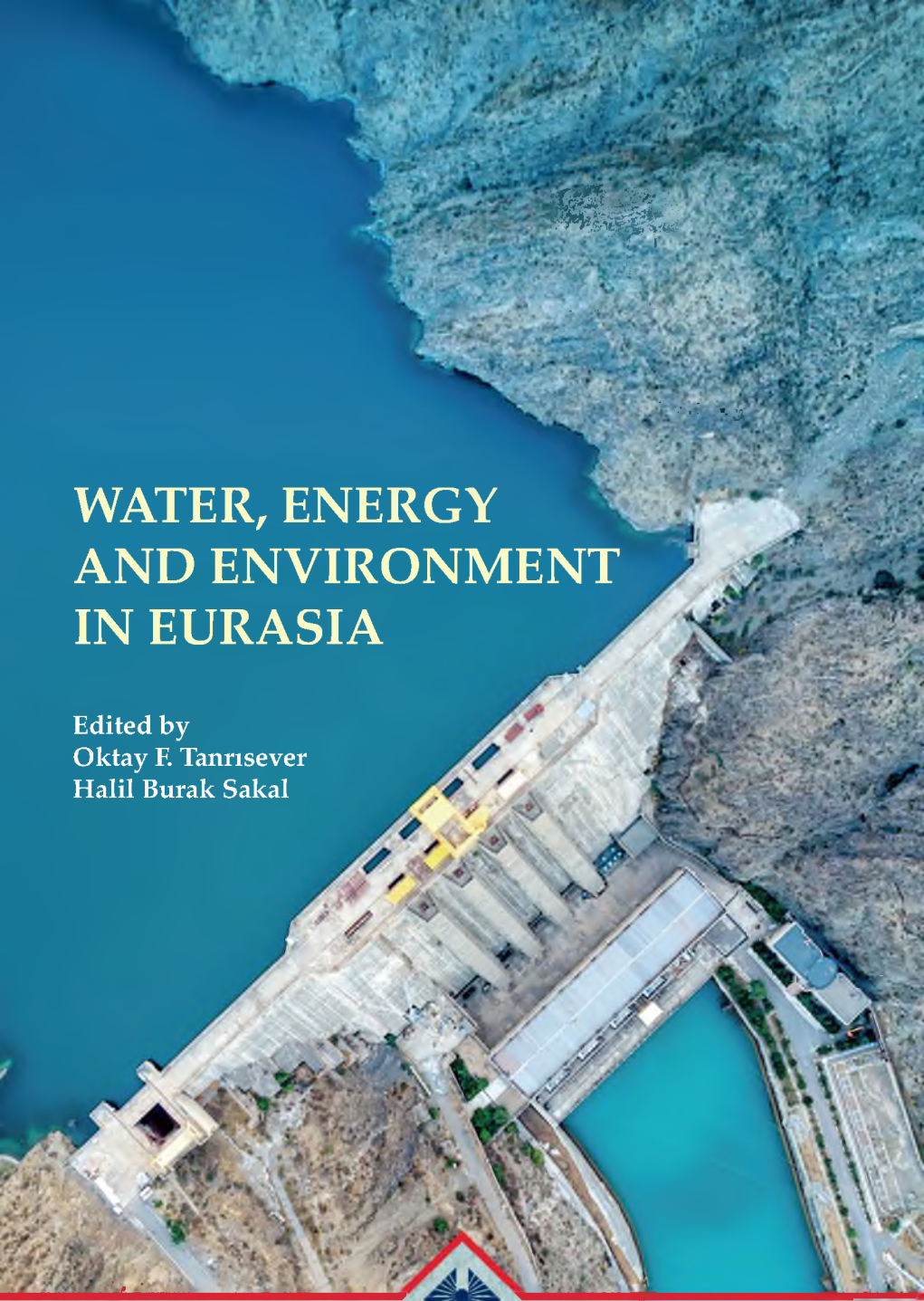
WATER, ENERGY AND ENVIRONMENT IN EURASIA

Edited by
Oktay F. Tanrısever
Halil Burak Sakal



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CAPPADOCIA
UNIVERSITY
PRESS
yayinevi@kapadokya.edu.tr
kapadokyayayinlari.kapadokya.edu.tr
+90-384-3535009
www.kapadokya.edu.tr

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Chapter 8

Harmonization of Water Quality Legislation in Shared Basins of Central Asia

Tais Reznikova, Shynar Sarikenova, Ruslan Melian

Introduction

Entering the 1990s, the newly independent countries of Central Asia on the whole retained the institutional systems for water resources management that had been developed under the Soviet Union. Since that time, they have continued to develop the legal frameworks for water resources management, including those related to water quality. The agreements "to cooperate in the field of environmental monitoring" and "in the field of hydrometeorology", signed in 1999 within the framework of the Commonwealth of Independent States (CIS), set the legal basis for the interactions of the countries of the region in the joint monitoring of water quality. These agreements aimed to provide the framework for the harmonization of national regulatory, technological and software systems, the regular exchange of information and the consolidation of resources for the implementation of joint programs, as well as other elements of cooperation. To date, however, most of these obligations have not yet been realized, or have been implemented only in part (OSCE, 2019).

Despite the general growing desire to collaborate in the regional management of water supply, each country in Central Asia continues to develop national approaches to the management

and governance of water based on their own interests. Tajikistan and Kyrgyzstan, as upstream countries, are less likely to suffer from water scarcity and water quality problems, and so these countries are more interested in the sustainability of the zones in which water runoff accumulates, the reduction of risks from industrial waste storage facilities, the prevention of mudflows and floods, breakthroughs of high mountain lakes, the development of hydropower and irrigated agriculture. Downstream countries such as Kazakhstan, Turkmenistan and Uzbekistan, in contrast, are experiencing a shortage of clean water, degradation of aquatic ecosystems, and the salinization and desertification of their lands (OSCE, 2019). Access to clean water is of utmost importance for these states, and this should be taken into account when analyzing the leading factors influencing cooperation in water quality issues in the region. The following problems can be drawn from the Soviet legacy and the current situation in the countries:

- The national water quality standardization systems often contain outdated regulations that ignore both the particularities of the current water resources and water use in the region, new monitoring technologies and technical facilities, and the more advanced water quality management practices applied in other regions of the world;
- The current standards are mainly focused on water quality parameters for a limited number of water uses, and overlook the need to set the requirements regarding acceptable environmental impact levels to ensure the sustainability of water ecosystems;
- A substantial proportion of the standards are not being implemented due to deficits in funding and limited human and technical capacities (Petrakov, 2010).

Nevertheless, the Central Asian countries are continuing to develop a national legal framework for water resources management: in Uzbekistan in 2013, the Law "On water and water consumption" was updated, while a new Water Code for the Republic of Tajikistan that takes into account the current trends and requirements was introduced and approved in April 2020. In Kyrgyzstan, plans are in place (as recommended) to introduce the expanded concept of the Integrated Water Resources Management (IWRM) principle into the Water Code, as well as the basin approach, related to the complex use and protection of surface, underground and return waters; to develop a unified water quality classification system for water objects; to elaborate standards for the maximum permissible harmful impacts on water objects, etc. Turkmenistan, on the other hand, developed a new Water Code in 2016 that includes interpretations of the IWRM and hydrographic principle (Melian et al., 2018). Finally, in 2018 Kazakhstan transited to the new Unified System of Classification of Water Quality in water bodies, which is based on the principles of the EU Water Framework Directive WFD 2000/60/EU (European Commission, 2000; Protocol of RWG meeting, November 2019).

The majority of water quality standards currently in use in Central Asia are based on the System of Surface Water Quality Specifications developed in the Soviet Union in the 1960s–1970s (Petrakov, 2010). The Central Asian countries make use of several different water classification approaches that have been developed based on different criteria. For example, all five Central Asian countries traditionally classify water bodies and their parts according to three categories of water use, each of which has special requirements for acceptable water quality indicators: fisheries; household and drinking water; and municipal supply (Petrakov, 2010). Specific water bodies, however, are not distinguished by these categories,

and often the same water body serves or is targeted to satisfy a large spectrum of water consumption (drinking and industrial water supply, irrigation, fishery and recreation and livestock watering, and also for the maintenance of the natural characteristics of the habitats of different water and semi-aquatic organisms, and as a whole for water and water-wetland ecosystems). It is not always clear, therefore, which standards should be applied in each case.

There are a few disadvantages of the system that could limit future cooperation in transboundary basins: 1) the maximum permissible concentrations have been defined based solely on scientific research, without taking into account the technical and economic feasibility or cost of the regulatory measures necessary to fulfill these requirements; 2) the standards have been developed based on a zero-risk concept for human health and aquatic organisms, and are therefore often unreachable for water users; 3) some of the maximum concentration parameters require immediate achievement; in other words, the time frames and the strategies to achieve them are not feasible; 4) the burden on all water users is related to the maximum concentrations, being based on the fishery standard, which makes it impossible for almost all bodies to achieve fishery status; 5) the maximum concentration system is rather difficult to control due to the presence of multiple parameters (OSCE, 2019).

Despite these indicated hurdles preventing the development of multilateral cooperation, there are some successful examples of bilateral cooperation in the region. Kazakhstan and Uzbekistan opened negotiations related to the monitoring of transboundary water quality on the Syrdarya River in 2018 when an Uzbek-Kazakh working group on transboundary water quality monitoring on Syrdarya River was officially established, supported by the governments of the two sides. Among the few regional initiatives existing in Central Asia is a

regional working group on water quality, established as an informal platform that brings together experts from all Central Asian countries. The platform was created within the framework of the UNECE and CAREC (2011) initiative on "Water quality in Central Asia", aimed at promoting the development of efficient and coordinated national policies related to the water quality aspects of integrated water resources management in Central Asia. Since 2018, the Regional working group on water quality in Central Asia has worked as per its mandate, supported by various regional projects. The Regional working group's mission, as mentioned in the mandate, is to come up with effective and coordinated water quality improvement policies for application at national, transboundary and regional levels, thus promoting integrated water resources management in the region (Regional Working Group Mandate, 2018).

The simultaneous use of different classifications, based on different principles and indicators within a region, or even within a country, complicates water quality management and the development of inter-state cooperation in the implementation of water protection activities on transboundary water bodies (Petrakov, 2010). Water quality experts from Central Asia have recognized the need to introduce a unified system for the assessment and classification of water quality, and to positively assess the experience of Kazakhstan in the transition to a new system of classes. During the last meeting of the Regional working group on water quality in Central Asia, held in Tashkent in November 2019, the working group members from the Republic of Kazakhstan presented their experiences in the transition to the new classification. The Regional Working Group members were highly interested in the implementation of such a unified classification approach in the shared basins in the future, using the experience of Kazakhstan as a starting point for the development of transboundary cooperation

(Protocol of the Regional Working Group meeting, 2019). During the meeting, experts from the working group agreed on the importance of transitioning to unified water quality standards for all Central Asian countries in the future (Interviews with experts from Kyrgyzstan, Tajikistan, Uzbekistan). However, the experts also highlighted the current barriers that would make such a transition challenging for the countries to implement soon. The main goal of the present study is to provide an overview and classification of the existing barriers, and to make some recommendations based on expert opinions and a review of literature.

Results

The review was based on data collected during a literature review of studies of water quality management in Central Asia, and on interviews conducted with water quality experts in CA countries. It was understood from a review of relevant scientific papers and publications that a lack of academic knowledge exists on the topic. Water quality management is of greater interest to international development organizations than national scientists in the region. A PESTELS analysis was used to categorize and assess the collected data, and this framework of political, economic, social, technological, environmental, legal and scientific factors helped in the classification of the main barriers in different areas.

Political barriers

In the context of the economic development of the Central Asian countries and population growth in the region, the distribution of the limited water resources between the countries and users within countries remains the most prominent problem on the political agendas of water sector agencies. The main objective of the ministries and committees related to water resources is,

still, to ensure the availability of water for agricultural, industrial and domestic use. After the dissolution of the Soviet Union, the underfunding of the environmental departments, the collapse of the infrastructure for the removal and treatment of wastewater, and the deterioration of waterworks and water conduits led to huge losses of water and the pollution of both the surface and underground waters (Petrakov, 2010). Today, the environmental agencies in the countries are required to ensure the control of water quality at a technical level, although their impact on water policy is limited due to the orientation of the economy toward the more urgent economic sectors to meet the requirements of the growing population for employment. For instance, the most water-polluting sectors, agricultural and industrial production, constitute large shares of the national economies in Central Asia. In Kyrgyzstan, as of 2019, the share of agriculture and industry in the gross domestic product was 39.7 percent (National Statistic Agency of Kyrgyzstan, 2020). These two sectors provide up to 53 percent of employment in the country (World Bank, 2004). One important constraint that hinders the development of a unified strategy for the measurement and improvement of water quality in the countries in question, therefore, is the fact that the environment and water departments often have fundamentally different goals. In all CA countries, aside from Turkmenistan, water committees are directly subordinate to the Ministries of Agriculture, which are the main water consumers (Petrakov, 2010). Thus, the development of a coordinated water quality assessment approach is not yet a priority of national governments.

The experts also confirm that currently, the main political barrier in the way of reforms to the management of water quality in the Central Asian countries is the lack of political will and the low political priority for environmental protection, which leads to a lack of funding and weak intersectoral

policy mechanisms. Environmental issues are thus left in the background of both the national and regional agenda (Interviews with the experts from Kyrgyzstan and Tajikistan). This not only hinders transboundary cooperation related to water quality, but also leads to the further country-wide deterioration of water quality and public health, particularly in rural areas. People living in irrigated areas use the untreated water from the irrigation canals as their primary source of drinking water, and the drainage water is used for further irrigation by downstream water users (Groll et al., 2013).

Another factor that limits the creation of a unified approach to water quality management in the shared basins is the lack of coordination in actions made at a regional level. As mentioned in one of our interviews, a supranational regional center or institution recognized by all CA countries could ensure a smooth transition to a unified assessment and classification approach in the transboundary basins (Interview with the international expert). This is well exemplified in Eastern European countries, where the common regional institutional framework has provided the necessary conditions for the "painless" transition to a unified approach in water quality management. Petrakov (2010) offers the example of the leading regional ecological organization – the International Fund for Saving the Aral Sea (IFAS) – to underline the eternal state of disagreement that exists between ecologists and water workers. IFAS comprises two commissions: one focused on the environment – the Interstate Commission for Sustainable Development (ICSD), and the other focused on water – the Interstate Commission for Water Coordination (ICWC) (Cawater.info, 2020). Even though these two regional organizations technically function under the umbrella of the Aral Fund, cooperation and coordination between them are practically zero.

It is noteworthy to touch upon the lack of institutional structures at national level and the lack of transboundary cooperation among the riparians in Central Asia on water quality. The functions and authorities related to water resources management, as well as the assurance of quality, have been assigned to different ministries and agencies. For instance, surface water resources management (including quality) is usually included within the responsibilities of the Ministries or Committees on water management and agriculture; while environmental matters are dealt with by ministries, committees and agencies involved in environmental protection; underground water management, on the other hand, is managed by a separate agency, as well as the sanitary and epidemiological situation (Melian et al., 2018); the quality of drinking water is under the mandate of the ministries of health, and technogenic accidents and extreme contaminations of water are usually addressed by the ministries of emergencies, the Cabinet of Ministers, and/or local authorities (Melian et al., 2018). This scattered system of management related to water quality is typical to all Central Asian countries, with slight variations. The monitoring of water quality is also carried out by different agencies by their programs that often are not coordinated in terms of the sampling sites, the analyzed parameters and the measurement frequency (Melian et al., 2018). Each agency usually applies its own standards and assessment systems, making the interpretation of data and calculations more complicated. Thus, another factor limiting a smooth transition to a new classification would be the coordination required to enact changes in all related agencies and at all levels (Interview with the expert from Tajikistan).

The expert from Kyrgyzstan highlighted that the main institutional barrier is the current national water management system, which is still based on an administrative-territorial

division, despite all legal efforts to apply a hydrographical principle. The transition to basin-wise management requires the development of comprehensive river basin management plans, containing detailed descriptions of how the target indicators on water quality for each water body in the basin will be achieved, including the ecological state, quantitative parameters, chemical state and established indicators (expert from Kyrgyzstan).

The political aspects of the transition to a unified methodology are considered as a potential driver rather than a constraint (interview with the international expert). The benefits from the common approaches to water quality assessment and management are perceived to be evident by the experts because common approaches and methodologies would eliminate the problem of different interpretations and classifications of data on transboundary water bodies. The development of a common approach would be possible only with support from the highest political level. In order to do this, the leaders of the Central Asian countries could be encouraged to include the issues of water quality management in the list of national priorities and regional agenda.

Economic barriers

Financial problems were identified as the main limiting factor by all of the interviewed experts, with "lack of budget" being mentioned in each category as a key barrier to any reforms (interviews with experts 1 and 2 from Kyrgyzstan; interview with the expert from Uzbekistan; interview with the expert from Tajikistan). There are major costs associated with the establishment of national working groups to review monitoring stations, with budgets required for meetings, round tables and expert consultations, as well as other related expenses. Also, additional budget is needed for the reconsideration/review processes of the main law and the secondary legislation. Resources

are needed for the development of new reporting forms and other documents for daily operations, as well as funding for legislative developments consistent with the innovations, and for the general needs of laboratories to increase their technical capacities (equipment, reagents, etc.).

That said, the review of literature and interviews with external experts have revealed alternative views from the economic perspective that suggest the economic aspects be seen as an opportunity rather than a barrier. In current national water quality management systems, all standards are based on fish, and so require the most stringently clean water. The new classification approach makes it possible to slightly soften the standards and to make the water quality targets for other water users more realistic and achievable (interview with the international expert). The quality of drinking water does not need to be as high as for fish, and even lower quality is required for irrigation. This does not mean that water quality should deteriorate after the introduction of the classes system, but it does provide more realistic conditions for the development of irrigation not tied to fish standards and norms (interview with the international expert). Thus, through the introduction of water classes, a certain amount of the economic burden will be removed from water users, for example, from farmers and industries whose discharge standards today are calculated based on concentrations for fisheries. Often, farmers and industries lack the capabilities and resources to comply with all the requirements and install water treatment systems that can produce the required standards. These are very expensive to purchase and usually costly to maintain, and so as a response, discharges are often made out without any treatment at all. By informing water users of the specific purposes of the water use in the specific section of the river the new system could provide certain economic exemptions for water users, allowing them to invest

an appropriate and affordable amount into water quality improvements in the basin.

In addition to the abovementioned economic incentives for the water users in the new system of classes, there is another motivation for the government. Paying for water pollution remains the main economic mechanism behind the improvement of water quality, and this includes reimbursements of costs for the maintenance and restoration of water sources, the operation of water facilities, water protection and protection from harmful environmental impacts (OSCE, 2019). The main economic mechanisms for the regulation of water quality include payment for wastewater discharge, payment for exceeding discharge standards, waste disposal fees, etc. A new classification system will make the application of these economic mechanisms more efficient, since it paints a more comprehensive picture of the current water class for each water user, and sets the achievable standards and targets with which to comply.

Social barriers

Social barriers are key factors to be considered by water quality managers in all Central Asian countries due to the historical process of water contamination and the poor (or lack of) wastewater treatment systems applied for industrial, agricultural and domestic water use. According to the experts from Kyrgyzstan, one of the main barriers is insufficient awareness of the population on issues of water quality and monitoring (interviews with experts 1 and 2 from Kyrgyzstan and the expert from Uzbekistan). Polluted water resources are responsible for the regular onset of infectious intestinal diseases (dysentery, hepatitis, cholera), and the consumption of products grown with contaminated water (herbicides, toxins, pesticides) in turn regularly lead to bodily dysfunctions, cancer and hereditary diseases (OSCE, 2019). The effect of poor water quality

on public health cannot thus be overstated in the region. More than 2 billion people in Central Asian nations suffer from water-related diseases. One particularly dangerous situation in the region has emerged in rural areas, where only one-third of the residents have access to safe water systems, and only 13 percent are connected to sewerage systems (Ivanov et al., 2017).

The presence of so many historical sources of water pollution and the prevalence of associated diseases in the population makes the transition to the new classification system a highly sensitive issue. It is necessary to understand that the introduction of water classes with different intended uses does not imply a deterioration in water quality standards and an associated negative impact on the population. One expert interviewed raised concerns related to public health. The residents can perceive the introduction of a new classification system as a threat to the public health and thus establish a potential barrier to the transition to a new and common system (interview with the international expert). Thus, full public support for the implementation of the new system will also support the smooth transition to a new system. This requires raising awareness among the general population, which is currently lacking. One of the goals of the new classification, as already noted, is to determine the purpose of use of each water body. This imposes certain water treatment requirements on local water users. The requirements are often more sparing if they are not tied to fishery standards, as in the case of the proposed class system. To understand the system and to gain the support of water users, informational support is needed, which is again perceived as a financial burden in countries (expert 2 from Kyrgyzstan and the expert from Tajikistan).

Weak public participation in policymaking is another significant barrier. Eco-education and level-up public awareness are necessary components in most environmental policy

implementation packages (OSCE, 2019). A society that is well-informed and educated on matters related to water quality creates a demand for open and accessible information about water quality. Currently, there is no such demand on a regular ubiquitous basis (Interview with the international expert).

The third and final barrier is slightly different in nature, but can be still attributed to the social category, and relates to the lack of professional cadres. There are two sides to this problem. The first relates to the lack of personnel and the aging of workers employed in the water sector, which is unattractive to the upcoming generation due to the low wages and social status and the poor working conditions. All this is detrimental to the introduction of innovations, especially those requiring little finance and more employee initiative (Alimbayeva, 2019). On the other side is the issue of the mindset of the water quality specialists, who often oppose any new approaches (interview with the international expert). If the new classification system is to be implemented, it should be made more understandable for all water users, as direct consumers of the information on water classes and the purpose of use. This demonstrates the importance of the awareness-raising component especially in the context of a region where integrated databases containing information on the quantity and quality of water are unavailable to the population and water users (OSCE, 2019).

Technological barriers

The low technical capacity of the water quality-related agencies, and particularly laboratories, is a serious problem in the Central Asian region that causes a deterioration of water quality monitoring systems (Petrakov, 2010). Since the collapse of the Soviet Union, the technical condition of the hydrological and hydrochemical monitoring network on transboundary rivers has declined significantly. The lack of a unified system for

the monitoring of water quality in the region also prevents the reliable assessment of pollution in the transboundary watercourses (Petrakov, 2010).

It is important to understand that various agencies are involved in water quality monitoring in Central Asian countries. The registration of qualitative and quantitative parameters of surface and underground water resources is the responsibility of hydrometeorology and hydrogeology bodies (Melian et al., 2018); the control of the quality indexes of the aquatic medium and pollution sources is carried out by the environmental protection authorities; and health agencies are responsible for the drinking water supply sources, in coordination with local authorities and water services companies; river authorities control the quality of irrigation and drainage waters. In this regard, the proper monitoring of water quality requires not only the coordination of all the relevant state bodies, but also the full technical equipping of each one. This necessitates appropriate financing to address the problem of the lack of laboratories, and the obsolete equipment and technical base of the existing laboratories. Thus, the lack of funding can result in a reduction in the number of water quality parameters for regular control, shortening the periodicity of samples collection, as well as a reduction in the number of hydrometric and hydro-chemical posts and the number of section lines of the water body being controlled (Melian et al., 2018).

All of the interviewed experts identified the lack of technical capacity in water quality institutions as one of the main barriers to the introduction of a unified classification approach. First, a unified monitoring system should be established within the country (expert 1 from Kyrgyzstan). The weak material and technical base (experts from Kyrgyzstan and Tajikistan), for instance, allows only 27 indicators to be monitored regularly in Kyrgyzstan. Such important parameters as heavy metals,

petroleum products, phenols, etc. are not measured due to the lack of resources (expert 2 from Kyrgyzstan), and the same can be said for the hydrobiological indicators in all Central Asian countries (expert 2 from Kyrgyzstan). The lack of a monitoring network among the countries and the large technology gap between the laboratories of neighboring states (as in the case of Kazhydromet and Kyrgyzhydromet) poses a significant constraint to the introduction of a unified system.

An alternative view was presented by the international expert, who shared the experience of the Eastern European group of post-Soviet countries. The situation in these countries is similar and comparable to the Central Asian case in terms of the technical capacities inherited from the Soviet era. The transition in these countries did not require much modernization of the laboratories or updating of the monitoring networks, and a significant increase in the number of regular water samples was also not necessary to support the changes in the water quality regulations. A more significant role here was played by the overall approach or the logic applied in the selection of monitoring points that should be reviewed often in transboundary basins. Currently, the Central Asian Hydromet agencies apply the Soviet methodology to the selection of the location of the monitoring points. In Soviet times, these points were set to assess both the background ecological state and the specific sources of pollution below and above the cities or industrial areas. The new system, in contrast, requires a different approach that takes into account the interests of different water users, including irrigation and drinking water supply, and assesses water quality in coherence with the development plans in the basin and the required water quality. This should underpin the logic applied in the revision of the monitoring network.

In the case of Tajikistan and Kyrgyzstan, the weak network of laboratories in the country requires significant investment if coordinated monitoring and assessment is to be implemented in the Syrdarya and Amu Darya basins. The large technical gap between the laboratories of Kazhydromet and Kyrgyzhydromet poses a significant constraint for bilateral cooperation on water quality (interview with expert 1 from Kyrgyzstan). The lack of equipment prevents the countries from assessing and defining the background physical and chemical pollution (or natural pollution), which is paramount for the successful application of the new classification system, according to the experts from Kyrgyzstan. The lack of funding for water quality laboratories was mentioned as the main limitation to any improvement in the management system (interview with the expert from Tajikistan).

An alternative view is often presented in literature (Melian et al., 2018), suggesting that financial limitations are not an insurmountable barrier, but rather an additional limitation. In Moldova, for example, the switch to the new regulation did not require any additional resources, but mostly a reconsideration of the system of Maximum Allowable Concentrations, which was previously based only on high and sometimes unattainable standards for fish, and is now supplemented with other requirements based on the water use purposes defined for each water body.

Environmental barriers

There is a lack of sufficient studies investigating the large-scale effects of water quality management on the water bodies of different WFD-based (Water Framework Directive) status classes (Destouni et al., 2017) on which to base discussions of the Central Asian region and to compare with the international results.

The protection and restoration of good water quality and ecosystem status in the inland and coastal waters of all EU member states were among the initial goals of the WFD (EU, 2000).

The water ecosystems of Central Asia are known to be sensitive to changes in ambient conditions, which relates to the levels, volumes, and biogeochemical status of the water bodies in endorheic basins (Karthe et al., 2017). The vulnerability of the regional ecosystems to climate change and other human pressures, including agricultural intensification, are noted among the key characteristics of water systems in the region, which also make them sensitive to any fluctuations in water quality. The pressure associated with high water utilization, temperature increases and changes in precipitation patterns aggravate the problems of water quality management and the need for more coordinated approaches in shared basins.

The interviewed experts mostly did not identify the environmental factor as a limitation to the introduction of new classes (experts 1 and 2 from Kyrgyzstan, the expert from Tajikistan). Some highlighted the need to develop a sound scientific basis for the assessment of the ecological impact of the proposed system (interview with the expert from Uzbekistan; interview with the international expert). Currently, the current national water quality standardization systems to some extent take into consideration the requirements for the assurance of natural water quality for water ecosystems (Melian et al., 2018). The permissible values are set to ensure the sustenance of the population, as well as favorable conditions for the water ecosystems. However, responsive management still largely prevails over a proactive approach. If the quality of waters deviates from normative requirements due to some anthropogenic impact, for instance, then certain measures to prevent or reduce the negative influence of the source of pollution are taken (Melian et al., 2018). No strategies or plans, however, have been developed

to prevent pollution and to improve the quality of water in water bodies. Currently, there is a tendency among the Central Asian countries to reduce the number of water quality indicators and to simplify the water quality measurement methodology. By doing this, the authorities in these countries aim at artificially increase the level of water quality. The frequency of sample collection is often reduced, as well as the number of hydrometric and hydro-chemical stations, as well as the number of section lines being controlled (Melian et al., 2018). These policies and applications can prevent a thorough understanding of the ecosystems state being obtained.

Another constraint to the introduction of a new classification was raised by the experts from Kyrgyzstan. A comprehensive assessment of the ecological state of the rivers of the basin requires access to relevant data on not only chemical and physicochemical parameters, but also biological parameters and characteristics, namely, the composition and richness of the aquatic flora and the bottom invertebrate fauna; and also hydromorphological parameters (structure and substrate of the riverbed, coastal zone structure, etc.). Such scientific investigations require additional resources, including funding and scientific expertise, which are often lacking in the countries.

Legal barriers

The legal barriers in both national legislation and in the context of the transboundary basins need to be considered. According to experts, the transition to a new system can be quite time-consuming and difficult to develop at a national level, requiring many legislative amendments in the field of environmental protection, as well as the harmonization of any new law, regulation, etc., and can require considerable resources (interviews with representatives of Kyrgyzstan and Uzbekistan).

In the case of Kazakhstan, the development of the new classification system was supported by private donors and the government. This shows that the issue is not always the lack of financial resources, but also a lack of motivation of the specialists and experts elaborating and implementing the laws and by-laws on water quality management.

Another barrier is the lack of a regional or bilateral (three-lateral) legal framework for the coordinated management of water quality in shared basins. Over the past two decades, the main areas of cooperation among the Central Asian countries have been the distribution of water resources; the harmonization of reservoir regimes, focused mainly on the energy and irrigation needs of states; the prevention of the degradation of the Aral Sea and its adjacent territories; and ensuring the safety of the water infrastructure. Against the background of these priorities, the problems of water quality, although periodically mentioned in the joint declarations of the states and regional agreements, have not been supported by joint actions in practice. Moreover, the quality of water resources is closely interconnected with quantitative parameters and, at the same time, often acts as an integrated indicator of the effectiveness of water resources management in general. International project assessments indicate (OSCE, 2019) that due to the limited potential and resource base of the Central Asian countries, the implementation of large-scale projects aimed at improving the quality of water resources in the coming years is complicated.

Currently, the existing bilateral agreements related to transboundary pollution have to date not produced the necessary practical results required to reduce the level of pollution of transboundary rivers (Petrakov, 2010). The lack of a unified system for the monitoring of water quality in Central Asia highlights the need for a reliable assessment of the current status of transboundary watercourse pollution. The emerging differences in

the standardization approaches to water quality in the region complicate the coordinated assessment of water quality. Based on the above, it can be considered necessary to come up with a unified system for the monitoring of water quality in Central Asia, and to standardize the quality standards. Such a unification requires the transition to the unified regulatory and methodological documentation based on the international water quality requirements (Petrakov, 2010).

Scientific barriers

One of the most important factors influencing the monitoring of water quality in Central Asian countries is the research base, which is currently lacking, according to experts (expert from Uzbekistan, expert 1 from Kyrgyzstan). There is a lack of research institutes that are able, and have the necessary resources, to develop normative and methodological manuals and instructions for the introduction of a unified classification system. For instance, in the Kyrgyz Republic, the State Agency for Environmental Protection and Forestry is mostly engaged in the development of normative documents. The experts highlighted the importance of compiling a research justification for the transition to a new water quality assessment system. There is a need to provide the necessary training to a water quality specialist, to be employed in the related national agencies, but also on-site in the regions where the new system will be implemented (interview with expert 2 from Kyrgyzstan).

The generally outdated educational programs were also highlighted by the experts as a potential barrier to the introduction of a new assessment approach. The dominance of theory over practical implementations was noted among the occurring disadvantages of the current education and training systems. Such methods that prioritize the theoretical approach over practical experience based on the outdated educational

programs were widely practiced before. The water quality-related education and training centers suffer from inadequate funding and the remuneration of university faculties. Switching from the centrally-planned economies to open market has negatively affected the attractiveness of water sector specializations, and higher and secondary special educational institutions often lack the basic resources to properly educate water sector specialists (OSCE, 2019).

The experts stated that the transition to a new system will open up considerable opportunities for the exchange of data and the introduction of more coordinated approaches to the control of water quality in transboundary rivers. However, the qualifications of the personnel in scientific institutes who are involved in this process are another significant limitation. In a move to a new system, it is important to familiarize young specialists with the new classification methodology during their education (interview with representatives of Uzbekistan and Tajikistan).

Conclusion

Water quality issues have traditionally fallen under the shadows of water quantity and distribution, which are associated directly with the economic growth of countries, and thus take the highest priority in the political agenda. The latest studies (Damania et al., 2019) have highlighted the importance of water quality across all economic sectors, illuminating its impacts on nearly all SDGs. The greater impacts on health, agriculture and the environment may lead to significant slowdowns in the economic growth of the Central Asian countries, and the need for more coordinated approaches to avoid this is already recognized at an expert level in Central Asia. The advantages of a unified water quality classification approach are also in the loop of water quality specialists. Such approaches could bring

benefits to both the residents of the basins and regional ecosystems as a result of the more accurate and target-oriented basin-wide planning and management.

A working coordinated water quality management system in the region requires a strong institutional framework, and participatory and transparent governance at the national level. The barriers associated with the transition to a new system identified in the current review can serve as a basis for the development of strategies for improvements to transboundary and regional cooperation on the issue of water quality. The outlined constraining factors in the political, economic, technological, social, environmental, legal and scientific realms can be mostly attributed to the flaws and gaps in the national water management systems. The economic aspect of cooperation in water quality management indicates a need for more intense political efforts in this direction, although it is important to realize that if the reforms to water quality policy are to be implemented in practice, there is a need for governments to facilitate the strengthening of technical, methodological and human capacity in the monitoring and management of water quality.

Recommendations

The following list of recommendations has been developed based on the insights shared by the interviewed experts and the solutions proposed in the reviewed literature.

1) The first recommendation was highlighted by most of the experts and describes an entry point strategy for the introduction of changes in support of better transboundary cooperation in water quality in cases where countries insist on retaining the current national systems. If such progress in joint coordination is to be achieved, a unified system involving the exchange of information can be introduced first for a few transboundary rivers on which the unified system of assessment and

classification can be applied, in addition to the current national systems. This approach was tested by Moldova and Ukraine, which established a working group to carry out monitoring based on a common approach, beginning from the lowest level, i.e., border gauges between the two countries. Ukraine opted to apply the system already developed in Moldova, which was based on the EU Water Framework Directive, in addition to the existing national system in Ukraine. Such a starting point made the transition smoother, and demonstrated the advantages of the new system before the necessary investments and adjustments at a country-wide level.

2) Further promotion of the IWRM – the basin management principle – and basin planning, which are now being implemented in all five Central Asian countries. The harmonization of the general water quality systems based on common principles and parameters will facilitate further cooperation in the regulation of water quality in Central Asia, and its implementation at a cross-border level. One of the main expected outcomes of the unification of the approaches, as highlighted by the experts from Kyrgyzstan, is the introduction of the hydrographic principle in water quality management. If the quality assessment is carried out according to the basin principle, covering the upper, middle and lower streams of the rivers, as well as various climatic zones within the river basins, the landscape features of the catchment area, water management conditions and requirements for the protection of water throughout the river basin, proper joint planning and holistic and proactive management will be achievable in the region.

3) To optimize the use of the resources indicated by the experts, the experiences of neighboring countries (Eastern Europe and Kazakhstan) can be utilized in the region. The developments encountered and the lessons learned can be applied when conducting a research justification for the transition to a

new water quality assessment system; when compiling a general list of water quality indicators for monitoring, especially in the areas at risk of severe pollution; and when developing a common approach to the determination of pollutants at other stages.

4) Another recommendation is to address the lack of funding for the resolution of water quality management problems at both national and transboundary levels through the development of investment programs and infrastructure projects that include the improvement of the water quality component. Transboundary cooperation in water quality issues should take into account not only regulatory, legal and informational issues, but also the potential to attract investment and technology, to bring about infrastructure improvements, and to ensure the more widespread engagement of the private sector in the search for solutions for the countries of the region. The latest World Bank report (Damania et al., 2019) outlines the economic risks and potential losses to the economies resulting from poor water quality. Thus, the economic benefits of coordinated approaches to water quality management should be further explored and presented to decision-makers.

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