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The negative impacts of AI on the environment and legal regulation

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Abstract
In the context of the 4.0 revolution, artificial intelligence (AI) is becoming increasingly popular and widely applied in daily life, production, and business activities. The development of AI creates expanded opportunities, challenges, and preliminary formulas for the entire society. AI has excellent potential in pollution control and environmental protection. However, the application of AI also negatively impacts the environment when it is not strictly controlled. This article focuses on clarifying the negative impacts of AI on the environment and the need for legal regulation as an effective tool to control the negative effects of AI on the environment.

Keywords: Artificial intelligence, AI, negative impacts, environment, environmental protection, law

Introduction

Artificial intelligence (AI) was born relatively early, along with the birth and development of computer science. There are many different ways to define AI. Still, artificial intelligence can generally be understood as a technology that allows machines to simulate human thinking, learning ability, understanding, problem-solving, decision-making, creativity, and automation, aiming to perform tasks requiring little or no human intervention.

Since its development and widespread research, scientists, in particular, and society, in general, have expected that AI can be applied to solve environmental emergencies on a global scale. With its increasingly strong development, AI operation requires adverse activities that shall negatively impact the environment with already existing problems. Controlling the negative impacts of AI to protect the environment is a compulsory and objective need in the context of increasing harmful environmental effects. Although AI brings many outstanding benefits in resource management and optimization, it also poses significant risks to ecological protection.

1. Negative impacts of AI on environmental protection

AI and related infrastructure are currently creating tremendous pressure on the environment. According to the United Nations Environment Program (UNEP), data centers that host AI servers generate a large amount of electronic waste. At the same time, AI operations consume considerable electricity, important minerals, and rare elements. Mining these minerals and elements to power AI is often done in an unsustainable way, leading to the depletion of these already scarce resources. In addition, operating AI requires a considerable amount of electricity, leading to increased greenhouse gas emissions and global warming. The impact of AI on the environment can be considered in the following aspects:

Negative impact of AI on the water environment: Current studies show that data centers that host AI servers use water during construction and operation. According to scientists' calculations, the amount of water that AI infrastructure worldwide will likely use is six times higher than that used in Denmark, which has a population of six million. High-performance AI servers consume water to cool electrical segments. The amount of water used by these data centers when released into the environment after use is often at high temperatures, which can cause thermal pollution, affecting the water ecosystem.

Negative impacts of artificial intelligence on the air environment: Artificial intelligence is currently emitting many greenhouse gases into the atmosphere. Along with its construction and development, artificial intelligence needs more energy to train and operate AI models. This energy source mainly comes from burning fossil fuels, which means that greenhouse gas emissions are increasing more and more. Greenhouse gas emissions are one of the key factors leading to climate change. Researchers have provided figures on artificial intelligence emissions into the environment. Specifically, the energy used to train a large AI model is five times larger than the emissions throughout the life cycle of a car. The air environment is affected by many different sources, including both dynamic and static emissions. However, the amount of energy consumed by AI and the amount of emissions that AI emits into the environment is still alarming regarding environmental protection and preservation.

Negative impacts of AI on natural resources: The construction and development of artificial intelligence models require a large amount of raw materials. According to calculations, it is necessary to use up to 800 kilograms of raw materials to create an AI model weighing 02 kilograms. At the same time, the microchips that provide energy for AI are often made of rare earth elements. What is worth discussing here is that the materials used in building and operating AI are not exploited sustainably, but instead in a way that harms the environment.

In addition, one of the negative impacts of AI on the environment is electronic waste. Electronic waste is electronic products that have reached the end of their life or are no longer used, containing many toxic chemicals such as mercury, lead, and cadmium. When electronic waste with these chemicals is released into the environment, it will pollute the soil and water sources and harm human health. In addition, artificial intelligence also negatively impacts the ecosystem, animals, and the natural environment. Artificial

intelligence applications in agriculture may lead to excessive use of pesticides and fertilizers, seriously affecting the quality of soil and water, which are essential elements of the environment and are home to many species of organisms. This leads to an imbalance in the ecosystem, directly affecting biodiversity.

In conclusion, along with the positive impacts, the construction and development of artificial intelligence lead to ecosystem degradation and biodiversity loss, negatively affecting the existence and development of animals, plants, and humans. Many measures, including legal measures, must control these negative impacts.

2. The need to control the negative impacts of AI on Environmental Protection by law

Legal regulation is the process by which the state uses law (as a regulatory tool) to impact social relations in specific directions to achieve the set goals. In the context of a strongly developing economy, law has now become the leading, most important, and most effective tool, an irreplaceable tool to regulate social relations, social organization, and management to ensure the stability and development of society by the purposes and orientations of the state. Social relations arise, develop, or change depending on the objective rules of life. Still, if they are left to operate according to those rules, it can lead to conflicts and mutual infringement, even having negative impacts, causing obstacles to social development and stability. The subject of law is social relations, but social relations are diverse. The law cannot regulate all; it only focuses on regulating social relations that are common and typical. From the above theoretical understanding, it can be seen that law only restricts a social relation in one particular period. After the process of movement and development, their impacts on life did not need to be regulated by law anymore. On the contrary, there are social relations that, at a certain period, have strong impacts, even negative impacts, on the development and stability of society. They are considered to be included and subject to regulation by law. Only then can we ensure that, although social relations arise or change in specific periods, if their existence has certain impacts on the development of society, it is necessary to become the subject of regulation by law.

In other words, legal regulation is the state's adoption of laws to regulate social relations that move and develop by the state's will in a specific period. In the context of the emergence of the 4.0 industrial revolution, especially the emergence of artificial intelligence (AI), it has substantially transformed humanity, affecting all areas from the economy and society to the environment and science and technology. In addition to its profound and positive impacts, artificial intelligence has left the world with urgent global issues that require joint efforts among countries, a typical example of which is environmental protection. The emergence of artificial intelligence and its negative impacts has raised the issue of environmental protection more urgent than ever. In general, countries have also taken action and responded to this issue by using control tools such as economic, technical, and educational tools. However, from the theoretical perspective of AI, environmental protection, and controlling the negative impacts of AI on environmental protection, it is necessary to use law as the leading, most important, and most effective tool to regulate AI. The need to control the negative impacts of AI on the environment through laws lies in the top urgency of balancing the technological advances of AI with sustainable development goals. Legal regulation can ensure that the development of AI is consistent with environmental protection, promoting the formation of "Green AI" more widely. The emergence of legal regulations to control the negative impacts of artificial intelligence on the environment is essential in preventing AI from exacerbating global environmental challenges such as climate change, water and energy depletion, over-exploitation of resources, and pollution.

Not all AI has harmful impacts on the environment. With its role, the law will detail the groups of AI with high risks to environmental protection that need to be banned and those with insignificant impacts. When applied, the subject must comply with certain conditions. Through this classification activity of the law, it will be shown that which group of AI has the potential to cause harmful impacts on environmental protection must be banned and which part needs to comply with the conditions when developing and applying, thereby showing that it is not necessary to regulate all subjects thoroughly but only a part that harms environmental protection. Above all, the emergence and development of AI are increasingly intense, with a tendency to increase negative impacts on environmental protection. Without human control, primarily through the law, "The development of complete artificial intelligence can mark the end of humanity". Allowing AI to develop, apply, and operate arbitrarily in life without being regulated by law will sooner or later put humanity in front of significant challenges in environmental protection, not stopping at the alarming level that has happened. After all, the birth or development of artificial intelligence comes from humans, replicates human behavior, and is a human's need. It can only be done through the law affecting human behavior to best control it. The law can prescribe rules of conduct that subjects must follow when exploiting environmental factors to produce and develop artificial intelligence (AI). Or prescribe standards on technology and techniques that subjects must strictly comply with when creating, developing, and applying artificial intelligence (AI) to minimize environmental impacts. The law also has civil and administrative sanctions for entities that have introduced artificial intelligence (AI) and caused adverse effects on the environment for some reason. Through the above regulatory directions, the law can contribute to controlling, minimizing, and limiting the negative impacts of artificial intelligence (AI) on environmental protection. Thus, with its role, the law regulates and orients the development of social relations by setting minimum standards for human conduct. Through the law, entities applying artificial intelligence into life will grasp which behaviors are legal, which are encouraged, mandatory, prohibited, and to have appropriate responses. For this reason, the law eliminates the negative development trend of social relations, eliminates the abuse of artificial intelligence causing negative impacts on environmental protection, and ensures compliance with objective laws. Furthermore, the law is also a means to safeguard and protect human rights.

Human rights are enshrined in the constitution and recorded in legal documents with the highest legal value of a country, typically the right to live in a clean environment. In other words, applying AI to life is not automatically an illegal act. Still, if one changes the typical characteristics of the human living environment, that subject will undoubtedly have to

bear adverse legal consequences. That is the way the law binds individuals to society; their rights must be placed in respect for the rights of others and respect for the standard rules of the community. Some countries have also focused on using the law to regulate the impacts of artificial intelligence. Still, most of them have only stopped at general impacts without a specific classification of implications, especially in the issue of environmental protection. Most recently, on March 13, 2024, the European Union (EU) passed the AI Act - the world's first set of basic rules for artificial intelligence management. The Act takes a risk-based approach, meaning that the higher the risk, the more strictly it will be managed, depending on the risk that AI poses to society. The EU AI Act is the beginning of forming a new legal framework to control the negative impacts of artificial intelligence on society, especially in terms of environmental protection.

3. Legal Provisions for Regulating the Negative Impacts of AI on the Environment

There must be legal frameworks established for appropriate provisions to regulate the negative impacts of AI on environmental protection, including (i) regulations on preventing the adverse effects of AI, (ii) regulations on controlling environmental pollution while adapting AI, (iii) provisions for natural resources conservation, (iv) regulations on addressing legal violations concerning the negative impacts of AI on the environment, as precisely stated below:

Firstly, laws governing the control of negative impacts of AI must include provisions to prevent such effects.

As a breakthrough in modern science and technology, AI holds significant potential for humanity but simultaneously poses risks to environmental sustainability. The incomplete development of AI necessitates forecasting potential risks across related disciplines. The establishment of legal provisions to preempt the negative effects of AI demonstrates proactive human efforts to mitigate environmental harm and reduce the adverse impacts of AI on environmental protection. In the domain of preventive regulations, national laws often emphasize precautionary principles, environmental impact assessments (EIA), environmental standards and technical environmental regulations, etc.

Secondly, legal provisions must address the control of environmental pollution caused by AI.

"Environmental pollution" refers to changes in environmental components that deviate from technical and environmental standards, negatively affecting humans and other living organisms. The goal of pollution control regulations is to protect human health and biodiversity. Regarding the negative impacts of AI on the environment, operating AI technologies emit substantial greenhouse gases. Researchers at the University of Massachusetts, Amherst, found that training large AI models could emit over 626,000 pounds of CO2, equivalent to five times the emissions of an average American car over its lifetime. It is evident that operating AI models contributes to changes in environmental components, and without legal provisions to control pollution resulting from AI, irreversible environmental degradation may occur. Environmental laws in many countries address pollution control through key provisions, including pollution control of environmental components (air, water, soil degradation, etc.), provisions of environmental emergency prevention, regulations on managing waste, etc. In Vietnam, pollution control is defined as *"the process of preventing, detecting, mitigating, and addressing pollution"*; thus, the fundamental content of Vietnam's legal framework aligns with international standards while also incorporating provisions from ratified international conventions (e.g., the Vienna Convention for the Protection of the Ozone Layer, the Montreal Protocol on Substances that Deplete the Ozone Layer, the UN Framework Convention on Climate Change, and MARPOL 73/78 on marine pollution prevention).

Thirdly, legal provisions for the protection of natural resources in AI-related activities.

The operation of AI technologies, particularly advanced AI models, requires a massive amount of technological infrastructure, such as high-performance computers, servers, and data centers. These devices rely on critical raw materials, including rare earth elements, lithium, and cobalt, for the production of chips, batteries, and other electronic components. Furthermore, running AI models requires substantial exploitation of natural energy resources, encompassing both renewable and non-renewable energy sources. A study on training Neuro-Linguistic Programming (NLP) models—an application of AI technology—documented the natural energy consumption associated with powering GPU and TPU processors for NLP tasks provided by three major cloud computing companies (Amazon, Google, Microsoft) across three major countries (China, the United States, Germany). The study revealed that much of the operational energy is derived from consuming large amounts of gas, coal, or nuclear power. It is evident that without legal provisions to regulate and protect natural resources, the operation of AI models can result in significant negative impacts on the environment and severely deplete natural resources, particularly non-renewable ones. Legal frameworks addressing the protection of natural resources encompass the following key elements: principles of natural resource protection and management, resource planning and regulation, biodiversity conservation, pollution control and resource exploitation, assigning responsibilities to relevant entities, and penalties for violations. The establishment of such legal provisions is essential to mitigate the environmental consequences of AI operations and ensure the sustainable use of natural resources.

Fourthly, legal provisions for addressing violations in regulating the negative impacts of AI on the environment.

AI cannot operate without human-led research, development, and application. Therefore, legal frameworks must emphasize the accountability of organizations and individuals in operating AI technologies and establish penalties for violations. The ultimate goal of such provisions is to ensure that organizations adhere to technical and environmental standards and manage AI-related energy consumption and emissions to achieve sustainable environmental development. Additionally, these provisions create a legal foundation for emerging technologies, ensuring they remain under legal control, especially as AI advances at a faster pace than regulatory frameworks. Legal provisions for addressing violations include civil liabilities (as *compensation for non-contractual damages*), administrative responsibilities, disciplinary measures, and criminal liabilities, along with regulations specifying the authority of state agencies to handle violations. Generally,

Vietnam's environmental laws addressing violations include these elements, although they are scattered across various legal documents.

Conclusion

In conclusion, the development and construction of artificial intelligence have created promising opportunities and also significant challenges in the environmental field which can cause resource depletion, environmental pollution, and ecological imbalance when they are not strictly controlled. Therefore controlling the negative impacts of AI on environmental protection is necessary and law is an effective and important mechanism to balance the transformational potential of AI and sustainable development goals. Through solid legal frameworks to control pollution, protect natural resources, and handle violations, the law can minimize the negative impacts of AI while promoting "Green AI" development. It is important that all actors in society, including the Government, lawmakers, organizations, and individuals, cooperate in developing and implementing legal measures to ensure control of the negative impacts of AI on the environment and use AI effectively and sustainably.

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