Sustainability of Water Resources of Azerbaijan, Future Prospects and Problems

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Abstract

In the integrated management of water resources, factors such as social status, economic development of the region, and energy costs should be taken into account while maintaining the principles of sustainability, efficiency, and priority. Sustainability in the use of water resources is the principle of transferring resources to future generations under the best conditions without causing changes in the ecosystem.

Rationality and sustainability in the use of water resources can be achieved through cross-sectoral integrated planning and management of water users. The protection and sustainability of water resources is a key principle in the integrated management of water resources.

This study examines the unplanned and wasteful use of water resources leading to disruption of many freshwater ecosystems, the likelihood of creation of more pressure by expected food and energy demand with rapid population growth on hydro systems, and the sustainable and better management of water resources being one of the most important topics of the 21st century.

The research method is based on the analysis of technical and legal documents and reports of the State Statistics Committee on water management data in Azerbaijan, compiled by regulatory bodies operating on water management.

Keywords: Water resources, water problem, water demand, water use, integrated management, sustainability.

JEL Classification Codes: Q15, Q22, Q25, Q53, Q57.

1. Introduction

Today, with the increasing demand for water resources, the lack of sufficient quantity and quality of resources, the importance of efficient use of existing water resources from an economic, environmental and social point of view, has made the rational use of water resources urgent. The global water problem, which is becoming more and more influential with its social, economic and environmental factors with each passing day, has become the most urgent issue in the world. Unplanned and wasteful use of water resources has led to the destruction of many freshwater ecosystems around the world. Sustainability and better management of water resources have become one of the most important issues of the 21st century, as food and energy demand with rapid population growth is expected to put more pressure on hydro systems. The rational use of water resources is of particular importance in Azerbaijan, which, due to its geographical location, is located in an arid zone and has limited water resources. For this reason, interest in the efficient use and protection of water resources has increased and integrated water resources management has begun. This process involves the inclusion and accounting of all types of water (surface, ground, return), taking into account natural and climatic conditions, the fight against non-productive water losses from water users, the requirement to create incentives for water conservation.

1.1. Statement of Purpose

The aim of the study is to develop solutions for decision-making and policy development for more effective integrated water resources management.

To this end, integrated water resources management has developed a balance between resource exploitation and growing demand for water, cost-effectiveness, equity and long-term sustainability as the main principles.

1.2. Literature Review

Rationality and sustainability in the use of water resources can be achieved through cross-sectoral integrated planning and management of water users (Pasha, 2021a). In international practice, the Integrated Water Resources Management, as a rule, is coordinated with the river basins and is carried out within the boundaries of the river basins. As it is the basis

of integration to plan and jointly manage the use of water resources within river basins for drinking, irrigation, energy acquisition, industrial purposes (Bakhshiyeva, 2019). The Global Water Partnership (GWP, 2000) has been introducing three key practical elements in Integrated Water Resource Management (IWRM) since 2000: strong and favorable environment – policies, laws and plans that enforce "rules of the game" for water management that use in IWRM; clear, robust and comprehensive institutional framework – water management using the basin as a key unit for management while decentralizing decision-making; and use of existing management and technical tools - use of assessments, data and tools for water distribution and pollution control to help decision makers make better choices (Smith and Clausen, 2015). Lenton and Muller, on the other hand, add to them the sound investment in water infrastructure with adequate funding sources, which they believe is necessary to ensure progress in meeting needs for water demand and flood management, drought resistance, irrigation, energy security and ecosystem services (Lenton and Muller, 2012). There are two main directions in the integrated management of water resources: the first is the protection of water resources, and the second is the management of water resources on the principle of sustainability (Harmancıoğlu, et al, 2013).

The main factor in the first direction is the improvement of treatment facilities to reduce water consumption, prevent the discharge of wastewater into water basins, the development of industrial wastewater treatment and recycling technologies (Meriç, 2004).

The main factor in the second direction is the organization of integrated Water Resources management (Soylu, et al, 2006). For this, it is necessary to draw up a reasoned water balance, monitoring water resources on their use, pollution, changes must meet modern requirements (Rzayev, 2019). The Ministry of Ecology and Natural Resources, Amelioration and Water Farm Company OJSC, "AZERSU" OJSC and other relevant organizations should organize more detailed accounting of water consumption and amount of waste discharged, including damage to the national economy as a result of pollution of water sources (Ahmadov, 2020), thereby strengthening control over pollution, regulation of pollution payments and rehabilitation of contaminated areas.

Azerbaijan's internal water resources are 28%. 70% of the remaining water resources are those formed at the expense of transboundary rivers (MENR, 2023). In order to develop opportunities for purposeful use of water resources, improve infrastructure capabilities, protect the water basins, save the water ecosystem and improve water quality, it is important to sign a transboundary water agreement with neighboring states by developing transboundary water cooperation on the distribution, protection and use of transboundary freshwater streams, surface and underground resources (Bakhshiyeva, 2019), which is increasingly taking geopolitical and geoeconomic character beyond the level of domestic and interstate economic-social relations (Veliyev, et al, 2018). Since surface and underground water resources of the regional states, transboundary water flows passing through their territories are of exceptional importance in the realization of the interests of not only specific states, the region, but also the global security as a whole, being the guarantor of economic, political and social stability, food security and energy policy in these countries.

The fact that the issue of dividing the water resources of the transboundary Araz and Kura rivers between the five bordering states (Turkey, Azerbaijan, Iran, Georgia, Armenia) remained legally unregulated is due to the fact that bilateral agreements between the USSR, Iran and Turkey, which have lost their fundamental and legal significance, remain in force. Thus, these agreements – Convention "On the use of border rivers and springs" (USSR-Turkey, January 8, 1927), Agreement "On the construction of a dam and reservoir on the border river Akhuryan" (USSR-Turkey, October 26, 1973), Treaty "On the regulation of border conflicts" (USSR-Iran, May 14, 1957), Agreement "On the preparation of preliminary projects on equal and joint use of Araz and Atrek rivers for irrigation and electricity production" (USSR-Iran, August 11, 1957) do not provide for water limits for each of the Azerbaijan SSR, Georgian SSR, Armenian SSR (Bakhshiyeva, 2019). In this case, the unilateral increase of water consumption limit by Turkey, Iran and especially Armenia in the territories crossed by the Araz River, construction of new dams, hydro stations and reservoirs on the river will lead to further aggravation of the problem of shortage of fresh water in the Republic of Azerbaijan (Humbatov, 2018).

In particular, there has been a 40% increase in the country's population over the last 30 years (SSCA, 2021a), which, in turn, has increased the demand for water. Approximately 70% of water resources in Azerbaijan are used for irrigation (Pasha, 2021a). This ratio is 40% in European countries (EEA, 2017). In Central and Western Europe, 57% of water resources are used for energy production and domestic use (EEA, 2023).

For sustainable and efficient management of water resources, it is necessary to study the quantitative and qualitative characteristics of water resources, the demand for water and the conditions for its complex use. This will make it possible to determine the needs of various sectors of the economy for the quantity and quality of water they need (Ahmadov, 2020).

2. Indicators of use of water resources and prospects in Azerbaijan

The use and management of water resources has already been considered one of the indicators of the level of development in the world. Thus, while in less developed countries the use of water for agricultural purposes is limited to 70%, in developed countries the amount close to this indicator falls to the share of energy production, household and industrial use (EEA, 2017).

The ranking of water resources in the world for its importance in the use is as follows:

1. Those used in drinking and household,
2. Those used to meet the sustainable natural needs of animals and other biodiversity,
3. Those needed to use in irrigation in agriculture, etc.,
4. Those needed in energy production and other industries,
5. Water demand used in trade, tourism, recreation, fishing, and other fields.

2.1. Water use indicators in Azerbaijan

Scarcity of available surface water resources in Azerbaijan, stable demand for water due to rapid population growth and increasing demand for water, and even declining due to global climate change, and therefore a declining per capita water volume, make it one of the most

water-scarce countries in the near future. Another factor accelerating this process is the acceleration of urbanization, industrial development and pollution of water bodies.

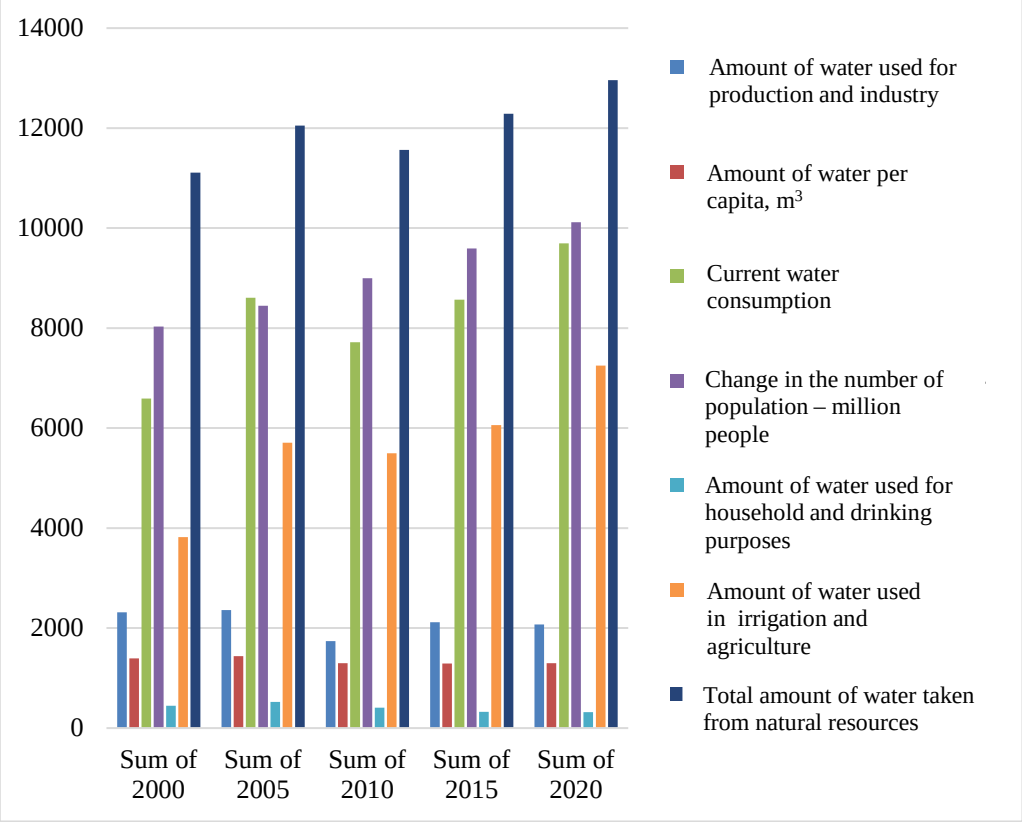
In the face of all these difficulties, just as wastewater treatment and reuse is relevant, the reuse of collector-drainage water for irrigation at low cost is promising in Azerbaijan.

Rational use of water resources can be significantly useful in the cultivation of aquatic products, especially fishing. Because the manufacturing of fishing and aquatic products is a highly profitable and economically efficient sector, and in this area the country is mainly dependent on imports.

The following table shows the consumption indicators of the main consumers of water resources in Azerbaijan for the last 20 years.

Table 1. Indicators of use of water resources in Azerbaijan in 2000-2020, *(MENR, 2022; MENR, 2023; SSCA, 2021a; SSCA, 2021b).*

Key indicators characterizing the protection and use of water resources in Azerbaijan in 2000-2020 - (million cubic meters)					
Years	**2000**	**2005**	**2010**	**2015**	**2020**
Change in the number of population - million people	8032,8	8447,4	8997,6	9593,0	10119,1
Total amount of water taken from natural sources	11110	12050	11566	12285	12961
Amount of water per capita, m^3	1397	1438	1295	1289	1300
Total water consumption	6588	8607	7715	8567	9693
Amount of water used for household and drinking purposes	449	521	405	323	319
Amount of water used for production and industry	2316	2360	1742	2117	2073
Amount of water used in irrigation and agriculture	3819	5710	5497	6057	7252



Note: Tables and graphs have been prepared based on the data of the Ministry of Ecology and Natural Resources and the State Statistics Committee of the Republic of Azerbaijan (MENR, 2022; MENR, 2023; SSCA, 2021a; SSCA, 2021b). (Authors).

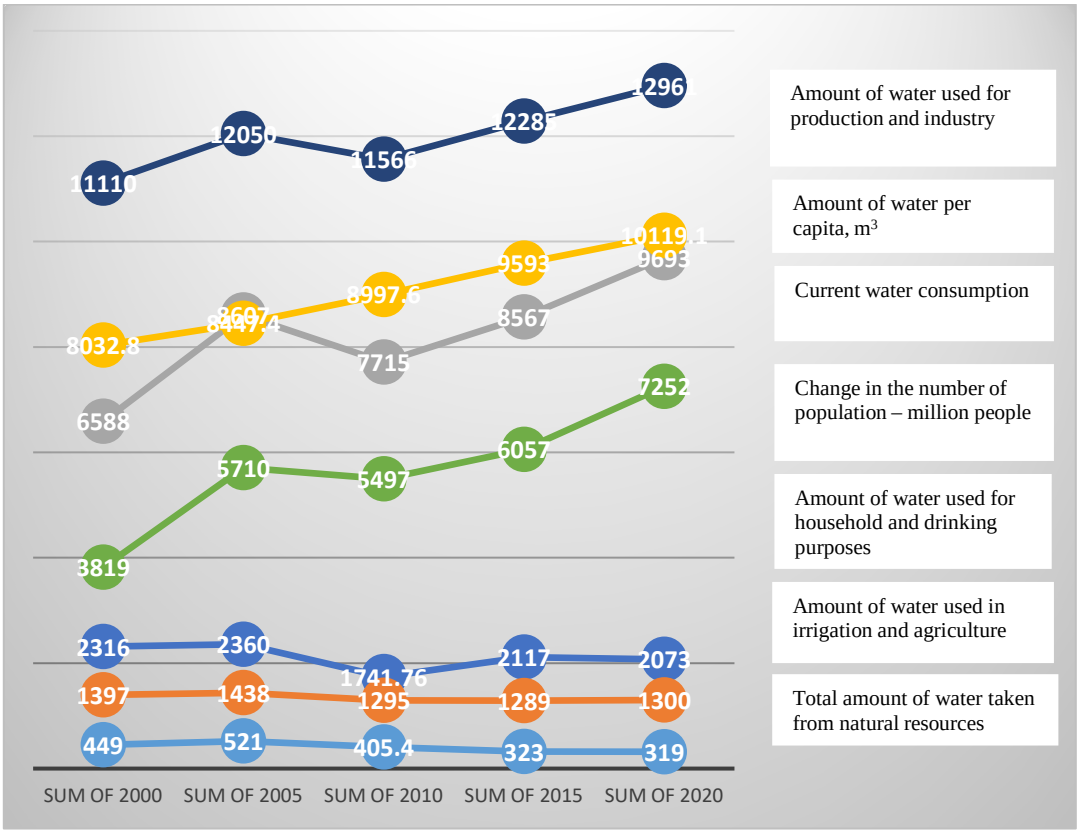
2.2. Mistakes and shortcomings in the use of water resources in Azerbaijan

One of the main reasons for such a high proportion of water resources in irrigation is water losses. If we look at the statistics of 2020 merely, the total amount of water taken from natural sources was 12960.8 million cubic meters, while the amount of water lost during transportation was 3267.8 million cubic meters (SSCA, (2021b). The vast majority of agricultural plants cultivated in Azerbaijan fall on Mil-Mughan lands. Excessive water losses are observed in these areas. İt has been reflected in the approved water balance (demo.novadigitalsolutions.net, 2023). In general, 73% of the canals on the balance of Amelioration and Water Farm OJSC are land canals (mst.gov.az, 2020). This, in turn, leads to water loss and a 40-60% reduction in the efficiency factor of the irrigation system.

Ensuring the protection and sustainable use of water resources, the recent climate change and the threat of global warming are gaining relevance in our country (Verdiyev, 2012). Good protection and rational management of water bodies is an important issue today to meet the water needs of people in residential areas with quality and sufficient water.

The problem of drinking water exists in our country as well as all in the world (MENR, 2022). According to studies, our surface water reserves are average 28,1-30,3 billion cubic meters per year (Azersu, 2022). In dry years (low water years), this figure decreases to 23 billion cubic meters (MENR, 2022). There are 23 764,28 million cubic meters/day of water reserves in underground drinking water sources. Azerbaijan lags behind the South Caucasus countries and Russia in terms of surface water resources per square kilometre of territory and per capita. Georgia accounts for 62% of the total water resources of the South Caucasus (310 billion cubic meters), Armenia for 28% and Azerbaijan for only 10% (Mammadov, 2010).

Table 2. Graphical description of intersectoral use of water resources in Azerbaijan in 2000-2020, (Pasha, 2021b; SSCA, 2021a; SSCA, 2021b).



The graph shows that against the background of rapid population growth and increasing demand for water, water resources remain stable, even declining due to global climate change, and therefore the declining amount of water per capita inevitably makes Azerbaijan one of the water-scarce countries in the nearest future. Another factor accelerating this process is the acceleration of urbanization, industrial development and pollution of water bodies (Verdiyev, 2012). At the same time, the high amount of wastewater, disposal of 49% of the total 9693.0 million cubic meters of water consumed in 2020, 4759.0 million cubic meters of wastewater (SSCA, 2021b) indicates a low level of wastewater reuse, which is an important influencing factor in the efficient use of water resources.

Another issue to be considered in the rational activities of water users is the protection of water resources from pollution (Nechaev, et al, 2017). Limited drinking water resources are subject to pollution as a result of insufficient treatment of industrial and domestic sewage water. It is known that one litre of untreated wastewater can pollute eight litres of clean water making it unusable (Harmancıoglu, 2013). In turn, polluted water causes damage to natural fauna, aquatic life and fish (Beisebin, 2015). Against the background of these problems, wastewater treatment and reuse is an urgent issue in the world today. In the Rhine River Basin, one of the most densely populated and industrialized regions of the planet, countries in Western Europe such as Switzerland, France, Holland and Germany consistently use the same water in irrigation, and this, according to experts, has a positive effect both on the source of water supply and on the life activity of the population living here. At the same time, the development and implementation of water legislation both at the interregional and international levels made it possible to develop a complex water management system that provides a comfortable and economically efficient living of tens of millions of people in a region where resources are scarce and highly anthropogenic (Nechaev, et al, 2017). Azerbaijan's collector-drainage water can be reused for irrigation at low cost (Zeynalova, et.al, 2018). 1,6-1,7 billion cubic meters of mineralized groundwater is discharged into the Caspian Sea annually from the Main Mil-Mughan Collector, which is the main artery of the existing collector-drainage network in our country (Aghabayov, 2013). Mineralized groundwater from the Main Shirvan Collector (72 cubic meters/sec), Mughan-Salyan (36 cubic meters/sec) and Mil-Garabagh (25 cubic meters/sec) is also discharged into the Caspian

Sea (ASWRA, 2023). Reuse of these waters in irrigation with low mineral content can be very useful in protecting water resources and the environment from pollution.

2.3. What are the prospects for the use of Azerbaijan's water resources?

Rational use of water resources can give significant benefits in the cultivation of aquatic products, especially fishing. Because the main goal in construction of water reservoirs and artificial lakes are energy, irrigation and, partly, drinking water. However, the production of fisheries and aquatic products is a highly profitable and economically efficient sector, and our country is mainly dependent on imports in this field. According to statistics from the Food and Agriculture Organization (FAO) of the UN, the average annual per capita consumption of fish in the world is 18 kg. In Azerbaijan, the average annual per capita consumption of fish was about 2 kg until 2009. However, this figure has increased in recent years and reached about 7 kg in 2014 (MENR, 2015). If this potential is used properly, it is possible to increase fish production from existing water reservoirs several times.

The rivers in the territory of Garabagh, which were cut off from the water resources of Azerbaijan and subjected to environmental pollution due to the occupation of the Garabagh region by Armenia for many years, are mainly tributaries of the Kura and Araz rivers. Many rivers here are fed by rain, snow and groundwater, and their water is mainly used for irrigation. However, in the waters of Tartarchay, Khachinchay, Gargarchay, Hakarichay, Bargushadchay, Okhchuchay there are also very valuable trout, kutum, khramulya, yellow fish, carp and other species. The creation of fish farming artificial lakes and ponds on the rivers for the purpose of reproduction and production of these species, the use of existing water reservoirs for this purpose is economically efficient and promising (Pasha, 2021a).

At the same time, these rivers are of great importance in irrigating the Mil and Garabagh plains. Also, these rivers are high-speed and pressurized, mainly because they are mountain rivers. Therefore, the construction of small hydropower plants on these rivers and reservoirs is very useful in terms of economic efficiency. This is an important factor in both the country’s energy security and the protection of the environment through the use of clean energy sources (Pasha, 2021b).

Drying of low rivers due to over-irrigation, artesian water used in excess of its natural recovery potential, which is not calculated correctly, leads to depletion of water resources. This, in turn, will confront us with environmental problems such as declining groundwater levels, deforestation, desertification, drought, and loss of biodiversity (Rajanna, et al, 2018).

This and other similar situations will also cause problems and conflicts in cross-sectoral water distribution. Therefore, it has been already accepted by experts that a complex, integrated approach to environmental parameters in water resource management will be more effective (Harmancıoglu, 2013). In this case, the principles of ecological restoration, improvement of water quality, the principles of meeting industrial, agricultural and natural needs of water use should be comprehensively addressed and new mechanisms of use should be developed (Pasha, 2021b).

According to the Water Code of the Republic of Azerbaijan, the internal waters of the Republic of Azerbaijan, the section of the Caspian Sea (Lake) belonging to the Republic of Azerbaijan are the national wealth of the Azerbaijani people, used and protected as the basis of life and activity of the population, ensuring the existence of flora and fauna.

3. Conclusion and recommendations

Sustainability of water resources is characterized by the principles of its efficient use, protection, and application of new technologies. In this context, water users' water use guidelines, roles and responsibilities, and economic development projects and programs should be reviewed.

The rational distribution of water resources among users can be made by integrated management, by a body in which all stakeholders participate. It would be more expedient to establish this body under the auspices of the Amelioration and Water Farm OJSC, and it may be useful to make some changes in the legislation and management system for the effective and efficient operation of the body.

According to the Water Code of the Republic of Azerbaijan, the inland waters of the Republic of Azerbaijan, the section of the Caspian Sea (lake) belonging to the Republic of Azerbaijan

are the national wealth of the Azerbaijani people, used and protected as the basis of life and activity of the population, ensuring the existence of flora and fauna.

At the same time, water resources must be valued as an economic value. The principles of water saving and use without pollution, and payment of the cost of water used should be applied both in domestic use and in agriculture and industry.

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