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Hydropolitical Relations: Identification and Classification of Effective Factors

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Abstract

Hydropolitical relations between different actors can include a range of behaviors from peace to military conflict. Because of the multiplicity of scales and discourses, hydropolitical relations are affected by various factors that have not been studied coherently in hydropolitics literature. The purpose of this research is to expound on the factors that impact hydropolitical relations, and measure their relative significance. To this end, 12 macro factors and 61 secondary factors were detected for the design of the questionnaire based on the library data in the field of hydropolitical relations. In order to rank factors, the AHP method questionnaire was used, which was completed by 10 experts in the field of hydropolitics studies. Based on the results, the 12 macro effective factors were ordered as: climate, geography, water resources shortage, water resources management, legal, political, environmental, economic, military, security, cultural, and technological factors.

Keywords: Hydropolitics, Shared Waters, Security, Conflict, Cooperation.

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1. Introduction

The location of transboundary waters does not correspond to international borders, and taking possession of them is often disputed (Kemp and Harkavy,2004:165). Unsustainable water management threatens national development, internal stability, political units security (Wolf,2007:27) and cause intense competition among the internal society groups (Alizadeh, 2004:27). This is expounded in the Figure(1).

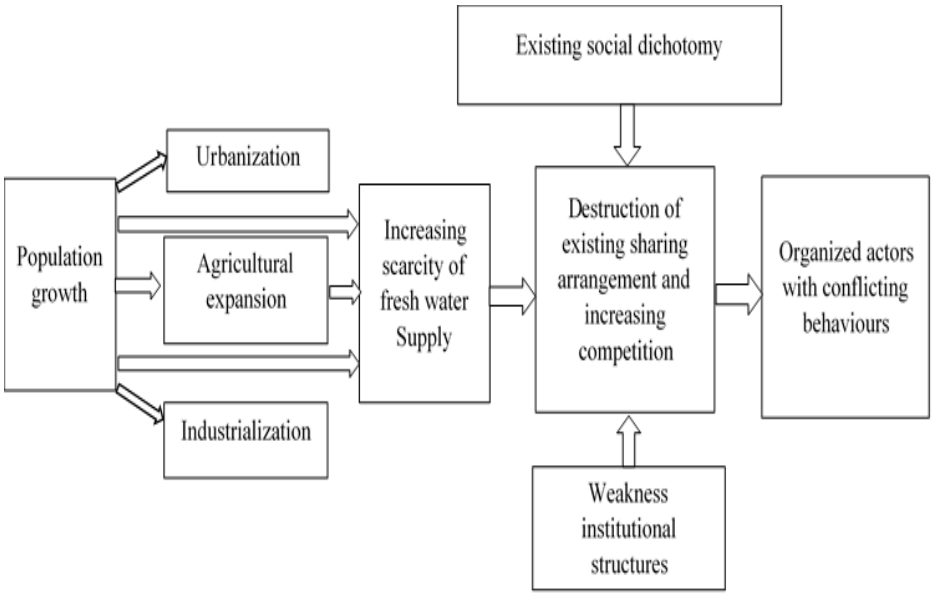

Figure (1): Increasing Demand over Water and Creation of Conflicting Actors

(**Source:** Swain,2004:20)

Two hundred sixty three transboundary river basins among 150 states have an undeniable impact on diplomatic relations (Eckstein,2002:11). There are approximately 38,000 statements or conventions and 300 international water management treaties (Ardekanian,2005:3). Hydropolitics studies the interconnections of water resources and politics at different levels (Hafeznia,2006:102). This includes studying the social and political tensions caused by government policies and agencies at the national level. At the regional level, the focus is on inter-state policies related to the distribution, control, and quality of water resources (Asgari,2002:497). Global hydropolitics involves negotiations, major discussions in international

meetings, and the formulation of international laws concerning water resources (Mollinga,2001:735). Because of the multiplicity of scales and discourses, hydropolitical relations are affected by various factors that have not been studied coherently in hydropolitics literature. These factors can have positive or negative effects on the cooperation or conflict among the riparian states, depending on the context and the situation. However, there is a lack of a comprehensive and systematic framework to identify and classify these factors, and to assess their relative importance. This gap limits the understanding and analysis of the hydropolitical dynamics, and hinders the development and implementation of effective and sustainable solutions. What is necessary to overcome this insufficiency is to identify and provide an identical definition of factors affecting hydropolitical relations and to measure the relative importance of these factors to prevent deeming the effect of these factors to be similar. Therefore, the aim of this article is to propose a framework for the identification and classification of the effective factors on the hydropolitical relations.

2.The theoretical Spectrum of Hydropolitical Relations

Hydropolitics is a rich and dynamic field that resembles a river with many branches rather than a straight canal. Therefore, hydropolitics studies draw on various theories from different disciplines, such as political science (mainly international relations, but also public policy, political economy and political ecology), environmental science, law (especially international water law and environmental justice), and science and technology studies. Based on this diverse theoretical background, hydropolitics researchers have tackled many complicated issues in recent years, such as: Do transboundary waters cause conflict or cooperation? The answer to this question has changed over time. In general terms, we can divide the answers to the conflict or cooperation puzzle into three types: (1) transboundary water as a source (or origin) of conflict; (2) transboundary water as a trigger for cooperation; and (3) transboundary water as a cause of both conflict and cooperation. The first researchers of hydropolitics focused on the links between water and conflict. Advocates of this water conflict (and even water war) story examined the reasons connecting water resources – especially those in transboundary basins – with conflict within and between states. These scholars claimed that the strategic value of water, along with the increasing needs for such resources and the social and political tensions

arising from competition, make transboundary water basins the ideal place for local and international conflicts. This water conflict argument was questioned after some scholars challenged the role of water as a cause of conflict. While recognizing the existence of conflicts over water resources (mainly at the local level), various scholars supported the higher chance for cooperation over transboundary waters. The core of their argument is that cooperation over water is more rational than conflict because it is more cost-effective at ensuring long-term access to water supplies, generates a wide range of benefits and is resilient to instability in the basin, even among hostile states and when other divisive issues spark conflict. All this makes transboundary water basins a perfect situation for win–win cooperation. A group of scholars came with a shift in the understanding of transboundary water conflict and cooperation. Instead of a binary question or a matter of state-to-state relations, interactions over transboundary water resources started to be seen as complex phenomena with multiple pressures at multiple levels of policy action, embedded in interrelated political, legal, economic and social systems. The governance of transboundary waters is now seen as a layered structure, with coexisting conflicting and cooperative relations. Most importantly, this third group of scholarship began to investigate what forms the essential part of discourses. Such emphasis on discourse – that is, the ideas, concepts and classifications that actors create, maintain and change into a specific set of practices and use to make sense of physical and social realities – has a three-part rationale. First, the discourses created by the different actors around (or beyond) the basin define the problems related to water and hence affect the range of solutions considered. Second, the use of these discourses influences the policymaking process, as they provide the context in which alternatives are evaluated and chosen. Third, both the creation and use of such discourses can reveal the power relations between actors of the basin (Brethaut and et al,2021:3-4).

3.Research Methodology

The current research adopted a descriptive-analytical approach. For the purpose of data collection, library and interview sources were used as follows. First, the factors impacting hydropolitical relations were explained through library studies. In the second step, after coding the data, 12 main factors and 61 secondary factors were extracted. In third step, the pairwise comparison matrix was designed in the form of a questionnaire, and using

the process of hierarchical analysis, the relative importance of each of the 12 main factors and 61 secondary factors was measured in comparison with each other. This comparison was made to measure the impact of each of the 12 main factors on hydropolitical relations and 61 secondary factors on main factors. The inconsistency index of the pairwise comparison matrixes of the Analytical hierarchy process is less than 0.1, which indicates their reliability.

4.Research Findings

4-1.Climate (0.192)

Peace and security are threatened by the dry climate and water shortage (Mujtahadzadeh,2006:15). Global warming affects the water cycle fluctuations and causes intense rainfall, which subsequently becomes unavailable in the form of floods. Climate change effects on the river flow originate from changes in volume, timing, and precipitation form. Globally, the annual precipitation variations and the incidents caused by these variations cause changes in hydropolitical relations.

4-1-1.Precipitation level (0.521)

The total level of precipitation, particularly its spatial and temporal variations, shows the lack of distribution and universal access to water. Seasonal and annual changes in precipitation are one of the most important aspects of hydroclimatology because of the determination of other hydrological parameters (Stahl,2005:5).

4-1-2.Being in the path of Air Currents (0.275)

Precipitation is one of the hydrological cycle's three major processes. Water evaporates, rises as vapour, forms clouds, moves in the atmosphere, and then returns to Earth as precipitation (britannica.com). Precipitation plays a crucial role in studying drought and wet periods. It has a direct relationship with the systems entering the TBBs (Transboundary Basins), as well as moisture sources that inject moisture into these systems (Lashgari and et al, 2013:57).

4-1-3.Evaporation Rate (0.203)

High evaporation increases agricultural water consumption. In France and Egypt, respectively 530 and 1100 litres of water are required to produce one kilogram of corn. The different evaporation rate is the main cause (Horlemann and Neubert,2007:18). In Iran, approximately 70% of the total

precipitation, returns to the atmosphere in the form of evaporation (Hafeznia,2002:83).

4-2.Natural Geography (0.141)

In arid regions, the main problem is water flow disruption in upstream. This situation turns water into international politics and the United Nations General Assembly as one of the human issues and challenges (Abdi and Mokhtari,2005:2). Physical geography determines the context of the political interaction. A thorough understanding of this is a prerequisite for political analysis (Jones,2003:2).

4-2-1.The Location of Headwaters (0.278)

The location in hydropolitical complexes is the tangible and stable leverage. The upstream states can exercise this leverage by threatening to alter the water flow toward the downstream states (Kehl,2017:14). In this context, water shortage is non-significant in comparison with the topographical factor (Toset and et al,2000:971).

4-2-2.Share of the Basin Area in the Total Country Area (0.168)

The greater share in the downstream can indicate more reliance and less negotiation power. In case of risks in a basin, it will be most vulnerable, and if the conditions lead to stability and constructive cooperation, it will benefit more (Towfique and Espey,2002:12).

4-2-3. Direction of Water Flow (0.164)

Water crosses international boundaries. The acts of upstream states can impact the downstream states (Kavianirad and et al,2019:50). The primary concern regarding international rivers revolves around establishing borders between countries and managing the river's resources for irrigation, energy generation, and dam construction (Nami and Mohammadpour,2010:137).

4-2-4.River path Deviation (0.142)

The river shape changes can provide a conflict basis (Engelman and LeRoy,1993:18-21). Floods are transforming driver in waterways structure and riverbank ecosystems (Schewe and et al,2014:10). Climate changes and increased rainfall cause changes in rivers. Therefore, river borders cause states' sensitivity over the Dispute Leading Changes in riverbeds (Solomon and Turton,2000:65).

4-2-5.Share of Countries in the Total basin Area (0.140)

A state which owns a limited surface area of the basin attempts to increase the amount of this control, and unlike a state which owns a large area of a basin under its control, it is less inclined to form formal measures, bilateral as well as multilateral treaties (Towfique and Espey,2002:13).

4-2-6.Country's Borders Features (0.108)

Confined topography limits access and neutralizes the shared river impact, and open access Areas provide interaction possibilities. The topography aggravates or reduces the other factors' influence. Once it allows for wide utilization, it is closely related to the well-being and security of the parties, so it presents the river as a communication facilitator. Hence, the topography significantly impacts river management efforts. In confined areas, water conflicts are improbable because of the physical barriers to water use, so conflict reduction measures seem unnecessary. On the other hand, the counterargument is true about open access areas where the river is completely accessible (Smedley and Rowntree,2012:6).

4-3.Water Resources Shortage (0.089)

Whenever renewable freshwater per capita falls short of a certain limit, water scarcity will be inevitable. Moreover, global climate change may lead to the redistribution or reduction of water resources and the intensification of storms and make it difficult to manage water resources (Sadeghi,2016:7).

4-3-1.Expansion of the Cities Located in the Basin (0.260)

Urbanization is expected to reach 70% of the world's population by 2050, posing threats to economic, social, and environmental well-being (Sheikh Azim and Razavian,2013:32). One noteworthy challenge is the availability of water in urban areas due to increasing demand caused by population growth (Nair and et al,2014:2). In such a situation, the required water should be provided from the outside located water resources (Lundqvist and et al, 2003:5).

4-3-2.Dependence on the Basin (0.198)

The state's dependence on inflows indicates its vulnerability to external forces, which escalates as demand rises. Additionally, regional tensions over shared water usage are intensifying, especially in areas experiencing water shortages (Sadeghi,2016:10).

4-3-3.Water Consumption amount in Agriculture (0.185)

High agricultural water consumption increases dependence, reduces bargaining power, and escalates competition for control over the basin, making it challenging to reach agreements. Developing agricultural economies, with their high consumption rates, have less bargaining power and are thus less willing to participate in treaties (Towfique and Espey, 2002:13).

4-3-4.Freshwater Reserves amount (0.180)

Freshwater reserves are limited and challenging to renew. Growing pressure on freshwater resources can lead to tensions within and between states. This increasing pressure will also impact local and international cooperative institutions (Michel,2009:2).

4-3-5.Population Changes in the Basin (0.177)

Population growth drives an escalation in demand, when it surpasses the renewable water resources limit of, gives rise to crises. In regions marked by enduring ethnic and political rivalries, water can act as a catalyst for conflicts (Brown and et al,1998). Population growth in arid and semi-arid regions intensifies tensions over shared water resources (Engelman and LeRoy,1993:18-21).

4-4.Water Management (0.089)

Effective water management requires the establishment of cooperation among political entities (Jones,2003:2). The political nature of managing shared waters is intricate due to its dependence on negotiations, control, exploitation, and allocation (Zeitoun and Mirumachi,2008:5).

4-4-1.Domestic Decisions of States in the Basin (0.205)

The internal measures of states in TBBs have a direct impact on the hydropolitical interests of other states. In 2013, Indian strategist Brahma Chellaney claimed that China's construction of massive dams and reservoirs along its borders aimed to manipulate the flow of major rivers, which are crucial for downstream states (Moore,2017:1).

4-4-2.Water Cost (0.184)

States prioritize the development of water resources to enhance their national economies, which involves generating energy, expanding irrigated agriculture for food and energy security, mitigating floods, and enhancing river navigation to exploit commercial opportunities (Hensengerth and et al,

2012:5). The management of shared waters necessitates investments and costs to ensure sufficient water for the benefit of national economies. The expenses incurred by states in international water projects can be a point of collaboration or disagreement.

4-4-3.Institutional Capacities (0.138)

Water resource policymaking and implementation can be subject to significant contention, and various governmental institutions and non-governmental parties seek to influence these policies through legal and institutional channels (Mollinga,2001:736). Signing agreements and establishing basin organizations are considered effective measures to enhance institutional capacity and mitigate water conflicts (Yoffe and et al, 2004). Treaties provide stability and predictability to the relationships between states (McCaffrey,2003:157). Basin resources managing institutions and organizations must be strong enough to balance the states conflicting interests in the allocation and exploitation of water (Petersen and et al,2017:6).

4-4-4.Water Allocation (0.106)

As water scarcity intensifies, an important issue arises in identifying the allocation of water resources based on factors such as usage, quality, quantity, timing, and location. This challenge becomes particularly critical in TBBs where the requirements of various user groups and states intersect. Nevertheless, the sustainable allocation of shared waters is necessary since 60% of the world's freshwater resources are shared waters. Well-designed, jointly agreed upon, adaptable, and effectively implemented transboundary water allocation arrangements can be advantageous for the participating States (UNEC,2021:5).

4-4-5.Segregating Drinking and Non-drinking Water (0.102)

Segregating the drinking and sanitary water network is costly, despite the fact that only a small fraction of purified water is used for drinking purposes. This expenditure becomes inefficient as the majority of the water is utilized for sanitary needs, which do not require the same level of adherence to physical, chemical, and biological standards. Implementing separate water consumption networks would lead to ultimately decrease overall production expenses (Emami and Shakeri,2015:3).

4-4-6.Dividing Manner of Internal Water Resources among Users (0.088)

Although cooperation on shared waters is generally expected, conflicts at the sub-national level over waterworks projects are rising as non-governmental actors and competing groups oppose each other and the central government (Grech-Madin and et al,2018:1). Insufficient water resource management at the national level causes conflicts that are usually resolved through legal or political processes. However, in weak governance situations, these conflicts can turn violent (Gehrig and Rogers,2009:4).

4-4-7.Excessive Groundwater Consumption (0.087)

As global reliance on groundwater grows, it brings new challenges in terms of ownership, usage, access, conservation, and development of these resources. Groundwater's invisibility sets it apart from surface waters, making it subject to various social, economic, institutional, legal, cultural, ethical, and political factors. The escalating exploitation of groundwater without considering aquifers' ecological capacity leads to tensions in these basins (Hayton and Utton,1998:668; Fereshtehpour and et al,2014:6).

4-5.Legal Considerations (0.085)

The absence of agreed-upon rules in shared waters law has led to conflicts. Upstream states assert complete sovereignty over the natural resources within their borders, including international rivers. Conversely, downstream states reject absolute sovereignty and prioritize limited territorial sovereignty concerning shared water resources. They argue that upstream states' utilization of transboundary river resources should not result in losses for downstream states (Rezaee Eskandari,2009:8).

4-5-1.Basin’s Historical Water Rights (0.590)

In arid or mixed regions, downstream states depend on rivers due to less precipitation. They claim "historical water rights" based on long-standing usage. Upstream states argue for absolute territorial sovereignty, like Ethiopia and Turkey, while downstream states like Iraq and Egypt emphasize historical rights (Sholi and et al,2015:125).

4-5-2.Lack of Basin Rules (0.410)

The lack of international rules for dividing water resources in transboundary basins increases the possibility of inter-state conflicts (Alizadeh,2003,34). On the contrary international water contracts like treaties and agreements

help reduce differences and conflicts among basin states (Wolf and et al, 2003,1).

4-6.Political Considerations (0.081)

Water has emerged as a significant factor in inter-state relations worldwide. International rivers serve as sites of conflict, disagreement, or cooperation (Dolatyar and Gray,2000:70). There are instances of both negative and positive effects of water on inter-state relations.

4-6-1.Bilateral and Multilateral Treaties (0.192)

Basin countries should be prepared to engage in interactive compromises (Elhance,1999:3). From 1820 to 2007, there have been 250 independent international treaties and 688 agreements signed concerning 113 transboundary basins, which cover nearly 70% of the world's transboundary basins. These treaties now prioritize water resource management, including frameworks, information sharing, dispute resolution mechanisms, and transboundary party participation (Giordano and et al,2013:17).

4-6-2.Territorial and Border Disputes (0.173)

Iran and Iraq have a long history of conflict over the 84 km river border known as the Shatt al-Arab. The 1975 Algerian agreement provided temporary relief by using the Thalweg line as border, but the situation changed with the Islamic Revolution in Iran, leading to war (Nayebpoor and BeitGhanem,2015:4).

4-6-3.Level of Inter-State Political Relations (0.156)

Interstate water cooperation is influenced by economic and political relations between countries. Common political views and strong economic ties enhance cooperation, while enmity or a reversal of these factors decrease the likelihood of cooperation (Beschorner and IISS,1992:15; Klare, 2001:108).

4-6-4.Inter-State Political Power Imbalance (0.142)

In transboundary basins, power imbalance hinders joint management and affects the legitimacy, complexity, and feasibility of international agreements on shared water use (Kehl,2017:2). This power disparity shapes states' ability to mobilize water control facilities (Daoudi,2008:3; Zeitoun and Mirumachi,2008:5). In cases of intra-basin power disparity, attitudes are

influenced by the water resources control strategy (Menga and Mirumachi, 2016:373).

4-6-5.Correlation Level of Subnational and International Interests (0.123)

During basin-related treaty negotiations, states face competitive pressure from internal regions, which can complicate the process. Internal groups' opposing international policies further increase conflict levels between subnational and international interests, making it more challenging to reach an agreement on shared waters (Towfique and Espey,2002:8).

4-6-6.Bilateral and Multilateral Trust-Building Measures (0.096)

Trust-building measures improve relations, soften parties' behaviour, signal positive intentions, and prevent crisis escalation. Mediators use these measures to reduce the likelihood of severe crises by fostering trust between parties. While they do not directly address the root causes of crises, trust-building measures create conditions for states to engage in basic negotiations and address those underlying issues. Therefore, trust-building measures serve as a pathway to negotiation, peace, and the resolution of states' strategic concerns (Mason and Siegfried,2013:57).

4-6-7.The Intervention of Foreign Powers (0.060)

Weak states, due to limited resources for maintaining balance, tend to align with transnational actors outside the hydropolitical complex (Kehl,2017:3). The power disparity within the basin allows foreign powers to enter through international organizations or third states. However, this presence, driven by the needs of weak riparian's, can have both positive and negative consequences.

4-6-8.Regional and International Organization's Cooperation (0.056)

Transnational organizations rely on soft power like bargaining and discourses due to their lack of territorial existence (Zinzani and Menga, 2017:6). Foreign support facilitates hydro diplomacy, incentivizing opposing states to cooperate on water issues (Priscoli,1994:8). Developing countries, lacking resources and expertise for large water projects, are encouraged to collaborate for shared benefits. International agencies invest in training water professionals to prevent conflicts (Sadoff et al,2017:10).

4-7.Environmental Factors (0.076)

Environmental threats directly and indirectly impact national security. Directly, states compete for scarce natural resources, while indirectly,

environmental changes create socio-political effects that contribute to inter-state conflicts (Homer-Dixon,1994:106-108).

4-7-1.Drought (0.323)

Drought exacerbates tensions within basins as upstream states seek to control the water flow and reduce it towards downstream regions. For example, Turkey's construction of the Keban dam on the Tigris and Euphrates rivers in 1974 coincided with a drought that caused damage and reduced water flow to Iraq and Syria (Kalpakian,2004:102).

4-7-2.The Crisis Internationalization (0.295)

The GOP project implemented by Turkey has negatively impacted the social and economic development of Syria and Iraq (Buchani and Fazeli,2013: 126). It has also led to a stray dust crisis in the region including Iran. The decrease in the Tigris and Euphrates water levels in Iraq will damage the environment and create an agricultural crisis affecting millions of people (Biswas and et al,1993:12; Sadeghi,2016:18).

4-7-3.Aquifers Exploitation (0.239)

Groundwater resources are affected by the constant need to meet growing demands, leading to the depletion of water ecosystems in states like Jordan (Mohsen,2007:6). There are a few frameworks that provide unified international rules for groundwater extraction management and shared groundwater resource conservation. This impacts more on water-poor states (Golovina,2018:4).

4-7-4.Water Quality (0.142)

Water resources are threatened by effluents from treatment plants and collection systems, which leads to environmental pollution (Mohsen,2007: 6). Currently, treatment plants are operating beyond their capacity, exacerbating the issue. This pollution affects downstream communities that depend on upstream water flow for agriculture and fishing (Vivekanandan and Nair,2009:2), resulting in poor water quality in those areas.

4-8.Economic Factors (0.068)

Water is a valuable resource with economic importance (Sadeghi,1997:1). It is renewable, recyclable, and widely available globally. To address the water problem, individuals must bear the cost of restoring water resources. Treating water as a commodity reduces conflicts among users (Zarghani and et al,2018:4).

4-8-1.Economic Requirement Level for Shared Water Per Country (0.232)

Water scarcity affects political, economic, and social stability. It disrupts agriculture, food security, industries like electricity production, employment, and public health (Kavianirad and et al.,2019:38). Water-dependent economies adopt a conservative strategy in negotiations for shared water management, leading to tensions and conflicts among basin states.

4-8-2.The Economic Value of Basin Resources (0.184)

Water resources provide various benefits, including direct exploitation of resources like fish and timber, as well as non-monetizable aspects such as aesthetic value, recreational opportunities, environmental functions like flood control and habitat preservation (Baumbach and et al,2013:11). Additionally, there are potential future benefits like discovering medicines and conserving water resources for future generations. Achieving a cooperative and fair division of water basins, accepted by all basin states, is considered just (Arjoon and et al,2016:1).

4-8-3.The Inter-State Trade Value (0.141)

Economically valuable water is an important variable in inter-state relations (Kehl,2017:15). States enter bilateral commercial agreements and treaties to increase the water trade profit and for this reason, upstream states form bilateral agreements in hydropolitical relations (Towfique and Espey,2002: 12).

4-8-4.Transported Virtual Water amount (0.125)

International virtual water exchanges have grown significantly, with agricultural products accounting for about 80% of these exchanges. The concept involves trading water-intensive products from water-rich states to others. Since 1990, there has been a doubling in the growth of agricultural products and virtual water trade following a price collapse (Horlemann and Neubert, 2007: 21).

4-8-5.The Cost of Alternative Means to Meet Water Needs (0.115)

The scarcity of alternative water resources has intensified inter-state competition for shared water resources, leading to political and sometimes military disputes. This has securitized the management of international shared waters and hydropolitical relations (Mian Abadi,2012:2). Utilizing

shared waters for agriculture and drinking is an irreplaceable necessity (lyob,2010:23).

4-8-6.Rivers as a path to High Seas (0.113)

Waterways are vital for riparian states, enabling international trades. Conflicts arise when downstream states limit upstream access to the high seas, as seen in past navigation disputes (Brochman and Gleditsch,2012:2). This lack of access fuelled tensions between Iran and Iraq, resulting in war (Sajjadpoor and Amiri Moghaddam,2009:4).

4-8-7.Desalination Cost (0.090)

Desalination methods are expensive and energy-intensive, especially when using fossil fuels or thermal power plants. These energy sources emit pollutants like NOx, SO2, and volatile compounds. Evaporation processes in desalination cause issues such as sedimentation and corrosion. Reverse osmosis and electro dialysis have limited application due to high costs. Membrane technologies and ion exchange resins are commonly used for water desalination (Massoudinejad and et al,2012:158). New technologies that boost freshwater production and lower desalination costs can enhance a state's position in water-related negotiations and alleviate political tensions.

4-9. Militarization (0.058)

Decreasing water resources and insufficient resources for supplying the world's population will result in military inter-state conflicts over water (Mahkouii,2016:7), in such contexts, the armies will play a decisive role (Kaviani Rad,2005:339).

4-9-1.Performing as a Border by the River (0.297)

Rivers have historically been a site of political exchange and conflict, with nations fighting over their benefits. This has made river borders a national concern. Interactions over international rivers can range from cooperation to conflict (Zarghani and et al,2018:9). Tensions in river borders arise from pollution, resource depletion, water scarcity, unfair distribution, and natural disasters (Spector,2001:207).

4-9-2.Being the Headwater and River path in Unstable Areas (0.257)

Water head or river path conflicts can disrupt agreements and cooperation, leading to failures. An example is the Okavango River basin, which flows primarily through Angola. The country experienced a civil war from 1975 to

2002, resulting in a significant number of internally displaced refugees (Meissner,2000:118).

4-9-3.Inter-State Military Imbalance (0.255)

There is more conflict possibility in basins where the balance of power is in favor of downstream states. A powerful upstream can take action at will, due to its military superiority and ignore the downstream claims and requests. If the upstream state's actions threaten the reserves and water supply, the downstream state should refrain from acting on explicit requests and claims as well as must stop military support of these requests. Otherwise, a powerful downstream will have the necessary tools to exert pressure and support the claims against the upstream (Hensel and Brochmann, 2008:10).

4-9-4.Military Forces Mobilization in the Basin's Common Borders (0.191)

The military mobilization on international borders indicates instability and tension, hindering negotiations and cooperation among states. Egypt and Sudan conducted military exercises in response to disputes over Ethiopia's construction of the Renaissance Dam near the Sudanese border. These exercises followed failed tripartite negotiations, with the Nile Eagles 2 exercise occurring after Egyptian President El-Sisi emphasized Egypt's water sovereignty (csr.ir).

4-10.Security (0.049)

Environmental destruction and resource depletion can lead to social, economic, and political instability, as well as civil and military conflicts (Dinar,2002:5). Water security is crucial for national security and foreign policy, making the water crisis a transnational issue with regional and even trans regional implications (Pishgah Hadian,2003:14).

4-10-1.River-Dependent Population Number (0.391)

Over 40% of the world's population depends on international rivers. In Turkmenistan, this reliance is at 100%, while in Egypt it is 97%, the Netherlands 89%, Pakistan 80%, Sudan 77%, and Iraq 66% (Swain,2001: 10). The presence of shared basins worsens the problem, with over 50% of the Middle East population living in these areas. This often leads to competition and conflicts as countries try to maximize their use of these resources (Mokhtari Hashi and Ghaderi Hajat,2008:24).

4-10-2.Understanding River as a Strategic Factor (0.322)

In hydropolitics, water is power, and water scarcity is a strategic problem that impacts the nations' socioeconomic development, and thus is a political power weakness determinant factor (Chenari and et al,2017:45). Iraq's main hydropolitical threat is extraterritorial originates of the Tigris and Euphrates rivers (Bigdeli,2007:45). Turkish Atatürk and Syrian Al-Thura Dams construction have created national security issues for Iraq. The Tigris and Euphrates geostrategic rivers control has enabled Syria and Turkey to significantly impose their views on Iraq (Sadeghi,1997:200).

4-10-3.Renewable Water per Capita (0.287)

Water scarcity is a growing concern due to decreasing availability and contamination (Chenari and et al,2017:45). The global average of available water per person, currently around 7,000 cubic meters, is declining annually (Boberg,2005:15). States with a per capita availability of 500-1000 cubic meters face chronic water shortages, while those below this range experience continuous or periodic water scarcity (Falkenmark and Widstrand,1989). By 2025, the number of states facing water scarcity is expected to increase to between 46 and 52, affecting an estimated population of 1 to 3 billion people over the next three decades (Engelman and LeRoy,1993:24-25).

4-11. Cultural Impact (0.042)

when there are inter-state similar political views or extensive economic, commercial, and cultural relations, the cultural factor will provide the basis for cooperation and agreement. However, when the scenario reverses or riparian states have hostile history, this factor leads to political distrust, which reduces cooperation and agreement possibility (Zarghani and et al, 2018:3).

4-11-1.The Existence of a Negotiation Culture over the Shared Water Division (0.269)

States usually do a cost-benefit analysis on tension or cooperation. The success chance of water-related violence is very limited and high cost. Entering conflicts, in case of an attack on the dams and riparian industries, is equal to greater vulnerability (Mokhtari Hashi and Kaviani Rad,2019:23).

4-11-2.Intra-Basin Upstream-Downstream Culture (0.225)

Disputes over international rivers arise from excessive use and water pollution, leading to reduced water quality (Bourbour and Abbasi,

2020,136). Four exploitation scenarios emerge based on users' culture: 1. win-win "Mutual balanced exploitation and benefit" for basin states, 2. absolute "loser upstream-winner downstream" where upstream is balanced but downstream uses excessive, 3. absolute "winner upstream-loser downstream" where downstream is balanced but upstream exploits excessively, and 4. "lose-lose" situation with excessive exploitation by both states (Labbaf Khaneiki and et al,2019:4).

4-11-3.Shared Exploitation Culture (0.140)

In 1968, Hardin proposed the "Common Resources Tragedy" theory. It highlights users' attitudes towards common resources, where maximizing benefits without considering their limited nature can lead to tragedy (Hardin,1968:3). The culture of shared water exploitation emphasizes the importance of users' responsible exploitation for the sustainability of shared waters.

4-11-4.Cultural Similarities and Differences (0.130)

Political tensions in West Asia and North Africa are heightened due to water scarcity and its uneven distribution. The conflict over water resources between Turkey, Syria, and Iraq in the Tigris and Euphrates rivers is a prominent example. The presence of diverse ethnic groups in these countries and their governments' efforts to ensure food security by providing more water for agriculture contribute to this tension (korkutan, 2001; Zawahri, 2006). Cultural misunderstandings further complicate negotiations, leading to misunderstandings and a lack of agreements (Bashir and et al,2014:11).

4-11-5.Water Consumption Culturalisation (0.119)

Understanding water consumption behaviour is crucial for effective water demand management (Jorgensen and et al,2009). To develop sustainable resource management strategies and promote a sustainable lifestyle, it is necessary to consider cultural factors and daily life experiences (Allon and Sofoulis,2006:46). Different cultures have distinct habits, and water usage patterns, leading to the formation of behavioural groups. Water consumption culture relies on three key components: 1. raising environmental awareness in communities, 2. involving diverse groups in decision-making processes, and 3. implementing resilience in daily habits of behavioural groups.

4-11-6.The Cater Consumption Cominant Culture (0.117)

Approximately 80 million people are added to the world population annually, increasing water consumption. In many states, the average daily

water per capita is around 300 litres. However, hidden water consumption per person is about 6000 litres per day (Mokhtari Hashi and Ghaderi Hajat, 2008:46). Water consumption culture mainly affects daily usage and has limited impact elsewhere.

4-12.Technological Impact (0.028)

While technology can enhance our capacity to address water needs and safeguard resources, it also amplifies the potential for human-driven destruction, overuse, and instability. The impact of technology on well-digging and groundwater extraction cannot be ignored, as it has led to excessive resource exploitation, land subsidence, and aquifer deepening.

4-12-1.The Technology Penetration Rate in the Basin (0.215)

The technology penetration rate means the extent of basin stability or instability (Harshadeep and Young,2020). If the higher rate promotes basin sustainability, it plays a constructive role. Water conservation technologies aim to achieve:

- Sustainability: ensuring future water access without harming the environment.
- Energy-efficient water pumping.
- Encouraging water-saving habits and reducing the need for water.
- Decreasing water consumption per area through appropriate cultivation methods (Sabouri and Emamzadeh,2015:634).

4-12-2. Inter-State Scientific Gap and Technical Distrust (0.200)

The efficiency of transboundary water arrangements depends on accurate and available information (Qaddumi,2008:7). Cooperation levels range from sharing information to investing in infrastructure projects. However, information sharing can be a challenge, as upstream states often use it as leverage in negotiations. Bilateral political relations play a role in information sharing or withholding. To ensure valid hydrological data, cooperation in information production and sharing is necessary. This will aid in establishing early warning systems and flood management (Kurian, 2004:8).

4-12-3. The Energy Production in the Basin (0.191)

Shared water resources can promote inter-state economic and political participation, reducing conflicts. The Chukha joint hydroelectric dam between India and Bhutan exemplifies cooperative exploitation of border

rivers. Initially constructed at 336 MW with 60% financial aid and 40% Indian loan, ongoing cooperation increased its capacity to 370 MW. This success led to the construction of Chukha 2 (1020 MW) and Chukha 3 (900 MW), generating over $100 million in annual income for Bhutan through electricity sales to India (Biswas,2011:20). Conversely, the threat to energy production can jeopardize peace, as seen in the tension between Iraq and Syria in 1975. Iraq threatened to bomb the Al-Thura dam due to decreased Euphrates River flow and subsequent reduction in electricity production (korkutan,2001:16).

4-12-4. Dam Construction Industrial Capacity (0.138)

Dams and water infrastructure can cause transboundary water conflicts (Gleick and Heberger,2013:5). Large dams built without downstream agreements create hydropolitical tensions (Wolf and et al,2003:10). The Ethiopian government's construction of the Renaissance Dam in the Nile basin led to protests from Egyptian politicians (Gebreluel,2014:7). However, benefit-sharing dams among riparian states can promote cooperation (Gryzbowski and et al,2009:14).

4-12-5.The Inter-State Technology Transfer (0.130)

Accurate information, reliable data, energy, infrastructure, and access to water conservation technologies have a high value in areas facing water shortages. Information and technology can be withheld or transferred in order to influence the results of the inter-state water negotiations (Kehl, 2017:15).

4-12-6.Water Desalination Amount (0.127)

Desalination is a viable option for meeting household water needs in oil-rich states and high-traffic islands. Advanced technologies have made desalination more affordable, but it cannot quickly solve the agricultural water reserves problem (Mohsen,2007:11). According to the IDA, 150 countries produced 86.8 million cubic meters of fresh water through desalination in 2015, serving 300 million people. Daily production of desalinated water by factories is 85,000 tons, with half of the factories located in the Middle East (International Desalination Association,2017).

5.Analysis and Discussion

Hydropolitics emerges from the intertwining of water and politics. The complex nature of hydropolitical relations, influenced by various factors and encompassing multiple discourses and scales, necessitates the definition, and measurement of the relative importance of factors. This is crucial to bridge the theoretical gap and address the analytical shortcomings in understanding hydropolitical relations. The outcome of this process reveals that hydropolitical relations are impacted by 12 broad categories of macro factors and 61 specific cases of micro factors. These factors are ranked based on their relative importance, as measured by the AHP method. Notably, climate and geography, as fixed infrastructure factors, exert the greatest influence on hydropolitical relations. Given the prevailing climatic trends, it is reasonable to expect an increasing impact of these factors in the future. While water shortage and water management are equally important, their significance extends beyond mere equality. It can be interpreted as highlighting the importance of effective water resources management. Both water shortage and inefficient water management can negatively affect hydropolitical relations, underscoring the need for improved management practices. The legal factor serves as a foundational element in conflicts and cooperation related to transboundary waters, warranting increased attention. The political factor plays a pivotal role in shaping how actors interact in hydropolitical contexts, actively influencing the creation of cooperative or confrontational scenarios. Among the human factors, it occupies a central position and assumes a multifaceted role. The environmental factor is expected to ascend in importance within this hierarchy due to climate trends. The economic dependence of countries on available water resources underlies the injection of stability or instability into hydropolitical complexes. Ultimately, the cooperative or confrontational future of hydropolitical scenarios will be determined by the growing significance of military and security factors compared to cultural and technological factors. While military and security factors tend to lead to conflict, culture and technology factors tend to foster cooperation.

Hydropolitical Relations							
1- Climate (0.192)							
1-1 Precipitation level (0.521)		1-2 Being in the path of air currents (0.275)			1-3 Evaporation rate (0.203)		
2- Natural Geography (0.141)							
2-1 The location of headwaters (0.278)	2-2 Share of the basin area in the total country area (0.168)	2-3 Direction of water flow (0.164)	2-4 River Path deviation (0.142)		2-5 Share of countries in the total basin area (0.140)		2-6 country's Borders features (0.108)
3- Water Resources Shortage (0.089)							
3-1 Expansion of the cities located in the basin (0.260)	3-2 Dependence on the basin (0.198)	3-3 Water consumption amount in agriculture (0.185)		3-4 freshwater reserves amount (0.180)			3-5 population changes in the basin (0.177)
4- Water Management (0.089)							
4-1 Domestic decisions of states in the basin (0.210)	4-2 Water cost (0.184)	4-3 Institutional capacities(0.143)	4-4 Water allocation (0.106)	4-5 Segregating drinking and non-drinking water (0.102)		4-6 dividing manner of internal water resources among users (0.088)	4-7 Excessive groundwater consumption (0.087)
5- Legal Considerations (0.085)							
5-1 Basin's Historical water rights (0.590)			5-2 Lack of basin rules(0.410)				
6- Political Considerations (0.081)							
6-1 Bilateral and multilateral treaties (0.192)	6-2 Territorial and border disputes (0.173)	6-3 level of inter-state political relations (0.156)	6-4 Inter-state political power Imbalance (0.142)	6-5Correlation level of subnational and international interests (0.123)	6-6 bilateral and multilateral trust-building measures (0.096)	6-7 The intervention of foreign powers (0.060)	6-8 Regional and international organization's cooperation (0.056)
7- Environmental Factors (0.076)							
7-1 Drought (0.323)		7-2 The crisis internationalization		7-3 Aquifers Exploitation(0.239)			7-4 Water quality (0.142)

		(0.295)				
8- Economic Factors (0.068)						
8-1 Economic requirement level for shared water per country (0.232)	8-2 The economic value of basin resources (0.184)	8-3 The inter-state trade value (0.141)	8-4 Transported virtual water amount (0.125)	8-5 The cost of alternative means to meet water needs (0.115)	8-6 Rivers as a path to High seas (0.113)	8-7 desalination cost (0.090)
9- Militarization (0.058)						
9-1 Performing as a border by the river (0.297)		9-2 Being the headwater and river path in the unstable areas (0.257)		9-3 Inter-state military imbalance (0.255)	9-4 Military forces mobilization in the basin's common borders (0.191)	
10- Security (0.049)						
10-1 River-dependent population number (0.391)		10-2 Understanding river as a strategic factor (0.322)		10-3 Renewable water per capita (0.287)		
11- Cultural Impact (0.042)						
11-1 The existence of a negotiation culture over the shared water division(0.269)	11-2 Intra-basin upstream-downstream culture (0.225)	11-3 Shared exploitation culture (0.140)	11-4 Cultural similarities and differences (0.130)	11-5 Water consumption culturalization (0.119)	11-6 The water consumption dominant culture (0.117)	
12- Technological Impact (0.028)						
12-1 The technology penetration rate in the basin (0.215)	12-2 Inter-state scientific gap and technical Distrust (0.200)	12-3- The energy production in the basin (0.191)	12-4 Dam construction industrial capacity (0.138)	12-5The inter-state technology transfer (0.130)	12-6 Water desalination amount (0.127)	

6. Conclusion

The availability and quality of water resources in transboundary basins are affected by climate change, which can have important effects on the hydropolitical relations among the riparian states. They may have to deal with challenges or opportunities for cooperation, conflict, or adaptation, depending on their institutional, legal, and trust factors. Climate change can also increase the risk of water scarcity, competition, and disputes. The distribution and variability of water resources in a water basin are influenced by its physical features, such as its size, shape, elevation, water level, and biodiversity. These features also determine how likely the states that share the basin are to cooperate or conflict with each other. For example, states that are upstream may have more control over the water flow and quality, while states that are downstream may face more risks of water shortage and pollution. Water resources shortage happens when there is not enough water to satisfy the needs of the people, either for a short or long time. This can be caused by natural factors, such as droughts, or human factors, such as population growth, urbanization, industrialization, and agriculture. Water resources shortage can increase the stress and rivalry among water users, both within and across borders, and threaten the rights, health, and lives of millions of people.

The hydropolitical relations can be improved by managing water resources well. This involves cooperating, communicating, and trusting each other, as well as addressing the problems and possibilities that climate change creates. Legal factors can help the riparian states to cooperate, resolve disputes, and share benefits, as well as to protect the environment and human rights. But legal factors can also cause conflict, especially when they are unclear, incomplete, outdated, or violated. The parties' power, positions, and plans, as well as their level of cooperation or conflict, can be shaped by political factors. Political factors can also be influenced by factors inside and outside the countries, such as public opinion, media, elections, ideologies, alliances, and geopolitics. The quantity and quality of water resources, and the health and well-being of the people and the environment, can be harmed by environmental factors. Environmental factors can also make it harder or easier for the riparian states to cooperate, depending on their awareness, commitment, and capacity to address them.

The allocation and efficiency of water resources, as well as their distribution and equity, can be shaped by economic factors. Economic factors can also

affect the reasons for the riparian states to cooperate or fight, depending on their development, integration, and interdependence. The use or threat of force by the riparian states can worsen the tension and aggression among them, as well as threaten the security and stability of the region and the world. The use or threat of force can also serve to maintain peace and help people, such as by monitoring, protecting, and providing water resources to those in need. Security factors are the risks and threats that affect the water resources and the people who depend on them, such as terrorism, sabotage, cyberattacks, and disasters. These factors can weaken the safety and reliability of water resources, as well as the resilience and adaptation of the water users.

Security factors can also require cooperation and coordination among the riparian states, as well as the involvement of regional and international actors, to prevent and respond to them. The parties' choices, goals, and hopes, as well as how they communicate and understand each other, can be shaped by cultural factors. Cultural factors can also bring diversity and richness, as well as conflict and misunderstanding, to the hydropolitical relations. The use and management of water resources can be enhanced by technological factors, such as tools and innovations. Technological factors can also make it harder or easier for the riparian states to cooperate or fight, depending on their availability, accessibility, and affordability.

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