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The Influence of Technology on International Environmental Law and Its Implications For Indonesian Environmental Law

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ABSTRACT

This study explores the influence of technology on international environmental law and its implications for Indonesian environmental regulations. The research utilizes a normative juridical approach, analyzing legal norms and theoretical literature to assess how technological advancements impact environmental law at the international level and within Indonesia. The findings indicate that while technology has exacerbated environmental issues like pollution and ecosystem degradation, it also offers solutions for environmental protection, such as advancements in sustainable industrial practices and pollution control technologies. International environmental law, particularly the Stockholm and Rio Declarations, highlights the need for balancing technological progress with environmental sustainability. For Indonesia, the study reveals that while the country has made strides in aligning its regulations with international standards, enforcement remains a challenge. The study concludes that Indonesia must strengthen its regulatory frameworks, improve the enforcement of environmental laws, and adopt cleaner technologies to mitigate the negative environmental impacts of industrialization.

Keywords: influence of technology; international environmental law; international law

INTRODUCTION

One example of the development of human civilization is the growing technological system. Technological developments today are an important part in making it easier for people to carry out an activity. According to Bain (1937) said that technology basically includes all tools, machines, tools, apparatus, weapons, housing, clothing, means of transportation and communication, and also skills, which allows us as a human being to produce all of them. Meanwhile, according to Sardar (1987) technology is a means of solving the fundamental problems of every human civilization. Without the use of technology, this will cause many problems to not be solved properly and perfectly.

According to the two opinions above, it can be said that technology itself is a human creation that is made with the aim of making it easier and helping humans in this case to solve a fundamental problem in society. At this time, technology is very attached to the culture and civilization of the community, this certainly has an impact on several areas of people's lives (Sood, 2021).

However, the development of technology is also not spared from the negative impact given. The negative impacts given not only affect humans themselves, but the negative impacts given also have an impact on the ecosystem (Puspitasari, 2023).

According to the WHO (World Health Organization), in 2019 as many as 6.7 million people died due to ambient air pollution, and in 2022 as many as 2.1 billion people were exposed to household pollution. The WHO also noted that 99% of humans live in areas with air pollution levels that exceed WHO guidelines. One of the indicators that is affected by household pollution exposure is people's dependence on the use of fuel and also technology for cooking (Organization, 2019).

Pollution due to technology has occurred since 400 BC where the relationship between air and health was developed as an important part of the book Air, waters, and places attributed to Hippocrates. This shows that humans have long been aware of the dangers of pollution due to the use of technology at that time (Putra, 2015).

Awareness is being aware of the behavior or deeds performed. Awareness of the environment includes many aspects, including cognitive aspects (knowledge and skills), affective aspects (attitudes), and aspects of a person's behavior when involved in an environmental action individually or in groups. Through formal and non-formal education, this awareness can be achieved (Wijoyo, 2017).

In its development, the practice of using technology has been practiced even since ancient times, this is seen from various discoveries related to the tools used by humans in the Ancient era, where these tools were used as tools to assist ancient humans in carrying out hunting activities, cooking and so on. This continues to develop until now. However, some uses of technology actually backfire negatively for humans, this is related to pollution caused by the use of technology (Nugraha, Handayani, & Najicha, 2021).

This problem was already documented in the 13th century when coal was first used in London. So in the 19th century, the atmosphere of major cities in England was often polluted by coal smoke in winter, giving rise to a mixture of smog and smog known as smog. So in 1273 the English government made a law that prohibited the use of coal because it was detrimental to health (Grennfelt et al., 2020).

The birth of the law as a control against air pollution due to the use of coal was clearly seen when the British government took steps by making "*The Smoke Abatement Act*". But in 1952 an event occurred in the city of London called the "*Haze"* where this incident began with the use of coal in the domestic and industrial fields which resulted in London being shrouded in thick smoke for more than four days, which caused 12,000 deaths in the weeks and months that followed (Read & Parton, 2019).

Problems related to the environment are very important, public awareness of the importance of a healthy environment has actually become a problem that was highlighted at that time. This is evidenced where in 1661 an English writer John Evelyn published "*Fumifugium or The Inconvenience of the Aer and Smoak of London*" where this document contains a picture of air pollution in the City of London and suggests ways to reduce the scale of the problem. John proposed moving industries including brewing and lime burning to the countryside, and away from the cities. John Graunt, who was a contemporary of Evelyn, also posited a correlation between mortality rates and pollution, especially in episodes of fog (Putri, 2020). At that time there was no scientific data, or even any numerical value to measure the pollutants that existed, but in his narrative that says " *that this glorious and ancient city should wrap her stately head in clouds of smoke and sulphur, so full of stink and darkness"* this shows the state of the city of London at that time which was covered by smoke pollution.

From 1800 to 1850 the population of England and Wales doubled, the increase in population also affected distribution and industry, this led to an increase in pollution that occurred at that time. One of its main pollutants is hydrochloric acid from the Alkaline industry. Soda production was essential for the British textile, soap, and glass industries at the time, but as demand increased, there was an increase in acidification that caused severe damage to vegetation. The British government's efforts at the time to control emissions were carried out through the so-called Alkali Act of 1863 (MacLeod, 1965).

Nevertheless, laws to control air pollution did evolve in the late nineteenth century, and these laws also reflected the sanitation reforms that characterized the widespread public health problems of the time. This regulation is common in Europe and North America, but it also follows imperial rule around the world, so it is very famous in India

(e.g. the Smoke Disturbance Laws of Bengal of 1905 and Bombay of 1912) and Hong Kong.

The above history is a negative impact of the use of technology on the environment, therefore environmental problems are still occurring, this is due to the increasing number of technology use in the industrial and technological fields and the transportation sector, where this use has led to the existence of new international rules that regulate the environment. However, apart from the negative impact, technology is also needed as a means of fulfillment in environmental conservation efforts, this can be seen from several elements of international law that contain the importance of technology in terms of environmental conservation. Therefore, this study aims to look at the influence of technology on international environmental law and its implications on Indonesian environmental law.

Several studies have addressed the intersection of technology and environmental law, particularly concerning its impact on ecosystem sustainability. For instance, Fadli & Lutfi (2016) emphasized how technology advances in industrial sectors have both contributed to environmental degradation and offered solutions for environmental management. Similarly, Idris et al. (2018) analyzed the role of technology in enhancing environmental monitoring, arguing that modern technological tools can significantly improve sustainable practices in industries and urban management. Both studies recognize the dual role of technology: it can harm or protect the environment, depending on how it is utilized and regulated.

The urgency of this research lies in the ongoing environmental challenges faced by Indonesia, exacerbated by rapid industrialization and technological growth. As the country continues to expand its industrial base, managing the negative impacts of technology on the environment has become critical. Pollution, particularly from vehicle emissions and industrial waste, has reached alarming levels. Understanding how international environmental law, influenced by technological progress, can guide Indonesia's regulatory frameworks is vital for reducing environmental harm and promoting sustainable development.

While previous research has explored the broader impacts of technology on environmental law, there is a limited focus on how technological advancements specifically interact with international environmental laws and their implications for Indonesian regulations. This study fills this gap by examining how international environmental laws address technology's negative impacts, with a particular focus on Indonesia's legal response and enforcement strategies. The research will also explore how technological innovations can be integrated into environmental conservation efforts, highlighting the regulatory challenges Indonesia faces.

The novelty of this study lies in its exploration of the relationship between technology and international environmental law, focusing on its implications for Indonesia. It examines how global frameworks such as the Stockholm Declaration, Rio Declaration, and various international conventions address the technological impacts on the environment. This study also investigates the potential for using advanced technologies to mitigate environmental damage in Indonesia, offering new insights into balancing economic development with environmental sustainability.

The purpose of this study is to analyze the influence of technology on international environmental law and its implications for Indonesian environmental regulations. This research aims to provide insights into how Indonesia can align its legal frameworks with global standards to better manage environmental challenges posed by technological advancements. The benefits of this study include offering recommendations for improving environmental law enforcement in Indonesia, promoting the integration of sustainable technologies, and enhancing Indonesia's compliance with international environmental obligations.

METHOD

This study uses several approaches, namely the statue approach, the case approach and the conceptual approach (Mahmud Marzuki, 2018). The specification of this research is descriptive, namely in this study the laws and regulations related to what is the object of the research will be stated. This type of research is normative juridical, for that the collection of legal materials is library research and will be analyzed normatively, in this case, by exploring theoretical literature, legal concepts and legal norms that have been regulated.

RESULTS AND DISCUSSION

The term environmental law in St. Munadjat Danusaputro's book regarding some of the meanings of environmental law is a translation of several terms, namely "Environmental Law" in English, "Millieeurecht" in Dutch, "L,environnement" in French, "Umweltrecht" in German, "Law of Nature Around" in Malay, "Batas nan Kapaligiran" in Tagalog, "Sinved- lom Kwahm" in Thai, "Qomum al-Biah" in Arabic (Fadli & Lutfi, 2016).

The development of international environmental law that is now a topic of discussion in every country is the term "sustainable development or in Indonesian it is sustainable development". This term will be related to all aspects that are called development and it may be related to oil, gas, mining, maritime, economic, and other exploitation activities. The principle of sustainable development has become a topic of discussion for the international community at various scientific meetings because the global environment and world natural resources are increasingly threatened by economic development carried out by humans. In the development of technology, it is also a part that is also highlighted, this is seen from several elements of international law that contain the impact given or obtained in the use of technology as a medium in helping environmental sustainability (Idris, Sibley, & Hadjri, 2018).

Technology as a focus of International Law on the Environment

Stockholm 1972

It is undeniable that the 1972 Stockholm Declaration is a pillar of the development of modern international environmental law, meaning that since that time environmental law has undergone a fundamental change from use-oriented to environment-oriented law (Hardjasoemantri & Supriyono, 2006).

From June 5 to 16, 1972, the United Nations (UN) held a conference in Stockholm, Sweden, to discuss important issues related to the environment. This conference is commonly referred to as the United Nations Conference on Human Environment abbreviated as UNCHE 1972. The 1972 Stockholm Declaration was signed by 113 heads of state and contained 26 principles of development. If we see that in Chapter 1 Number 1 there is a narrative that says:

"*1. Man is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale. Both aspects of man's environment, the natural and the man-made, are essential to his well-being and to the enjoyment of basic human rights-even the right to life itself.* "

It is said that the acceleration of science and technology affects humans in changing their environment, which shows that the great impact of technological advances on the environment is very influential. This shows that technology and the environment are things that go together and cannot be separated, the two affect each other. This is realized by humans themselves so that this becomes the first center of environmental change itself.

Number 3 also emphasizes that actually the ability of humans to change the environment is actually able to provide development benefits or quality of life if used correctly, but as we see that the impact it gives actually creates more and more

environmental damage, as evidenced by the number of areas that have high and dangerous pollution levels. The 6th principle explains the fear of toxic substances released into the air due to human activities. This can be understood as industrial waste and disposal from vehicles, which this appeal has been clearly written in principle 6. Some of the principles lead to the supervision of the environmental state by carrying out development for the improvement and increase of the living standards of the current generation by not reducing the right of future generations to enjoy a healthy environment.

However, there are several things that are important to note, namely related to the economic development of a country, one form of economic development of a country is currently determined by the size of the industry owned by a country.

According to Joseph Schumpeter, a country's economy can improve if entrepreneurs create innovations and make new combinations related to production processes to business investment (Schumpeter 1982, 395). Meanwhile, Robert M. Solow emphasizes more on the series of production activities carried out by humans, capital accumulation, the use of modern technology and results or outputs.

Therefore, the economy and industry are a unit that has existed for a long time. However, it must be seen again that industrial companies are also the largest contributors to pollution in the world. One of them is factory waste that is poorly managed so that it causes pollution. The main sources of outdoor pollution include residential energy for cooking and heating, vehicles, power plants, agriculture/waste incineration, and industry. Policies and investments that support sustainable land use, cleaner household energy and transportation, energy-efficient housing, power generation, industry, and better municipal waste management can effectively reduce major sources of ambient air pollution. So it can be seen that the importance of a country's economic development must also be seen from the management and ability of the state in managing its industries, this was also emphasized in the Stockholm conference.

The Stockholm Declaration triggered the birth of several international conventions that protect the environment. Among the conventions are the 1974 Paris Convention, the 1976 London Convention, the 1982 Law of the Sea Convention, the 1985 Vienna Convention, the 1992 Climate Change Convention, the 1982 Convention on Biological Diversity and others (Fadli & Lutfi, 2016).

RIO Declaration 1992

The Rio de Janeiro conference highlighted how various social, economic, and environmental factors are interdependent and co-developed, and how success in one sector requires action in another sector to be sustained over time. The main objective of Rio's 'Earth Summit' is to produce a broad agenda and a new blueprint for international action on environmental and development issues that will help guide international cooperation and development policy in the twenty-first century. The content of this conference also contains directions for technology development.

Apart from the negative impact, technological developments also have a positive impact on preserving and developing the quality of human life with a healthy environment. It is clear that the 1992 Rio Declaration recognizes the importance of the use of technology in systematic assessment and observation activities in management activities. Where it facilitates periodic evaluations.

In addition to playing a role in management activities, the Rio Declaration also encourages the country to improve the genetic repair process by applying biotechnology in increasing environmental productivity such as tree recovery, seed technology, seed procurement, and germplasm banks. This shows the awareness of the importance of technology that is not only used as an industrial tool but also used as a tool to empower the environment.

Convention on Biological Diversity (CBD)

Regarding the use of technology in this convention, it is very clear that it can be seen in the content of Article 16 which talks about appeals related to Access and Transfer of Technology where this section contains the importance of biotechnology, where countries must prepare and provide access to each other technology to other parties that are relevant to the conservation and sustainable use of biodiversity or utilize genetic resources and do not cause significant damage to the environment.

This shows that the relationship between countries related to environmental empowerment does not only rely on prohibitive rules, but intellectual property is needed in understanding the use of technology as the basis for countries to be able to help each other in achieving the goals of this convention, namely biodiversity conservation, sustainable use of its components and fair and equitable distribution of benefits from the use of genetic resources. including in an appropriate manner. access to genetic resources and through the appropriate transfer of relevant technologies, taking into account all rights to such resources and technologies, and through appropriate funding.

Apart from the 3 international legal instruments above, there are several specific rules that regulate the use of several technologies in order to prevent environmental damage, namely:

1. **MARPOL 73/78 1973**

The 1973 International Convention for the Prevention of Pollution from Ships, as amended by the 1978 Protocol, or "MARPOL 73/78" (for "Marine Pollution"), is one of the most important international marine environmental treaties.

It was developed by the International Maritime Organization with the aim of minimizing marine pollution such as landfills, oil and air pollution.

2. **Biological Weapons Convention (BWC), or Biological and Toxin Weapons Convention (BTWC) 1975**

A disarmament treaty that effectively prohibits biological and toxic weapons by prohibiting their development, production, acquisition, transfer, stockpiling, and use.

3. **Chemical Weapons Convention 1993**

The arms control agreement is managed by the Organization for the Prohibition of Chemical Weapons (OPCW), an intergovernmental organization based in The Hague, Netherlands. This agreement entered into force on April 29, 1997. The Convention prohibits the use of chemical weapons and the development, production, stockpiling and transfer of chemical weapons or their precursors on a large scale, except for very limited purposes (research, medical treatment). The primary obligation of Member States under this Convention is to enforce this prohibition and destroy all chemical weapons currently in existence. All sabotage activities must be carried out based on OPCW verification.

4. **Comprehensive Nuclear-Test-Ban Treaty (CTBT) 1996**

The Comprehensive Nuclear Test Ban Treaty (CTBT) is a multilateral treaty that prohibits nuclear test explosions and other nuclear explosions for civilian and military purposes under all circumstances.

The Convention was adopted by the United Nations General Assembly on September 10, 1996, but it has not yet entered into force because certain eight countries have not ratified the Convention.

5. **Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency 1986**

The Convention on Assistance in Cases of Nuclear Accidents or Radiological Emergencies is a 1986 agreement between the International Atomic Energy Agency (IAEA) that states that each country agrees to notify the IAEA of any assistance in the event of a nuclear disaster creature accident that occurs in another country that has ratified the treaty. This convention, along with the Convention on Early Reporting of Nuclear Accidents, was adopted

in April 1986 in direct response to the Chernobyl accident. It should be noted that nuclear disasters are very dangerous for nuclear-affected ecosystems.

Some of the conventions above show that the use of technology must be used as well as possible, this is because negligence in the use of technology can result in environmental damage which has an impact on the development of ecosystems and health.

Implications for Rules in Indonesia

Rules Related to Motor Vehicle Technology

Talking about world pollution, according to IQAir in 2023 Indonesia is the country with the 14th largest polluter in the world, pollution in Indonesia is mostly sourced from waste burning, burning in household activities, motor vehicles, and industrial activities.

In principle 6 of the Stockholm Declaration shows concern about the impact of technology where toxic substances damage the health system in humans, in Indonesia itself one of the main causes of pollution is vehicle emissions. In which in exhaust gas emissions there are a number of chemical elements, such as water (H2O), carbon monoxide (CO), carbon dioxide (CO2), nitrogen dioxide (NO2), and hydrocarbons (HC). Vehicles are one of the main causes in Indonesia due to the very dense number of users. The table below will show the number of vehicles in Indonesia from 2021 to 2022.

Types of Motor Vehicles	**Development of the Number of Motor Vehicles by Type (Unit)**	
	2021	**2022**
Passenger Car	16.413.348	17.168.862
Bus Car	237.566	243.450
Goods Cars	5.299.361	5.544.173
Motorbike	120042298	125.305.332
Sum	141.992.573	148.261.817

It can be seen in the table above that there is an increase in the number of vehicles in Indonesia. This can also be seen with several big cities that until now are still experiencing very congested traffic flows. This is also what has resulted in the amount of pollution in Indonesia increasing.

Actually, there are no rules that specifically regulate the limits on vehicle ownership so that the addition of the number of vehicles cannot be limited. However, some rules actually regulate the feasibility of using vehicles as an effort to prevent rising pollution due to inappropriate vehicle gas emissions. This can be seen in article 48 paragraph 1 of Law No.20 of 2009 where *Every Motor Vehicle operated on the Road must meet the technical requirements and roadworthiness*. Roadworthiness as referred to in paragraph 1 is determined by performance, one of which is exhaust gas emissions.

In determining vehicle exhaust gas limits in stages, it has actually been regulated in the Regulation of the Minister of State for the Environment Number 05 of 2006 concerning Motor Vehicle Exhaust Gas Emission Thresholds, which has now been replaced by the Regulation of the Minister of Environment and Forestry No. 8 of 2023 concerning the Implementation of Vehicle Emission Quality Standards. This is because of long use for a certain period of time, there is a possibility of a change in size in the engine parts so that the engine work is less perfect, this results in wasteful fuel so that the pollution produced also increases. To overcome this, the vehicle needs to be maintained periodically, namely retuning and replacing damaged parts.

But sometimes In reality, until now the government has not been firm enough in cracking down on perpetrators of emission limit violations.

Rules Related to Industrial Technology

The environment and industry today go hand in hand, but as we know that companies are obliged to take responsibility for their industrial waste. Actually, in Indonesia there are several rules that regulate related to the regulation of Industry. The following are the rules that specifically regulate industry in Indonesia as a measure to prevent industrial waste pollution. This is also related to the Quality Standards of the technology used.

1. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 13 of 2021 concerning Continuous Industrial Emission Monitoring Information System
2. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 12 of 2021 concerning Quality Standards for Recycled Emissions of Lithium Batteries
3. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 11 of 2021 concerning Quality Standards for Engine Emissions with Internal Combustion.
4. Government Regulation of the Republic of Indonesia Number 5 of 2021 concerning the Implementation of Risk-Based Business Licensing
5. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.15/Menlhk/Setjen/Kum.1/4/2019 concerning Emission Quality Standards for Thermal Power Plants
6. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.19/Menlhk/Setjen/Num.1/2/20 17 concerning Emission Quality Standards for Cement Industry Businesses and Activities
7. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number: P. 87/Menlhk/Setjen/Kum.1/11/2016 concerning Electronic Reporting System for Environmental Licensing for Businesses and/or Activities
8. Regulation of the Minister of Environment of the Republic of Indonesia Number 4 of 2014 concerning Quality Standards for Immovable Source Emissions for Mining Businesses and/or Activities
9. Regulation of the Minister of State for the Environment of the Republic of Indonesia Number 07 of 2012 concerning Management of Immovable Source Emissions for Businesses and/or Activities of the Rayon Industry
10. Regulation of the State Minister of Environment Number 13 of 2009 concerning Quality Standards for Immovable Source Emissions for Oil and Gas Businesses and/or Activities
11. Regulation of the State Minister of Environment Number 18 of 2008 concerning Quality Standards for Immovable Source Emissions for Businesses and/or Activities of the Carbon Black Industry
12. Regulation of the State Minister of Environment Number 17 of 2008 concerning Quality Standards for Immovable Source Emissions for Businesses and/or Activities of the Ceramic Industry.
13. Regulation of the State Minister of Environment Number 07 of 2007 concerning Quality Standards for Emissions from Immobile Sources for Steam Boilers

The above rules are very clear as the government's efforts to prevent environmental pollution due to the use of technology in the industrial sector. As a result, economic development is the main point for the country today as a form of embodiment of the legitimacy of the community, making industry one of the definite choices in realizing it. However, it should be noted that the above rules are a form of awareness of the great impact of industrial

technology. So that the person in charge is not only from the government but also from the business actors themselves.

CONCLUSION

The development of technology is inherently linked to environmental issues, highlighting both positive and negative impacts on ecosystems and economies. As technology facilitates human activities, it can lead to competition between environmental sustainability and economic growth, especially in developing countries like Indonesia, where industrialization is crucial for economic progress. This transformation has resulted in significant pollution levels, prompting the Indonesian government to enact regulations. However, the enforcement of these rules remains weak, necessitating a more robust approach to hold violators accountable. Ultimately, sustainable solutions must balance current needs with the preservation of resources for future generations, ensuring that common resources like oceans, freshwater, and air are protected through careful planning and technological management.

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