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Vietnamese Environmental Law in Controlling the Risk of Water Resource Degradation Triggered by the Adverse Impacts of Artificial Intelligence

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Abstract
The rapid development of artificial intelligence (AI) has presented both opportunities and challenges for environmental protection, particularly in water resource conservation. Alongside its positive applications—such as monitoring water quality, forecasting droughts, and optimizing water use in agriculture and industry - AI generates numerous adverse impacts that are either underestimated or insufficiently regulated under the current legal framework. The operation of AI infrastructures, especially data centers, consumes substantial volumes of water for cooling purposes, thereby intensifying pressure on both surface and groundwater sources and posing a significant risk of water resource degradation. This article focuses on analyzing the negative impacts of AI that contribute to the potential degradation of water resources, thereby assessing the responsiveness and adequacy of Vietnam's current environmental law in addressing these challenges. Based on this analysis, the paper proposes several legal and policy recommendations to improve regulatory responses in the context of rapid technological advancement.

Keywords: Artificial Intelligence, Water Resource, Environmental Protection, Water Resource Degradation

1. Introduction

While AI brings certain benefits to human life, it has also been causing significant adverse impacts on natural resources, particularly water resources. Data centers used to operate AI systems consume enormous amounts of electricity, which in turn necessitates large-scale cooling systems to prevent server overheating. This demand has posed substantial challenges to water supplies required for these cooling operations. In reality, Google's major data centers alone consumed approximately 2.1 million liters of water per day in 2024 to operate core services such as YouTube, Gmail, and Google Drive, with an estimated total annual water usage reaching 760 million liters [1]. Furthermore, the rapid proliferation of large-scale data centers has become a serious threat to water security in the United States, especially in states experiencing high levels of water stress [2]. According to a recent U.S. Data Center Energy Report, the total onsite water consumption of U.S. data centers by 2028 is projected to double or even quadruple compared to 2023 levels, potentially reaching 150 to 280 billion liters annually, thereby placing additional pressure on already strained water infrastructure systems [3, 4].

Under the influence of human activities-particularly excessive and wasteful exploitation-water resources have inevitably suffered from various negative impacts and, in some cases, face the risk of degradation. Water resource degradation can be understood as the deterioration in both quality and quantity of water resources, which adversely affects human health, biodiversity, and natural ecosystems. In the context of the rapid and large-scale expansion of AI, identifying the obligations and responsibilities of relevant stakeholders in the protection of water resources becomes increasingly urgent. The protection of water resources is a domain within environmental protection activities, encompassing measures to preserve both the quantity and quality of water, as well as to prevent and mitigate harmful consequences caused by water-related hazards. Vietnamese environmental law establishes the duties and responsibilities of the State, organizations, and individuals in safeguarding and developing water resources. It also provides legal mechanisms to ensure that these obligations are implemented strictly and effectively. These regulations apply broadly to all production and livelihood activities of human beings, and therefore also extend to AI-related activities that may negatively affect water resources. At present, Vietnam has promulgated some legal instruments governing the protection of water resources from degradation risks, such as the Law on Environmental Protection 2020, the Law on Water Resources 2023, and Government Decree No. 53/2024/ND-CP detailing the implementation of the

Law on Water Resources, among others. These legislative instruments serve as an initial legal framework for controlling the adverse impacts of AI on the sustainable management and protection of water resources.

2. Research methods

This study is conducted through data collection, demonstrating the significant volume of water consumption by major AI data centers around the world, such as those operated by Google and Microsoft etc. It is further combined with legal analysis and commentary on the regulatory mechanisms addressing the risk of water resource degradation from the perspective of Vietnamese environmental law, thereby identifying both its strengths and limitations.

3. Research findings

3.1 Regulatory Provisions on Preventing the Degradation of Water Resources in Response to the Adverse Impacts of AI

First, *regulations on the formulation and implementation of strategies, master plans, and plans for the exploitation, use, protection, and development of water resources*

Strategies for the protection and development of water resources refer to comprehensive and long-term objectives and tasks formulated and directed by the State, aiming to ensure the rational, economical, and efficient exploitation and use of water resources, as well as the prevention and mitigation of water-related disasters. Master plans and development plans for water resources are activities undertaken by competent state authorities to identify, classify, and assess the quantity, quality, and dynamics of water sources within specific regions, localities, and across the entire country, for rational and effective use and protection. The formulation and implementation of programs, strategies, master plans, and plans related to water resource protection and development have always received special attention from the Vietnamese Government and have been increasingly promoted. For example, Prime Minister's Decision No. 1622/QD-TTg approved the National Water Resources Master Plan for the 2021–2030 period, with a vision to 2050. This is a milestone marking the first national sectoral master plan developed in the field of water resources in Vietnam. Notably, the National Environmental Protection Strategy to 2030, with a vision to 2050, was approved under Prime Minister's Decision No. 450/QD-TTg dated April 13, 2022. The Strategy identified several key issues related to the protection of water resources as part of the broader national environmental protection framework.

Second, *regulations on water resource permits and environmental permits (wastewater discharge permits)*

A water resource permit is a legal certificate issued by a competent state authority to organizations or individuals, clearly stipulating their rights and obligations to ensure the rational and efficient exploitation and use of water resources. Currently, water resource permits in Vietnam include permits for groundwater exploration and permits for the exploitation and use of water resources, among others. The provisions on the issuance, revocation, suspension, as well as the legal grounds, duration, and the rights and obligations of licensed entities are detailed in the Law on Water Resources 2023 (Articles 42, 43, 47, 52, 53, 54, 56, and 57 of the 2023 Law on Water Resources).

Previously, under the 2012 Law on Water Resources, wastewater discharge into water sources was also governed by water resource permits. However, with the entry into force of the Law on Environmental Protection 2020 and the pilot implementation of the 2023 Law on Water Resources starting from July 1, 2024, wastewater discharge permits are now integrated into environmental permits. An environmental permit is a legal document that reflects the competent authority's approval for an organization or individual engaged in production, business, or service activities to discharge waste into the environment (Clause 8, Article 3 of the 2020 Law on Environmental Protection). Furthermore, the legal basis for issuing environmental permits concerning wastewater discharge applies to investment projects classified under Groups I, II, and III that generate wastewater requiring treatment (Article 39 of the 2020 Law on Environmental Protection).

Accordingly, any entity engaged in production, operation, or development activities involving AI that exploit water resources and meet the prescribed conditions is obligated to apply for a water resource permit. At the same time, if the relevant AI project falls under group I, II, or III (Article 28 of the 2020 Law on Environmental Protection) and generates wastewater requiring treatment, the entity must also complete procedures to obtain an environmental permit.

Third, *regulations on the obligations of organizations and individuals in the protection and development of water resources.*

Organizations and individuals are prohibited from engaging in acts that may cause harm to the quantity and quality of water sources. This obligation is concretized through a range of legally prohibited behaviors, including: discharging wastewater into groundwater sources; discharging untreated wastewater that fails to meet environmental technical standards into surface water or marine environments; discharging wastewater or introducing waste materials into protected sanitary zones surrounding drinking water intake areas; unauthorized exploration, exploitation, or use of water resources; and engaging in unlicensed groundwater drilling activities (Clauses 2, 3, and 4, Article 8 of the 2023 Law on Water Resources).

Furthermore, users must utilize water in a circulating, economical, efficient manner, for the correct purposes, and under the approved plans and strategies for exploitation, use, protection, and development of water resources, as authorized by competent state agencies (Article 58 of the 2023 Law on Water Resources).

Additional obligations include, among others: the obligation to provide water resource-related information to competent authorities upon request for inspection and assessment purposes; and the obligation to conduct environmental impact assessments (EIA) to predict and evaluate the potential effects of projects or activities on water quantity and quality (Articles 42 and 47 of the 2023 Law on Water Resources).

3.2 Assessment of the current legal framework on mitigating water resource degradation triggered by the adverse impacts of AI in Vietnam.

In terms of advantages, the current Vietnamese environmental law has initially established a basic legal framework to control the exploitation of water resources by entities to integrate AI into socio-economic activities. This

includes provisions on water resource permits, environmental permits, and prohibitions against certain harmful acts. These regulations are formulated within the broader context of protecting and developing water resources in general; therefore, whether or not an entity engages in AI-related activities, any action that affects water resources is subject to strict legal compliance. Moreover, the content of water resource protection has been elevated to the level of national strategies and master plans, which not only impose binding obligations on organizations and individuals but also require the State to assume responsibility for controlling negative impacts from production and daily life activities on water resources. These developments contribute to mitigating water resource degradation caused by AI deployment activities that generate significant adverse effects on such resources.

Regarding limitations,

First, *the current regulations on controlling the adverse impacts of AI on water resources-particularly those concerning water resource permit requirements and the obligations of organizations and individuals during the process of exploitation and use-remain limited in terms of the subjects to which they apply.*

Specifically, Clause 1, Article 52 of the 2023 Law on Water Resources stipulates that entities required to obtain water resource exploitation permits include organizations and individuals extracting water for domestic use, agricultural production, aquaculture, industrial production, hydropower, irrigation, sports, tourism, business, services, source creation, saltwater intrusion prevention, flood control, landscaping, and other purposes. However, this provision does not effectively ensure the control of AI-related impacts on water resource degradation, as it only imposes obligations on entities directly engaged in water exploitation. In cases involving other related parties who utilize AI products but are not direct exploiters, indirectly cause negative impacts on water resources-there remains no effective regulatory mechanism. For instance, ChatGPT is an AI product developed and deployed by OpenAI [8], a company headquartered in San Francisco, and is now widely used across most countries. To maintain the continuous operation of ChatGPT, a massive volume of water resources is exploited, particularly for the cooling of server systems. A scientific report indicates that Microsoft and OpenAI's data centers in the United States consumed more than 700,000 liters of water during the training of the GPT-3 model amount equivalent to what is needed to cool a nuclear reactor [9]. Accordingly, the entity operating ChatGPT, based on the existing provision, would theoretically be obligated to obtain a water resource exploitation permit. Nevertheless, as an AI chatbot, ChatGPT is being increasingly and widely adopted across the globe due to its convenience, and it is estimated that every 50 questions posed to the system consumes approximately 500 milliliters of water [9]. This illustrates that users of AI products (such as ChatGPT) may also indirectly contribute to significant negative impacts on water resources. However, legal regulations to effectively control such activity remain a major challenge for Vietnam's water resources and environmental protection law.

Provisions on the obligations of entities during the process of exploiting and using water resources-such as the prohibition of illegal acts, the requirement to use water efficiently through circulation, and the obligation to use water for proper and approved purposes-are currently limited to subjects who directly exploit or utilize such resources. However, in the context of AI, the affected subjects are not limited to entities directly engaged in water extraction and use, but also include related parties such as those who utilize AI-generated products and services, all of whom may, through their activities, indirectly impact water resources (as illustrated in the aforementioned example). These users are not directly exploiting or using water resources to operate AI systems; however, their use of AI-generated products can indirectly lead to excessive consumption of water resources. Despite this, the current legal framework does not clearly define the legal obligations of such parties, thereby creating a notable limitation in the protection of water resources from the adverse effects of AI.

Second, the State's formulation of strategies, master plans, and plans for the protection and development of water resources has not yet addressed the issue of controlling the negative impacts of AI. In reality, Prime Minister's Decision No. 1622/QD-TTg approving the National Water Resource Master Plan for the 2021–2030 period, with a vision to 2050, as well as the National Environmental Protection Strategy to 2030, with a vision to 2050, approved under Decision No. 450/QD-TTg dated April 13, 2022, have not adequately responded to the pressing needs of society concerning high-tech production activities, particularly those involving AI, which have been and are continuing to pose serious and alarming threats to water resources. The short-term goals and long-term visions set forth by the State in these strategies and plans have yet to fully recognize AI as a matter requiring greater attention, nor have they established mechanisms to effectively regulate its adverse effects on water resources. Given the nature of AI as an activity with the potential to cause degradation and even depletion of water resources, AI must be explicitly included in future strategies, master plans, and plans for water resource protection.

4. Conclusion

The rapid development of AI not only raises expectations for improved efficiency and innovation in resource governance but also presents significant risks to the sustainability of water resources. Among these, indirect yet severe impacts, such as the overexploitation of water for cooling AI infrastructure, increased pressure on groundwater ecosystems, and imbalances in water allocation, have emerged as new challenges for Vietnam's environmental legal framework.

Through legal analysis, it becomes evident that Vietnamese environmental law has made initial strides in addressing these issues, particularly via regulations on water resource exploitation permits and the obligations of entities involved in extraction. However, current legal provisions have yet to adequately encompass the novel characteristics of AI technology-especially its deep integration into sectors that consume and manage water resources.

The absence of specific legal criteria for identifying AI-related risks, as well as the lack of effective monitoring mechanisms and enforcement measures for AI activities that could degrade water resources, has created a regulatory gap that must be urgently addressed. Consequently, to improve the effectiveness of legal control over the risk of water resource degradation in the context of rapidly evolving

technology, Vietnam must continue to modernize its environmental legislation. This includes enhancing its predictive capacity, integrating technological risk assessment into environmental evaluation processes, and establishing specialized standards for high-risk AI applications.

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