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Implementation Constraints on Israel–Palestine Water Cooperation: An Analysis Using the Water Governance Assessment Framework

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Abstract: This study uses a diagnostic and multidisciplinary water governance assessment framework to examine the main factors influencing water cooperation on the shared Mountain Aquifer between Israel and Palestine. It finds that effective cooperation between Israel and Palestine is unlikely in the foreseeable future if both parties persist with the business-as-usual approach. What constrains the two parties from achieving consensual agreement are political tensions, the constraints of current technology, the different perceptions of the value of the shared water, the mistrust between the two parties, the lack of external enforcement mechanisms, and the impacts of the domestic political environment.

Keywords: water cooperation; water governance; Israel–Palestine; implementation; constraints



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1. Introduction

In the semi-arid to arid climatic conditions of the Middle East, water resource management is a contentious issue between parties sharing the same resources. The tension between the need for water and its limited availability makes water both an object and tool in conflict [1]. Solving water-related problems has been identified as a topic of common interest to those parties [1]. Transboundary cooperation on water issues is believed much more likely to occur than violent conflict [2], and its benefits have been widely acknowledged [3].

Water has remained a manifestation of the Israel–Palestine hostilities since the Six-Day War in 1967. Israel and Palestine attempted to settle their disputes through peace talks in the 1990s, which gave rise to an initial framework for cooperative water management. Since then, a number of initiatives have worked on promoting water cooperation in the region, and governmental and non-governmental institutions have started several bilateral and regional water cooperation projects [1,4]. It is believed that cooperation on water issues might be a step toward fostering better relations between the two parties [2].

Cooperation between Israel and Palestine in the water sector has been analyzed in a rich body of literature and interpreted through different disciplines, for example, legal [5,6], international relations and politics [7–9], engineering [10,11], and economics [12], and different perspectives such as climate change [13], water management [14,15], socio-environmental relationship [16], cultural [17], and human rights [6]. These different views have all contributed to the understanding of the water issues between Israel and Palestine. Asymmetrical relations [18,19], inequality of water allocation [6,13], and different discourse structures [16,17] have been identified as the main factors that hinder the water cooperation between the two parties. However, since the water problems are with complex characteristics and driven by a multitude of elements in the region, the current segmented perspectives may each be subject to different strategies but not able to provide the whole picture. Adopting a water governance approach, therefore, is necessary. It could help decision-makers to see the connectivity between elements in the situation, so as to better

address the issue. This study aims to contribute to knowledge in this regard by assessing the cooperation conditions between Israel and Palestine in the Mountain Aquifer, using an integral and diagnostic water governance assessment framework [20] (Table 1).

Following this introduction, in the next section, the case of the “Mountain Aquifer”, the assessment framework, and the research methods are presented. The third to fifth sections investigate the main elements influencing water cooperation between Israel and Palestine. The sixth analyzes the main findings and the final section concludes.

2. Scope and Framework of Analysis

The Mountain Aquifer, the highest-quality underground reservoir in the region, is the most important groundwater resource shared by Israel and Palestine. The Aquifer underlies the central mountain ridge stretching along a north–south axis for some 150 km through Israel and the West Bank [21], which is a landlocked territory near the Mediterranean coast of western Asia. The Mountain Aquifer consists of three sub-aquifers: Eastern, Northeastern, and Western. The Western Aquifer is the largest and most productive, yielding more water than the Northeastern and Eastern Aquifers combined [22].

Israel occupied the West Bank in 1967 and has since imposed strict control policies on Palestine’s utilization of the Mountain Aquifer. Currently, West Bank residents are fully dependent on the Mountain Aquifer as the source of natural freshwater. The Aquifer is now the sole remaining water resource for Palestine and is one of the most important groundwater resources for Israel. The conflict over allocating water from the Aquifer is long-standing and has become a focal point that needs to be addressed in solving the Israel–Palestine dispute [14,23].

This research aims to examine the elements contributing to the Israel–Palestine water governance. The literature has offered a rich variety of frameworks that can be used to assess water governance practices [24]. For example, the 10 Building Blocks Framework [20], the OECD Water Governance Indicator Framework [25], the Governance Capacity Framework [26], the Operational Framework for Water Governance [27], and frameworks that focus on the conditions of good governance [28,29], and the individual governance criteria (such as effectivity, efficiency, and legitimacy) [30,31]. These frameworks demonstrate one of the more important general conditions, such as the importance of indicators [25], the interconnective capacity of governance [31], and the conditions for governance from a broad perspective [20,24,29,32–35].

This study proposes to examine the implementation constraints on Israel–Palestine water cooperation. To do so, the author chose the 10 Building Blocks Framework as the analytical framework. This is because, compared to other frameworks, the 10 Building Blocks Framework distinguishes water governance conditions related to content (characterization of water in terms of issues, drivers, and values), organization (the role of stakeholders, trade-offs, and regulations), and implementation (financing, enforcement, and conflict resolution) [36]. It, therefore, offers the opportunity of testing the proposition.

The 10 Building Blocks Framework was developed by van Rijswijk et al. [20] with the aim of identifying the strengths and weaknesses in water governance capacity from a holistic perspective. It has been tested at different water governance scales (local, basin, national, and international) and political contexts [24,37–40]. Given its diagnostic nature, the framework could provide a broad overview of the Israel–Palestine water issue and identify the constraints on water cooperation between Israel and Palestine.

The framework consists of three dimensions (Content, Organization, and Implementation) and 10 relevant elements generated from diverse disciplines, including economics, public administration, legal science, civil engineering, and hydrology. Each of the 10 elements is assessed by answering corresponding questions. Since the judgment is case-specific, for this study, the author modified the questions to fit the Israel–Palestine water cooperation case, as shown in Table 1. The framework was selected for this study because it is superior to the traditional one-dimensional approach, which focuses on only one aspect and would not yield an integrated view of the water challenges. Thanks to its mul-

tidisciplinary nature, this framework will enhance the connectivity of water governance, i.e., it takes into account different elements that each play a particular role in developing sustainable water management.

Table 1. Ten Building Blocks for Assessing Integrated Water Governance [20].

Assessment of Water Management and Governance	Content	1. Water System Knowledge	Is sufficient knowledge available to assess the impact on the water system of changes in the environment and societal functions?
		2. Values and Policy Discourses	Is there sufficient knowledge of shared or conflicting values, viewpoints, and principles for water issues, and their consequences for facing water management issues?
	Organization	3. Regulations and Agreements	Are regulations and agreements legitimate and adaptive, and if not, what are the main problems?
		4. Responsibility, Authority, Means	Are authorities, responsibilities, and means well-organized to deal with water issues at the appropriate administrative scale(s) in a participative and integrative way?
		5. Stakeholder Involvement	Are all relevant stakeholders involved? Are their interests, concerns, and values sufficiently balanced and considered in the problem analysis, solution search process, and decision-making?
		6. Trade-offs between Social Objectives	Do trade-offs exist? If so, how?
	Implementation	7. Financing	Is the financial arrangement sustainable?
		8. Engineering	Are the design and consequences of different alternatives sufficiently available?
		9. Enforcement	Are regulations and agreements enforceable by public and/or private parties, and are appropriate remedies available?
		10. Conflict Prevention and Resolution	Are there sufficient conflict prevention and resolution mechanisms in place?

This study was mainly conducted by desk research, i.e., information was collected from governmental and non-governmental reports, political agendas, policy documents, news, and academic publications. Building on the literature analysis, discussions were held at the 2019 European Environmental Law Conference. Additional perspectives were solicited from water experts from different disciplines, including law, public administration, and political science.

3. Content

3.1. Water System Knowledge

An agreed annual recharge estimate in a shared water system is the key to a fair distribution of the resources between parties who share the resource. The Mountain Aquifer is replenished mostly in the West Bank by the infiltration of rainfall and snowfall [41]. However, due to disputes about the exact location of the eastern boundary of the Western Aquifer, it is difficult to reliably estimate the annual recharge of the Western Aquifer Basin [10]. Current estimates, which are from 270×10^6 to $455 \times 10^6 \text{ m}^3 \text{ a}^{-1}$, are too wide-ranging to be able to provide a basis for water allocation between the two parties [10]. In addition, this unclear situation also affects the calculation of water availability for yearly consumption in the region and also adds to the difficulty of determining the sustainable abstraction rates. At the time of the Oslo II Agreement (Section 4.1), a joint team of Israeli and Palestinian water experts agreed that the annual yield of the Mountain Aquifer was 632 million m^3 . However, the current water withdrawal has substantially exceeded this [42]. Though a range of estimates of recharge to the Western Aquifer Basin are available, no single one can be considered as the best [10,11]. Therefore, it is not yet possible to deliver a defensible amount of annual recharge for the Western Aquifer [10].

Another main challenge concerning knowledge on the water system of the Mountain Aquifer lies in the biased perception that both the Palestinians and Israelis seem to have of the amount of water contained in the Aquifer. Based on the yields of 632 million m^3 estimated and agreed on by a joint team of Israeli and Palestinian water experts [43], the Israelis consistently underestimated the size of the shared water resources, which could limit the size of claims for water that the Palestinians can make. Conversely, the Palestinians tend to overestimate the size of the shared resources, since this increases the amount of water they can claim [23,44]. Additionally, this biased view, which is motivated by the desire to reduce the amount of water from the shared water resource that the other party has a right to, also applies to the estimations both parties make of each other's water resources.

Furthermore, population growth and climate change will combine to pose great pressures on the availability of water resources in this region. It indicates that in the coming years, the population in the West Bank will increase greatly, with annual rates of 2.18% for Palestine and 1.67% for Israel [45], and regional water stress will be significantly increased and negotiations between the two parties will be even harder. However, the currently available climate-related models are not sufficiently detailed to enable assessments of the impacts of climate change on groundwater recharge rate in the Mountain Aquifer [46]. According to recent research, it is still challenging to build climate change into plans for the future at the Israeli side [14].

3.2. Values and Policy Discourses

Though both Israel and Palestine suffer from water scarcity, their perceptions of water scarcity are different and manifest in their respective water discourses.

In Israel, natural water scarcity has been perceived to be absolute [47]. Since the beginning of Zionism (a nationalist movement among the Jewish people that espouses the re-establishment for a Jewish state) [48], unrestricted access to water resources has been perceived as a non-negotiable condition for the survival of a Jewish national home [49]. Throughout the first twenty years of existence of the state of Israel (1948), developing water legislation and large-scale water infrastructure was a central pillar of its nation building [50]. Water issues largely shape relations between Israel and Palestine because they always play an important role in the agenda of Israel's national security. Israelis often view cooperation on water issues with Palestine as a zero-sum game [51]. As Lowi [49] has stated, "accepting an independent Palestinian state on the West Bank, and hence relinquishing control of the territory's resources, is interpreted by some as equivalent to an act of national suicide", which has been widely acknowledged [51–55]. Things only improved in the early 2000s; several different discourse coalitions have emerged within

Israel, some of which favor cooperation with the Palestinians on water issues [7]. According to the Israel Water Authority, Israel is interested in cooperation based on sustainable water use and management in the West Bank region [56]. Although Israel has advanced water cooperation with Palestine through bilateral and regional initiatives, progress in establishing water relationships is still discontinuous and circumstantial [51].

For Palestinians, the natural water resources were believed to be adequate for at least a major improvement in the Palestinian standard of living before Israel's occupation of Palestinian land. Palestinians believe that their experienced water scarcity is entirely politically induced [57], i.e., the control by Israel is seen as the origin of water availability problems in the West Bank region [57,58]. The demand for adequate water allocations in Palestine has therefore been discursively inseparable from rejecting Israeli control over large parts of the water resources and demanding the reallocation of these resources [47]. Consequently, Palestinians adopt a discourse of collective rights of self-determination over water resources and insist on the recognition of these rights as a pre-condition for further discussion on the division of the region's water resources [8].

Besides the different policy discourses, Israel and Palestine also have different understandings of what should be achieved through an agreement on water sharing. Israel argues that it has already done what international law required it to do. It claims that Palestinians have caused the water scarcity in the Mountain Aquifer by refusing to develop their own underground water resources, fix leaking infrastructures, build sewage treatment plants, irrigate land with modern water-saving devices, or bill their own citizens for water usage, etc. [59]. Israel, therefore, suggests that Palestine should reuse wastewater, apply desalination technology, or look to other countries within the Jordan basin for necessary resources to mitigate the water shortage problem [60]. Palestine, however, rejects these ideas and continues to claim compensation for the aggressive water policies Israel has applied in the past [17]. In fact, Palestine is not able to fully implement the suggestions proposed by Israel due to its highly unstable political environment and the comparatively lower level of development in water infrastructure and services [61].

4. Organization

4.1. Regulations and Agreements

Prior to 1995, Israel–Palestine water relations were not institutionalized in any official joint body or platform [62]. The Oslo II Agreement, signed between Israel and the Palestine Liberation Organization in September 1995, is the most important agreement regarding the water issues in the West Bank. It was intended to be an interim agreement of five years, but more than two decades later, it is still in place because the parties have not achieved a final consensus about its revision. Article 40 of the Oslo II Agreement, entitled “Water and Sewage,” contains provisions relating to the allocation of water between Israel and the Palestinian Authority, with a major focus on the Mountain Aquifer, the mutual obligation to treat and reuse wastewater, and the establishment of a coordinated water management body, the Joint Water Committee (JWC) (see Section 4.2).

The Oslo II Agreement allocates to both parties specific quantities of water from the Aquifer (the share allocated to the Palestinians was about one-quarter of the share allocated to Israel and its settlements) and states that “both sides recognize the necessity to develop additional water for various uses” [63]. It estimated that future needs for Palestine will be at 70–80 million cubic meters per year, which was based on the needs (population size) at that specific moment. Because of population growth and the likelihood of supply increasing as a result of climate change, the water supply today is unable to meet the demand from Palestinians, who currently receive only 75% of the amount of water agreed upon [64]. Though the Agreement stipulates that Israel recognize Palestinian water rights in the West Bank side of the Mountain Aquifer, it fails to define these rights, as well as what quantity of water would fulfill those rights.

Israelis and Palestinians have both been critical of the Oslo II Agreement [14]. The Israeli critics are mainly drawn from right-wing politicians who opposed the Oslo peace

process from the outset, seeing the Agreement as a “giving away of Israeli water” that poses a serious threat to Israel’s supply in the future [65]. Palestinian critics denounce the Agreement for not specifying Palestinian water rights [65,66]. The international community criticizes Israel for violating the Oslo II Agreement [67]. As The World Bank [42] noted, without the JWC’s approval of the “estimated potential”, Israel has abstracted over 50% more water—up to 1.8 times its share under the Oslo II Agreement—which has put the Mountain Aquifer at risk and has resulted in a decline in the water available to Palestinians. Israel, however, argues that hundreds of illegal wells that Palestinians drilled have led to the drying up inside Israel [68]. The Oslo II Agreement commits both Israel and Palestine to “using the water resources in a manner which will ensure sustainable use in the future, in quantity and quality” [63]. However, the Agreement makes no provision for action in response to violations such as the over-abstraction by Israel. This has been deemed one of the major failures of the Oslo II Agreement [42].

Besides the Oslo II Agreement, there are some cooperation projects on shared water issues in the region (<https://main.knesset.gov.il/EN/activity/mmm/me02767.pdf> (accessed on 10 December 2020)). For example, the Regional Water Data Banks Project, started in 1995, aims to improve the availability and applicability of water data and information [1]. The Nanotechnology in the Service of Peace project, which began in 2005, aims to facilitate the research on using nanotechnology in water treatment [4]. The Streams that Cross Borders project, initiated in 2009, aims to work in the preparation of master plans for the rehabilitation of drainage basins [4]. The Good Water Neighbors project, initiated in 2001, aims to provide dialogue and cooperation at the local level with community members in Israel, Jordan, and the Palestinian territories, mainly through education and awareness-raising activities on the regional water situation [1]. These projects are not part of the political contacts between Israel and the Palestinian Authority, but are led by environmental organizations. However, since any project working on water is difficult to separate from the questions of water rights and justice [1], the actual cooperation remains stuck at the level of technical cooperation and communication among local communities. Cooperation in water management, therefore, seems not to have improved.

4.2. Responsibility, Authority, and Means

The Oslo II Agreement set up the JWC, in which each party has equal representation and veto power, to implement the undertakings under Article 40. According to the Agreement, the JWC functions on the basis of consensus; both Israelis and Palestinians must give their approval for any project involving water abstraction from the Mountain Aquifer. However, in practice, the power relations in the JWC are not equal and this has been subjected to extensive analysis [4,19,42,69]. A large proportion of Palestinian applications have been delayed by the Israeli representatives in the JWC and the approval rates for Palestinian applications are significantly lower than for Israeli applications. A report revealed that between 2010 and 2014, 98.5% of the Palestinian building permit applications for projects in Area C of the West Bank (covering 62% of the area) were rejected [70]. This is partly because on top of approval from the JWC, all projects in Area C must also be approved by the Israeli Civil Administration (ICA). Decision making can take up to three years [42]. This means that for Palestinians, uncertainties remain even after the JWC has approved their projects.

The World Bank has criticized the JWC, noting that it “has not fulfilled its role of providing an effective collaborative governance framework for joint resource management” [42] and does not break but rather perpetuates the old system of Israeli domination. An empirical study by Selby [19] confirms this criticism. After examining 142 JWC and subcommittee meeting protocols for the period 1995–2008, Selby concluded that the JWC is not “working well”.

The Joint Supervision and Enforcement Teams (JSETs), established as the enforcement arm of JWC, were intended to monitor the implementation of Article 40 and rectify the situation whenever an infringement occurred [68]. However, the JSETs could not work

well due to the following reasons. In practice, Palestinians have access to the hydrological data that JSETs collected; the data, however, remain highly fragmented, providing little access to past hydrological data and vital current data, rendering them of little practical utility and leaving Palestinians highly dependent on Israeli databases and the willingness of Israeli officials to share them. Palestinians claim that “the access and mobility restrictions by the Israeli authorities made their work impossible” [68]. Therefore, Palestinians and Israelis have collected data separately since 2001, which has further reduced the interaction between the two parties.

Concerned by this asymmetry in the JWC functioning, the Palestinians withdrew their cooperation in the JWC in 2010. After a six-year freeze and long negotiations, the two parties signed a new agreement to reactivate the JWC in 2017, with modified approval procedures that allow Palestinians to lay water pipes and networks without the JWC’s approval [71]. However, since the new agreement does the same for Israel, allowing it to lay new supply lines for Israeli settlements without JWC approval, Israeli overall control of the Palestinian water sector remains, since no additional water goes to Palestinians except with Israeli consent [72].

4.3. Stakeholder Involvement

Cooperation relating to the Mountain Aquifer is embroiled in a bipartisan conflict, and the key stakeholders are the coordinative JWC, national stakeholders in Israel and Palestine, and international donors.

On the Israeli side, the Israeli Water Authority (IWA), the Israeli Civil Administration (ICA), and Mekorot Water Company are three major water-related stakeholders involved in the water issues in the Mountain Aquifer region. The IWA is responsible for administering all water issues within Israel, including the preservation and restoration of natural water resources, development of new water resources, and supervision of water consumers and producers [73]. Though the JWC’s role is to implement the Oslo II Agreement, the IWA is the *de facto* regulator to prevent Palestinian drilling in the Western Aquifer. It has veto power over all Palestinian water resource extraction and infrastructure projects [42].

The ICA is an Israeli governing body that operates in the West Bank and is subordinate to the Israeli military. As shown above, the ICA remains effectively in control of Area C of the water resources in the West Bank. It works as a regulator to restrict Palestinian drilling in the Western Aquifer, for the reason that—according to ICA—Israeli water production is at risk because Palestinians are violating the Oslo II Agreement by drilling water wells without the approval of the JWC [56]. However, Palestinians argue that this drilling is in response to Israel keeping control of the region’s resources and over-pumping the Aquifer [67].

To meet the growing Palestinian demand for water supply, the Israel Mekorot Water Company, which abstracts water from the Mountain Aquifer, makes up the supply shortfall. The company was established in 1937 and is fully owned by the Israeli government. It started connecting Israeli settlements to its water supply network after Israel took control of the West Bank’s water resources in 1967. Since the signing of the Oslo II Agreement, it has been responsible for the management and maintenance of Israeli water installations and pipelines and for the maintenance of drinking water quality. It supplies almost half of the domestic water consumed by Palestinian communities in the West Bank, making it the largest single water supplier in the region. Palestinians believe that Mekorot demonstrates discriminatory water policies toward Palestine and profits immensely from Palestinian water insecurity [67]. The WHO has also noted that Mekorot provides much more water to Israeli settlements than to Palestinian communities and charges Palestinians higher rates than Israelis; for example, the daily per capita utilization in an Israeli settlement is around 400 liters whereas in a nearby Palestinian community it is 20 liters [74].

On the Palestine side, one of the most important achievements that grew out of the Oslo II Agreement is the evolution of the Palestinian Water Authority (PWA) [65]. The PWA was established in 1995 prior to the signing of the Agreement and is responsible for

the development and management of the Palestinian water resources. Since the signing of the Agreement, PWA officials have started to coordinate with Israeli partners on the JWC to implement Article 40 of the Agreement [65]. However, due to the power asymmetries, as illustrated above, the PWA does not have an equal voice in terms of the co-management of water resources in the Mountain Aquifer. In addition, water resources are largely not under the control of the PWA in the region. For example, in Area C, water resources are mainly controlled by the ICA and Mekorot, and in the rest of the areas of the Mountain Aquifer, they are largely under the control of Palestinian municipalities or utilities [42]. Even in Area A (covering about 18% of the West Bank, and exclusively administered by Palestine) or B (covering about 22% of the West Bank, and administered by both Palestine and Israel), Palestinian projects require coordination with Israeli authorities to get through the Israeli-imposed restrictions [42]. Besides these external factors, the PWA has internal challenges of improving its performance in its role of resource manager and regulator of service provision [42].

International donors also play a role in the Mountain Aquifer region. However, they are generally reluctant to interfere in the political and legal water disputes between Israel and Palestine. More often they provide financial support for the water projects in the West Bank and the Gaza Strip, repair water infrastructure damaged by Israeli military attacks, or offer emergency water services to Palestinians whose homes and properties have been destroyed or who have no access to adequate water supplies [41,75].

4.4. Trade-offs between Social Objectives

Water for agricultural use is an important factor in the water crisis between Israel and Palestine (El-Fadel et al., 2001). When the strain of large population growth is added to this agricultural demand for water, trade-offs between water and agriculture become more visible.

In Israel, agriculture remains the largest water consumer. The government has invested heavily in developing alternative sources since the 1950s because the supply of natural fresh water is limited. Over the years, water usage for irrigation has been extensively improved [76]. In 1990, approximately 95% of fresh and surface water was used in agriculture, but this declined to 55% by 2001, to 45% by 2008 [77], and to around 40% by 2017 [78]. The efficiency of water use has also largely improved. To do so, Israel applies diverse instruments, including policy reforms such as price control, subsidy, investment support, direct payments, income support, and insurance schemes [77], and technology such as drip irrigation, sprinklers, micro-jets, treatment and reuse of wastewater, and desalination [79].

For Palestinians, agriculture is a key sector that provides a backbone to their economy, supports food safety, and employs 11.5% of the labor force [80]. The West Bank, especially Area C, has most of the fertile farmland in Palestine. Prior to the Israeli occupation, Palestinian agricultural production was almost equal to Israel's [81]. The share of agriculture, however, has since shrunk, from 33% in 1994 to 19% in 2010, mainly due to the restrictions imposed by Israel on water usage and exploration, according to Palestine's side [80]. Accessing water has been identified as the greatest challenge facing Palestinian farmers [82]. However, the problem is twofold. Besides the impact of the Israeli occupation, "the Palestinian Ministry of Agriculture has paid little to no attention to seeking and supporting emerging science related to agro-productivity and agro-technologies", and a Palestinian project manager has noted, "The Ministry is donor-dependent on the international community, which fails to address the core needs of the sector." [82]

5. Implementation

5.1. Financing and Engineering

The Israeli water sector has almost achieved financial autonomy as of 2017. This has been done through a combination of domestic reforms, such as charging water users

on the basis of full cost recovery, providing incentives for operational performance, and implementing public–private partnership (PPP) [83].

One of the key innovations in Israel is large-scale desalination. Before 2000, desalination in Israel was limited to small plants processing brackish water. To date, five mega desalination plants have been constructed in Ashkelon, Palmachim, Hadera, Sorek, and Ashdod, with total production capabilities of some 585 million·m³ [84]. Desalinated water now supplies 40% of the country's total water consumption [83] and Israel has become one of the world leaders in this regard.

One important factor that contributes to this success is that all of these large-scale desalination plants, with the exception of a desalination facility in Palmachim, were built using the build–operate–transfer (BOT) method, in which the concessionaire designs, finances, builds, and operates the facility for 25 years [85]. This has brought many benefits. For example, under such schemes, private investors are greatly motivated to minimize the costs of operating the plants and to have flexible technological options. As a result, most of the plants have achieved strong performance in energy efficiency [83].

Besides desalination, Israel has implemented a national water system to connect all water infrastructure to deal with the unequal spatial and seasonal variability of rainfall; it has operated a large program of reuse of treated wastewater to relieve the stress of water scarcity, and, as noted above, it has long been working on improving agro-technologies to enhance irrigation efficiency. Although these actions are not solely confined to the Mountain Aquifer, they have relieved water stress in the region to a great extent.

Compared with Israel, Palestinian water tariffs barely cover operating costs. Although the Oslo II Agreement clearly states that the price of water should be based on real cost, i.e., water should be regarded as a commodity, Palestinians insist that attention should be paid to the payment for water as part of the population's total income, and so water is framed as a social good [62]. The water service providers, therefore, only collect 68% of all bills, and 76 cents on each dollar in the West Bank [86]. The failure of service providers to cover their operating costs results in a need for operational subsidies. However, the Palestinian national authority is not able to allocate domestic revenue to the water sector. While the National Water and Wastewater Policy estimates that the sector investment in total will be USD 7 billion by 2032, only USD 100 million has been allocated over recent years [86]. This insufficient municipal revenue has resulted in a persistent financial shortfall for maintaining the Mountain Aquifer in the West Bank.

Due to a lack of financial resources, the Palestinian authorities have had to largely rely on international aid to develop their water infrastructure over the last decade [86]. International donors are one of their main sources of project money, which currently constitutes around 10% of Palestine's GDP [69]. However, donations are often based on the political ties of the donors and receivers—in other words, donations are not stable. A PWA employee recalled the consequence when donors pulled out the money and suspended projects they were implementing: “the drop in financial assistance even led to the PWA's inability to pay salaries” [69]. In addition, some donors are not willing to be involved with projects in the West Bank requiring permits from the JWC or Israel.

Though Palestine operates small desalination plants in the West Bank too, these are limited in scale since Palestinians face the challenge of energy availability. For example, currently, only half of the need for electricity can be met by the available power supply in Palestine [86]. A study has shown that the development of PPP is difficult in Palestine in general because of the unstable political environment [87].

Although the overall water supply has increased with the rapid development in desalination of seawater from the Israeli side, the question of whether desalinated seawater is an alternative to freshwater resources in transboundary contexts remains contentious [46]. The Palestinians argue that desalination is a substitute for freshwater resources, and hence, Israel should desalinate, whereas the Palestinians should obtain most of their water from the Mountain Aquifer [88]. The Israeli position is that the desalinated water produced by industrial processes should be considered as an industrial product and only the shared

resources are negotiable, and that desalinated seawater is an augmentation that each party should finance itself [46].

5.2. Enforcement

Since no accountability mechanism is provided in the Oslo II Agreement, the Palestinians argue that their stance is supported and endorsed by international law, especially the UN Convention on the Law of the Non-Navigational Uses of International Watercourses (UN Watercourses Convention) and the International Covenant on Economic, Social and Cultural Rights (ICESCR). This section examines whether these two international laws could play a role.

The UN Watercourses Convention, which was adopted in 1997 and entered into force in 2014, promotes equitable and reasonable use of watercourses and has significant influence regarding international transboundary water cooperation. However, besides the complexity of applying it in real cases, this Convention, unfortunately, cannot be applied in the case of Palestinian–Israeli water disputes for several reasons. The first reason is that the Convention only provides a regulatory framework for sovereign states, and as Palestine was not recognized as a sovereign state by the United Nations until 2015, before then, it did not, therefore, have access to the arbitration or enforcement mechanisms. Second, the Convention is not applicable to the Mountain Aquifer even though it is transboundary, since, according to the Convention, “Watercourse means a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus” [89]. Although the Mountain Aquifer crosses the political border between Israel and Palestine, it has no physical relationship with any surface water body and is, in reality, unrelated to any other identifiable water resource [90].

In 2002, the human right to water was officially interpreted by General Comment No.15 of the UN Committee on Economic, Social and Cultural Rights (CESCR), which states that, “The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses” [91]. In 2011, the Supreme Court of Israel also affirmed that access to water is a basic human right [92]. However, regarding Palestinian access to water in the Occupied Palestinian Territory, Israel is of the opinion that this is not its responsibility. In its second periodic report submitted to the UN in 2001, Israel claimed that signing the Oslo II Agreement in 1995 resulted in transferring the “overwhelming majority of powers and responsibilities in all civil spheres” to the Palestinian Council, and therefore, the Palestinian Council should be “directly responsible and accountable vis-à-vis the entire Palestinian population of the West Bank . . .”, and “Israel cannot be internationally responsible for ensuring the rights under the Covenant in these areas [West Bank].” [93]. In its fourth periodic report in 2019, Israel reaffirmed this [94]. The UN Committee, however, disagrees; it has urged Israel to take measures to ensure the availability of sufficient and safe drinking water for Palestinians living in the Occupied Palestinian Territory [92] and also continues to reiterate that Israel has obligations to honor human rights in the Occupied Palestinian Territory and pressures Israel to adhere to its responsibilities under the ICESCR [95]. However, because the ICESCR, like many other international treaties, suffers from the shortcoming of weak enforceability, coupled with the fact that achieving human rights to water is subject to the obligation of progressive implementation over time, it is still unclear how compliance with such an obligation can be assessed [96]. Therefore, the possibility that Israel will take substantive measures to realize Palestinian rights to water in the Occupied Palestinian Territory in the near future, as the UN expected, seems small.

5.3. Conflict Prevention and Resolution

Different stakeholders sharing the same value assigned to water is the best instrument to prevent conflicts [40,97]. However, from the points discussed above, it is clear that there is no shared value in the Israel–Palestine water conflict. Furthermore, conflicts can also be prevented by having clear norms, standards, responsibilities, and enforceable rules and

agreements [20]. Although the Oslo II Agreement stipulates that any issues arising out of the application or implementation of the Agreement must be resolved through negotiations, the inherent complexities embedded in the water conflict between the two parties make this very unlikely.

In many cases, when disputes occur, parties can seek help from a third party—for example, an independent mediator—to adjudicate who is able to force the parties to act in accordance with the final ruling. However, as stated above, the existing mechanisms are not able to resolve the dispute.

6. Discussion

Based on the foregoing analysis, it is clear that cooperation on the water management of the Mountain Aquifer between Israel and Palestine faces significant constraints (Table 2). These constraints, however, should not be attributed to any single element, i.e., technical, political, institutional, or legal, but rather to the interaction and combination of these different elements.

Table 2. An Overview of the Assessment of Constraints to Israel–Palestine Water Cooperation on the Mountain Aquifer.

Assessment of Water Management and Governance	Content	1. Water System Knowledge	Is sufficient knowledge available to assess the impact on the water system of changes in environment and societal functions?	Knowledge gap regarding the Western Aquifer; there is a dispute about the shared amount of water, climate change, and population growth will worsen the situation
		2. Values and Policy Discourses	Is there sufficient knowledge of shared or conflicting values, viewpoints and principles for water issues and their consequences for facing water management issues?	Israel: water is related to sovereignty; Palestine argues it has water rights
		3. Regulations and Agreements	Are regulations and agreements legitimate and adaptive, and if not, what are the main problems?	Oslo II Agreement: lack of accountability mechanism; reflects power asymmetry; is outdated
	Organization	4. Responsibility, Authority, Means	Are authorities, responsibilities, and means well-organized to deal with water issues at the appropriate administrative scale(s) in a participative and integrative way?	JWC and JSETs are incompetent
		5. Stakeholder Involvement	Are all relevant stakeholders involved? Are their interests, concerns and values considered in a sufficient balanced way in the problem analysis, solution search process and decision-making?	Strong ICA, weak PWA, and neutral international donors
		6. Trade-offs between Social Objectives	Do trade-offs exist? If so, how?	Israel's agriculture relies less on freshwater source; Palestine's agriculture is severely affected by Israel's occupation
	Implementation	7 & 8. Financing and Engineering	Is the financial arrangement sustainable? Are the design and consequences of different alternatives sufficiently available?	Israel has achieved financial autonomy in the water sector; Palestine cannot recover costs and relies on international aid
		9. Enforcement	Are regulations and agreements enforceable by public and/or private parties, and are appropriate remedies available?	An enforcement mechanism is not available
		10. Conflict Prevention and Resolution	Are there sufficient conflict prevention and resolution mechanisms in place?	Conflict prevention and resolution mechanisms are not available

6.1. Content

Promoting cooperation in asymmetric situations, as Selby [19] has indicated, is not a neutral activity but a profoundly ideological one that can distort policy priorities. In the case of Israel–Palestine water conflicts, their respective perceptions as well as the values they attach to water have inherently influenced their water discourses. Israel links its water resources to political or military aspirations for securing sovereignty; this, to some extent, will diminish the possibility for negotiation since any change from the status quo would be perceived as a threat to national security. Palestinians favor a territorial solution because their water rights have been denied and basic water demands have not been met under Israeli occupation [98]. Though this claim has been widely supported by the international community, the lack of an effective enforcement mechanism to ensure that Israel fulfills its obligations causes the present author to believe that the chance for Palestinians to realize the substantial water right in the near future is small. From a practical perspective, it suggests that Palestine change its mindset from blaming its water insecurity solely on the Israeli occupation and instead to improve its domestic water management where this is possible. Though it is difficult for Palestine to reform its water institutional setting because of a multitude of rules (of both Palestine and Israel) governing water management at the local level [14], Palestinians could improve their water facilities—for example, in Area A of the West Bank, where they have exclusive administration—fix the leakage in their distribution networks, or stop discharging effluent into natural rivers [14].

Besides the political factor, both the unclear recharge rate and the disputed amount of water in the Mountain Aquifer to be shared have hindered the process of negotiating water allocation between Israel and Palestine. Although many studies have predicted that climate change will increase water stress in the Mountain Aquifer region, a recent analysis [99] shows that neither of the two parties has paid sufficient attention to the implications of climate change. However, the impacts posted by climate change will have serious implications for the political stability of the regions. For example, the reduced availability of natural water will further lead to greater difficulty in rationing of water [99].

6.2. Organization

Water cooperation is a long-term commitment that requires ongoing efforts. The establishment of joint institutions is usually a promising start. A capable institution can balance conflicting interests and is the key to achieving durable cooperation. Whereas the Oslo II Agreement established a framework for the cooperative management of the Mountain Aquifer, the JWC was established with high expectations. However, due to the asymmetry in power between Israel and Palestine, it turns out that the JWC is not able to function as expected. For Israel, it has become a tool for strengthening its position in the West Bank, and for Palestine, it is a structural barrier to developing the water resources in the region. Research suggests that if parties can engage on more equal terms, prospects improve for equitable and lasting cooperative processes [100]; this is, however, not the case for the Mountain Aquifer. In order to offset the effect of Israeli constraints on developing new water sources, Palestinians are purchasing water from an Israeli company and rely on it. This inequitable situation has prevented the development of a consensual approach to conflict resolution in the region.

Pressure on water resources could be greatly relieved not only by developing capable institutions but also by advances in technology, as proven by Israel (for example, the development of desalination). Some researchers are of the opinion that the production of new water resources by Israel may provide an opportunity to negotiate the water issue between Israel and Palestine since water would no longer be a zero-sum game [51]. This is, however, too optimistic, given that Israel considers its artificial water (desalinated seawater and treated sewage water) to be an industrial product and, hence, not part of the negotiation on water.

Domestically, although Israel is now able to supply adequate fresh water for domestic use, the increase in supply also increases the risk of “moral hazard”, which Katz [101]

describes as, “consumers, knowing that additional supplies are available or are soon to be available, discount the need for conservation.” This is evidenced by recent data: household water consumption in Israel has been increasing—by nearly 10% in the two years ending in 2017—mainly because desalination makes consumers feel that water conservation is less necessary [14,102]. Although desalination has considerably relieved pressure on water resources, it comes with a high energy cost, as well as with new environmental problems [14]. Research has shown that many available water conservation measures are cheaper than the cost of new desalination capacity for equal volumes of water [103]; the main focus of water management for Israelis as well as for Palestinians, therefore, needs to shift from supply management to demand management [14].

6.3. Implementation

Israel, as stated above, has been successful in developing technologies to deal with its stressed domestic water supply. Israelis are of the opinion that Palestinians should develop practical solutions as well, such as fixing leakages and building desalination plants or sewage treatment plants to address water shortages in the region rather than using water as a weapon against Israel. Though biased, this contention is not entirely wrong. The leakage rate from Palestinian water pipes is indeed much higher than from Israel's: 33% in Palestine versus 10% in Israel [59]. Palestine introduced a new Water Law in 2014 that aims to improve existing urban utilities; its implementation, however, has been slow “due to an incomplete legal structure, lack of financing, and lack of clarity of rules and responsibilities at the local level” within Palestine [86].

Although international laws are, theoretically, legally binding and may help to facilitate cooperation, in real life, they are often constrained by various factors, as indicated above: disputes about Palestine's identity, Israel's disagreement about the applicability of certain rules, and the weak enforceability of international laws. In practice, it is often not international rules that determine an agreed solution but rather practical considerations that are addressed through negotiations. Research shows that water-related conflict prevention and resolution is largely the result of processes of research and of fact finding and negotiation, which are grounded in a comprehensive understanding of the social conditions and the political context [104]. The greatest threat to cooperation between Israel and Palestine on water issues seems to stem from the perception that cooperation may expose a country to harm or jeopardize something of value to the country [14], which leads to a zero-sum mindset. However, when parties understand that there are no absolute winners and losers and instead work toward building and enhancing trust, the process of agreement can be largely facilitated.

7. Conclusion

This study examines the main factors influencing the water cooperation, or lack thereof, on the Mountain Aquifer that Israel and Palestine share. Based on the analysis above, it concludes that effective cooperation in the region is unlikely to be realized in the foreseeable future if both parties persist with the business-as-usual approach. Apart from asserting that the political factor—Israel's occupation of Palestine—is the most crucial contributor, as much previous research has concluded, the present study provides a holistic perspective to look at the whole picture. It shows that besides the political tensions and the different perceptions of the value attached to the shared water, the current technology, the mistrust between the two parties, the lack of an external enforcement mechanism, and the impacts of the domestic political environment all constrain the two parties from reaching a consensual agreement. Each of these elements contributes to the problem; however, thinking from only one cannot solve the problem since different elements interact with each other.

In order to make water cooperation possible in the future, it suggests that the argument should move away from water being central to national security, especially on the Israeli side. Joint management needs to be the priority for both parties. In order to

facilitate progress on cooperation, water problems should first be addressed from a technical perspective; clear borders and the amount of available water are critical for further cooperation. Second, building a competitive joint institution has been proven by existing literature to be one of the most effective ways of preventing and resolving conflicts about transboundary waters; the JWC, therefore, needs to be fundamentally reformed to change it into a problem-solving entity, and more mutual trust and the two sides being on equal footing are important for it to succeed. In addition, the impact of climate change should be included on the agendas of both Israel and Palestine; the creation of a road map for regional adaptation and mitigation of climate change impacts could be a step toward effective cooperation in the future.

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