“Characteristics and features of Kazakhstan’s water security policy”

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CHARACTERISTICS AND FEATURES OF KAZAKHSTAN'S WATER SECURITY POLICY

Abstract

Amidst the complex geopolitical dynamics of Central Asia, Kazakhstan grapples with urgent water security issues exacerbated by climate change, underscoring the critical need to examine this issue within the context of regional security. Therefore, this study seeks to comprehensively analyze Kazakhstan's water security policy, examining its various elements and components at national and regional levels. Using system analysis and statistical techniques, data were collected from an array of sources, including strategies, development plans, statistical reports, analytical articles, methodological guidelines, and official government and international organization websites. The analysis revealed key challenges in Kazakhstan's water security, including deteriorating infrastructure, outdated management practices, vulnerability to floods and low water levels, inadequate training, and regulatory deficiencies. A novel approach is offered by examining current trends in Kazakhstan's water security domain, which involves scrutinizing the activities of relevant state bodies and analyzing regulatory frameworks amid rapid climate shifts. Additionally, the heightened potential for conflict across the continent was recognized. Despite earnest attempts to mitigate these challenges, the country confronts imminent water shortages exacerbated by heightened consumption and dwindling runoff from neighboring states. In light of these findings, policymakers and stakeholders are urged to devise robust policies and management strategies aimed at fortifying water security and addressing the underlying vulnerabilities in this critical domain.

Keywords water security, water resources, water management, regional cooperation, Kazakhstan

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INTRODUCTION

Water security is paramount for the balanced and prosperous development of any state. In the context of Central Asia, a region deeply intertwined with political, economic, and social connections, a cohesive approach to managing water resources on national and regional levels is imperative. In recent years, questions concerning this topic have been raised more and more frequently: climate change, which affects virtually all spheres and sectors of public administration and the economy of Kazakhstan, requires the immediate attention of the responsible authorities of the country.

The interrelation of water resources protection with such policy directions as food and energy security is clearly manifested in the rapidly changing world order, when the usual forms and systems of conducting domestic and foreign policy are collapsing, and new mechanisms and tools are just beginning to function. A prompt and effective response to emerging challenges in water security in Kazakhstan would enable the country to adapt successfully to a rapidly evolving world. Therefore, understanding the evolving challenges and strategies employed by Kazakhstan is essential for ensuring sustainable develop-

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ment and regional stability. Thus, investigating the characteristics and features of Kazakhstan's water security policy serves as a crucial step toward addressing these pressing issues and fostering informed decision-making in the region.

1. LITERATURE REVIEW

Water security is a critical concern for Kazakhstan, particularly given its geographical location and the interconnectedness of its water resources with regional and global dynamics. The literature surrounding water security in Kazakhstan has addressed various aspects of this complex issue, ranging from environmental degradation to policy frameworks and international cooperation. Some studies underscore the urgency of addressing water security challenges within the country. For example, Suleimenova (2020) highlighted the unique political circumstances in Central Asia following the collapse of the Soviet Union, which have spurred renewed security processes in the region, including those related to water security. Additionally, Oshakbaev et al. (2021) emphasized the national importance of water security in Kazakhstan, advocating for the monitoring of indicators to control the overall security situation.

The environmental degradation of the Aral Sea basin and its implications for the region's hydrological and ecological systems is another critical water security concern for Kazakhstan. Anchita et al. (2021) warn of catastrophic consequences lasting for centuries due to declining water levels. Furthermore, Brassett et al. (2023) emphasize the importance of international cooperation in addressing water security issues, highlighting the need for collaboration with countries beyond the region. Wegerich et al. (2015), who note its prominent place on the global agenda concerning river resources, also emphasize the international dimension of water security. Similarly, Karatayev et al. (2017) and Park et al. (2022) highlight the global nature of water-related challenges, including shortages, pollution, and environmental degradation, with significant implications for human development.

Several studies reported specific challenges such as land cultivation and transboundary reservoir pollution, highlighting the multifaceted nature of water security issues in Kazakhstan (Sembayeva et al., 2023; Amirgaliev et al., 2022). Additionally, the prioritization of water resources and security by regional countries post-independence reflects the broader significance of this issue (Duzdaban, 2021).

The issues of rational water use, equitable access to river sources, and uniform distribution of water flows along the bed of large rivers in the context of ensuring water security have been considered by many Central Asian and world researchers. The experts present the most effective conclusions from Kazakhstan, Uzbekistan, and other countries of the region. Thus, to assess the impact of economic activity on river runoff and changes in climatic conditions, a set of different methods should be used and appropriate techniques should be developed. According to Krzymowski (2021), this approach would allow for the most accurate and coordinated control of all processes regarding the dynamics of changes in the state's water resources, their growth and quality indicators, especially in the context of sustainable development goals. Hamidov et al. (2022) suggest that in socio-ecological systems, the management of natural resources can be characterized by compromises between sectors and sustainable development goals. They argue that successful and stable development of security policy, including in the field of water resources, is achievable only through the pursuit of solutions acceptable to all stakeholders.

Central Asia, characterized by its vast expanses of arid landscapes and isolated geographical features, experiences a harsh and unforgiving climate, presenting unique challenges to its inhabitants and ecosystems alike. There is a need for intensive management of water and other natural resources for the region to maintain its water-energy and food system in the future. The region's pollution problem, including Kazakhstan, remains severe, requiring immediate solution (Qi et al., 2020). Menga (2018) explained this by analyzing the activities of several oil refineries and companies that began operating back in the Soviet Union. The shallowing of the Ural-Caspian basin

created a serious problem, the key cause of which was, among other things, reckless pollution of the environment.

The causes of climate change, among various influences, are intricately linked to human activities, notably including the emission of greenhouse gases, deforestation, and industrial processes, all of which contribute to alterations in the global climate system. van Dijk (2019) believed that by controlling the processes of water intake and organization of water supply in Kazakhstan and monitoring the occurrence of ground and collector-drainage water levels, it is possible to monitor most of the negative aspects of the transformation of natural conditions and adequately respond to them using financial and economic instruments. de Boer et al. (2021) propose that the environmental challenges facing Southern Kazakhstan could impede the nation's complete engagement in the "One Belt, One Road" initiative in the foreseeable future. Additionally, Kosowska and Kosowski (2022) regard energy security as a fundamental component of safeguarding river resources and upholding equilibrium in the region's power dynamics.

In the realm of regional water resource management, collaboration between neighboring countries is crucial for ensuring sustainable development and environmental preservation. In the context of Kazakh-Uzbek cooperation concerning transboundary water resources, Asanov et al. (2017) suggest that fostering mutual understanding and peacefully resolving disputed issues between the two nations could yield positive outcomes for the entire region. Furthermore, Dharmaputra (2018) underscores the shared objective between Astana and Tashkent regarding the Aral Sea, despite their differences, emphasizing the joint commitment to mitigating environmental degradation and conserving the reservoir for future generations.

For instance, the Agreement between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, and the Government of the Republic of Uzbekistan on the Use of Water and Energy Resources of the Syr Darya River Basin defines the legal regime and features of equal management along the waterway by all parties of the document (CAWater-Info, 1998). The Decree of the Government of the Republic of Kazakhstan dated May 26, 2021, no. 344 "On Approval of the Main Directions of the State Policy of the Republic of Kazakhstan in the Field of Official Development Assistance for 2021-2025" emphasizes the development of a far-sighted policy for sustainable socio-economic development of the country (Adilet.Zan, 2021b). Similarly, the Order of the Minister of Ecology, Geology, and Natural Resources of the Republic of Kazakhstan dated June 9, 2021 No. 22974 "On Approval of the Rules for Organizing and Implementing the Process of Adaptation to Climate Change" outlines the state's strategy towards swift response to natural condition transformations and familiar forms of conducting agro-industrial and other types of activities (Adilet.Zan, 2021a).

The literature review underscores the critical importance of addressing water security challenges in Kazakhstan, particularly in the context of regional and global dynamics. The scholars have extensively documented the multifaceted nature of these challenges, ranging from the environmental degradation of the Aral Sea basin to the implications of climate change on water resources. However, there are gaps in understanding the comprehensive policy frameworks and their effectiveness in addressing the multifaceted challenges posed by water resource management. The existing literature often focuses on specific issues or regions within the broader context of water security, leaving room for a more comprehensive examination of Kazakhstan's water security policy at both national and regional levels. Thus, this study aims to fill this gap by comprehensively analyzing Kazakhstan's water security policy, shedding light on its elements, components, and implementation challenges to inform evidence-based decision-making and policy development.

2. METHODOLOGY

This study applied a system analysis and statistical techniques. First, system analysis was conducted to understand the general characteristics and key features of national strategies concerning water security in Central Asian countries, with a particular emphasis on analyzing the specifics of Kazakhstan's endeavors in this domain.

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Concurrently, statistical methods facilitated the analysis and categorization of significant quantitative and qualitative indicators related to water usage and supply, thereby illustrating the dynamic changes in the management of river resources in the region, notably in Kazakhstan.

In the preparation of this paper, a diverse range of information sources was consulted, including strategies and development plans for water resource management in Central Asian states, including Kazakhstan (CAWater-Info, 2013; Ministry of Agriculture, Water Resources, and Regional Development of the Kyrgyz Republic, 2021; Ministry of Ecology and Natural Resources of the Republic of Kazakhstan, 2020a, 2020b; Official information resource of the Prime Minister of the Republic of Kazakhstan, 2012); statistical reports (Horsman et al., 2018); analytical and critical articles (Anchita et al., 2021; van Dijk, 2019); methodological guidelines (Shibutov, 2017); and materials available on the official websites of government agencies and international organizations (KazAral, 2010).

To thoroughly investigate the issue of water security, particularly to analyze the activities of the responsible bodies of Kazakhstan in this area at national, regional, and international levels, several regulatory documents were selected, reviewed, and analyzed.

3. RESULTS

The findings underscore significant challenges in Kazakhstan's water security landscape, including deteriorating infrastructure, outdated management practices, and inadequate regulatory frameworks. Despite earnest attempts to mitigate these challenges, the country confronts imminent water shortages exacerbated by heightened consumption and dwindling runoff from neighboring states.

Effective water management is integral to the development and execution of national development strategies (Hamidov et al., 2022). The results show the Central Asian republics, including Kazakhstan, Uzbekistan, Tajikistan, Turkmenistan, and Kyrgyzstan, demonstrate a responsible approach to water security, given their location within the Aral Sea basin, which encompasses the Syr Darya and Amu Darya river basins (Ministry of Agriculture, Water Resources, and Regional Development of the Kyrgyz Republic, 2021). Notably, conflicts over access to river resources have intensified in this region (Oshakbaev et al., 2021). Instances such as the uneven distribution of river flows from the upper reaches underscore the urgency of addressing water-related issues promptly (CAWater-Info, 1998).

An analysis of the strategies of Kazakhstan, Uzbekistan, and neighboring states reveals a focus on short-term objectives rather than long-term planning (Lex.Uz, 2021; Zakeri et al., 2022). It is imperative to correctly interpret the concept of water security, which encompasses various factors such as the volume and accessibility of water resources, water quality, import/export dynamics, pollution, and infrastructure (Peña-Ramos et al., 2021). Achieving water security entails meeting consumer needs regardless of climatic, political, and economic fluctuations, utilizing both domestic reserves and those from neighboring basins.

According to Table 1, water resources in Central Asian countries as of 2022, provide key metrics such as total water resources, internal resources, dependence on external waters, and resources per capita. Table 1 highlights significant variations in water resource availability and dependence on external waters among the Central Asian countries, which can have implications for water management, development policies, and regional cooperation initiatives.

Kazakhstan's distinct characteristics, including its geographical location, climate conditions, and water management policies, exert a unique influence on the availability of water resources throughout the region. Since the onset of the 21st century, the economies of Central Asian nations, including Kazakhstan, have confronted challenges stemming from water scarcity, posing significant state-level concerns and security threats (Wegerich et al., 2015). As the first country in the region to embrace integrated water resources management aligned with United Nations (UN) standards, Kazakhstan stands poised to spearhead efforts in fostering transboundary water integration among all Central Asian nations (Amirgaliev et al., 2022).

Table 1. Water resources in Central Asian countries as of 2022

Source: Qin et al. (2022).

Metrics	Kazakhstan	Kyrgyzstan	Uzbekistan	Tajikistan	Turkmenistan
Resources, km³/year	100	48.6	53.6	64	26.3
Internal resources, km³/year	54	46	10	60	1
Dependence on external waters	46%	1%	81%	6%	96%
Resources per capita (m³/year per person)	5.29	8.5	1.55	6.64	4.16

Kazakhstan is the ninth country by area and has different climatic zones (Oshakbaev et al., 2021). The average annual precipitation is about 250 mm (315 mm – in the North, 150 mm – in the center, and about 880 mm in the mountains) (OECD, 2021). In 1991, Kazakhstan declared independence and, like other states in the region, experienced the collapse of the economic system and socio-economic upheavals (Sembayeva et al., 2023). Together with migration from rural areas to cities, this has created a strain on water supplies and infrastructure (Suleimenova, 2020). The complexity of water supply in the countries is a confusing problem due to the status of the Syr Darya and Amu Darya rivers, which are transboundary (CAWater-Info, 1998).

As a result of the analysis of various sources, the following main problems of Kazakhstan in the field of water security were identified: deterioration of infrastructure facilities, outdated management methods, weak protection from floods and low water, insufficient level of training, and imperfection of the regulatory framework. During the Recommendations of the Government Hour on the Topic "Water Security of Kazakhstan: Modern Challenges and Prospects for Their Solution" (Government of Kazakhstan, 2020), proposals were voiced to update the legislative framework of the sphere, accelerate scientific research in the line of modernization of water infrastructure, and other ideas were presented regarding the listed problems.

Kazakhstan's lack of river reserves concerns water for the population, agriculture, and industry (Park et al., 2022). The data analysis showed that in Kazakhstan, the shortage of clean water is due to the deterioration of infrastructure and the lack of innovation in constructing water supply systems. Water is supplied to remote settlements in limited quantities in tanks or in trucks (Ministry of Ecology and Natural Resources of the Republic of Kazakhstan, 2020). Water consumption in Kazakhstan will increase by 46% by 2040, and the shortage of water resources will be up to 12 m²/year; the deficit will occur due to a possible decrease in runoff from neighboring states (Menga, 2018). By 2050, the water shortage will increase threefold if measures are not taken to address this issue (de Boer et al., 2021). In 2020, the water level in the Syr Darya fell to a critical level (Zakeri et al., 2022). This brought serious problems to the lands of the republic along the riverbed – the lack of water volumes necessary for agriculture and the difficulty of access to sources (Suleimenova, 2020). By 2025, the country's authorities plan to provide 100% of the population with drinking water, but this goal remains elusive: as of today, 1543 villages do not have access to clean water due to outdated equipment and the lack of necessary tools to deliver drinking resources to consumers. In a number of villages, water pipelines are outdated; some of them were built 50 years ago (Central Asian Bureau for Analytical Reporting, 2022).

Among other things, about 70% of all development problems in Kazakhstan are caused by a shortage of fresh water (Barandun et al., 2020). However, the paradox is that the fully renewable water resources (surface and groundwater) of Kazakhstan are estimated at over 100 km³/year (water resources outside the country account for less than half of this volume) (Amirgaliev et al., 2022). Thus, the total renewable volume of water per capita per year is sufficient for the population. Consequently, Kazakhstan does not experience a water shortage in terms of total water supply per capita.

Table 2 shows the provision of water basins in Kazakhstan with various water resources. The table outlines the volumes of local resources, transboundary resources, underground resources, and other sources in each basin, as well as the total resource volumes for the entire country. It also pro-

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vides insight into the distribution of water resources across different basins in Kazakhstan, highlighting the reliance on both local and transboundary sources to meet the country's water needs.

Uneven distribution creates a shortage of water, especially in the southern regions (van Dijk, 2019). Okusheva, a leading expert at the Institute of Economic Research of Kazakhstan, stated that water resources amount to about 100 km³ (44% are formed outside the country – in China, Uzbekistan, and Kyrgyzstan); in terms of dependence on the inflow of transboundary rivers from the territory of neighboring countries, Kazakhstan is on par with Israel and Portugal (Kazinform, 2022a). The country is dependent on external water flows (in particular, from Tajikistan and Kyrgyzstan); therefore, the solution of freshwater issues from transboundary sources is extremely important for the country. Irrational use of resources in the agro-industrial sector creates a serious problem for the stability of the situation in the field of water security in Kazakhstan (Barandun et al., 2020). Climate change is exacerbating the consequences, which leads to a reduction in the availability of river water. The situation is of a multiple nature: the average annual air temperature increases; in winter, the number and duration of thaws increases, and the depth of soil freezing decreases, which leads to the release of meltwater into the soil instead of filling rivers (Kazinform, 2022b). A warm source causes water to evaporate and instead of flowing into reservoirs, enters the atmosphere (Dharmaputra, 2018).

The Kazakh authorities are actively working to solve these problems. Thus, during the Recommendations of the Government Hour on the Topic "Water Security of Kazakhstan: Modern Challenges and Prospects for their Solution" to reduce the threat of flood events, the introduction of new irrigated lands into circulation, the creation of new jobs, intentions were announced to build about 40 reservoirs (Government of Kazakhstan, 2020; Ministry of Ecology and Natural Resources of the Republic of Kazakhstan, 2020). At the end of 2021, the government headed by Prime Minister A. Smailov intensified the development of a national strategy to resolve the problems of irrational use of river resources. In particular, in November 2022, during a working meeting, it was decided in the summer of 2023 to begin the construction of reservoirs to collect and preserve floodwater for its reuse (Brassett et al., 2023).

Astana is addressing this issue by studying the most appropriate mechanisms and methods for extracting and preserving water resources. An additional incentive for the abovementioned processes was the situation of increased flood risk in the southern regions of Kazakhstan in early February 2023 – 255 settlements of the country, where over 700 thousand people live, were in the risk zone; a dangerous situation is developing in the Turkestan, Kyzylorda, Jambyl, and Almaty regions of Southern Kazakhstan, where there was a threat of overflow of the Shardara reservoir on the river Syr Darya, where, in addition to flood waters, water comes from the Toktogul reservoir in Kyrgyzstan. In addition, residents of settlements in the area of the Koksarai reservoir have been experiencing a shortage of water resources for several years in a row due to the decline in the volume of water entering the region (Kazakhstan Today, 2022).

Table 2. Provision of water basins of the Republic of Kazakhstan with surface waters

Source: Amirgaliev et al. (2022), Peña-Ramos et al. (2021), van Dijk (2019).

Basin	Local resources, km³/year	Transboundary resources, km³	Underground resources, km³	Other sources, km³	Resource volumes, km³
Aral-Syr Darya	3.4	14.6	0.2	3.2	21.4
Balkhash-Alakol	15.4	12.2	0.4	0.4	28.4
Yertis	25.9	7.8	0.2	0	33.9
Yesil	2.6	-	0.1	0	2.6
Zhaiyk-Caspiy	4.1	7.1	0.2	0.3	11.7
Nura-Sarysu	1.4	-	0.1	0	1.5
Tobol-Turgay	1.3	0.3	0	0	1.6
Shu-Talas	1.6	2.6	0.1	0	4.4
Total by Republic of Kazakhstan	55.7	44.7	1.2	3.9	105.6

At the end of the 20th century, Kazakhstan and Central Asia have experienced a colossal environmental crisis. The Aral Sea, the fourth largest lake in the world, dried up; the reason for this was the doubling of the area of irrigated agricultural land from 4.3 to 8.2 million hectares (Anchita et al., 2021). Due to the changed ecology, hundreds of thousands of km² were affected, on which more than a million people live (Dharmaputra, 2018). The Concept of Foreign Policy of the Republic of Kazakhstan for 2020–2030 solving the problems of the water and energy sector – the shortage of water sources – is the main task for the next decade. It is stated that the government will improve the regulatory framework with neighboring countries on using transboundary river sources. Notably, in the field of regional water cooperation, Kazakhstan focuses on cooperation with China (issues of transboundary waters), Japan and South Korea (supply of technologies and equipment) (Brassett et al., 2023). Interaction with Central Asian countries is not given much attention and effort on the part of Astana. Because of uneven policy in the region, conflicts and clashes periodically arise based on access to river sources (Asanov et al., 2017). However, a very positive example is regional cooperation in the Balkhash-Alakol basin, which has the most effective coordinating council for monitoring water resources in the region (Adilet.Zan, 2007).

In a National Address from the Head of State Kassym-Jomart Tokayev to the People of Kazakhstan, the President called the shortage of water resources "a serious barrier to the sustainable economic development of the country" and "a matter of national security" (Official website of the President of the Republic of Kazakhstan, 2022). The politician stated that the reduction in the external inflow of water is aggravated by its inefficient use, the deterioration of infrastructure, low level of automation and digitalization, lack of scientific support, and lack of personnel, and called for a plan to solve these problems (Kazinform, 2022b). One of the most important issues in the field of water security is the problem of the Aral Sea. Within the framework of the foreign policy concept, Kazakhstan announced its intentions to continue to cooperate with the international community, especially within the framework of the International Fund for Saving the Aral (IFAS). However, Kazakhstan did not plan to strengthen coordination on this issue with the states of the region, especially with Uzbekistan.

The program of measures to eliminate the consequences of the drying up of the Aral Sea and prevent the Aral Sea disaster was presented by Uzbekistan in early 2013 (CAWater-Info, 2013). During the meeting of the Second Committee of the 68th UN General Assembly, D. Khakimov, the official representative of Tashkent stated that the development and launch of facilities in the basins of the Amu Darya and Syr Darya rivers are dangerous for the ecology of the entire region. Kazakhstan supported this initiative; however, it continues to pursue a more active policy on this issue as a member of international organizations. In April 2022, a meeting of representatives of Kazakhstan and Uzbekistan was held, at which issues of the Aral Basin were discussed: strengthening cooperation between the two states to restore the Aral Sea, protect its ecosystem, and implement joint educational projects in the field of science and ecology (UNDP, 2022).

In the process of analyzing the existing problems in the field of water security in Kazakhstan, it can be stated that the probability of serious conflicts and armed clashes based on access to water or uneven use of river sources by different states of the region is not high (Krzymowski, 2021). If there are some problems with Kyrgyzstan and Uzbekistan and local disputes with Tajikistan, conflict issues are very successfully resolved through negotiations and the signing of bilateral agreements. In 2001, Kyrgyzstan adopted a law on water supply, according to which a mandatory fee for using river sources is introduced in the context of international cooperation. This statement alarmed the authorities of Kazakhstan and Uzbekistan. Moreover, there are protracted disputes between Astana and Tashkent regarding the violation of the previously signed agreement on the equal use of the Naryn-Syr Darya cascade of reservoirs (CAWater-Info, 1998). In 2004, the conflict broke out with renewed vigor when Bishkek, which is also a signatory to the agreement, began to claim a dominant role in resolving issues regarding the Syr Darya basin.

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Disputes over the transboundary rivers Chu and Talas are being resolved more successfully. Thus, in 2000, as a result of lengthy but successful negotiations (Kazakhstan insisted on starting a dialogue since there was a threat to its water security due to the start of construction of two hydroelectric power plants in the Kambar-Ata area on the initiative of Kyrgyzstan), a positive decision was made on the issues of joint use of water infrastructure in the border territories (Kabar, 2022). In May 2021, a Joint Protocol of Government Delegations on the Delimitation and Demarcation of the Kyrgyz-Tajik State Border was signed between Almaty and Tashkent, as well as peace agreements on Kambar-Ata and the Rogun hydroelectric power station (Cabinet of Ministers of the Kyrgyz Republic, 2021). It is worth noting that some protracted problems related to the use of river resources of rivers (water supply of villages along the Syr Darya riverbed) are regulated by acts of Soviet times, but Astana is taking part in the development of new regulatory documents, as this is required by the realities of the third millennium (CAWater-Info, 1998).

With the accumulation of problems in the field of water purification, access to river resources, and the emergence of hotbeds of conflict, the leadership of Kazakhstan began to develop special regulatory documents that would regulate certain vectors of activities related to water security. As of the beginning of 2023, management issues of river sources in Kazakhstan and several documents control the related areas.

The analysis revealed a growing trend in Kazakhstan towards an escalation of water-related challenges, particularly in regions downstream of rivers, which may exacerbate the water security crisis. The issue of irrational water usage across different regions of the country remains a significant concern. Nevertheless, there are promising developments at the governmental level, including the formulation of new regulatory frameworks and increased engagement in bilateral discussions. Given Kazakhstan's prominent economic and political position within Central Asia, it is plausible to anticipate that these challenges could be tackled in the near future. However, this outcome is contingent upon the sustained pursuit of proactive domestic policies and strategic foreign engagements by the country.

This study sheds light on the critical issue of water security in Kazakhstan, which has garnered considerable attention from both domestic and international researchers. Some researchers have notably focused on water management and the control of river resources, meticulously examining the specific characteristics of water policy stakeholders within the country. Additionally, insights from reports issued by official representations of international organizations and authorities in Kazakhstan have proven invaluable, providing clarity on certain contentious issues in the international relations of Central Asian states, particularly regarding cooperation in the management of transboundary rivers and river basins.

One of the key findings of this study is Kazakhstan's significant dependence on external river sources despite its abundant reserves of drinking water and water for industrial purposes. Park et al. (2022), who highlighted Kazakhstan's vulnerability due to its unfavorable geographical position in the lower reaches of these basins, have underscored this reliance on transboundary river basins. Issues such as water scarcity and pollution further compound the country's dependence on the water management practices of neighboring nations.

The collapse of the Soviet Union precipitated a host of unresolved issues, transforming them into significant challenges for many regions, particularly in Central Asia. Conflicts arising from disparities in river flow distribution and unequal access to drinking water have emerged as particularly acute issues, escalating notably since the turn of the 21st century. This assertion finds support in the work of Suleimenova (2020) who contends that a comprehensive examination of factors pertaining to water management, security, and development, along with their interconnectedness and ramifications, underscores the imperative of addressing water-related challenges through collaborative efforts involving national and regional stakeholders, as well as international organizations and alliances.

Furthermore, the importance of Kazakhstan's engagement with countries beyond the Central Asian region has been underscored. Brassett et al. (2023) echo this sentiment, highlighting Kazakhstan's recognition of the potential benefits of cooperation with China in joint initiatives like the One Belt, One Road initiative. However, exacerbating water-related issues, including the depletion and contamination of river sources and transboundary waters, compel Astana to approach bilateral cooperation with other states more cautiously, considering its own strategic imperatives.

The problem of shallowing of the Aral Sea is emphasized as the main unresolved issue in the region, which, in turn, aggravates other problems of ecology, geology, health protection. Dharmaputra (2018), comparing the strategies of Kazakhstan and Uzbekistan in relation to the Aral Sea, analyzed the problems of water security in Central Asia as a whole and found out that over the past decades, the situation has significantly worsened; the efforts of the governments of the two countries were scattered and disorganized, which led to disastrous consequences for all countries in the region.

Moreover, it has been stated that the root cause of catastrophic changes in the quality and quantity of water resources was the human factor – the activity of the local population, especially in agriculture and agricultural industry. Central Asia's water resources were exploited solely to boost cotton production in the region's central areas, with little consideration for the future sustainability of river sources. According to Duzdaban (2021), this approach is predicted to yield dire consequences for both health and ecology, thereby severely influencing water security. Nevertheless, at the same time, Duzdaban (2021) considered some medical programs, as well as the implementation of reforms to support a healthy lifestyle, sufficient measures to equalize the situation in the field of health protection of the local population.

Peña-Ramos et al. (2021) were convinced that all environmental problems in Kazakhstan are associated with insufficient provision of the population with high-quality drinking water and the agricultural sector with technical water. However, at the same time, they stated that even after solving all issues of water use (transportation, installation of equipment, cleaning), it will be impossible to completely get out of the crisis of water management due to Kazakhstan's strong dependence on the river resources of neighboring states.

The Ural-Caspian basin is the largest water source both for Kazakhstan and for other states of the region and beyond. The importance of maintaining clean and pristine river flows in the basin was highlighted in this paper and agreed upon by the international team (Amirgaliev et al., 2022), confirming the importance of these river sources for Central Asia, particularly for Kazakhstan. However, as a solution to the problem of water pollution, the findings, instead of an individual approach to the problem, propose to develop a single methodology for assessing and correcting the critical situation of the Ural-Caspian basin for all countries.

Renewable energy sources are indisputable new innovative solutions that are necessary both for the region as a whole and for Kazakhstan in particular. This idea was voiced based on considerations of the efficiency of the use of water flows and to gain greater independence in the process of solving issues of water use and access to clean drinking water. This was also the opinion of political scientists from Austria, Zakeri et al. (2022), calling renewable energy the solution of the near future, indicating a comprehensive approach as the answer to the problems of developing and using this type of energy as the best and most effective in the rapid transformation of climatic conditions.

After thoroughly reviewing the available scientific literature, it can be concluded that Kazakhstan is poised to take proactive measures to address future water security concerns. The findings from the study of potential solutions to Kazakhstan's most pressing water resource challenges indicate that Astana recognizes the gravity of the current situation amidst growing threats to the stability of water management. However, the specific actions and decisions of the state will ultimately hinge on various factors, including the intensity of climate change in the region and its repercussions for the country, the water management policies of neighboring states, and the overall global security landscape.

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CONCLUSION

This paper aims to comprehensively analyze Kazakhstan's water security policy, elucidating its elements, components, and implementation challenges to inform evidence-based decision-making and policy development. In the course of this study, were delved into the specifics and nuances of Kazakhstan's water management policy, summarizing both the positive and negative facets of its water security strategy at the national, regional, and international levels. The results showed that the issue of access to water resources emerges as particularly pressing in Kazakhstan due to its reliance on external sources, with the requisite volume of water for agricultural and population needs often met through imports from upstream countries along the riverbed. Despite grappling with challenges in water security activities, Astana has been actively striving to address them, evidenced by the adoption of several documents in recent years aimed at navigating through these complexities.

Moreover, the analysis revealed certain weaknesses in bilateral cooperation between Kazakhstan and other regional countries, including a deficient regulatory framework and a lack of clear mechanisms for monitoring ecological and hydrographic conditions in transboundary river basins. However, considering prevailing global legislative trends, strategic planning imperatives, and the imperative to develop recommendations amidst climate change, it is foreseeable that Astana's efforts to tackle water security issues will remain robustly proactive. To mitigate the risk of water use conflicts among Central Asian states, Kazakhstan is poised to bolster cooperation, particularly in the provision of resources for production, agriculture, and agro-industry.

Finally, the paper offers a novel approach by examining current trends in Kazakhstan's water security domain, which involves scrutinizing the activities of relevant state bodies and analyzing regulatory frameworks amid rapid climate shifts. Additionally, the heightened potential for conflict across the continent was recognized. Building on this groundwork for future research endeavors, is recommended a more detailed exploration of water utilization challenges within the context of sustainable development in Central Asian countries as a cohesive region. This entails giving due consideration to potential interstate conflicts and exploring avenues for resolving emerging contradictions and disagreements.

AUTHOR CONTRIBUTIONS

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