran, offering support and resources to help incorporate environmental considerations into the treaty and related policies to obtaining. This collaborative effort would be crucial for ensuring the long-term sustainability of water resources in the Helmand basin. It is also possible to have a joint basin governance through River-basin Authority to work for the sustainable and integrated transboundary water management.

Limitations

One of the major technical limitations in the Helmand River basin is the lack of accurate and consistent hydrological data, which hinders effective planning and management of shared water resources. This is compounded by the absence of a formal data-sharing mechanism between Iran and Afghanistan, which limits transparency and trust among the actors. Moreover, there is a notable lack of joint scientific research and monitoring initiatives involving experts from both countries, which could otherwise contribute to a shared understanding of the basin's dynamics.

A significant concern is Iran's perception of climate change impacts on the Helmand River's flow regime, which may not align with Afghanistan's understanding. This divergence underscores the need for mutual scientific engagement to reach a common interpretation of climate variability and its implications on ecosystem, environmental sustainability and water availability. Additional limitations include the lack of standardized monitoring systems, outdated or incompatible water infrastructure, and limited capacity for integrated water resources management (IWRM) on both sides. These technical challenges must be addressed through enhanced and active cooperation, capacity building, institutional coordination, and the establishment of a neutral, science-based platform for data exchange and joint assessments and research efforts.

5.7 Conclusion

The Helmand River basin remains at the intersection of historical grievances, geopolitical complexity, environmental degradation, and pressing socio-economic needs. Despite the signing of the 1973 Helmand River treaty, cooperation between Iran and Afghanistan has remained fragmented, inconsistent, and frequently undermined by fluctuating political relations, lack of institutional coordination, and differing interpretations of the signed treaty obligations.

A central insight from this chapter is the absence of trust, transparency and cooperation in bilateral water relations. Decades of mutual suspicion exacerbated by Iran's perception of upstream control by Afghanistan and Afghanistan's resistance to perceived Iranian political dominance, have stalled the implementation of critical components of the treaty, including joint monitoring infrastructure and real-time data sharing mechanisms. Political instability in Afghanistan, Iran's internal governance challenges and political challenges, followed by lack of a neutral dispute resolution platform have all contributed to the breakdown in effective and active cooperation.

Another key finding is the inadequacy of current technical arrangements, especially in terms of hydrological data sharing mechanism, environmental monitoring, and integrated infrastructure development along the basin. The 1973 treaty, while a landmark achievement, fails to address contemporary issues such as climate change impacts, groundwater depletion, and the ecological

collapse of shared wetlands like the Hamuns. Iran and Afghanistan have both engaged in unilateral water infrastructure projects such as the Kamal Khan Dam and Iranian's Chahnimah reservoirs without mutual planning, collaboration and consideration of shared ecological impacts.

Moreover, the legal and policy frameworks in both countries remain insufficient. Iran suffers from a centralized and often fragmented water governance system, plagued by poor coordination, over-extraction, and policy misalignment. Afghanistan, despite implementing IWRM principles and river basin authorities, lacks a coherent transboundary water policy and is heavily dependent on international aid and technical assistance. However, the flow of foreign aid has significantly slowed down since the Taliban took power in August 2021. Neither country has adequately addressed groundwater governance, despite its critical role in the region's hydrology.

Environmentally, the degradation of the Helmand delta, drying of the Hamuns, and increasing water scarcity are not solely attributable to one party. While Iran frequently blames Afghanistan's dams, Afghan experts highlight the significant role of climate change, as well as Iran's own poor water management and artificial interventions in the delta. These disputes emphasize the urgent need for shared scientific understanding, based on joint research and mutually agreed environmental assessments toward active cooperation.

In terms of legal interpretation, this chapter emphasizes the importance of contextualizing International Water Law (IWL) principles that suits both nations. Terms such as "significant harm" and "equitable use" remain vague and contested as an assumption. The parties must localize these principles, codify customary practices, and move beyond abstract commitments to develop shared definitions and present practical guidelines for treaty interpretation and application.

To move forward, the chapter proposes a shift from symbolic to active cooperation, underpinned by the Active Water Cooperative (AWC) Framework presented earlier in the thesis. This framework calls for phased trust-building, participatory institutional mechanisms, equitable benefit-sharing, and adaptive legal interpretations aligned with IWL and local realities. Key recommendations include:

- Establishment of joint water monitoring stations through construction of water receiving infrastructures as outlined in the treaty.
- Establishment of active cooperation mechanism focusing on first four criteria (Treaty, Commissioning, Ministerial meetings and Technical projects) as stated in the Active Cooperative Framework in section 2.9.
- Transparent, real-time data-sharing protocols and mechanisms to be acceptable for both parties.
- Cooperative infrastructure development planning to mitigate environmental damage and mutual respect to national interests (political, economic and ecological benefits) as discussed in the Active Cooperative Framework in section 2.9.
- Integration of groundwater governance into bilateral water discussions.
- Engagement of Track II diplomacy ensure involving academia, civil society, and technical institutions to foster trust and shape public perception and prepare ground for sustainable and active cooperation.

- Codification of customary and tribal water-sharing practices alongside international legal norms and emphasizing on contextualization of IWL principles and application of IWRM practices.

Finally, the Helmand basin's experience is not unique. Comparative insights from basins like the Nile, Tigris-Euphrates, and Columbia reveal that long-term cooperation is only possible when power asymmetries are acknowledged, mutual benefits are prioritized, and trust is institutionally embedded. It is also important to follow the slow track process (social motives, institution capacity, and political status) as outlined in the ACF shaping public perception to ensure sustainable trust and pave the ground for effective implementation of treaty and benefits sharing collaboration.

In conclusion, while political tensions and environmental stressors continue to strain Iran-Afghanistan political relations over the Helmand River, the opportunity for collaboration remains viable. By embracing an integrated, inclusive, and adaptive approach to transboundary water governance, both nations and actors can transform the Helmand from a source of conflict into a catalyst for regional stability, environmental restoration, and shared prosperity.

CHAPTER SIX

6 Recapitulation of the Research Questions and central problem

This chapter presents the recapitulation of the research questions and central problem which have been addressed in Chapter 1 and has been discussed throughout of the thesis. The main objective of this study and research is to explore the root causes of the persistent disputes between Iran and Afghanistan over the Helmand waters, despite the 1973 treaty. Additionally, the study aims to propose an active cooperation framework in respect to the treaty's full and effective implementation toward exploring how transboundary water management can foster economic, social, and political collaboration between the riparian states. The Helmand River basin chosen as single case study and this research has been based on the three research questions in section 1.4 which have been addressed in Chapter four and five with recapitulation in Chapter sex.

This research argues that addressing transboundary water challenges and disputes requires active cooperation and collaboration among riparian states to achieve integrated and sustainable water resources management within the Helmand basin. The criteria for establishing Active Water Cooperation between Iran and Afghanistan are discussed in Section 2.9, with the existence of a formal treaty identified as the first critical criterion. After nearly a century of disputes, dating back to the 1870s, Iran and Afghanistan successfully signed the Helmand River Treaty in 1973. However, despite this historic agreement, the treaty has not been fully implemented. A range of factors and reasons most notably political upheavals have continually hindered its effective enforcement and operationalization (Khalid & Zahra, 2019).

6.1.1 First question: Reasons for continual disputes despite the 1973 Treaty

The general reasons behind the disputes and ongoing tensions over Helmand River water have been examined in Chapter 5, Section 5.1 of the findings. These insights are drawn from both desk-based research and direct interviews with 26 participants, including Iranian, Afghan, and third-party experts from diverse professional backgrounds, as outlined in Section 3.8.

The comparative analysis of responses from these different interviewee groups highlights the key drivers of the ongoing disputes. While the core issues are consistent, each group offers slightly different perspectives shaped by national, political, and institutional viewpoints. The discussion below provides a more detailed examination of the responses to the first research question.

The summary of responses from the Afghanistan's interviewees

Research Question	Detailed Insights Based on Interview Responses- Afghans
Reasons for continual disputes despite the 1973 Treaty	Historical disputes: Border and land demarcation tensions since 1872; Dehrawood measurement point misused and not developed with an advanced water flow monitoring system (BRAAFG2, 2024; FZAAFG3; 2024)
	Climate change: Climate change decreased flow and caused unpredictable and irregular river flow which worsened water scarcity, fuelling competition and water availability is now more irregular and difficult to predict (ENZAFG7, 2024; IDMAFG11, 2024; WAAFG4, 2024)
	Lack of trust and instability: Political instability in Afghanistan and mistrust from Iran have eroded the treaty's credibility (FHMAFG8, 2024; ENZAFG7, 2024). Frequent regime changes after the treaty's signing including coups in both countries and in the last two decades Taliban resurgence and insecurity affected enforcement and treaty implementation (ENZAFG7, 2024).
	Conflicting perceptions: Iran perceives Afghanistan as withholding water through infrastructure projects like Kamal Khan Dam (various responses) and Afghanistan sees Iranian overuse beyond treaty allocations and neglecting internal water management and governance (AWBAFG10, 2024)
	Weak implementation Mechanism: Even though 28 meetings were held mostly since 2004, there was no practical implementation of resolutions with no practical actions (BRAAFG2, 2024). The treaty is perceived more as a political tool rather than an operational agreement (WAAFG4, 2024).
	External influence: Pakistan and Iran back groups disrupting Afghan development projects this caused grievances and political and social resentments to Afghans (RFAAFG11, 2024; AWBAFG10, 2024; WAAFG4, 2024)
	Infrastructure development: Construction of dams and irrigation projects without joint planning fuels perceptions of unfairness, this argument refers more to Iranian Chahnimah (artificial reservoirs) and supply of water out of Sistan (AWBAFG10, 2024; WAAFG4; 2024).

The summary of responses from the Iran's interviewees

Research Question	Detailed Insights Based on Interview Responses – Iranians
Reasons for continual disputes despite the 1973 Treaty	Disagreement over water rights: Iranian respondents often mentioned that while Afghanistan claims sovereignty, Iran views the treaty as insufficient and outdated, especially in addressing Sistan's growing water needs and demand (MHRIRN1, 2024; SBMIRN3, 2024).
	Lack of implementation mechanisms: Interviewees noted the treaty lacks a strong enforcement or joint monitoring system, and there is no consistent political will to apply it (MRJINR5, 2024; HSNIRN10, 2024). This reason is a common reason which alluded by Afghans as well.
	Geopolitical instability and political interference: Afghan political transitions and regional interventions have undermined continuity and trust between actors (BNMIRN2, 2024; HSNIRN10, 2024).
	Climate change disagreements: While Afghan interviewees see climate change as reducing water availability, some Iranian respondents dismiss this as a major factor, attributing the river

flow changes to Afghan infrastructure and dam projects (MDJIRAN8, 2024; ZRGIRAN7, 2024).

No shared interests or cooperative frameworks: A perceived lack of common goals and shared responsibility between the two governments weakens incentives to work together (MRJINR5, 2024; SBMIRN3, 2024).

Infrastructure development: Water infrastructure development project by Afghanistan has more sense of political objectives which hamper cooperation and control river flow regime down to Iran (MDJIRAN8, 2024; ZRGIRAN7, 2024).

The summary of responses from the non-Afghan and Iran origin-water Experts interviewees

Research Question	Detailed Insights Based on Interview Responses – Non-Afghan & Iran origin
Reasons for continual disputes despite the 1973 Treaty	Infrastructure and Water Flow Control: Disputes arise due to how water flow is managed and diverted, particularly by Afghan infrastructure projects. Iran perceives reduced flow as intentional (VCE1, 2024; DND2, 2024).
	Climate Change Denial and Misunderstanding: Experts noted that Iran does not fully acknowledge the role of climate change (e.g., El Niño/La Niña), which affects river flow patterns and worsens misunderstandings between actors (GRE4, 2024; NVK3, 2024).
	Lack of Basin-Level Management: The absence of a comprehensive basin authority or shared water management strategy has prevented coordinated action (DND2, 2024).
	Unilateral policy Approaches: Both sides act based on national interests rather than joint commitments and shared responsibility, leading to mistrust and inconsistent policy (NVK3, 2024).
	Politicization of Water: Water issues are used more politically rather than approached as technical or humanitarian concerns (GRE4, 2024).

6.1.2 Second question: Impact of disputes on diplomatic, political, and social relations

The impact of water disputes on political and social relations between Iran and Afghanistan is discussed in detail in Chapter 5. The proposed Active Cooperation Framework in Section 2.9 directly addresses this issue, emphasizing the need for a long-term, gradual process to build trust and reduce political and social tensions over the Helmand waters. While both countries express interest in cooperation, the findings suggest that mutual trust and robust treaty enforcement are essential for mitigating conflicts and fostering stable diplomatic and social relations. Water remains a key factor shaping the broader political dynamics between the two nations. In recent years, climate change has exacerbated economic challenges in Iran, contributing to increased migration and political instability. This is an issue which is deeply interlinked with water scarcity.

The analysis of responses from the various interviewee groups further highlights how these disputes affect political and social relations. While perspectives differ slightly across groups, a consistent theme emerges: the lack of trust and institutional effectiveness continues to hinder meaningful cooperation. The following visual table presents the experts' views related to the second research question in greater detail.

Research Question	Detailed Insights Based on Interview Responses – Afghans
Impact on diplomatic, political, and social relations	Diplomatic strain: Water disputes consistently overshadow other diplomatic issues (AWBAFG10, 2024; IDMAFG11, 2024).
	Use of Migration Pressure: Iran politicizes Afghan migration to pressure Afghan authorities into concessions on water (common observation across all interviews).
	Distrust and Public Perception: Iranian public believes Afghanistan is not honouring the treaty, while Afghans perceive Iran as exploiting Afghanistan's internal weakness (ENZAFG7, 2024; NBLAFG13, 2024).
	Undermined Regional Cooperation: Lack of collaboration prevents broader economic and political integration efforts in the region (FHMAFG8, 2024).
	No Strong Institutional Mechanism: Even though commissions are established, they lack authority and consistency with event driven agenda whenever raise concern from Iran. There are no regular meetings for fostering cooperation and basin integrated management (WAAFG4, 2024; WAAFG4, 2024).
	Weakened treaty enforcement: Lack of consistent political engagement has eroded the credibility of the 1973 agreement and existing commissions lack authority (WAAFG4, 2024)
Research Question	Detailed Insights Based on Interview Responses – Iranians
Impact on diplomatic, political, and social relations	Diplomatic strain: Water remains a core political tension point in bilateral discussions, often framing broader foreign policy positions (ZRGIRAN7, 2024 HSNIRN10, 2024). This is obviously a similar impact alluded by the Afghan experts during the interviewees.
	National security concerns: For Iran, water access is linked to security in the Sistan region. Water crisis and disputes make political situation more sensitive for Iran which causes political tensions with Afghanistan (ZRGIRAN7, 2024; MRJINR5, 2024).
	Public dissatisfaction and mistrust: Iranian public and political actors' express frustration over perceived lack of transparency from Afghanistan (MHRIRN1, MDJIRAN8).
	Undermined Regional Cooperation: Water disputes are obstacles to building broader bilateral and economic ties, especially in border regions where cooperation is most needed (MRJINR5, 2024; BNMIRN2, 2024). This is common impact stated by the Afghan interviewees too.
Research Question	Detailed Insights Based on Interview Responses – Non-Afghan & Iran origin
Impact on diplomatic, political, and social relations	Increased Political Tensions: Water disputes have exacerbated political and diplomatic frictions, often surfacing during broader bilateral dialogues (NVK3, 2024; GRE4, 2024).
	Reduced Trust and Cooperation: Failure to implement the treaty has led to erosion of trust and a lack of political will to cooperate which also cause social frictions (GRE4, 2024; NVK3, 2024).
	Social Impact and Misinformation: Public perception in both countries is shaped by national and political narratives, often lacking transparency and facts (DND2, 2024).
	Missed Opportunities for Peacebuilding: The treaty, once seen as a symbol of cooperation, is now a source of dispute due to lack of effective implementation (NVK3, 2024; DND2, 2024).

6.1.3 Third question: In what ways can both countries engage in active water cooperation for effective treaty implementation

The paradigm of transboundary water management must evolve from traditional cooperation to effective collaboration a shift emphasized by Yildiz (2015) where riparian countries work toward shared objectives, outcomes, and visions. Section 2.9 discusses active water cooperation approaches in detail, based on analysing three relevant distinct cooperative frameworks to explore potential avenues for Iran and Afghanistan to collaborate over the Helmand River waters. Among them, the Active Water Cooperation model proposed by the Strategic Foresight Group (Philip et al., 2015) identifies ten key indicators that help create a foundation for meaningful water collaboration.

From a practical standpoint, these indicators offer a pathway to move beyond a narrow focus on water quantity and toward a more comprehensive, basin-wide management approach that emphasizes mutual benefits. Currently, both Iran and Afghanistan remain primarily concerned with securing water allocations, rather than pursuing integrated basin management strategies.

As result of this study, I proposed Active Water Cooperation Framework in Section 2.9 outlines a step-by-step methodology and criteria for fostering active collaboration and enhancing the implementation of the 1973 treaty considering IWL principles and trust building process. Interviewee responses further support this cooperative framework, highlighting key actions for treaty implementation such as strengthening joint monitoring mechanisms, integrating climate adaptation strategies, maintaining regular dialogue, engaging civil society, and modernizing the treaty framework by addendum of environmental legislation. The following visual table illustrates the expert perspectives related to the third research question in greater detail.

Research Question	Detailed Insights Based on Interview Responses – Afghans
In what ways can both countries engage in active water cooperation and collaboration for effective implementation of the treaty?	Joint Monitoring and Transparent data sharing mechanism: Need for joint water measurement stations to remove ambiguity overflow levels (several respondents like AQKAFG1, 2024; FZAAFG3, 2024). Set up real-time, transparent water measurement stations along the Helmand River (NBIAFG13, 2024; AWBAFG10, 2024)
	Institutional Strengthening: Formalize the Helmand River Commission into a stronger, treaty-enforcing body (BRAAFG2, 2024). Regularize high-level meetings: Move from ad-hoc commissioner meetings to structured, periodic negotiations and updates.
	Integrate climate change adaptation plans: Integrate climate change scenarios into water-sharing agreements and create flexibility for low-flow years (ENZAFG7, 2024; IDMAFG11, 2024). Acknowledge reduced water availability due to climate change and agree on flexible water management strategies (BRAAFG2, 2024)
	Track II Diplomacy: Academics, researchers, and NGOs should be involved to facilitate trust-building and technical understanding (FHMAFG8, 2024).
	Public Awareness and Education: Educate and increase public awareness of both nations on the shared nature of the basin and the importance of cooperation (various respondents).
	Treaty amendment or expand legal frameworks: Update the treaty to include provisions for environmental protection, groundwater use, and dispute resolution

under international frameworks (NBLAFG13, 2024). Other respondents added to just update the 1973 treaty to include environmental, groundwater components (WABAFG12, 2024).

Joint infrastructure planning: Coordinate dam construction, irrigation development, and wetland rehabilitation efforts across the basin and establish a participatory approach including the indigenous community (FZAAFG3, 2024)

Research Question	Detailed Insights Based on Interview Responses – Iran
In what ways can both countries engage in active water cooperation and collaboration for effective implementation of the treaty?	Revise and modernize the 1973 treaty: Several respondents suggested updating the treaty to reflect current realities such as climate change, population growth, and environmental needs (MHEIRN6, 2024; MRJINR5, 2024).
	Establish joint technical mechanisms: A strong recommendation was to implement a shared data monitoring and water measurement system, particularly at border delivery points (MDJIRAN8, 2024; HSNIRN10, 2024).
	Enhance institutional cooperation: Respondents highlighted the need for a formal, empowered joint commission with the authority to resolve disputes and oversee implementation (MRJINR5, 2024).
	Promote shared interests: Encouraging mutual benefit frameworks, such as joint environmental and agricultural initiatives, may increase political will to collaborate (SBMIRN3, 2024; MDJIRAN8, 2024).
	Create diplomatic consistency: Long-term trust-building measures and regular engagement at the ministerial or head-of-state level were seen as essential to ensure continuity (MHEIRN6, 2024; BNMIRN2, 2024).

Research Question	Detailed Insights Based on Interview Responses – Non-Afghan-Iran origin
In what ways can both countries engage in active water cooperation and collaboration for effective implementation of the treaty?	Joint Basin Management: Establishing a basin-level authority or an active joint commission to monitor, plan, and manage water usage is key (DND2, 2024; NVK3, 2024).
	Acknowledging Scientific Data: Using climate and hydrological data transparently is essential to build consensus and cooperation willingness (GRE4, 2024).
	Depoliticizing the Issue: Reframing water as a shared environmental and humanitarian issue can encourage collaboration (VCE1, 2024; GRE4, 2024).
	Trust-Building Measures: Initiating Track II diplomacy, academic exchange, and shared research can support formal negotiations (NVK3, 2024).
	Modernizing the Treaty: Amend treaty to including environmental protection, data-sharing, and dispute resolution mechanisms under modern legal norms (all experts).

The summary of responses to the third research question indicates that approximately 70–80% of interviewees across all groups expressed closely aligned or similar perspectives regarding areas of common interest. The most frequently mentioned themes included joint basin management,

transparent data-sharing mechanisms, trust-building, institutional cooperation, and the modernization⁶⁹ or amendment of the treaty.

This section presents a comparative analysis of responses from Afghan and Iranian stakeholders and researchers, and independent non-Afghan Iranian experts regarding the long-standing water disputes between Iran and Afghanistan over the Helmand River. Despite the existence of the 1973 Helmand River Treaty, tensions persist due to a variety of historical, political, technical, climate change impacts and environmental challenges. The following visual table synthesizes the key findings drawn from different groups interviews, highlighting shared and divergent views across three main research questions.

6.1.4 Comparative Analysis of Afghan, Iranian, and Experts Perspectives and Views on Helmand River Disputes, Cooperation & Treaty implementation

Research Question	Afghan Interviewees	Iranian Interviewees	Experts Interviewees
1. Reasons for continual disputes despite the 1973 Treaty	Historical land demarcation issues (since 1872). Climate change reducing and irregular flow. Lack of trust & political instability in Afghanistan. Differing national narratives and treaty expectations. Weak treaty implementation (28 meetings, no action). External influences (Pakistan/Iran backing insurgents). Unilateral development by Afghanistan & Iran.	Treaty viewed as outdated and insufficient for Sistan needs. No strong enforcement or joint monitoring system. Afghan political instability weakens continuity. Climate change impact dismissed; focus on Afghan dams. Lack of shared interests or cooperative vision.	Infrastructure control disputes (Afghanistan seen as restricting flow). Iran denies climate change impact. Absence of basin-level joint management. National interest drives unilateralism. Water politicized instead of being managed technically or scientifically.
2. Impact on diplomatic, political, and social relations	Diplomatic relations overshadowed by water disputes. Iran uses migration as pressure. Mutual distrust and public frustration. Regional cooperation undermined. Institutional mechanisms lack authority.	Water tied to national security (Sistan). Transparency concerns cause public frustration. Diplomatic strain limited bilateral cooperation. Missed economic and regional opportunities.	Heightened political tensions. Lack of trust reduces, no willingness to cooperate. Public narratives lack factual basis. Missed chance to use treaty for peacebuilding.
3. Pathways to engage active cooperation toward treaty implementation	Establish joint water monitoring systems. Strengthen Helmand River Commission. Integrate climate change flexibility. Engage in Track II diplomacy (NGOs, academia, civil society, etc). Raise public awareness. Amend treaty with environmental/legal updates. Joint infrastructure planning.	Revise treaty to reflect current climate and population dynamics. Implement border data-sharing and monitoring. Formalize empowered joint commission. Develop shared environmental/agricultural initiatives. Promote consistent, high-level diplomatic engagement	Create basin-level joint authority. Use climate data to build shared. Understanding. Depoliticize water discussions. Build trust via academic and civil society exchange. Modernize treaty with legal and environmental standards

⁶⁹ During the interview Afghan side were more cautious and conservative about modernization or amendment of treaty to avoid any new expectations from Iran about addition water and their emphasize was only to include environmental aspect (all Afghan experts, 2024). The Iranian group strong emphasize was on full revision of the treaty to reflect their current water demand due to population growth and environmental needs.

The analysis of responses highlights the perspectives of each interviewee group regarding pathways to engage in Active Water Cooperation (AWC) for the effective implementation of the 1973 Helmand River Treaty. For both Afghan and external expert groups, the highest priority is the establishment of a joint water monitoring system to minimize the risk of disputes over water allocation. Such a system would also foster a transparent and accurate data-sharing mechanism, which is considered essential for building trust and cooperation. In contrast, the Iranian group places the highest priority on revising the treaty to reflect current water demands, particularly due to population growth in the Sistan region. Many Iranian interviewees expressed concerns that the 14% allocation specified in the treaty is insufficient to meet the current region's needs.

While joint water monitoring was mentioned by some Iranian experts, it was often framed as a measure to ensure that Afghanistan does not withhold water from Iran. However, as discussed in the analysis chapter, there appears to be a contradiction: Iran has historically shown limited interest in establishing a water measurement system (AWBAFG10, 2024). According to senior Afghan officials from the Ministry of Energy and Water, Iran is currently receiving up to three times more water than its legal entitlement under the treaty (BRAAFG2, 2024; WAAFG4, 2024; AWBAFG10, 2024). Iranian officials, however, dispute this claim and instead accuse Afghanistan of restricting water flow due to dam development in upper reaches (BNMIRN2, 2024; MDJIRN8, 2024; ZRGIRN7, 2024).

To address this mutual distrust, several external experts recommend the implementation of an advanced joint water monitoring system with full transparency in data sharing, which could serve as a foundational step toward trust-building and conflict mitigation (VCE1, 2024; GRE4, 2024). Beyond these core issues, all three groups expressed similar support for strengthening the Helmand River Basin Commission, integrating climate change adaptation, and protecting the environment and ecosystems, particularly the Hamoun wetlands. However, it is worth noting that many Iranian experts and officials remain reluctant to acknowledge the impact of climate change⁷⁰ on the river's annual flow. In February 2025, Iran's Foreign Minister Araghchi during his visit to Kabul, expressed scepticism about the effects of climate change, stating, "we do not know the extent of climate changes impact on the river flow regime (Fahim, 2025). Similarly, several interviewees and academic sources have explicitly denied or downplayed these effects (Hajihosseini et al., 2016; ZRGIRN7, 2024; HSNIRN9, 2024).

To resolve these divergent views, a joint research initiative between Afghan and Iranian experts or an independent technical assessment by a neutral institution should be undertaken to conduct a comprehensive hydrological analysis of the Helmand River. This would help establish a reliable baseline for annual river discharge in comparison with "normal water year" as stated in the treaty. This will facilitate evidence-based dialogue around water sharing and treaty implementation.

Another key step to cooperate and implement treaty, as discussed by both the Afghan group and external experts, is the use of Track II diplomacy to involve international organizations, academia, and civil society stakeholders. This informal yet strategic level of engagement promotes trust-building, encourages the exchange of knowledge, and creates a collaborative platform that can inform and positively influence official negotiations (Yıldız, 2025). This approach aligns with the

⁷⁰ Climate change is a global threat with both direct and indirect, systemic impacts on environmental and social dimensions. On the environmental side, it contributes to deforestation, ecosystem degradation, water scarcity, soil erosion, and the decline of agricultural productivity. The social consequences are even more severe, including increased food insecurity, economic instability, and disruptions to the labour market.

“slow-track process” outlined in the Active Cooperation Framework in Section 2.9, which emphasizes the role of social dynamics, institutional capacity, and power asymmetry in fostering long-term and sustainable cooperation.

In contrast, the Iranian expert group does not support the involvement of international stakeholders. They argue that Iran has had negative experiences with past dialogues and negotiations involving external actors. According to these respondents, international organizations are often perceived as lacking neutrality and acting in accordance with their own strategic interests rather than facilitating fair and just mediation (MDJIRAN8, 2024; BNMIRN2, 2024).

One of the common points discussed by all groups is the environmental and legal updates of the treaty. This issue has deep root with Hamun deltas current situation that really required to protect and conserve the wetlands within the basin. The main challenging point is that environmental aspect has not been included in the treaty in 1970s discussions. That why Iranian and external group emphasize on modernization of treaty with legal and environmental standards while Afghan experts recommended only to be discussed as an annex to the treaty not the entire treaty amending. Afghans emphasize that 1973 treaty is a permanent ratified treaty and Afghanistan never want to discuss the entire treaty materials to avoid new expectation about water allocation (WABAFG12, 2024; FHMAFG8, 2024).

To address this issue and establish common ground, a joint Strategic Environmental Assessment (SEA) should be conducted with the involvement of technical experts from both countries and might be get support of international experts. The findings of the SEA should then be translated into an actionable strategy and incorporated as an addendum to the Helmand River Treaty, ensuring that it covers the entire basin, including the three major wetlands and the Godazari lake. This environmental annex must be developed with the mutual consent of both countries, and its recommendations should be implemented and regularly monitored by the respective River Basin Organizations (RBOs) in coordination with the Helmand River Commissioners.

Public awareness is another critical element highlighted by the Afghan group, particularly in relation to social motivations and trust-building, which are essential components of the slow-track process outlined in the conceptual cooperative framework in Section 2.9. To promote an environment conducive to cooperation, both countries must address the three key drivers of this process: social motives, institutional capacity, and political power. These factors play a pivotal role in building trust not only among officials and institutions but also across societies.

Raising awareness and promoting knowledge-sharing about the nature of shared water resources and the potential for mutual benefits can significantly strengthen public support for cooperation. Public trust and willingness to collaborate are more likely to grow when citizens understand that sustainable and equitable management of transboundary water can benefit both nations.

For many years, the social and institutional relationships between Iran and Afghanistan have been shaped by a complex mix of historical agreements, geopolitical tensions, environmental stressors, and an emotionally charged public narrative. This emotional dynamic expressed in phrases like “This is our water; why should we give it to Iran?” or the reverse perception from the Iranian side that “Afghanistan is blocking our water” must be transformed. Changing this narrative requires targeted public awareness, education campaigns, and civil society involvement to shift perspectives from confrontation to cooperation.

CHAPTER SEVEN

7 Conclusion and Recommendations

7.1 Conclusion

Chapter seven revisits the core objectives and research questions that guided this research namely, to explore the underlying causes of the enduring disputes between Iran and Afghanistan over the Helmand River, and to propose practical mechanisms for fostering long-term active cooperation and effective treaty implementation. Drawing from a single-case study of the Helmand River basin, the research presents a multidisciplinary analysis that integrates political, socioeconomical, environmental, and institutional perspectives.

Despite the signing of the Helmand River Treaty in 1973 after nearly a century of bilateral tensions, the treaty has yet to be fully and effectively implemented. The study finds that while the treaty represents an essential legal framework, its lack of adaptive environmental clauses, ineffective enforcement mechanisms, absence of joint institutional structures (e.g. water measurement), and political upheavals have significantly limited its operational success. Political instability, divergent national priorities, and mistrust have further strained cooperation, particularly in the context of increased water scarcity and the looming impacts of climate change.

The research also demonstrates that sustainable and equitable transboundary water governance cannot be achieved through legal instruments such as treaty alone. Instead, it requires active cooperation a dynamic, multi-level social and political process that builds trust, fosters joint responsibility, and prioritizes mutual benefits. As discussed in Section 2.9, the proposed Active Water Cooperation Framework offers a comprehensive roadmap that can transition both countries from a reactive, quantity-focused approach to a collaborative, benefit-sharing model of basin management.

Moreover, through in-depth interviews with Afghan, Iranian, and external (non-Afghan & Iranian) experts, the study reveals a substantial convergence of views on certain foundational elements of cooperation such as joint monitoring, transparent data sharing mechanism, institutional strengthening and knowledge sharing, environmental and ecosystem preservation, and climate adaptation despite significant political differences. These shared views provide a critical entry point for confidence-building measures that can lay the groundwork for treaty effective implementation and long-term peacebuilding including mutual respects to the national and basin interests.

This chapter concludes that while the challenges are complex and deeply rooted, they are not insurmountable. What is required, is political will, technical collaboration, good transboundary governance, and sustained engagement through both formal and informal channels. Only by embracing a shared vision for the Helmand River as a common and shared resources rather than a contested boundary, can Iran and Afghanistan move toward a future of water security, ecological resilience, and regional stability.

In addition, a sustainable solution outlined in Section 2.9 is the Active Water Cooperation Framework, which details the necessary steps to resolve disputes, foster active cooperation, and effectively implement the 1973 Helmand River Treaty. This proposed framework serves as a foundational roadmap for guiding Iran and Afghanistan toward meaningful collaboration by promoting trust-building and mutual recognition of national and basin interests whether economic, ecological, or political.

The framework also emphasizes alignment with IWL and IWRM principles. As a final step, it encourages a transition toward benefit-sharing collaboration, guided by the six key criteria outlined in the framework. At this stage, both riparian states are expected to work jointly toward shared objectives, ensuring the practical and sustainable implementation of the treaty.

7.2 Recommendations

To move toward effective implementation of the 1973 Helmand River Treaty and foster active water cooperation including future improvement of TWM, the following actionable recommendations are proposed:

1. Establish a Joint Water Monitoring System

- Create real-time, transparent monitoring stations at key three delivery points as specified in the treaty article III and ensure hydrological⁷¹ data is publicly available and jointly verified.
- Use monitoring as a confidence-building measure with transparent data sharing mechanism

2. Strengthen Institutional Cooperation

- Formalize and empower the Helmand River Commission with dispute resolution authority.
- Shift from ad-hoc commissioner and event-based meetings to regular, structured dialogues.

3. Modernize/Amend the Treaty Framework

- Add an environmental annex to address climate change impacts, ecosystem health, and groundwater management.
- Avoid full renegotiation to preserve treaty stability and contents; instead, use appendix to include new legal and environmental dimensions.
- Align environmental annex with International Water Law (IWL) and Integrated Water Resources Management (IWRM) principles.

4. Conduct a Joint Strategic Environmental Assessment (SEA)⁷²

⁷¹ In the shared watercourses hydrological analysis provides a fundamental ground for understanding the water flow regime in the river basin in respect to the water quantity, water availability and climate change impact including infrastructure development (De Stefano et al., 2017).

⁷² This is a strategic focus to evaluate the environmental consequences of water policies and development plans. It helps governments to prevent environmental crisis, promote public trust, foster long term resilience and equity and able riparian/actors to respond to global challenges like climate change. Traditional EIA doesn't help in such basin wide assessment because it is for individual project and its often lack of accurate data and transparency while SEA helps with a practical framework to align water resources development with environmental integrity (Azad, 2025).

- Collaborate on a basin-wide SEA covering the Hamun wetlands and Godzari depression lake including impact of dams and artificial reservoirs
- Involve neutral third-party technical institutions for credible, science-based findings and technical support.
- Translate SEA findings into a policy roadmap, formally as an annex to the treaty.

5. Integrate Climate Change Scenarios

- Acknowledge reduced flow due to climate variability on science-based analysis and study.
- Include flexible water allocation provisions for low-flow years and discuss environmental flow from the specified water allocation in the treaty.

6. Promote Track II Diplomacy

- Engage academia, civil society, and international institutions and experts to foster informal trust and knowledge exchange.
- Use Track II mechanisms to feed into official negotiations and policymaking.

7. Depoliticize the Water Issue

- Frame water sharing as a humanitarian, environmental, and technical challenge rather than a political dispute.
- Launch joint awareness campaigns to inform the public in both countries about the shared nature and shared responsibility of the Helmand River Basin and associated ecosystem.

8. Facilitate Public Engagement and Education

- Raise public awareness of the importance of active water cooperation and long-term sustainability through trust building.
- Include indigenous communities in planning and decision-making, especially those affected by irrigation, dam and artificial reservoirs projects.

7.3 Study limitations

Since this study is based on qualitative research and literature review so finding of right information and data is a challenge even by using different key words. It is also time-consuming process to review plenty of articles to pursue right information and conceptions. It is difficult to investigate connection or establish causal relationships between variables and the analysis process extremely difficult to make it in line with the context. On one hand some of important journal articles were not available for free and some of them presented only with abstract which have needed to approach the specific library or reach out the author(s). The Helmand River basin single case study data and scientific literatures has made this research relatively hard to find out enough data, relevant scientific literatures, overview papers and research articles for the review and analysis of disputes impacts on socioeconomics and political relations and treaty implementation.

Currently, water institutional organizations in Afghanistan are under rule of a de facto or unrecognized government. From political point of view, it looks sensitive and almost impossible to approach local authority for interviews or obtaining data, they may also not confidence to provide information, as they may not confident and worry that their statements could be misused.

Traveling to the local areas within the Helman River basin is a major logistical challenge and security threat which is not safe at all to reach the local indigenous people and farmers. On the other side traveling to Iran is not safe due to security problem and political sensitivity of transboundary water issue therefore I have planned to interview experts and water resources professionals virtually.

Consequently, this thesis is based on available data and information gathered from the accessible libraries' literature, institutional websites, international organizations, and personal interviews with key focused groups such as policymakers, local authorities, experts, academics, the Afghan and Iranian diaspora, and non-Afghan and Iranian experts. The qualitative research approach is more time-consuming and challenging compared to quantitative research. To preserve the anonymity of respondents, a coding system has been used instead of names, given the sensitivity of the topic. Most interviewees did not recommend recording the interviews, as transboundary water issues are politically sensitive, and there was a concern about being targeted or identified by politicians. Furthermore, recording interviews presents the additional risk of data being stored on servers, where it could potentially be leaked, compromising the anonymity of respondents.

7.4 Future Research Direction

The Helmand River basin lies at the intersection of historical grievances, geopolitical complexity, environmental degradation, and pressing socio-economic challenges. Despite the 1973 Helmand River Treaty, cooperation between Iran and Afghanistan has been inconsistent, hampered by fluctuating political relations, weak institutional coordination, and differing interpretations of the treaty's provisions.

A key point of contention is water allocation, particularly in light of climate change impact in the last two -three decades. Studies and analyses indicate a decline in the river's annual discharge, yet Iranian authorities and experts have not acknowledged this reduction compared to the agreed-upon "normal water year." To resolve this dispute, future research should involve a joint hydrological and river flow analysis, assessing climate change impacts with reference to the river annual discharge on "normal water year" at Dehrawoud hydrometric station as specified in the treaty.

Another critical issue is the environmental degradation and drying of the Hamun wetlands. A joint⁷³ Strategic Environmental Assessment (SEA) or study by Iran and Afghanistan or an independent assessment by a neutral⁷⁴ third-party technical institution is essential to determine the root causes. This would clarify whether the problem stems from human activities (such as dam and artificial reservoirs like Chahnimah construction) or natural climate variability, while also providing technical recommendations for ecological restoration of the wetlands, Godzari and

⁷³ A jointly conducted SEA can act as a platform for scientific cooperation, reducing blame and focusing on evidence-based causes (climate variability vs. upstream interventions). SEA incorporates climate models, hydrological data, socio-economic impacts, and ecosystem services, offering a comprehensive view of the basin's health. Its findings can inform transboundary water policy, especially regarding treaty updates, flow thresholds, and wetland rehabilitation strategies. When both parties contribute data and expertise, it can lead to better transparency and trust, which is critical in politically tense environments. SEA will enable them to differentiate between climatic variability and water regulation impacts (Azad, 2025).

⁷⁴ Set up a neutral advisory panel with representatives from both states and third-party observers (e.g., UNEP or ESCAP).

entire basin. Additionally, an interdisciplinary research approach is needed, integrating political, social, and economic perspectives to develop holistic and sustainable solutions for the basin's challenges including developing a joint monitoring mechanism to strengthen long-term Iran–Afghanistan water cooperation in the Helmand River basin.

References

- Abbasian, P. (2023, June 8). Border Clashes and Water Disputes Complicate Taliban-Iran Relations. *The Diplomat*.
- Abidi, A. H. H. (1977). Irano-Afghan Dispute over the Helmand Waters. *International Studies*, 16(3), 357-378. <https://doi.org/10.1177/002088177701600304>
- Abtew, W., & Melesse, A. M. (2014). Transboundary rivers and the Nile. *Nile River Basin: Ecohydrological Challenges, Climate Change and Hydropolitics*, 565-579. DOI 10.1007/978-3-319-02720-3
- Adelphi (n.d.). Transboundary Water Disputes between Afghanistan and Iran. <https://climate-diplomacy.org/case-studies/transboundary-water-disputes-between-afghanistan-and-iran>
- Afzal N., Yaseen Z., Muzaffar M., (2020). China and India: On the Edge of Water Disputes and Co-operations, *Journal of Arts and Social Sciences*. VII (2), 231-244.
- Afzali, R., Kamran Dastjerdi, H., Zibasaz Khoshmanzarch, S., Zaki, Y., & Yazdanpanah Dero, Q. (2022). Monitoring of water resources and vegetation in the Helmand Basin using satellite image time-series and border hydro-political challenges. *Water Policy*, 24(8), 1223-1246.
- Ahlers, Rhodante, et al. "Ambitious development on fragile foundations: Criticalities of current large dam construction in Afghanistan." *Geoforum* 54 (2014): 49-58.
- Ahmadzai, A. (2021). The Implementation of the IWRM Guided Water Reforms in Afghanistan: Progress and Challenges. *AREU*. <https://doi.org/10.20935/AL1278>
- Akhtar, S. (2019). Water sharing conflicts and management in the Indus River Basin. *J Aqua Sci Oceanography*, 1, 202.
- Al Jazeera (2023, May 30). What caused deadly Afghan-Iran border clashes? What happens next? Al Jazeera. <https://www.aljazeera.com/news/2023/5/30/what-caused-deadly-afghan-iran-border-clashes-what-happens-next>
- Aljazeera (2023, May 30). What caused deadly Afghan-Iran border clashes? What happens next? Taliban fighters clash with Iranian border guards. Al Jazeera. <https://www.aljazeera.com/news/2023/5/30/>
- Aljazeera, A. (2023, May 27). At least three killed in shooting at Iran-Afghan border: Taliban fighters clash with Iranian border guards. Aljazeera. <https://www.aljazeera.com/news/2023/5/27/clash-on-iran-afghan-border-kills-at-least-three>

- Alka, P. K. S. (2017) Trans-boundary water resources of Afghanistan and water sharing relations with its neighbours. *International Journal of Advanced Research and Development*.
- Amini, A., Ghoreishi, S. Z., & Mianabadi, H. (2021). Understanding 1973 the Helmand Treaty by Invoking Rules of Interpretation According to Vienna Convention 1969. *Water Management and Irrigation*.
- Amiraslani, F., & Dragovich, D. (2023). Iran's regional transnational water partnerships: Unclear rules, unstable partnerships, and an unsettled future. *Sustainability*, 15(15), 11889.
- Analysis, D. R. (2015). Resources in Greater Central Asia: Afghanistan's Trans-boundary Waters: An Overview. Duran Research and Analysis. www.duran.af
- Ansari, A., Mukhlisin, M., Baba, A., & Krishna, L. S. (2021). Water Quality Assessment of Ground and River Water in Lashkar Gah city of Helmand Province, Afghanistan. *International Journal of Pharmaceutical Research* (09752366), 13(1).
- Arfa, A., Ayyoubzadeh, S. A., Shafizadeh-Moghadam, H., & Mianabadi, H. (2025). Transboundary hydropolitical conflicts and their impact on river morphology and environmental degradation in the Hirmand Basin, West Asia. *Scientific Reports*, 15(1), 2754.
- Askari, N., & Bashardost, N. (2021, March 24). Afghanistan no longer relinquishes free water: Ghani. *Pajhwok Afghan News*. <https://pajhwok.com/2021/03/24/afghanistan-no-longer-relinquish-free-water-ghani/>
- Azad, M. A. (2025, May 15). Why Traditional EIA Isn't Working-The shift from EIA to SEA [Lecture Note]. LinkedIn. <https://www.linkedin.com/in/mdasifazad/>
- Azizi, , A. H., Akhtar, F., Tischbein , B., Borgemeistera , C., & Wang, Q. (2025). Understanding Water Storage Dynamics in Afghanistan: An Integrated Perspective. *Globalwaterstorage: University of Bonn, Germany and Chinese Academy of Sciences, Beijing, China*. <https://www.globalwaterstorage.info/en/understanding-water-storage-dynamics-in-afghanistan-an-integrated-perspective>
- Barati, A. A., Pour, M. D., & Sardooei, M. A. (2023). Water crisis in Iran: A system dynamics approach on water, energy, food, land and climate (WEFLC) nexus. *Science of the Total Environment*, 882, 163549.
- Batchelor, C. (2007). Water governance literature assessment. *International Institute for Environment and Development*, 2523.
- Bauer, P. (2023, September 12). Indus Waters Treaty. *Encyclopedia Britannica*. <https://www.britannica.com/event/Indus-Waters-Treaty>

- BBC, News. (2024, July 26). ایران وایي د حقابي تامین لپاره یې په کمال خان بند کې اصلاحات اړین دي. Iran asking that Kamal Khan Dam Design Required Modification. BBC. <https://www.bbc.com/pashto/articles/cv2gm55j040o>
- Boltuc, S. (2025). Water, Security, and Cooperation: Iran and Afghanistan Address the Helmand River Dispute. *Special Eurasia*, Volume 29 Issue 6. <https://doi.org/ISSN 2975-0598>
- Boltuc, S. (2025). Water, Security, and Cooperation: Iran and Afghanistan Address the Helmand River Dispute. *SpecialEurasia*. ISSN 2975-0598 Volume 29 Issue 6. <https://www.specialeurasia.com/2025/01/30/helmand-river-iran-afghanistan/>
- Boone, J., & Kamali, S. (2016, May 23). Death of Mullah Mansoor highlights Taliban's links with Iran. *The Guardian*. <https://www.theguardian.com/world/2016/may/23/death-of-mullah-mansoor-highlights-talibans-links-with-iran>
- Boyle, R. (2024, February 22). The Devastating Impact of Deforestation on Watershed Management. *Emission Index*. Retrieved February 22, 2024, <https://www.emission-index.com/deforestation/watershed-management#>
- Bozorg-Haddad, O., Bahrami, M., Gholami, A., Chu, X., & Loáiciga, H. A. (2024). Investigation and classification of water resources management strategies: possible threats and solutions. *Natural Hazards*, 1-26.
- Brown, C., & King, J. (2013). Environmental flows in shared watercourses: Review of assessment methods and relevance in the transboundary setting. *Transboundary Water Management*, 107-123.
- Cascão, A. E., & Nicol, A. (2016). Sudan, 'kingmaker' in a new Nile hydropolitics: Negotiating water and hydraulic infrastructure to expand large-scale irrigation. In *Land and hydropolitics in the Nile River Basin* (pp. 105-132). Routledge.
- Cascão, A. E., & Zeitoun, M. (2013). Power, hegemony and critical hydropolitics. In *Transboundary water management* (pp. 27-42). Routledge.
- Creswell, J. W. (2009). Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approach*. SAGE Publications, Inc. 2455 Teller Road Thousand Oaks, California 91320 E-Mail: Order@Sagepub.com, Third Edition. <https://doi.org/ISBN 978-1-4129-6557-6> (pbk.)
- Cullather, N. (2002). Damming Afghanistan: Modernization in a buffer state. *The Journal of American History*, 89(2), 512-537. <https://doi.org/10.2307/3092171>
- De Bruyne, C., & Fischhendler, I. (2013). Negotiating conflict resolution mechanisms for transboundary water treaties: A transaction cost approach. *Global environmental change*, 23(6), 1841-1851.

- Dehgan, A., Palmer-Moloney, L. J., & Mirzaee, M. (2014). Water security and scarcity: Potential destabilization in western Afghanistan and Iranian Sistan and Baluchestan due to transboundary water conflicts. In *Water and post-conflict peacebuilding* (pp. 305-326). Routledge.
- Do, S. K., Akhtar, F., Goffin, B., Aryal, A., Lipscomb, M., & Lakshmi, V. (2024). Assessing terrestrial water storage variations in Afghanistan using GRACE and FLDAS-Central Asia data. *Journal of Hydrology: Regional Studies*, 55, 101906.
- Earle, A., Jägerskog, A., & Öjendal, J. (2013). Introduction: setting the scene for transboundary water management approaches. In *Transboundary water management* (pp. 1-10). Routledge.
- Earle, A., Jägerskog, A., & Öjendal, J. (2013). Introduction: setting the scene for transboundary water management approaches. In *Transboundary water management* (pp. 1-10). Routledge.
- Ettehad, E. (2010). Hydro-politics in Hirmand/Helmand international river basin and Application of Integrated Water Resources Management. Online publication: <http://stud.epsilon.slu.se>
- Express Web Desk (2017, June 25). Salma Dam attacked by Taliban: Here is all you need to know about the dam. Indian Express.com. <https://indianexpress.com/article/what-is/what-is-salma-dam-taliban-attack-afghanistan4721346/>
- Fahim, N. A. (2025, February 1). نتایج سفر شتابزده عراقچی وزیر خارجه ایران به کابل چه بود [Video]. Jaihoon Channel. https://www.youtube.com/watch?v=VGV40_i1ecY
- Faris, M. R., et al. (2016). Conflict resolution in the Euphrates River dispute using the graph model for conflict resolution. *Academic Journal of Science*, 6(01), 295-306.
- Fatemeh, A. (August 2016). Water Dispute Escalating between Iran and Afghanistan. Atlantic Council. <http://www.jstor.com/stable/resrep03471>
- Fatemeh, A. (March 2016). Iran-Afghan Differences over Helmand River Threaten Both Countries. Atlantic Council
- Fry, J. D., & Chong, A. (2018). UN Security Council Resolution of International Water Disputes. *Geo. J. Int'l L.*, 50, 363.
- Ganoulis, J., et al. (2018). Transboundary water conflicts and cooperation. *Transboundary Hydro-Governance: From Conflict to Shared Management*, 55-76.
- Gaybullae, B., Chen, S. C., & Gaybullae, D. (2012). Changes in water volume of the Aral Sea after 1960. *Applied Water Science*, 2, 285-291.

- Gebrehiwot, T., Van der Veen, A., & Maathuis, B. (2011). Spatial and temporal assessment of drought in the Northern highlands of Ethiopia. *International Journal of Applied Earth Observation and Geoinformation*, 13(3), 309-321.
- Gerring, J. (2004). What is a case study and what is it good for? *American political science review*, 98(2), 341-354.
- Ghanizada, A. S. (2011, September 8). Iranian concerns over Kamal Khan dam construction baseless: Officials. *The Khama Press News Agency*.
- Ghomeshi, S. Z., Mianabadi, H., Warner, J., Nagheeby, M., Vij, S., Parvaresh Rizi, A., & ArfaFathollahkhani, A. (2024). Maintaining status quo or realizing transformation in transboundary water conflicts? The power-interests-identity nexus in the Helmand River basin. *Water International*, 49(5), 664-689.
- Gleick, P. H., & Heberger, M. (2014). Water conflict chronology. *The World's Water: The Biennial Report on Freshwater Resources*, 173-219.
- Gleick, P. H., & Shimabuku, M. (2023). Water-related conflicts: definitions, data, and trends from the water conflict chronology. *Environmental Research Letters*, 18(3), 034022.
- Gleick, P. H., & Shimabuku, M. (2023). Water-related conflicts: definitions, data, and trends from the water conflict chronology. *Environmental Research Letters*, 18(3), 034022.
- Glinski, S. (2020). God, gas and heroin. Now, the fight's over water. *Los Angeles Times*. *World and Nation*.
- Goes, B. J. M., et al. (2016). "Integrated water resources management in an insecure river basin: a case study of Helmand River Basin, Afghanistan." *International Journal of water resources Development* 32.1: 3-25.
- Hajihosseini, H., et al. (2016). Hydrological Assessment of the 1973 Treaty on the Transboundary Helmand River, Using the SWAT Model and a Global Climate Database. *ReaserchGate*. <https://doi.org/DOI: 10.1007/s11269-016-1447-y>
- Harrison, J. (2019). A project of the Oregon Historical Society: Columbia River Treaty (1964). *Oregon Encyclopedia*. https://www.oregonencyclopedia.org/articles/columbia_river_treaty_1964/
- Hashemi, S. M (2024). Iran-Afghanistan Hydro-political Interaction for Socio-economic Development of Lake Hamun Basin in Sistan Region.
- Hearns, G. (2015). The Helmand River and the Afghan - Iranian Treaty 1973. *International Water Law Project Blog*. Eco-logical-resolutions.com

- Heijden, D. V. K., & Stinson, C. (2019, March). Water is a growing source of global conflict. Here's what we need to do. In World Economic Forum. <https://www.weforum.org/agenda/2019/03/water-is-a-growing-source-of-globalconflict-heres-what-we-need-to-do>.
- Hessami, E. B. (2023). Avoiding a Central Asian Water War: Challenges and Opportunities for Cooperation between the Islamic Republic of Iran and the Islamic Emirate of Afghanistan. *SAIS Review of International Affairs*, 43(2), 21-38.
- Hirsch, P., & Cheong, G. (1996). Natural resource management in the Mekong River Basin: Perspectives for Australian development cooperation. Sydney: AMRC, <http://www.usyd.edu.au/su/geography/Hirsch>
- Hoefler, R. (2022). The Multiple Streams Framework: Understanding and Applying the Problems, Policies, and Politics Approach. *Journal of Policy Practice and Research* (2022) 3:1–5, 3. <https://doi.org/10.1007/s42972-022-00049-2>
- Hoominfar, E.; Radel, C. Contested Dam Development in Iran: A Case Study of the Exercise of State Power over Local People. *Sustainability* 2020, 12, 5476
- Houk, A. (2011). Transboundary water sharing: Iran and Afghanistan. *Spotlight*, <http://www.stimson.org/spotlight/transboundary-water-sharing-iran-and-afghanistan>, 22.
- Iqbal, A. (2018, May 20). Explainer: What is the Kishanganga water dispute. *DAWN*. <https://www.dawn.com/news/1408795>
- Islami, R., & Rahimi, A. (2019). Policymaking and water crisis in Iran. *Quarterly Journal of the Macro and Strategic Policies*, 7(27), 410-435 DOI: 10.32598/JMSP.7.3.5
- IWRM Action Hub: International Water Law. <https://iwrmactionhub.org/learn/iwrmtools/international-water-law> (n.d.)
- Jabeen, R., & Bukhari, M. (2023). What's in the waste? Plastics threaten Pakistan's mighty Indus. *World Bank Blogs: Published on End Poverty in South Asia*. <https://blogs.worldbank.org/en/endpovertyinsouthasia/>
- Jahanmal, Z. (2020, September 8). Kamal Khan Dam in Nimroz Province 'Nearly Finished': Official. *TOLONews*. <https://tolonews.com/business/kamal-khan-dam-nimroz-province-nearly-finished-official>
- Jalali, Z. (2025, January 27). Araghchi Says Kabul Visit Marks Start of 'New Path'. *TOLONews*. <https://tolonews.com/index.php/opinion-192802>
- Jarvis, T., & Wolf, A. (2013). Managing water negotiations and conflicts in concept and in practice. In *Transboundary Water Management* (pp. 125-141). Routledge.

- Kamil, I. (2021). Afghanistan, the Amu Darya Basin and Regional Treaties. *Chinese Journal of Environmental Law*, 5(1), 37-62. <https://doi.org/10.1163/24686042-12340063>
- Kamil, I. (2023, January 27). Afghanistan's Kamal Khan Dam and the Helmand River Treaty. *The Diplomat*. <https://thediplomat.com/2023/01/afghanistans-kamal-khan-dam-and-the-helmand-river-treaty/>
- Katouzian, H. (1979). Nationalist trends in Iran, 1921–1926. *International Journal of Middle East Studies*, 10(4), 533-551.
- Kawusi, N. (2024). Nowhere To Turn: The crisis of Afghan refugees in Iran. *The Blueprint*. <https://www.linkedin.com/pulse/nowhere-turn-crisis-afghan-refugees-iran-naweed-kawusi-wjtcf/>
- Khaled, I., & Zahra, S. (2019). Hydro-politics in Iran and Afghanistan: An Overview. *Pakistan Social Sciences Review*, 3(2), 594-605.
- Khalid, I., & Zahra, S. (2019). Hydro-politics in Iran and Afghanistan: An Overview. *Pakistan Social Science Review*, Vol. 3, No.2. <https://doi.org/P-ISSN 2664-0422>
- Khan, M. Z. (2013, December 22). India told to ensure water flow for Neelum-Jhelum project. *DAWN*. <https://www.dawn.com/news/1075591>
- Khan, N. (2023, August 18). Hydropolitics of the Helmand River: Iran-Afghanistan water-sharing dispute could imperil regional security and ecology Read more at: <https://www.Southasiamonitor.Org/spotlight/hydropolitics-helmand-river-iran-afghanistan-water-sharing-dispute-could-imperil-regional>. South Asia Monitor.
- Khaneiki, M. L. (2019). *Territorial water cooperation in the central plateau of Iran*. Springer International Publishing.
- KI, K. (2021, March 24). Kamal Khan Dam inaugurated in Nimroz. *KABULNOW*. <https://kabulnow.com/2021/03/kamal-khan-dam-inaugurated-in-nimroz/>
- Kibaroglu, A. (1996). Prospects for Cooperation in the Euphrates-Tigris Basin. *Cooperation Within International River Basins. Water Policy: Allocation and Mangement in Practice, Proceedings of International Conferene on Water Policy, held at Cranfield University*, 31-38.
- Litke, A., & Rieu-Clarke, A. (2015, February). The UN Watercourses Convention: A milestone in the history of international water law. In *Global Water Forum*.
- Loodin, N., & Warner, J. (2022). A Review of Hydro-Hegemonic Dynamics on the Transboundary Harirud River Basin: 2001–Present. *Water*. <https://doi.org/https://doi.org/10.3390/w14213442>

- Loodin, N., & Wolf, A. T. (2022). Will Islamic Water Management Principles Be Included If the Helmand River Treaty Is Revisited?. *Water*, 14(1), 67.
- Loodin, N., Eckstein, G., Singh, V. P., & Sanchez, R. (2023). Assessment of the trust crisis between upstream and downstream states of the Helmand River Basin (1973–2022): a half-century of optimism or cynicism? *ACS Es&t Water*, 3(6), 1654-1668. <https://pubs.acs.org/doi/epdf/10.1021/acsestwater.2c00428>
- Lu, Y., et al. (2021). Socio-hydrologic modeling of the dynamics of cooperation in the transboundary Lancang–Mekong River. *Hydrology and Earth System Sciences*, 25(4), 1883-1903.
- Madani, K. (2014). Water management in Iran: what is causing the looming crisis?. *Journal of environmental studies and sciences*, 4, 315-328.
- Madani, K. (2021). Explainer: Iran's "Water Bankruptcy". The United States Institute of Peace. <https://iranprimer.usip.org/blog/2021/dec/05/explainer-irans-water-bankruptcy>
- Magdy, A. H. (2011). Water Diplomacy: A Tool for Enhancing Water Peace and Sustainability in the Arab Region. Presented in preparation for the Second Arab Water Forum Theme 3:" Sustainable and Fair Solutions for the Trans-Boundary Rivers and Groundwater Aquifers.
- Mahmoodi, S. M. (2008). Integrated Water Resources Management for Rural Development and Environmental Protection in Afghanistan. *Journal of Developments in Sustainable Agriculture*, 3, 9-19. <https://doi.org/10.1007/s42972-022-00049-2>
- Majidiyar, A. (2018). Iran and Afghanistan at loggerheads over water. Middle East Institute. <https://www.mei.edu/publications/iran-and-afghanistan-loggerheads-over-water>
- Makengo, B. M., et al. (2021). Water: A Major Stake of Conflicts in the Twenty-First Century. *Open Journal of Social Sciences*, 9(11), 125-148.
- Mansfield, D., & Alcis (2025). Digging an ever-deeper hole: The response to climate change in the Helmand River Basin. Policy brief. XCEPT. info@xcept-research.org.
- Mayar, M. A., & Shapour, R. (2023). The Long Winding River: Unravelling the water dispute between Afghanistan and Iran. Afghanistan Analysts Network, Updated 28 Aug 2024. <file:///C:/Users/HTSTSE/Downloads/Helmand-Water-FINAL.pdf>
- McCaffrey, S. (1998). The UN Convention on the Law of the Non-Navigational Uses of International Watercourses: prospects and pitfalls. *World Bank Technical Paper*, 17-28.

- McMahon, A. H. (1905). Helmand River Cases: Award of Arbitrator McMahon, AD HOC ARBITRATION. View the Document on Jsumundi.com
- Medema, W., McIntosh, B., & Jeffrey, P. (2008). From premise to practice: a critical assessment of integrated water resources management and adaptive management approaches in the water sector. *Ecology and Society*, 13(2): 29
- Mehrotra, S. (2023). Understanding conflict and dispute. LinkedIn. <https://www.linkedin.com/pulse/understanding-conflict-disputes-sangeeta-mehrotra/>
- Milani, M. M. (2006). Iran's policy towards Afghanistan. *The Middle East Journal*, 60(2), 235-279. Vol. 60. <http://www.jstor.org/stable/4330248>
- Miri, M., Akbari, E., Amrane, A., Jafari, S. J., Eslami, H., Hoseinzadeh, E., ... & Taghavi, M. (2017). Health risk assessment of heavy metal intake due to fish consumption in the Sistan region, Iran. *Environmental monitoring and assessment*, 189, 1-10.
- Mirza, M. N. (2016). Indus water disputes and India-Pakistan relations (Doctoral dissertation).
- MIWRE (2004) Water Resources Management Policy, Ministry of Irrigation, Water Resources and Environment: Transitional Islamic State of Afghanistan, page 3-10
- Moridi, A. (2017). State of water resources in Iran: A review article. *Med Crave: International Journal of Hydrology*. <https://doi.org/DOI:10.15406/ijh.2017.01.00021>
- Moseley, C. (2024). Collaboration vs cooperation: Is there really a difference? (Spoiler: There is). <https://blog.jostle.me/blog/collaboration-vs-cooperation>
- Nabavi, S. A. (2024). Fundamental Problems of Water Resources Management in the Helmand River Basin, Afghanistan. *Randwick International of Social Science Journal*, 5(2), 263-274.
- Nagheeb, M., & Rieu-Clarke, A. (2020). Water diplomacy in the Helmand River Basin: Exploring the obstacles to cooperation within the shadow of anarchy. In *River basin organizations in water diplomacy* (pp. 201-221). Routledge.
- Nagheeb, M., & Warner, J. (2022). The 150-Year Itch: Afghanistan-Iran Hydro-politics Over the Helmand/Hirmand River. *Water Alternatives*, 15(3), 551-573.
- Nagheeb, M., & Warner, J. (2022). The 150-year itch: Afghanistan-Iran hydropolitics over the Helmand/Hirmand river. *Water Alternatives*, 15(3), 551-573.
- Najafi, A., & Vatanfada, J. (2011). Environmental challenges in trans-boundary waters, case study: Hamoon Hirmand Wetland (Iran and Afghanistan). *International Journal of Water Resources and Arid Environments*, 1(1), 16-24.

- Najafi, A., & Vatanfada, J. (2011). Environmental challenges in trans-boundary waters, case study: Hamoon Hirmand Wetland (Iran and Afghanistan). *International Journal of Water Resources and Arid Environments*, 1(1), 16-24.
- Najafi, A., & Vatanfada, J. (2013). Transboundary water management improvements, the way forward in the middle east; case study: transboundary water management of Iran and neighbours.
- NEAOIR (2012). Controversy Between Iran and Afghanistan Over the Helmand River Waters - Sanitized copy approved for release in 2012. Department of the State.
- NOAA (2024, June 16). National Ocean Service: National Ocean and Atmospheric Administration (NOAA). <https://oceanservice.noaa.gov/facts/ninonina.html>
- Nori, S. M. (2020). Challenges of transboundary water governance in Afghanistan. *Central Asian Journal of Water Research (CAJWR)* Центральноазиатский журнал исследований водных ресурсов, 6(1), 18-38.
- Öberg, M. (2016). Case studies as literatures. EKP 14 Halmstad University ETN, Halmstad Sweden. <http://www.ne.se/uppslagsverk/encyklopedi/lång/kvantitativ>
- OECD. (2015). Organization for Economic Cooperation; Water governance Indicator Framework <https://www.oecd.org/regional/OECD-Water-Governance-Indicator-Framework.pdf> OIR Report. N0.4509 -October 1947
- Pannier, B. (2023). New Canal Threatens the Peace Between the Taliban and Central Asia. Foreign Policy Research Institute.
- Philip, D., & Raj, A. et al., (2015). Water Cooperation Quotient. Strategic Foresight Group. ISBN 978-81-88262-25-0
- Radio Free Europe (2011, August 23). Captured Taliban Commander: 'I Received Iranian Training. Radio Free Europe - Radio Liberty. https://www.rferl.org/a/captured_taliban_commander_claims_trained_in_iran/24305674.html
- RadioLiberty, R. (2011, August 23). Captured Taliban Commander: 'I Received Iranian Training. RadioFreeEurope. https://www.rferl.org/a/captured_taliban_commander_claims_trained_in_iran/24305674.html
- Ranjan, A. (2023, August 14). Afghanistan's Water Fight with Iran. Afghanistan's Water Fight with Iran – NUS Institute of South Asian Studies (ISAS). <https://www.isas.nus.edu.sg/papers/afghanistans-water-fight-with-iran/>
- Rawan, Z. A. (2025). The Indus Waters Treaty Under Threat: India's Hostile Posture and Pakistan's Call for Peace. Modern Diplomacy.

<https://moderndiplomacy.eu/2025/05/03/the-indus-waters-treaty-under-threat-indias-hostile-posture-and-pakistans-call-for-peace/>

- Rezaei Zadeh, M. (2023, October 24). The Afghan Immigrant Crisis in Iran and the Rise of Afghanophobia. STIMSON: Middle East & North Africa. <https://www.stimson.org/2023/the-afghan-immigrant-crisis-in-iran-and-the-rise-of-afghanophobia/>
- Rowland, M. (2005). A framework for resolving the transboundary water allocation conflict conundrum. *Groundwater*, 43(5), 700-705.
- Sadat, S. H. (2012). Large Infrastructure Management: Analysis of Dam Failure in Italy and Afghanistan (Publication No. LAP Lambert Academic Publishing ISBN: 9783659229695) [Master's Thesis, IHE-Delft, the Netherlands].
- Sadat, S. H., & Nasrat, S. (2020). Afghanistan and Iran: From water treaty to water dispute. Lowy Institute. <https://www.lowyinstitute.org/the-interpreter>
- Sadat, S. H., & Nasrat, S. (2019). Afghanistan: Water management for peace: Formalising agreements with neighbouring countries over water usage will go a long way towards preventing conflict. Lowy Institute. <https://www.lowyinstitute.org/>
- Sadat, S. H., & Sayed, N. (2024). Water as Leverage? Improving Iran's Treatment of Afghan Migrants. *South Asian Voices*. <https://southasianvoices.org/geo-m-af-n-water-afghan-migrants-12-17-2024/#>
- Saikia, P., et al. (2020). Unpacking Water Governance: A Framework for Practitioners: Stockholm International Water Institute. MDPI-Water: www.mdpi.com/journal/water
- Salamé, L., & Van der Zaag, P. (2013). Enhanced knowledge and education systems for strengthening the capacity of transboundary water management. In *Transboundary water management* (pp. 171-186). Routledge.
- Sanchez, R., Rodriguez, L., & Tortajada, C. (2020). Effective transboundary aquifer areas: An approach for transboundary groundwater management. *JAWRA Journal of the American Water Resources Association*, 56(3), 360-378.
- Schmeier, S. (2024). International Water Law and Its Developing Role in Conflict and Cooperation Over Transboundary Water Resources. In *Oxford Research Encyclopedia of Environmental Science*.
- Scollon, M. (2023). Iran And Afghanistan's Taliban Clash As Water Dispute Boils Over. RadioFreeEurope, RadioLiberty.
- Seyf, A. (2006). On the importance of irrigation in Iranian agriculture. *Middle Eastern Studies*, 42(4), 659-673.

- Shirani Bidabadi, F., & Afshari, L. (2020). Human right to water in the Helmand Basin: Setting a path for the conflict settlement between Afghanistan and Iran. *Utrecht Law Review*, 16(2), 150-162.
- Siddique, A., & Radio Azad, I. (2022, January 26). In Sign Of Deepening Ties, Taliban Increases Afghanistan's Water Flow To Iran. RFE/RL's Radio Azadi.
- Spar, Ira. (2009) "Flood Stories." In Heilbrunn Timeline of Art History. New York: The Metropolitan Museum of Art, 2000.
http://www.metmuseum.org/toah/hd/flod/hd_flod.htm
- Swain, A. (2024). More Conflicts, More Deaths—Everyone Talks about Winning the War, but No One Talks About Achieving Peace. *Social Development Issues*, 46(2).
- Tarhan, K. (2019). Iran's foreign policy towards Afghanistan since the Islamic revolution (Master's thesis, Necmettin Erbakan Üniversitesi Sosyal Bilimler Enstitüsü).
- Tarhan, K. (2019). Iran's foreign policy towards Afghanistan since the Islamic revolution (Master's thesis, Necmettin Erbakan Üniversitesi Sosyal Bilimler Enstitüsü).
- Tasnim (2022, August 10). Iran's energy minister in Kabul after Taliban releases water from Helmand. PressTV. <https://www.presstv.ir/Detail/2022/08/10/687144/Iran-energy-minister-Afghanistan-visit-water-treaty>
- Tayebi, A. (2023). Iranian President Warns Afghanistan to Abide By Treaty On Water Flows. RadioFreeEurope, RadioLiberty - Written on an Original Story in Persian by RFE/RL's Radio Farda.
- Tayebi, A. (2023). Protests In Southeastern Iran As Water Crisis Deepens. RFE/RL's RadioFarda.<https://www.rferl.org/a/iran-water-protests-sistan-baluchistan/32529908.html>
- Thomas, V., & Varzi, M. M. (2015). A legal licence for an ecological disaster: the inadequacies of the 1973 Helmand/Hirmand water treaty for sustainable transboundary water resources development. *International Journal of Water Resources Development*, 31(4), 499–518.
<https://doi.org/10.1080/07900627.2014.1003346>
- Thomas, V., et al. (2016). Developing transboundary water resources: What perspectives for cooperation between Afghanistan, Iran and Pakistan? Case study: Afghanistan Research and Evaluation Unit: <https://doi.org/SBN:978-9936-628-07-6> (ebook).
- Trang, D. T. (1995). Sustainable Development in the Mekong River Basin. Lincoln Institute of Land Policy. <https://www.lincolninst.edu/publications/articles/>

- Transboundary Freshwater Diplomacy Database (TFDD) website
<<https://transboundarywaters.science.oregonstate.edu/content/transboundary-freshwater-dispute-database>>. (n.d.). Oregon State University
- Turgul, A., et al. (2023). Can Water Help Quench the Flames of Hostility? How Shared Waters Can Promote Dialogue During Conflict. *SAIS Review of International Affairs*, 43(2), 69-94.
- Turton, A. R. (2005). Water as a source of Conflict or Cooperation: The Case of South Africa and its transboundary Rivers. CSIR Report, 2.
- Turton, A. R., et al. (2007). Governance as a dialogue: Government-Society-Science in transition. Springer Science & Business Media. Water Resources Development and Management. Springer CSIR.
- UNCHR, n.d., Committee to Protect Journalists, Journalists Killed in 1998 - Motive Confirmed: Mahmoud Saremi, January 1999,
<https://www.refworld.org/reference/annualreport/cpj/1999/en/80844>
- Van Beek, Eelco, et al. (2008) "Limits to agricultural growth in the sistan closed inland delta, Iran." *Irrigation and drainage systems* 22 (2008): 131-143.
- Van Vugt, M. (2009). Triumph of the Commons. helping the world to share', *New Scientist*, 203(2722), 40-43.
- Varis, O., et al. (2008). Management of transboundary rivers and lakes (p. 271). Berlin: Springer. ISSN: 1614-810X; Library of Congress Control Number: 2007937519. ISBN: 978-3-540-74926-4
- Vinogradov, S., Wouters, P., & Jones, P. (2003). Transforming Potential Conflict into Cooperation Potential: the role of international water law. UNESOC-IHP-WWAP, University of Dundee, UK.
- Wasefi, A., & Rashid, A. F. (1981). Iran-Afghanistan: Helmand River Dispute Still Sensitive. CIA-RDP08C01297R00010030002-7, (Declassified in part-Sanitized copy approved for release 2012/09/06).
- Wei, J., et al. (2021). News media coverage of conflict and cooperation dynamics of water events in the Lancang–Mekong River basin. *Hydrology and Earth System Sciences*, 25(3), 1603-1615.
- Wei, Y., et al. (2022). A socio-hydrological framework for understanding conflict and cooperation with respect to transboundary rivers. *Hydrology and Earth System Sciences*, 26(8), 2131-2146.
- Whitney, J. W. (2006). Geology, Water, and Wind in the Lower Helmand Basin, Southern Afghanistan. USGS, (Scientific Investigations Report 2006-5182).
<https://doi.org/10.3133/sir20065182>

- Wolf, A. T. (2005). Transboundary water conflicts and cooperation. In *Search of Sustainable Water Management*, 131-54.
- Wouters, P. (2002). The Legal Response to International Water Scarcity and Water Conflicts: The UN Watercourses Convention and Beyond". *Allocating and Managing Water for a Sustainable Future: Lessons from Around the World* (Summer Conference, June 11-14). <https://scholar.law.colorado.edu/allocating-and-managing-water-for-sustainable-future/2>
- Wouters, P. (2013). Universal and regional approaches to resolving international water disputes: what lessons learned from state practice?. Available at SSRN 2359872.
- Wu, I. S., & Savić, B. (2010). *How to Persuade Government Officials to Grant Interviews and Share Information for Your Research*. Cambridge University Press.
- Xie, L., & Shaofeng, J. (2017). *China's international Transboundary Rivers: Politics, security and diplomacy of shared water resources*. Routledge.
- Yao, L., Xu, Z., Moudi, M., & Li, Z. (2019). Optimal water allocation in Iran: a dynamic bi-level programming model. *Water Supply*, 19(4), 1120-1128.
- Yıldız, D. (2015). International Water Issues Need More Than Cooperation (pp. 12(2015)70-80). *World Scientific News*. www.worldscientificnews.com
- Yorth, B. (2014). International Mekong River basin: events, conflicts or cooperation, and policy implications.
- Yousefian, E., Faghihi, A., & Daneshfard, K. (2022). Designing a model of integrated policy for water governance in Iran. *Iranian journal of management sciences*, 16(64), 1-32.
- Zaag, V. D. (2011). Lecture note: Introduction to Water Resources Management, UNESCO-IHE, Institute for Water Education, Delft, the Netherlands. *Water*. <https://doi.org/IHE-Delft>
- Zeitoun, M., & Mirumachi, N. (2008). Transboundary water interaction I: Reconsidering conflict and cooperation. *International Environmental Agreements: Politics, Law and Economics*, 8, 297-316.
- Zeitoun, M., & Warner, J. (2006). Hydro-hegemony—a framework for analysis of trans-boundary water conflicts. *Water policy*, 8(5), 435-460.

Appendices

Annex – I

Helmand River Water Dispute Between Iran and Afghanistan: Toward an Active Water Cooperative Framework

Research Strategy

A- Exploring the root causes of the persistent disputes between Iran and Afghanistan over the Helmand River basin, and effective implementation of the 1973 treaty.

No	Objectives	Data required/needed	Data source	Method of research
1	Reasons for continual disputes despite the 1973 Treaty	Information about Afghanistan and Iran water resources management in current policy and strategy both in Iran and Afghanistan	Data has been collected from the different governmental organizations, libraries, Google scholar, Donor agencies, United Nations, Afghanistan and Iran Research Units, etc.	Literature, water law, water strategy, 1973 treaty and technical reports and journal papers have been reviewed. Conversations/interviews with Afghan, Iranian experts, researchers and non-Afghan and Iranian (international) experts.
		Information about dam and Chahnimah development process in Iran and Afghanistan and their impacts on wetlands		
		The geopolitical status and institutional arrangement of the water resources management and Helmand basin governance.		
2	Impact on diplomatic, political, and social relations	Impact of water disputes on diplomatic, economic and social relation	Scientific literature, UN agencies and international organizations	Scientific Literature and study and even-based reports have been reviewed. Interviews with different experts' group from Iran and Afghanistan including international experts .
		The overview of treaty and it is improvement with the environmental clauses		
		Social, institutional and power status dynamic overview		

3	In what ways can both countries engage in active water cooperation and collaboration for effective implementation of the treaty	Conceptual and case study-based literatures review about different river basins in the world Study and analysis of various cooperation frame works for TW management Review of IWL and IWRM principles and contextualization. Conflict status and cooperation models analysis	Indus, Nile, Mekong, Colombia and Ephrata and Tigris River basins TW management and relevant literatures. UN-Water Report and research papers	Five river basins TWM practices and treaties have been reviewed. Interviews conducted with various experts from Afghanistan and Iran researchers including international experts

B – Proposal of Active Cooperative Framework for the Helmand River Basin

No	Objectives	Data Required	Data source	Method of research
1	Active Water Cooperation Framework for the Helmand River Basin	Review and analysis of various cooperative models and Case Study-based literature review of various Transboundary River Basins Overview of 1973 Treaty and comparison with similar river basin Environmental flow analysis and impact of water infrastructure on Hamun wetlands	i) PCCP – UNESCO cooperation model, ii) ii) Socio-hydrological Framework and iii) Strategic Fourth Sight cooperative models have been reviewed. IWL and IWRM principles papers have been reviewed	Three cooperative models have been reviewed and analysed The previous assessment reports have been reviewed. The proposed cooperative framework has been discussed with experts during the interview.

Annex- II

Interview Questionnaire

Selinus University of Science and Literature

Transboundary Water Resources Challenges

Helmand River Water Dispute Between Iran and Afghanistan: Toward an Active Water Cooperative Framework

Interview identification	
Interview number	
Date	
Interviewee Name	
Occupation	
Current location	
Country of origin	
Language of interview	
Gender	
Contact	

Interview introduction

Thank you very much for making yourself available to speak with me in the context of Helmand River basin challenges between Iran and Afghanistan. I am a researcher from Selinus University, Italy. The main objective of this study is to explore the root causes of everlasting disputes between Iran and Afghanistan over the Helmand River basin waters despite of 1973 treaty and propose a framework for active cooperation in respect to the signed treaty full functioning and effective implementation by both countries toward understanding how transboundary water management serves induce economic, social, and political collaboration between the riparian states.

I would like to assure you that the information obtained will be used exclusively for scientific purposes and is treated with strict confidentiality. This means that anything you say during the interview and any comments you make will not be linked to your name. When we report on findings from interviews, selective quotes may be used, but they will not be linked to you personally. Do I have permission to record the interview? The audio file will be shared only with my mentor and professor for this research project to ensure that we represent your views accurately.

Do you have any questions for me before we begin?

Here's a structured questionnaire for interviewing experts and officials about the Helmand River disputes between Afghanistan and Iran, aimed at finding solutions and establishing cooperation. This questionnaire is designed to delve deeply into the specifics of the 1973

Helmand River Treaty, addressing the various aspects of its implementation, the challenges faced, and the potential for improved cooperation and compliance.

Question	Answer
What are the primary sources of contention and dispute regarding the Helmand River between Iran and Afghanistan?	
How have recent developments (e.g., climate change, population growth, infrastructure projects) impacted the river's water availability and distribution?	
How has the implementation of the 1973 Treaty progressed since its signing?	
What roles do local communities, government agencies, and international organizations play in Helmand River disputes resolution.	
How can both countries enhance cooperation in water management and dispute resolution in the light of International Water Law (IWL) principles?	
How can joint infrastructure projects be developed and managed to benefit both countries?	
How can environmental sustainability be ensured while addressing the Helmand River disputes?	
In what ways both countries get engaged in active water cooperation and collaboration for effective implementation of signed treaty over usage of Helmand River waters?	
What is the impact of the dispute over shared water courses between both countries diplomatic, political, and social relations	
What are the key challenges that need to be addressed to achieve a long-term solution?	
How do you envision the future of Afghanistan-Iran cooperation over the Helmand River in the next decade	

* The interview transcripts and their corresponding analyses are presented in a separate document. Due to the extensive length of the scripts and analysis, they were not included in the main body of the thesis.

