

How to Resolve Transboundary River Water Sharing Disputes

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Abstract: There are more than 260 transboundary rivers in the world, which are sometimes the cause of conflict. Therefore, management of these rivers is important not only for the economy but also for harmony and peace. Various methods are followed to resolve water-sharing disputes. A systematic review was carried out to determine how water disputes are resolved. It was found that cooperation, mediation, perfect river basin organisation, a proper monitoring system, information exchange, and benefit-sharing are the keys to success. On the other hand, non-cooperation, disregard of international water laws, water hegemony, imbalance of military power, and the absence of a proper institution, mediator, or benefit-sharing approach are the causes for failure of transboundary river management. This study also summarised the evaluation report of the river basin management and diagnosed whether the riparian countries are successful in conflict management, diagnosing 53% of the river basins as successful, 35% as unsuccessful, and 12% as neutral (neither successful nor unsuccessful). This result indicates that there is dissatisfaction with 35% transboundary rivers of the world. It was also revealed that the most frequently identified mode for resolving water conflict is benefit-sharing.

Keywords: transboundary river water dispute; resolve; cooperation; mediation; river basin organisation; benefit-sharing



Citation: Hossen, M.A.; Connor, J.; Ahammed, F. How to Resolve Transboundary River Water Sharing Disputes. *Water* **2023**, *15*, 2630. <https://doi.org/10.3390/w15142630>

Academic Editors: Mariusz Adynkiewicz-Piragas and Qiting Zuo

Received: 3 April 2023

Revised: 19 May 2023

Accepted: 25 May 2023

Published: 20 July 2023



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1. Introduction

Fierce competition for freshwater may well become a source of conflict and wars in the future—Kofi Annan 2001 [1]. Water is a cause of political tension between Arab countries and Israel, Iraq, and Turkey; India and Pakistan; India and China; India and Bangladesh; America and Mexico; and all riparian countries of the Nile River, Mekong River, and Amu Daria River basins [2–4]. River and rival or water and war have the same root [5]. On the other hand, a total of 145 water treaties have been signed between different countries [4,6], illustrating that water can be the cause of both conflict and cooperation.

There are more than 260 transboundary rivers and 450 aquifers, which cover nearly half of the Earth's surface [7,8]. The basins of these rivers, traversing approximately 145 countries are home to 40 percent of the world's population [5,9,10]. History tells us that conflict is less often caused by scarcity of water than by poor governance or management of water [11]. Therefore, management of these rivers is important not only for the environment, ecology, and the economy but also for harmony and peace [6].

There is no international agency to resolve transboundary water disputes. Although several UN agencies, such as UNEP, UNDP, UNESCO, WHO, FAO, UNIDO, and the World Bank, have water-related issues in their charter, none of these institutions provides mechanisms for resolving transboundary water-sharing disputes within its mandate [4]. Although there are various factors for transboundary water disputes, the main reasons are water storage or diversion of water from upstream, which causes the variability of flow (high or low) or scarcity of water downstream [12]. Some other factors, such as political, socioeconomic, or physical circumstances, determine the probability of violent conflict [13]. Basins with a high risk of conflict are indicated largely by high population density; low per

capita income; overall hostile relations; politically active groups; large dams, barrage, or other water development projects; and lack of water-sharing agreements [14]. On the other hand, good water governance, such as good policy, high quality river basin organisations, stakeholders' participation, transparency in exchange of hydrological data, accountability, and rules of law, can mitigate water disputes [15].

Various methods are followed to resolve water disputes. The first step is dialogue or negotiation. There is no fixed method to initiate negotiation, rather it depends on the geography, socio-economy, culture, religion, and historical relationship of the riparian countries [16]. The other dispute resolution methods are mediation by a third party, benefit-sharing diplomacy, international court of justice, and use of military power [17]. Many water disputes have been resolved with the mediation of international organisations or by third countries. For instance, initially, the UN and later the USA mediated water disputes for the Jordan River [3]. The United Nations Development Program (UNDP) took initiatives for the 1995 Mekong treaty between Cambodia, the Lao PDR, Thailand, and Vietnam [18].

Furthermore, many treaties have been accelerated by non-water catalysts. A study by [3] shows that a total of 44 treaties involved monetary compensation, 6 involved land agreements, 2 involved political concessions, and 10 involved other forms of negotiated outcome. One example of negotiated agreement is the 1929 Nile greement, in which the British provided technical support to Sudan and Egypt. In the 1972 Vuoksa agreement, the Soviet Union agreed to compensate Finland for power loss. Moreover, some treaties also compensate for hydropower losses and irrigation losses due to changes in reservoir storage. In the 1952 Egypt–Uganda treaty; Egypt agreed to pay Uganda for the Owen Falls in Lake Victoria [19].

1.1. Scope of the Review

There are many studies on the resolution of transboundary river water disputes. Various academic fields have provided various conflict resolution theories that could be used to resolve transboundary water conflicts [20]. However, there has been no review on conflict resolution methods to date. Moreover, there is no quantitative analysis on dispute resolution methods. This study reviewed the evaluation/analysis of the river basin management or the water-sharing treaty and diagnosed whether the riparian countries are successful in conflict management. Therefore, the focuses and conclusions from this review provide a different contribution to the literature than other similar studies.

1.2. Objectives of the Review:

This study carried out a systematic review on how international water disputes are resolved. Our specific objectives are:

- ✓ What are the methods used to resolve the transboundary river water-sharing disputes?
- ✓ What is the most effective technique for resolving transboundary river water conflicts?
- ✓ Which rivers are successful with respect to conflict management?
- ✓ Which factors influence successful water agreements/treaties?
- ✓ What are the causes for the failure of river basin management?

2. Methodology of Systematic Review

The first step was a literature search in Google Scholar, with keywords including transboundary water dispute, integrated river basin management, resolution of water dispute, and benefit sharing. Moreover, the literature was searched manually and by a generic Google search to locate similar articles to ensure inclusion of all articles. Then, the research was extended to other research bases, such as Elsevier, Taylor and Francis, Springer, Wiley, Emerald, and Oxford University Press. More than 300 articles were identified. Then, the focus was narrowed to consider only articles that reported on evaluation/analysis of the basin management/treaty or included comments about factors influencing treaty or basin management. Initially, a total of 100 articles/books were selected, and final scrutiny allowed us to retain 50 articles with sufficient information to conclude that the authors judged the

agreement, arrangement, or conflict that they studied to be classified as successful, failed, or neutral (neither successful nor unsuccessful) on the basis of transboundary water conflict management. This then allowed factors of that success and failure to be diagnosed. Some authors did not strongly comment about the failure or success, so we categorised those as neutral. The flow diagram demonstrating the method of the systematic literature review is presented in Figure 1.

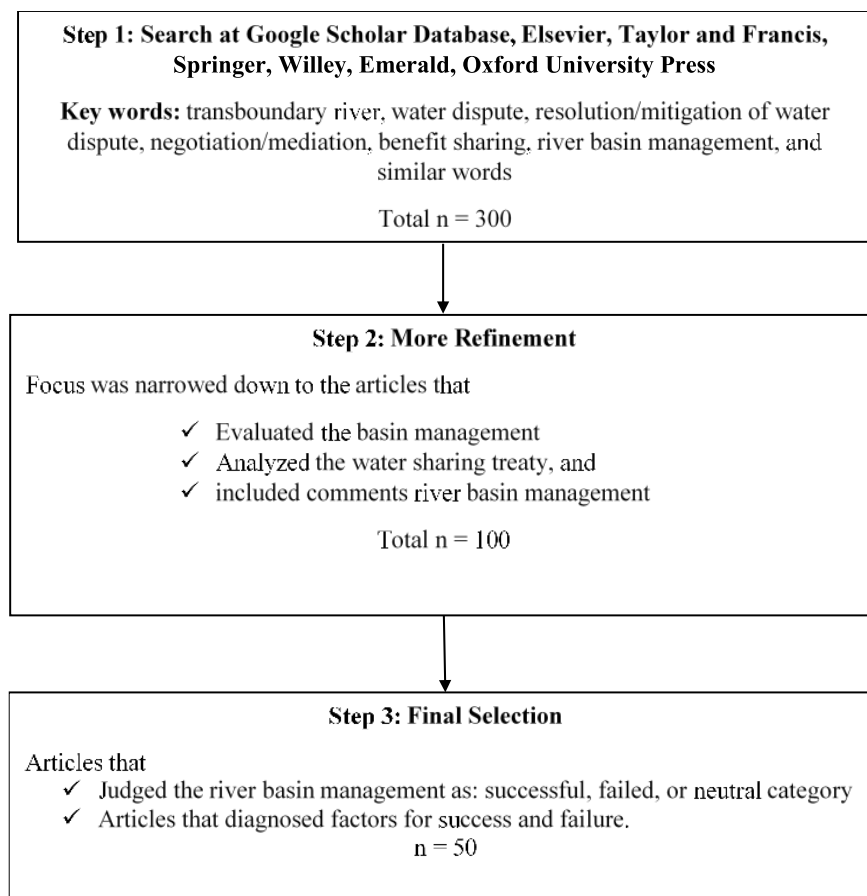


Figure 1. Methodology of review.

3. Result and Discussion

3.1. Summary of the Review

It was found that cooperation, mediation, strong river basin organisations, proper monitoring systems, information exchange, and benefit-sharing are the keys to success in most cases [21]. On the other hand, non-cooperation (unfriendly relation), disregard of international laws, water hegemony, imbalance of military power, and the absence of proper institution, mediator, or benefit-sharing approach are the causes for failure of transboundary river management [22]. It was found that, although there are treaties in many transboundary rivers, there is dissatisfaction with the treaties. On the other hand, there is no treaty among many transboundary river basins. Nevertheless, there is no conflict or war due to an imbalance of power. In addition, some treaties are uneven due to an imbalance of power between riparian countries; thus, these treaties/transboundary rivers fall in the failure category. Moreover, some river basins are successful in conflict resolution, but integrated river basin management is absent in most cases. A summary of the review is presented in Table 1.

Table 1. Different types of river basin management—Success/Failure/Neutral.

Name of the River Basin	Type (Countries Involved)	Evaluation (Evaluated by the Reference)	Factors for Success/Failure	Reference
Any river basin	All rivers (no specific country)	Success	Political will and socioeconomic condition	[13,14]
			Institutional arrangement	[23]
			Benefit-sharing	[8]
The Mekong	Multi-Country (China, Myanmar, Cambodia, Laos, Thailand, and Vietnam)	Success	Political will and foreign policy interest	[17]
			Mediation and funding by international organisation	[17]
			Benefit-sharing	[5,18,24]
		Failure	China and Myanmar are not included, unstable political situation, shift of policy, trend of bilateral negotiation, and absence of integrated basin management	[12,18]
The Teesta	Two-Country (India and Bangladesh)	Failure	Lack of political will, faith, and cooperation	[25–28]
			Lack of benefit-sharing agreement	[29,30]
The Ganges–Brahmaputra–Meghna	Multi-Country (India, Nepal, Bhutan, China, and Bangladesh)	Failure	Lack of political will, faith, and cooperation	[14,31–33]
			Disregard to water laws	[34]
			Non-functional commission and lack of institutional arrangement	[31,32]
			Lack of mediator	[31]
			Lack of benefit-sharing arrangement	[18,32,33,35]
			Lack of integrated management	[18,31,33,36]
		Neutral	Lack of integrated management	[37,38]
			Lack of benefit-sharing arrangement	[39,40]
The Indus	Two-Country (India and Pakistan)	Failure	Non-cooperative and non-functional commission	[14,41]
			Mediation by World Bank	[42]
			Riparian countries are equally strong	[43]
		Success	Conflict-resolution mechanism	[4,44]
			Lack of benefit-sharing, integrated development, and third-party mediation	[4,44]
The Euphrates–Tigris	Multi-Country (Iraq, Syria, and Turkey)	Failure	Absence of mediator and non-functional commission	[16,43]
			Lack of benefit-sharing	[45]
The Jordan	Multi-Country (Israel, Jordan, Lebanon, Palestine, Syria)	Neutral	Third-party mediation and military power	[4,21]
		Failure	Lack of monitoring and conflict-resolution mechanism	[43] [2]

Table 1. Cont.

Name of the River Basin	Type (Countries Involved)	Evaluation (Evaluated by the Reference)	Factors for Success/Failure	Reference
The Eastern Nile	Multi-Country	Success	A strong institution	[46]
			Interdependence of the riparian countries, pressure from GCC, USA, and other external agents, and political will	[6]
			Benefit-sharing (exchange of power and agricultural products)	[6,21,45–47]
		Neutral	Upstream–downstream linkage, strong institution, and stakeholders’ participation	[48]
The Zambezi	Multi-Country	Success	Mediated by UNEP,	[42]
			Institutional arrangement, benefit-sharing	[21,42]
The Senegal	Multi-Country	Success	Benefit-sharing	[5]
The Rhyne	Multi-Country	Success	Benefit-sharing	[5]
The Danube River	Multi-Country	Success	Benefit-sharing	[5,49]
Rivers between the USA and Canada	Two-Country	Success	Cooperation and third-party mediation,	[4,31]
			Benefit-sharing	[4,21,49]
			Institutional arrangement	[4,15,21,31,43]
Rivers between the USA and Mexico	Two-Country	Success	Cooperation and institutional arrangement	[31]
The Murray-Darling	Multi-State	Success	Political commitment, mutual trust, and stakeholders’ participation	[18]

3.2. Discussion

It was found from the table that some river basins are evaluated as a success by some authors but a failure by some other authors. For example, consider the Mekong and the Indus. According to Browder, “The 1995 Mekong Agreement” is a sign of success [17]. Moreover, Lee contended that mediation by UNDP and funding by the Asian Development Bank (ADB) for the Greater Mekong Subregion (GMS) programme has resulted in tremendous development to this region, which is a sign of success [24]. On the other hand, Shahjahan and Yorth found it to be a failure due to the non-participation of China and Myanmar, the trend of bilateral negotiation, and the absence of integrated basin management [12,18]. Zawahri opined that the Indus is a successful river management example, as conflict-resolution mechanisms are robust in the Indus treaty [42,50]. In contrast, some authors classified it as unsuccessful due to its non-functional commission and the lack of integrated river management [14,41]. In addition, Sarfraz and Wolf did not strongly comment on the failure or success of the Indus River management, which we categorised as neutral [4,44].

The Ganges–Brahmaputra–Meghna (GBM) basin was diagnosed as a failure in river basin management by all the authors except very few who did not provide any firm stance; we categorized those few into the neutral group. In contrast, the Nile was assessed as a success by most authors and failure by very few authors. The Teesta and the Euphrates–Tigris were evaluated as failures in all indices by all the authors. On the other hand, the Rhyne, the Danube, and the rivers between the USA and Canada and the USA and Mexico were deemed to be successful river basins by all the authors.

Approximately 15 river basins were evaluated by different authors. Among them, 53% of river basins were diagnosed as successful, 35% as unsuccessful, and 12% as neutral (neither successful nor unsuccessful). Although it is not a perfect representation, it may be concluded that there is dissatisfaction with 35% of the transboundary rivers of the world.

From the table, it is seen that different authors used different words with the same meaning. For example, political will, faith, cooperation, good relations, and upstream–downstream linkage could all be termed as “political will”. On the other hand, conflict resolution mechanism, institutional arrangement, and joint commission can be captured with the term “institutional arrangement”. In this way, all the mentioned factors from the table can be summarised as political will (identified as a success-promoting factor by 21 papers), institutional arrangement (identified as a success-promoting factor by 24 papers), mediation by third party (identified by 14 papers), benefit-sharing (identified by 29 papers), stakeholder participation (identified by 2 papers), military power (identified by 3 papers), and integrated water resource management (identified by 8 papers). The summary of the conflict resolution methods identified in the literature is presented in Figure 2.

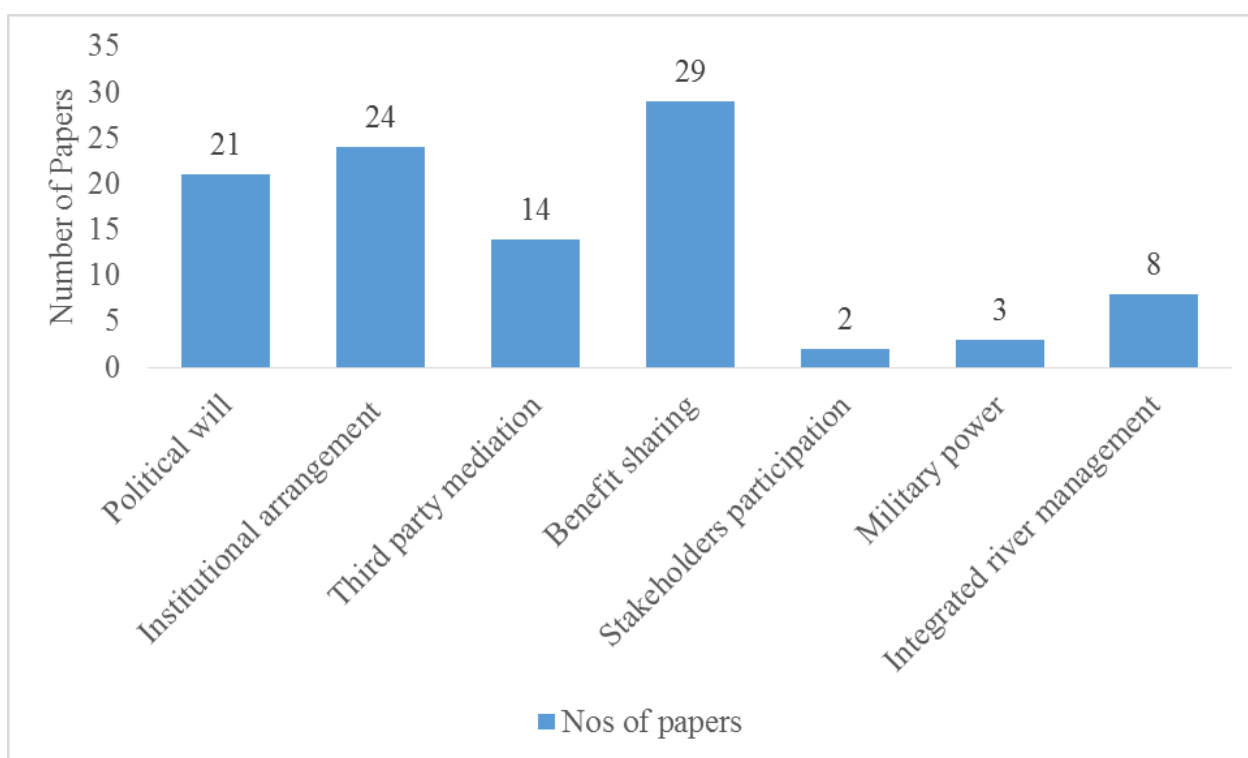


Figure 2. Conflict resolution method.

From the figure, it can be seen that the most frequently identified method for the resolution of the water-sharing conflict is the benefit-sharing method. Most of the treaties were successful by negotiation not by war [29]. War over water seems neither strategically rational, hydrographically effective, nor economically viable [3,43]

3.3. Benefit-Sharing

Benefit-sharing is a diplomatic term, but its use in transboundary water management has become increasingly popular. It means that co-riparian basin states share not only water but also various other forms of benefits from the river [5]. It is a win–win solution—everyone is better off, no one is worse off. Traditional conflict resolution, such as the judicial method, distributes water among different user groups, which means one party gains at the expense of the others. This is known as the ‘zero-sum’ or ‘distributive’ solution, as it neither increases the overall benefits nor satisfies every party. In contrast, an alternative dispute resolution method known as benefit-sharing, which optimizes benefits, is adopted

in some water and environmental conflict resolutions [49]. Arbitration, mediation, negotiation, cooperation, and consensus-building are the main principles of benefit-sharing. The benefit-sharing method is motivated by the possibility of positive-sum games, which aims to optimize benefits, in contrast to the zero-sum game, which resolves the dispute by simple water-sharing [5]. Benefit-sharing typically involves sharing water but also involves countries offering one another various forms of social, political, or environmental benefits or various combinations of these [51]. If two or more parties claim the ownership of the same water sources with a high emotional and political value, it will be difficult to resolve the dispute. On the other hand, if cost and benefit changes due to changes in ownership/management of water are expressed as monetary values, in many cases, ways to resolve conflicts over the water can be found. By treating water as a tradable good, the conflict can potentially be mitigated [52].

A benefit-sharing plan is seen by some to offer an efficient, impartial, and acceptable basis for all basin states in a transboundary water dispute to understand the potential to resolve the dispute [47]. The success of benefit-sharing depends on how the riparian countries are willing to cooperate, how much additional benefits the cooperation can bring to each country, or how much better off each riparian country will be after benefit-sharing [53].

Sadoff and Grey (2002) [5] referred to sharing four types of benefits: benefits to the river, benefits from the river, benefits due to the river, and benefits beyond the river. They are discussed below.

Benefits to the River are benefits from flow management in a river that do not involve extraction and do not provide direct consumption benefits but provide enhancement of outcomes that humans may value. This includes benefits of ecological improvement, such as water quality, floodplain, wetland, and fish biodiversity, as well as the health and productivity of fisheries. Such management may indirectly provide goods and services that people value, such as fish for human consumption, lower water treatment cost, enhanced water-based recreation, and other amenities. A good example of benefits to the river from transboundary cooperation is the Rhine River in Europe. The salmon fish in the Rhine River disappeared in 1920 due to a change in river management. After combined initiatives of the co-riparian countries, salmon returned to the river in 2000. The floods in Mozambique were managed by constructing a dam upstream of Zimbabwe [5]. Another example is the Columbia River between the USA and Canada. In 1960, the USA constructed four dams in Canada upstream of the river to produce hydro-power and reduce floods in the USA. As compensation, Canada was provided USD 64.4 million for flood reduction in the USA and received half of the electricity produced for 60 years [54]. Improved water quality from improved management upstream in the Ganges in India was able to increase the production of Hilsha (a popular Ganges basin food fish) farther downstream in both India and Bangladesh [32].

Benefits from the River refer to the direct benefits from extracting and consuming water, for example, for agricultural production or urban/industrial water supply. This concept also refers to changes in flow management, with a primary emphasis on direct benefits often in ways that involve trade-offs with benefits to the river. A prime example would be managing water for hydropower. When benefits from the river are non-consumptive, the difference between benefits to and from the river is not always completely unambiguous and not completely differentiated. Flood and drought management are examples of such ambiguity; they do not involve direct consumption of water but do involve changes in the timing of flows and operations of storages, and they can affect overall availability by, for example, altering evaporation from storages or inundated land. There are many successful examples of managing rivers for benefits from the river across borders. In the Senegal basin, there are common hydraulic structures operating under cooperative agreements across national borders. The Manantali Dam, whose capacity is 740 GWh per year, is situated 300 kilometres inside Mali. However, approximately 55% of the electricity is used

in Mali, 30% in Senegal, and 15% in Mauritania [54,55]. In the Southern Africa Development Community, hydropower is shared by all the countries [56].

Benefits due to the River refer to the costs saved because of the river. If there is a good relationship between/among the riparian countries, they can change their policy from self-sufficiency to self-dependence and reduce military expenditure through combined defense. For example, there are many rivers between India and Bangladesh acting as borders. Less border guarding and patrolling along such border rivers can save costs. Internationally shared rivers have high political importance; non-cooperation may cause tensions which will cost the riparian countries, for example, by reducing cross-border navigational opportunities [8].

Benefits beyond the River refer to non-water-sector cooperation using the river, such as regional cooperation, business opportunities, and exchange of culture. International rivers can act as catalysts among the riparian countries and, thus, can promote cooperation in trade, commerce, exchange of technologies, and various other fields. The Mekong facilitated Laos and China in trading gas and electricity [24]. The Owen Falls Dam is situated in Lake Victoria in Uganda. Egypt agreed to pay Uganda for loss of hydropower according to the “1952 Egypt–Uganda Treaty”. The Ganges and Brahmaputra river routes promoted trade among Bhutan, Bangladesh, Nepal, India, and China [11]. The best example of a beyond-the-river-benefit case is the Syr Darya case, which is described below.

Syr Darya case: The Toktogul reservoir in the Syr Darya, Kyrgyzstan, was the cause of political tension between Kyrgyzstan and the downstream countries. It was the biggest hydroelectric power plant (1200 MW) in the river basin and produced 91% of all electricity consumed in Kyrgyzstan [57]. Electricity demand is highest during the winter, whereas irrigation demand in downstream Uzbekistan is highest during the summer. Therefore, Kyrgyzstan wanted to produce power and discharge water in winter, but Uzbekistan required more water during the summer. Interestingly, downstream countries have greater material and non-material power than upstream countries. Then, an agreement on the “Use of Water and Energy Resources in the Syr Darya Basin, 1998” was signed to provide coal, gas, or money to upstream countries to compensate for energy loss. The agreement included the Kayrakum reservoir in Tajikistan in 1999. According to the agreement, water allocations from the Toktogul dam and the amount of energy are to be determined yearly [58].

4. Conclusions

The transboundary river water dispute between many neighbouring countries on the river basin is a long-standing problem that must be resolved. A possible win–win solution for the problem is vital for good relations between the neighbouring countries. Benefit-sharing, which optimizes benefits from the river basin, has been successful in mitigating transboundary river water disputes in many countries of the world. However, neither the diplomats nor the politicians of many countries place an emphasis on benefit-sharing, as they are not convinced about the potential gain of benefit-sharing. This study reveals that benefit-sharing is the most efficient method in resolving water disputes. However, other strategies, including cooperation, mediation, and perfect river basin organisation, are also important and need to be investigated for implementation parallel to the benefit-sharing approach. This study provides an idea of how to resolve the transboundary river water-sharing dispute.

Author Contributions: Conceptualization, J.C.; methodology, F.A.; discussion, M.A.H.; writing—original draft preparation, M.A.H.; writing—review and editing, J.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: No new data were created.

Conflicts of Interest: The authors declare no conflict of interest.

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