

The Water Resource Management for Sustainable Economic Development in Viet Nam

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Abstract: Water is an urgent issue in Vietnam's economic growth. The gap between the growing water demand and the decreasing water supply has put pressure on all sectors, including the economy in Viet Nam. The uneven water distribution over time and region is a big problem that Vietnam is facing. The rainy seasons are unevenly distributed in most provinces from North to South. Besides, climate change has also brought about significant changes to the surface water as well as groundwater. The effects of water scarcity and water pollution also have a negative impact on Vietnam's annual gross domestic product. Viet Nam's population growth will also be a driving factor for water demand. Research by the World Bank in 2019 has shown that pollution is the biggest threat that could cost Vietnam about 3.5% of GDP each year by 2035 [1]. The region's rapid development in urban areas, untreated industrial wastewater, and pesticides in agriculture put tremendous pressure on Vietnam's river basins. This paper aims to provide an overview of Vietnam's water management situation, including water management with sustainable economic development, environmental water security, ecological water security, and water-related disasters. The paper also clearly analyzes the major challenges that Vietnam faces in managing scarce water resources to maintain economic growth, maintain ecosystems, and protect water resources in the coming years.

Keywords: water resource, development, sustainable

1. INTRODUCTION

Water plays a vital role in socio-economic development and maintains the integrity of the natural environment. That is why the management of water resources is a very complex issue. The water management sector has encountered difficulties in balancing between the declining water resources and amid growing demands. The crucial factors of demographic and climate change also make water resources more stressful.

There are significant regional variations in water resources. Also, the water supply changes over time, such as seasonal changes and annual changes. It is difficult to predict the amount of water supplied in phases, which poses significant challenges for water managers in particular and society. Most developed countries overcome this situation by utilizing water supply infrastructure to secure water use and minimize water risks. Underdeveloped countries are currently looking for solutions for their water supply, but not enough to deal with the growing needs due to population, economic and climatic pressures. Wastewater treatment and water demand management and reuse solutions are being introduced to cope with water challenges.

In addition to water volume, water quality also has problems. Water pollution poses significant problems for water users as well as for the maintenance of natural ecosystems. In many regions, both volume and quality of water are severely affected by weather and climate change changes; the less or more rainfall in the different areas, the more extreme the weather phenomenon. Also, in many regions, water demand increases due to population growth and other demographic changes (particularly urbanization) and agricultural and industrial development. Continued are changes in production

and consumption patterns. As a result, some areas are now in a state of oversupply. Many regions are experiencing water shortages at critical times of the year due to deficient water availability in many areas.

2. LITERATURE REVIEW

The basin's water resources include both surface water and groundwater. There is a hydraulic relationship between surface water and groundwater, so overexploitation of one component also affects the other. Therefore, to use effectively and sustainably, it is necessary to manage both the quantity and quality of surface water and groundwater. Besides, managers must pay attention to measures to manage and control sources of water pollution. The basic principles of water resource management include the following [2].

Firstly, freshwater is a finite and vulnerable resource; it plays an essential role in sustaining life, development, and the environment. This principle opens up a new approach to water management. It is a method that must consider all the characteristics of the hydrological cycle and the interactions of water with other resources and ecosystems. The principle also states that water is necessary for many purposes and that management must consider usage demands and threats to water resources. The perception that water is a finite resource, not an infinite amount as previously misunderstood, has set in the process of water management and use to limit losses. Countries must-see water as a primary natural asset that needs to be maintained for sustainable benefits.

Secondly, water resource development and management should be based on a participatory approach for water users, planners, and policymakers at all levels. This new approach management has improved the efficiency of water use, in which the role of water users must be as important as that of

the planners and policymakers. This principle emphasizes the need for genuine participation of all stakeholders as part of the decision-making process. A participatory stakeholder approach is the only way to reach long-term mutual agreements on water use and management. Implementing this management approach, the government from the central to local groups need to create favorable mechanisms for all parties' participation, especially the communities who directly benefit or lose [3].

Thirdly, water has an economic value in all its forms of competitive use and should be seen as a commodity of monetary value. This principle shows that the economic value of water is the latest human realization discovered in recent decades. That has raised human requirements in management, how to use water economically, and how to promote the value of water like any other commodity. In water resource management, it is necessary to fully take into account the importance of water, including the economic and intrinsic value of the water resources, and to provide a mechanism for water users who can afford to use and pay sufficient water costs for "buying water" as well as their responsibility in water protection [4].

3. FINDING

3.1. The situation of water resources in Vietnam

3.1.1. Water resources in Vietnam

Vietnam is located in the humid tropics with relatively large rainfall averaging 1,800mm - 2,000mm. Still, it is unevenly distributed, mainly in the rainy season from April to October, especially in the coastal areas. In Hai Trung, the rainy season starts and ends a few months later. Uneven distribution of rainfall and complex fluctuations over time cause erratic floods and droughts, causing great damage to crops and property, affecting the national economy. In addition, it also causes many obstacles to the water treatment and exploitation of the river. It is estimated that the annual rainfall in the whole territory is about 640 km³, creating a flow of about 313 km³ of rivers and lakes. If the amount of water flowing from the outside into Vietnam's territory through two significant rivers, the Mekong River (550 km³) and the Red River (50 km³), the total annual rainfall is about 1,240 km³, and the amount of water that rivers flow into the sea about 900 km³ annually. Thus, compared to many countries, Vietnam has a plentiful freshwater source; the average water volume per capita reaches 17,000 m³ / person/year [5]. However, due to the underdeveloped Vietnamese economy, the demand for water used is not high; currently, only 500 m³ / person/year is exploited, which means that only 3% of natural water can be exploited. It is only exploited in surface water and mostly concentrated for agricultural production.

3.1.2. Groundwater

Water stored in the ground is also an essential part of water resources in Vietnam. Although groundwater has been exploited for domestic use for a long time, a comprehensive and systematic investigation of this resource has only been

conducted in the last few decades. Currently, the movement of digging wells to exploit groundwater is being carried out in many places, especially in rural areas, by manual means. Simultaneously, the exploitation by modern means has also been carried out but still very much. The restriction is only aimed at serving production and living in large industrial and residential centers [6].

3.2. The water management in Vietnam

Vietnam is the Southeast Asian country with the most irrigation costs. The whole country currently has 75 irrigation systems with 659 lakes, large and medium dams, over 3,500 lakes and dams, 1,000 drains, more than 2,000 large and small pumping stations, over 10,000 pumps of all kinds capable of supplying 60-70 billion m³ / year. However, the irrigation system has deteriorated seriously, only meeting 50-60% of the design capacity. The annual amount of water used for agriculture is about 93 billion m³, for industry about 17.3 billion m³, for services is 2 billion m³, for domestic use is 3.09 billion m³[7]. By 2030, the water use structure will change according to agriculture trends at 75%, industry at 16%, and consumption by 9%. Water demand will double, accounting for about 1/10 of river water, 1/3 of domestic water, 1/3 of stable water flow. Due to heavy rainfall and steep terrain, our country is one of 14 countries with excellent hydropower potential. Hydroelectric plants currently produce about 11 billion kWh, accounting for 72 to 75% of the country's electricity output.

Vietnam has 1 million ha of freshwater surface, 400,000 ha of brackish water surface, and 1,470,000 ha of river water surface, with more than 14 million ha of inland water surface and territorial sea. However, only 12.5% of the brackish water, salt water, and 31% of the freshwater surface area have been used. Many lakes and small dams across the country serve irrigation, such as Cam Son (Bac Giang), Ben En and Cua Dat (Thanh Hoa), Do Luong (Nghe An) [8]. According to statistics, Vietnam currently has more than 3,500 small reservoirs and about 650 large and medium-sized reservoirs use for hydroelectricity, flood control, water navigation, irrigation, and aquaculture [9].

3.3. Method of water resources management in Vietnam

According to the provisions of law, Vietnam performs water resources management according to the administrative topography within the locality. The management system includes the management of canals with many stakeholders' participation from the administrative apparatus from central to local levels. Management, in this way, also has a significant impact on economic development.

Vietnam also practices river basin management. River water resource management aims to manage water exploitation and economic activities in a river basin. River basin water management will also provide economic benefits and ensure environmental sustainability. Water management tools include legal tools, technical and economic tools, and educational tools.

Vietnam has enacted laws on water resources, including legal provisions on water resources use and protection. The law

also sets out procedures for licensing and permitting water exploitation and use. The law also sets out the provisions on responsibility for organizations that manage and protect water resources, especially water resources' sustainable development.

The primary technical tools used to manage water resources include monitoring systems to monitor water quality and create a background data system for water resource management. Besides, the information processing system also helps a lot with water management. This tool will help managers make decisions, process information related to the exploitation, use, and management of water resources. Software models are also tools for technical assistance in water resource management. The water resource system's simulation model is also an optimal water resource management model in Vietnam.

Economic instruments used in water resource management in Vietnam include taxes and fees. These taxes and fees apply to organizations and individuals exploiting and using groundwater for production, business, and service. The environmental fee applies to the use of cases of water causing wastewater. Domestic wastewater is calculated as a percentage of the selling price of 1m³ of clean water. Industrial wastewater depends on the concentration of pollutants.

3.4. Managing water resources for sustainable socio-economic development

Directive No. 36-CT / TW dated June 25, 1998, of the Politburo on enhancing environmental protection in the period of national industrialization and modernization, has stated the "environmental protection as a cause. of the entire People's Party and the entire army" to the top position. Resolution No. 41-NQ / TW (dated November 15, 2004) on environmental protection in the period of accelerating national industrialization and modernization. Resolution assesses the ecological situation, outlining the causes of success and weakness, setting out five guiding points, three goals, five common tasks, two specific tasks, and seven solutions to protect the environment. One of the functions mentioned in this resolution is "to firmly investigate natural resources and have a plan to protect, rationally exploit and protect biodiversity." The views on the strategic direction outlined in this resolution aim to regulate social activities in the transition period towards industrial production and a knowledge economy. This is a potential imbalance risk between economic development and maintenance of natural resource protection in general, water resources connected separately.

Section II, part 4 of Agenda 21 of Vietnam, outlined four priority activities for water resources in Vietnam: improving policies and laws, economic activities; technical activities; raise awareness. According to practical criteria, any policy must be based on an objective requirement in the social development process; a sustainable development orientation is not out of that rule. The development and management of water resources are attached to each national goal and strategy

in each period. The success of sustainable development policy will make an essential contribution to improving people's lives and in each socio-economic sector. This has been confirmed by the results recorded through the water supply, active in irrigation, flood prevention, and control.

The first resolution 41-NQ / TW has introduced the policy of "encouraging economic use of resources" and "exploitation of natural resources. The use of natural resources must ensure efficiency and sustainability and must be associated with immediate and long-term environmental protection". The Sustainable Development Program (Agenda 21 of Vietnam) has proposed protecting the water environment and economical use of water resources, exploiting and protecting the marine, coastal, and island environment, and priority service in natural resources and environment.

Thus, water resources in Vietnam are relatively abundant but not infinite. On the other hand, the amount of water is not evenly distributed according to the year's space and time. During the rainy season, the amount of water accounts for 70-80% of the total annual water volume. The yearly discharge only focuses on 3-4 months of the rainy season, while the four months between the dry season only accounts for 5-8%. Besides, the potential groundwater resource flow is about 1,500 m³ / sec. However, this water resource distribution is uneven. The policy of efficient and economical water use according to a combined multi-sector and inter-provincial structure is necessary.

4. CONCLUSION

Water plays an essential role in human life and the ecological environment. It has a significant influence on the productive life, socio-economic development of the human species. Although the amount of water in the world is quite large, the distribution and water use still has many problems, not meeting the increasing demand for water use, causing disputes over water sources. Also, the deterioration of water quality seriously affects the quality of life and has a negative impact on socio-economic development and the environment.

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