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The Israeli-Palestinian Water Conflict
—Impact of the Technology and Climate Change—

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Abstract

Management of the scarce water in the Jordan River basin has caused prolonged tension among riparian countries. Despite the new water distribution framework following the Oslo Accords, equitable water sharing was not achieved. This paper focuses on incremental development of the water conflict in the post-Oslo period, and examine the influence of political negotiation, climate change, and new technology. Based on the geographic conditions and political imbalance of power, it also explores the nexus among water, conflict, and SDGs.

1. Water and Conflict in the Middle East

Water resource management has been a crucial topic in southern Jordan catchment countries. The distribution of the transboundary water has been discussed at successive regional negotiations and comprises an essential part of the Israeli-Palestinian conflict. The Oslo Accords from 1993[1] has received primary international attention and has developed a framework of cooperation on this issue. However, political developments in the region during the 2000s hindered the expected cooperation. In addition, technological developments such as desalination and the introduction of sustainable development goals (SDGs) have affected the consumption pattern of water resources. This paper focuses on this point and tries to clarify the impact of the SDGs in the region. In addition, the development of the water conflict in the post-Oslo period is investigated, and the nexus between water resources, conflict, technology, and SDGs are explored.

The relationship between the conflicts and scarcity of natural resources has been the focus of many scholars, and water resources have comprised a significant part of their studies. Gleick, the author of the

[1] The Oslo Accords consist of a series of agreements between Israel and Palestinians signed in the 1990s. It began with the Declaration of Principles (DOP) signed in September 1993 at the White House. DOP represents the formal name of "Declaration of Principles on Interim Self-Government Arrangements."

biennial series on the global state of water called *The World's Water*[2], is also the editor of the online version of 'Water Conflict Chronology', which deals with conflict data from 3000 BC to 2019[3]. He advocates that the basic water requirements should be met as a standard of human rights and warned that "the risk of social and military conflict" should not be met (Gleick 1999: 11). At the end of the Cold War, natural resource management was estimated to be the next central global conflict issue, and potential 'Water Wars' was conceptualized as a major threat to international society (Starr 1991).

Trottier argued that the idea of 'Water Wars' in the Middle East "could become ideologically hegemonic" (Trottier 2003: 6). Being a semi-arid area with severe water use restrictions, the Middle East has been considered one of the most contentious regions with regard to water resources. Allan, another pivotal scholar in this field of research, formulated the concept of 'virtual water.' In addition, he edited books containing multi-dimensional analyses of water conflict, including the Israeli policy of water management, the influence of technological developments, education on water consumption, and the Islamic tradition in water usage (Allan 1996; Allan 2001).

More recently, the nexus between climate change and violent conflict has been investigated, focusing on the impacts of drought (Caitlin and Femina 2013; Feitelson and Tubi 2017; Weinthal, Zawahri and Sowers 2015). Based on the case studies on two river basins in the Middle East, the Euphrates and lower Jordan River basins, Feitelson and Tubi explored the conceptual framework of the nexus. It suggests that "droughts do not constitute the main driver of armed conflict in the Middle East," yet they "may lead to conflict when more fundamental factors, particularly adaptive capacity, have been compromised" (Feitelson and Tubi 2017: 46). In other words, "climate change may lead to conflict if the geopolitical and internal settings move in that direction" (ibid.).

As is indicated in the case studies by Feitelson and Tubi, the conflict over the Jordan River basin is one of the central issues in the Middle East, and numerous studies have been conducted from geological and hydrological perspectives (Allan 2002; Arlosoroff 2000; Elmusa 1997; Feitelson and Haddad 2000; Haddadin 2006; Nasser 1996; Selby 2003). Lowi (1993) investigates the Israeli-Palestinian conflict from a geopolitical perspective. While the focus of the study is that of the riparian disputes over the Jordan River basin since 1967, its significance also derives from its detailed historical review of the Johnston Mission, given that its plan composed the basic standards for water usage up to the present[4]. Weinthal, Zawahri, and Sowers (2015) dealt with the cases from Jordan, Syria, and Israel to clarify the framings of the water-climate-migration nexus. Starting from a similar research question as in the aforementioned Feitelson and Tubi

[2] The latest issue, Volume 9, is available from the following site: https://www.worldwater.org/book-details/ (last accessed on 23 January 2021)

[3] Water Conflict Chronology: http://www.worldwater.org/conflict/list/ (Last accessed on 23 January 2021).

[4] The Johnston Mission's plan proposed allocating water from the Jordan River in 1955 based on the right to an equitable and reasonable share between the riparian population. It provided 250 MCM/y water for Palestinians in the West Bank; however, Israel opposed the plan and never ratified it (al-Shalalfeh, Napier and Scandrett 2018: 118).

(2017), all three cases focus on the Jordan River basin and identify the different conditions that produce the different forms of nexus.

While many aspects of the usage of water resources in the region have been investigated in the nexus to various other aspects, including conflict, these studies focus on analyses based on a one-shot observation. Each phenomenon, such as drought, is selected from different areas and compared for the sake of examination of theoretical frameworks. Other studies focus on a temporary aspect, such as the policies of a specific country. As a result, most of the studies explain each locality as a static phenomenon and do not mirror the expected change occurring by the introduction of new technologies and strategic goals.

This study attempts to overcome these problems by analyzing the incremental changes to the region. Focusing on developments after the Oslo Accords, the influence of political negotiation, new technology, and goals will be examined. Because water management is a vital issue for both Israel and Palestinian governments, they try to procure as many available resources as possible. However, geographic conditions and political power balance have significant effects on their possible choices. The current developments indicate the achievements and limits of these choices.

The geographical background of water resources and political agreements adapted in Oslo II will be explained in Section 2. Section 3 explores the technological development accelerated by climate change and its applicability to Israel and Palestine. The effect of technology and its political limit will be clarified based on the current situation.

2. Water Resources and Political Agreements in the Oslo II

Palestine/Israel is located in the Mediterranean climate zone, and most of the land they occupy, together with the other Middle Eastern countries, is semi-arid. Each locality has a different specific climate: the Jordan Valley, Negev, and south of Gaza are arid desert, the coastal and hillsides such as Tel Aviv, Jerusalem, and Ramallah are sub-humid, and Galilee, Jenin, and Qalqilia districts in the north enjoy richer water resources. The annual rainfall varies substantially, and occasional heavy rainfalls recover the water table level lowered by droughts (Elmusa 1997: 24; Harpaz, Haddad and Arlosoroff 2000: 44–45). The allocation of water resources has been planned and coordinated among riparian entities considering their natural environment.

There are three kinds of water resources available in the Palestine/Israel region: surface water, renewable aquifers, and nonrenewable aquifers. While nonrenewable aquifers have a tremendous amount of fossil groundwater, they cannot ensure continuous water distribution. The other water resources are shared among Israel, Palestine, Syria, Lebanon, and Jordan, based on successive agreements.

The main source of surface water is the Jordan River. It is a trans-boundary water system shared with the riparian states of Syria, Lebanon, Jordan, and Israel. Being a non-state actor, Palestine is excluded here,

and all the access and usage of the surface water of the Jordan River is barred for Palestinians according to the terms of Oslo II (Zeitoun 2009: 46). The extent to which each entity was admitted political representativeness in the international sphere decided on the access to this resource according to the Oslo II agreement.

In the Upper Jordan River basin is the Golan Heights, the water resources of which became a pivotal bone of contention in the war of 1967 between Israel and Arab countries. In 1964, Israel built the National Water Carrier to divert 420 MCM/y[5] from the Upper Jordan River (Zeitoun 2009: 67), and after three years, militarily occupied the Golan Heights. Water procurement in this area has been a vital issue, and Syria and Jordan also planned another project of the al-Wihda Dam (or Maqarim Dam). The two countries made bilateral riparian agreements, and the preliminary work was completed by the end of 1989. However, the project was stopped due to Israeli opposition over water allocation (Elmusa 1997: 233; Murakami 1995: 91). The contention over the international water in this area suggests the decisive importance of political and military power in determining water procurement.

The Lower Jordan River is mostly shared between Israel and Jordan and flows into the Dead Sea. Water diversions and barrages in the Upper Jordan River deplete freshwater flows into Lake Tiberias and increases the salinity level in the Lower Jordan River. The annual inflow of water has been dramatically reduced, and the Dead Sea shrinks at a rate of one meter of shoreline yearly. Therefore, the available amount of surface water resources from the Jordan River is rather limited, and there is already severe international contention regarding the allocation. The shrinkage of the Dead Sea was caused not by climate change but rather due to the decrease of water input affected by barrage construction. This situation leaves little room for the Palestinians, whose political power is also limited in the international space, to participate in the distribution.

Therefore, the most important water resources for the southern Jordan catchment countries are the renewable aquifers that lead to groundwater flows. These aquifers have become the target of international and regional coordination for water management. There are eight groundwater basins in Palestine/Israel, four of which—Tiberias, Western Galilee, Carmel, and Negev basins—lie within Israel. The other four—Coastal, Western, Eastern, and North-Eastern Aquifer—are located partially or totally in the West Bank and the Gaza Strip. Gaza relies only on the Coastal Aquifer, which is shared with Israel.

After the DOP, 'the Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip' (hereafter referred to as Oslo II) was concluded in 1995. An important point was that in Oslo II, Israel explicitly recognized the 'Palestinian water rights in the West Bank' as follows.

[5] MCM stands for "million cubic meters" and "/y" stands for "per year" in this paper.

Oslo II　Annex III: Protocol Concerning Civil Affairs

Article 40. Water and Sewage

1. Israel recognizes the Palestinian water rights in the West Bank. These will be negotiated in the permanent status negotiations and settled in the Permanent Status Agreement relating to the various water resources.

These protocols were the product of international negotiations in the peace process and set the framework for the following coordination among Israelis and Palestinians. In other words, the agreement on an international level was converted to the regional level for implementation. At the regional level, several organizations were formed for the administration of water management.

As a framework for administrative cooperation in the water sector between Israel and Palestine, the Joint Water Committee (JWC) was organized under the terms of Oslo II (Article 40). The major participant from the Palestinian side was the Palestinian Water Authority (PWA), which was established by Presidential Decree No.5 in 1995. Law No. 2 provided legal authority to the PWA in 1996, according to which the PWA is a juridical body with its own budget under the authority of the President of the Palestinian Authority (Haddad 1998: 182). Water Law No. 3 formalized the tasks and responsibilities of the PWA in 2002 (Husseini 2004; Zeitoun 2009: 74) and was considered the first step of institution-building for water management at the regional level in Palestine.

The JWC is composed of water professionals appointed by both Israeli and Palestinian governments. Within the JWC there are several subcommittees working on specific topics such as sewage treatment or water pricing. The JWC was designated as the primary forum for negotiations and decision-making on trans-boundary water policy and has held 61 meetings between 1995 and 2008 (Katz and Fischhendler 2011: 18).

However, the task of developing institutional capacity from limited resources is challenging. According to one study, "To achieve it under conditions of water and capital scarcity and the lack of professional and bureaucratic experience compounds the problems immensely" (Nasser 1996: 53). Many critics have pointed out the limited effectiveness of the activity of the JWC, criticizing the arrangement as perpetuating the asymmetric status quo rather than a forum for joint management. Some local Palestinian communities considered joint infrastructures such as the JWC as technically desirable but politically undesirable at the national level. Therefore, representatives of local interest groups did not take part in the JWC meetings (Katz and Fischhendler 2011: 21).

The JWC was unable to play a significant role in water management, even in critical situations when coordination was most required. For example, the existence of the committee could not mitigate the destruction of the water infrastructure in Jenin caused by Israeli military operations in April 2002. Although there was a "Joint Declaration for Keeping the Water Infrastructure out of the Cycle of Violence" issued just a year ago, the PWA could not even use the JWC office to have more water released to Jenin via Israeli

controlled water supplies (Zeitoun 2009: 87–93). The JWA was also criticized for being biased, as it only makes decisions concerning Palestinian water management and not Israeli water management, reflecting the political imbalance of power (Brooks and Trottier 2010: 110). The deteriorating relations between the Palestinian Authority and Israel finally led to the boycott of JWA by the Palestinians in 2010. After that, only technical cooperation continues, and no further meetings were held (Corradin 2016: 10; Feitelson and Tubi 2017: 45).

Based on the administrative turmoil discussed above, another difficulty facing the Palestinian people is the licensing process. Because the use of surface water from the Jordan River is not allowed in the agreement, the wells are the main water resource for Palestinians and comprise 70.4% of the total quantity (PCBS 2018[6]). Article 40 of Oslo II states that all kinds of development of water resources, including the issue of licenses for drilling new wells, must be approved by the JWC. However, the JWC does not have the power to issue the license in Area 'C', and the Israeli Civil Administration (ICA) under the jurisdiction of the Israel Defense Forces (IDF) makes the ultimate decision for all permits required. According to Oslo II, Area 'C' is designated to be fully under Israeli civil and security control, except over Palestinian civilians. It comprises roughly 72% of the West Bank; hence, the decision by the ICA is required in most of the geographical areas (Zeitoun 2009: 101).

The process of drilling wells indicates the actual state of water management in the OPT. In this process, decisions over water development are issued from the political authority on the Israeli side, and the proposed administrative body for coordination does not have the power to grant licenses. In other words, political inability is mirrored at the administrative level. Even on the administrative level, procedures planned in the Oslo Accords do not work, and the preceding institutions have assumed an essential part of the management. A similar situation continues until now.

3. Climate change and influence of the New Desalination Technology

In addition to the strained water resources in this area, occasional droughts have further promoted the introduction of newly developed hydrological technology. The Middle East has experienced an increase in aggregate temperatures, a decrease in the number of cold days, and an increasing frequency of wintertime droughts. They cannot be explained by natural climatic variability alone and rather classified as climate change. Precipitation has declined in Jordan, Syria, Lebanon, Palestine, and Israel (Weinthal, Zawahri and Sowers 2015: 296). The extreme 1999–2001 drought on natural water resources motivated the Israeli government to advance the desalination technology (Feitelson and Tubi 2017: 45). After that, Israel faced 7

[6] Calculated from (PCBS 2018): While the source of "Water Pumped from Palestinian Wells" in 2018 was 274.2 MCM, the total Annual Available Water in Palestine was 389.5 MCM.

more years of consecutive drought from 2003 to2011. The Water Commission's Master Plan was adopted in Israel for 2002-2010 to stabilize the water system by augmenting the supply through desalination and water reuse (Weinthal, Zawahri and Sowers 2015: 297).

Thereafter, the recycling and desalinating water technology in Israel reached the highest level in the world. From the early 2000s, five mega desalination plants based on seawater reverse osmosis (SWRO) were constructed along the Mediterranean Coast with a total capacity of 585 MCM/y (Marin, Tal, Yeres, and Ringskog 2017: 21). The world's largest seawater desalination plant, located about 15 km south of Tel Aviv, called "the Sorek desalination," began its operation in 2013 and supplied around 150 MCM/y at a reasonable cost of 54 cents per cubic meter (Ibid.: 22; Water Technology 2021). At the same time, reclaimed wastewater has become a major source of water, with more than 87% of wastewater being reused in 2015. The water crisis of 1985 further accelerated the reuse of treated sewage effluents. Most of the recycled water is used in agriculture, and more than 40% of the country's irrigation needs are met from reused treated water (Marin, Tal, Yeres, and Ringskog 2017: 18–19). The introduction of modern technology has contributed to diversifying the available alternative water resources other than natural water. Nevertheless, the total amount of water extracted for consumption or distribution did not increase. Figure 1 indicates transitional changes in water supply resources in Israel.

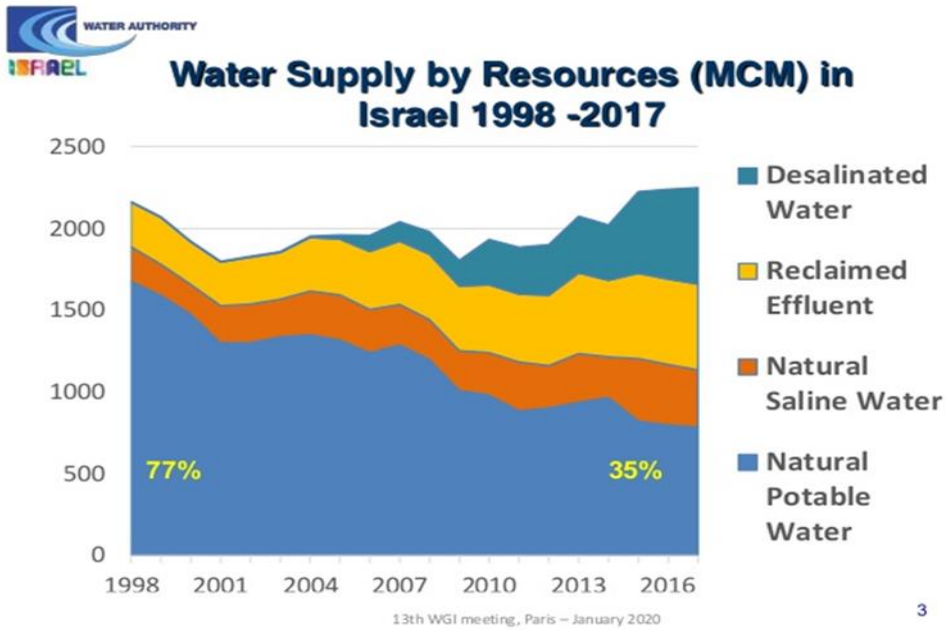

Figure 1: Changing Water Supply in Israel between 1998-2017

Source: Israel Water Authority. (last accessed on November 16, 2020)
https://www.slideshare.net/OECD-regions/an-israeli-experience-implementation-of-sdg-6-on-water-and-sanitation-for-all

Israel's growing capacity for desalination and effluent reclaim significantly increased the water

supply flexibility. Some sources suggest that this flexibility contributed to certain quantities of water being conveyed to Jordan to reduce the regional tension (Amidror and Lerman 2015). With the strategic interest in mitigating the international critique of its continued occupation in the West Bank, Israel increased the quantity of water supply to the West Bank Palestinians. This allocation might have a significant impact because dependency on agricultural sector of Palestinians is considerably high compared to Israel, whose economy has shifted towards an industrial and later a post-industrial economy (Feitelson and Tubi 2017: 45–46). Considering the above-mentioned technological development and water supply sharing, water conflict in the region sounds to have high expectation to be mitigated in the long run.

However, the sources from the Palestinian side indicate a different reality. As shown in Figure 2, while Israelis have access to around 240 liters of water per person per day, Palestinians in the West Bank have access to as little as 73 liters[7], which is well below the World Health Organization's minimum standard of 100 liters per day (Corradin 2016: 11). The Palestinians, therefore, mostly depend on purchased water, from the Israeli water company, Mekoroth, for domestic use. Of the total 389.5 MCM consumed water, 85.7 MCM (22.0%) was purchased in 2018 (PWA website). Some of the water purchased by the PWA was delivered to the wells in the West Bank and Gaza Strip through 25 connection points controlled by Mekoroth. In addition, more than 200,000 Palestinians who are not served by piped networks buy water from private Palestinian water tankers, which are sometimes filled up in Israeli settlements (PASSIA 2009: 363). Buying water from tankers costs five to ten times more than the water supplied through a water network (Corradin 2016: 11). According to Dr. Ayman Al-Rabi of the Palestinian Hydrology Group (PHG), Palestinians spend 30–40% of their monthly income on water compared to the global average of 5% (PASSIA 2009: 362).

While wastewater treatment has also been introduced in Palestine, the plants treat only 25% of the generated wastewater, and no more than 1% is reused for agricultural purposes. Desalination technology was also adapted in Gaza Strip, and the largest seawater desalination plant was constructed in 2017 (State of Palestine 2018: 4, 45). In 2018, it supplied 4.1 MCM/y of water for the people in Gaza, which comprised 2.2% of the total water supply (PWA website). However, the severely interrupted electricity supply in the Gaza Strip hinders the capacity of desalination and water treatment centers to operate at the available capacity (State of Palestine 2018: 45).

[7] According to the Water Tables issued by PWA, the Daily Consumption Rate of 73 in the West Bank represents the number in 2010 and 2011. The same data in Gaza Strip in the same years are not available.

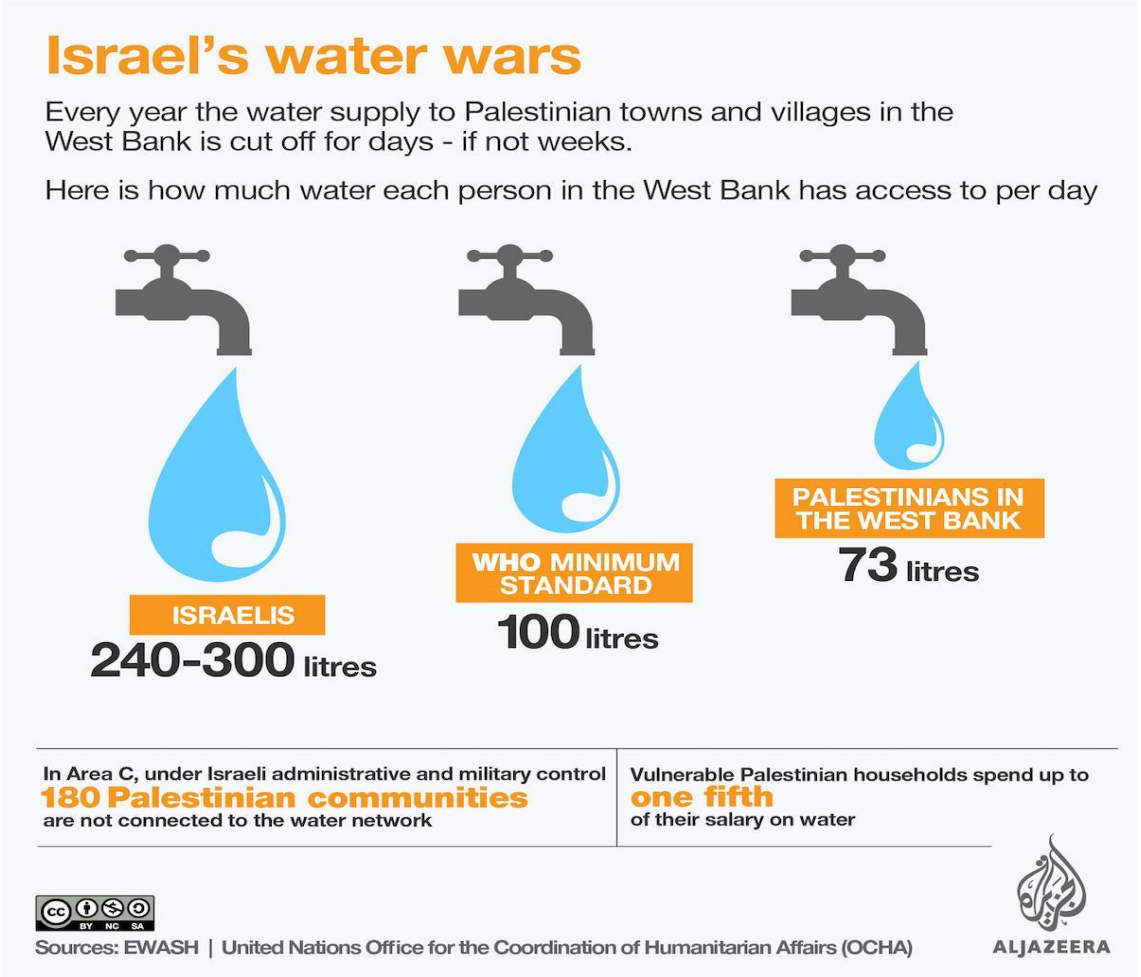

Figure 2. Water Availability in Israel and Palestine

Source: Al-Jazeera (2016)

The water crisis, caused by geographical and political reasons, is extremely severe in the Gaza Strip. As mentioned in Section 2, Gaza relies on water from the Coastal Aquifer, which is shared with Israel. Its annual sustainable yield is around 450 MCM/y in Israel, but only 55 MCM/y in Gaza (al-Shalalfeh, Napier, and Scandrett 2018: 121). In addition, being located downstream of the aquifer, the water is heavily contaminated by the upstream riparian state, Israel, and only 5% is suitable for human consumption. Moreover, the repeated military attack on Gaza Strip has damaged the water infrastructure; the 2014 conflict alone caused losses of 94 million dollars to the entire water sector (al-Shalalfeh, Napier and Scandrett 2018: 121; Corradin 2016: 11–12). The blockade on the Gaza Strip since 2006 disturbs the rebuilding or development of water-related facilities, as 70% of the materials needed are under import restrictions. Therefore, 85% of Palestinians in Gaza rely on private desalination services, which charge up to five times the cost of water from the municipal distribution network (State of Palestine 2018: 45).

With the launch of the SDGs in 2015, the Palestinian Authority has committed to achieving these goals. A national team was formed, headed by the Prime Minister's Office with the membership of all

interested parties, including civil society and the private sector. Among them, SDG 6—to ensure availability and sustainable water management and sanitation for all—is considered a national priority, and the Palestinian Authority has engaged in expanding access to safe water. The Palestinian Water Authority, an institution established in the Oslo process, leads the SDG 6 effort and set up the National Water and Wastewater Sector Strategy 2013–2032. However, unjust and unequal access to water hinders the achievement of these goals. The continuous political and military turmoil in the 2000s has also hindered the cooperation between Israel and Palestine.

4. Conclusion

The Jordan River basin has been one of the most contentious regions of water resources in the Middle East. The countries in the region have experienced both hot and cold wars over its availability. There are three water resources in the region, and agreements by the Oslo Accords set the basic distribution framework. Article 40 of the Oslo II explicitly mentioned the Palestinian water rights in the West Bank; however, available water resources remained limited for Palestinians, and the agreements did not bring about drastic change. The access and usage of the surface water from the Jordan River was barred for Palestinians, and they could rely only on the four renewable aquifers. While JWC was established as a forum for coordination between Israeli and Palestinian governments, it could not play a significant role in water procurement even in critical situations. Decision making was biased, reflecting the political imbalance of power, and JWC did not have the power to issue licenses for wells-drilling.

In response to climate change, the Israeli government promoted the technological development of water reuse and desalination. As a result, alternative water resources increased the flexibility of the water supply. However, technological developments did not bring about significant changes in water distribution. While certain quantities of water being conveyed to the surrounding contentious areas, inequality in the available water quantity remained the same for Palestinians. Unavoidably, they are forced to purchase water from Israeli companies and spend five to ten times more on water costs. The available water from the newly developed technologies, such as wastewater treatment and desalination, is still quite limited for Palestinians. This is because of under-developed facilities and electricity fluctuations caused by the political blockade in Gaza Strip.

This study analyzes water conflict between Israel and Palestine due to geographical and political reasons. While technological development provides flexibility and more choice in water resources, the tension over water distribution is not necessarily eased. While the Palestinian government indicates a willingness to achieve SDGs, a state without full sovereignty has difficulty controlling its resources to realize the goals. The ultimate scarcity of water resources combined with an overwhelming imbalance of political

power does not allow easy coordination between riparian groups. Equitable water use can be achieved only through debates between equal partners e, accompanied by efforts to increase the volume of shared resources by utilizing modern hydrological technology.

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