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A SYSTEMATIC REVIEW OF ENVIRONMENTAL LEGISLATION AND POLITICS REGARDING THE REGULATION OF DEVELOPING CONTAMINANTS IN INDONESIA

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Abstract

A systematic evaluation of the environmental regulations that apply to emerging pollutants at the international level, with a particular focus on Indonesia, is to be conducted. The search for articles and documents was conducted according to the PRISMA statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) in databases including PubMed, Scopus, ScienceDirect, Jane's, Dimensions, Google Scholar, and the Comprehensive System of Standards and Evaluation of the Indonesian Ministry of the Interior. A total of 3089 documents were examined, and based on the inclusion, exclusion, and quality criteria, two tables were created: the first comprising 24 scientific publications and the second containing 7 Indonesian standards. The regulation of developing contaminants is a crucial matter that necessitates the involvement of many sectors, including political, economic, social, and environmental domains. To achieve this, it is essential to coordinate the government and society while taking into account the experiences of other nations for its execution. The challenges related to access to information and educational programs significantly affect compliance with environmental standards, and there is a paucity of scientific knowledge regarding this topic.

Keywords: Emerging pollutants, environmental regulations, environmental legislation, environmental laws, environmental polities

INTRODUCTION

A country in the southeast Asia continent, Indonesia is home to a diverse array of ecosystems, flora, fauna, and valuable natural resources (Apriyanto et.al., 2021). Currently, Mexico confronts numerous challenges in monitoring various environmental issues, necessitating the adoption of an appropriate strategy to handle the immediate and indirect economic, social, health, and environmental ramifications of its policies and actions. The major environmental issues confronting the nation are climate change and the degradation of land and marine ecosystems, together with their associated biodiversity. The scarcity and contamination of water resources, together with air quality issues, are significant concerns. Consequently, quick efforts are necessary as these issues may adversely affect the environmental and economic domains. Consequently, they influence societal dimensions (e.g., health or food security) and may jeopardize production and commerce, as evidenced recently (Azhar et al. 2023). Environmental concerns are intricately linked to economic and social challenges. The advancement of environmental education is crucial for fostering sustainable lives. A comprehensive, systematic, and collaborative strategy is essential to devise strategies and governmental policies that effectively integrate economic development with environmental protection and restoration.

In order to safeguard the environment, numerous laws have been implemented. Nevertheless, the majority concentrate on regulating airborne pollutants, with few addressing water contaminants. Conversely, numerous regulations have remained unchanged for three to four decades, and there are no significant repercussions for non-compliance. Simultaneously, they concentrate exclusively on regulating specific categories of contaminants. Emerging contaminants, such as pharmaceuticals, perfluorinated chemicals, hormones, illicit substances, and personal care goods, are not addressed by Mexican regulation. Moreover, nanomaterials, identified as pollutants of rising concern in recent years, are excluded from these laws.

The issue of emerging pollutants and their regulation has gained significant global attention, despite numerous nations, particularly within the European Union, having undertaken the implementation of rules for these substances for some years. The onset of the epidemic highlighted the urgent necessity for prompt response.

The existence of developing pollutants in aquatic ecosystems (e.g., potable water, groundwater, influent surface water, and effluent from wastewater treatment facilities), atmosphere, aquatic creatures, and sediment poses a significant challenge to both environmental integrity and human health. The necessity to regulate the presence of these compounds in the environment stems from the reality that these micropollutants, produced by human activities, are typically discharged into the environment in minimal amounts. Nonetheless, with the passage of time and as a result of their widespread and thorough application, they accumulate in the environment. The paramount concern is that even at minimal quantities, they might adversely impact live organisms, particularly over extended periods.

A direct correlation exists between industrial activities, urban areas, and their environs and the presence of emergent pollutants in wastewater. The regulated or unregulated release and the persistence of emerging pollutants present a substantial challenge to the government, encompassing policy and regulatory formulation, scientific inquiry, and the advancement of technologies for the elimination of these contaminants. In recent decades, Mexico has produced numerous papers (e.g., declarations, recommendations, non-binding agreements, and community accords) intended for environmental enforcement, lacking any legally binding authority and possessing merely advisory significance.

This study conducted a systematic assessment of international environmental rules utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) methodology. Additionally, we examine the existing state of political legislation and environmental education initiatives established to address environmental issues in Mexico. Ultimately, we analyze how this can assist in regulating the prevalence of new pollutants.

LITERATURE REVIEW

Normative hierarchy in Indonesia

Standardization is a crucial tool for the national economy and international trade. It is delineated as the procedure through which the public and private sectors in the domains of health, environment, and commercial information are governed. Conversely, standardization denotes the amalgamation of information acquired through discussions among specialists in a certain field or productive endeavor. In Indonesia, standards are categorized into three types: NOM, NMX, and NRF.

NOM constitutes obligatory technical requirements that delineate the requisite qualities that processes or services must adhere to when they pose a danger or threat to human health. Furthermore, it pertains to terminology as well as its compliance and enforcement. They must undergo review every five years after their enactment, followed by any modifications, cancellations, or ratifications. NMX offers standards, attributes, test methods, guidelines, characteristics, and prescriptions for common and repeated usage regulations relevant to a product, process, installation, system, activity, service, or method of production or operation. Additionally, it encompassed regulations pertaining to terminology, symbols, and marked or labeled packaging.

These standards are obligatory just when designated as NOM. NRF standards apply to goods or services when Mexican or worldwide standards do not address their requirements, or when their specifications are outdated or irrelevant.

In Indonesia, the Constitution serves as the paramount legal framework governing the state. Moreover, it derives all normative order that is really secondary, whether at the federal or municipal levels. It comprises a dogmatic section that delineates guarantees or individual rights and an organic section that regulates the form, function, and authority of federal and municipal governments. It may be deduced from the aforementioned reasons that it holds hierarchical superiority above any other legal standards, including international treaties, laws, regulations, and decrees now in effect in the country, which must conform to the Constitution's mandates. Consequently, the fundamental axis of the nation's legal framework is ever evolving in response to societal demands.

In the 1940s, environmental awareness and concern in Mexico were initiated as a result of the country's metropolitan areas' increased industrialization, urbanization, development, and demographic concentration. This scenario was exacerbated by the decline in air quality in major urban areas of the country and the global response within academic, intellectual, and governmental spheres over atmospheric issues. It has been formulating solutions to mitigate pollution and the degradation of natural resources. In 1988, the General Law of Ecological Balance and Environmental Protection was enacted, delineating the principles for inter-institutional coordination, fostering sustainable development, and laying the foundation to ensure the right of all individuals to inhabit a healthy environment, as well as to promote health and welfare, thereby remaining the preeminent legislation concerning environmental matters.

In 1989, the National Water Commission was tasked with safeguarding national waterways and their intrinsic public assets for sustainable management and maintaining water security, with accountability to governmental and societal directives (Angelakis et al, 2021). Established in 1992, the National Institute of Ecology was founded to formulate standards and delineate policies. Moreover, the Federal Attorney for Environmental Protection was responsible for monitoring and ensuring adherence to regulations and legislation. In late 2000, the Ministry of the Environment and Natural Resources, encompassing various societal sectors and public functions, proposed criteria and instruments to guarantee the optimal protection, conservation, and utilization of the nation's natural resources, thereby establishing a comprehensive environmental policy. Table 1 illustrates the historical regulation and management of water in Mexico. Initial accounts from the nineteenth century distinctly reveal that the administration and regulation of water were overseen by towns and privately owned by individuals, communities, and landowners, who may acquire it through various means.

Nonetheless, this persisted until the Porfirio Díaz era, during which the government assumed the authority to regulate water rights and their utilization. Following that period, as technology progressed and the population grew, more substantial support and more finances began to be allocated. Concurrently, hydraulic projects were executed, and the initial legislation addressed water explicitly and immediately. Likewise, several agencies specialized and delineated their tasks, with a primary focus on water utilization, energy generation, and agricultural irrigation.

METHOD

A systematic review of published publications and documents was conducted in accordance with the PRISMA guidelines (Branes, 2022). Document identification and search methodology A bibliographic search was conducted to find pertinent papers and documents from inception to November 2021. The search utilized databases including PubMed, Scopus, ScienceDirect, Jane's, Dimensions, Google Scholar, and the Integral System of Standards and Evaluation of the Mexican Ministry of the Interior.

The inquiry was conducted utilizing the PICO framework with the keywords: “environmental law,” “environmental protection,” and “emerging pollutants.” The search method utilizing "OR," "AND," and "NOT" is as follows: "environmental law" OR "environmental legislation" AND "environmental policy" OR "environmental policies" AND "environmental protection" OR "environmental education" AND "emerging pollutants." It is noted that some filters were performed during the search process, including published articles and those in the English language.

The procedure for identifying pertinent documents can be outlined as follows: (1) conduct a literature search in designated databases; (2) export results to reference management software (Mendeley) and eliminate duplicates; (3) select abstracts based on inclusion and exclusion criteria, as well as the research question, utilizing the PICO strategy. It was conducted by two members of the research group utilizing Rayyan software; (4) a third group member reviewed conflicts and selected

pertinent articles by examining the full texts read by two study group members; and (5) any additional relevant papers were identified using the snowball technique.

Criteria for eligibility

Papers were deemed eligible for inclusion in the review if they met the following criteria: (1) original research articles published in a peer-reviewed journal, along with Mexican laws, standards, agreements, and policies; (2) publication in English for articles and in both English and Spanish for normative documents; (3) focus on water legislation; (4) examination of the implications of emerging contaminants in aquatic organisms and human health; (5) consideration of issues arising from the presence of contaminants in water bodies; and (6) investigation of emerging contaminants: occurrence and toxicity.

Articles were omitted if they pertained to the following: (1) Mexican legislation, regulations, treaties, or policies pertaining to soil, air, and sediment; (2) emphasizing elements of bioremediation, water purification, and inactive legislation.

Data extraction

Data were extracted from qualifying papers by two reviewers, utilizing a consistent methodology in accordance with the PRISMA statement. A variety of facts was gathered, and a third group member adjudicated the disputes.

RESULTS AND DISCUSSION

Overview of publications.

Initially, the database search yielded 3062 international documents and normative documents for Indonesia. Additionally, 27 articles from mother sources were identified, resulting in a total of 3089 documents. Subsequently, with the Mendeley program, 178 duplicate records were removed, resulting in a total of 2911 documents. Subsequently, these were inputted into Rayyan for the evaluation of titles and abstracts, resulting in 78 publications being reviewed in full text. Upon reviewing the 78 papers, 47 were removed, resulting in 31 final pieces. Utilizing the selected papers, we commenced the building of the summary table for the final articles. The table was constructed with 24 final articles in mind, as seven articles were identified during the construction process. However, they were excluded due to their failure to satisfy the quality criteria established for this review. Subsequently, the quality of each item was evaluated.

Following the investigation, 24 research articles were utilized, as indicated in Table 3. Seven pieces were recognized from China, four from the United States, and two from India. Simultaneously, five stories encompassed more than three countries, whereas one piece pertained to Ethiopia, Russia,

Bangladesh, and Mexico. Ultimately, two articles were composed in a broad manner, excluding any specific nation references. Out of 24 articles, 11 employed a conceptual methodology, one utilized a hybrid methodology (de Economia, 2022), while the remaining articles adopted a qualitative methodology.

Global concerns over environmental management have intensified, resulting in heightened interest in actions, environmental obligations, and the establishment and verification of punishments. This is seen in five of the referenced articles.

The subsequent seven articles demonstrate the government's internal involvement and the external assistance from environmental organizations in the implementation of legislation, taking into account the economic factors and their fluctuations in relation to environmental rules and culture. The population has demonstrated a lack of interest in engaging with these concerns.

The article discusses resilience in socio-economic systems. Nonetheless, it underscores the necessity of implementing reforms promptly, as the article indicates that an abundance of laws exists; however, without coordination among governmental sectors, non-governmental organizations will struggle to achieve their established objectives.

A total of eight articles addressed emerging pollutants, which accounts for one-third of the total publications. Three papers discussed the issue of microplastics, outlining measures to mitigate these chemicals due to their hazardous consequences. They significantly impact creatures and human health. California aims to create a collaborative framework to mitigate the effects of microplastics across multiple sectors. Three papers posited that the enforcement of regulations is contingent upon the nature of the pollutant and the investigations conducted to create correlations that facilitate effective environmental management (Apriyanto et al., 2021; Azhar et al, 2022). The final two papers addressed international treaties and worldwide legislation concerning hazardous substances, with a focus on new contaminants. They also discussed how its application and legislative reforms could mitigate their environmental and human health consequences.

The existing environmental legislation originate from 1996 to 2005. These regulations are promulgated by many secretaries, specifically the Ministry of Health (SSA) and the Ministry of the Environment, Natural Resources, and Fisheries (SEMARNAT).

The initial three standards pertain to the maximum allowable concentrations of contaminants in wastewater, primarily metals, substances, compounds, and organic debris. In the standard, it pertained to forestry utilization. Nonetheless, the guideline highlighted the concern over hydrocarbons.

The two remaining standards addressed water quality for human use and consumption, defining the allowable levels for contaminants. In contrast to the initial standards, this one encompasses a greater quantity of pollutants. Simultaneously, the standard delineated the tasks associated with monitoring and evaluating water quality, referencing the allowed limits specified in the standard. Both tables address the considerations pertinent to pollution management.

The political sector pertains to choices made by the government; the economic sector governs capital investment. Additionally, we have the social sector, which signifies the engagement and oversight of the populace.

CONCLUSION

National and worldwide scientific research has enhanced understanding of the aquatic environment and the likelihood of encountering developing pollutants, facilitating the measurement of their concentration and the assessment of their potentially detrimental impacts on the ecosystem and human health.

At the national level, these investigations could provide a foundation for establishing regulations governing these compounds and for the deployment of technologies facilitating their removal. A more pertinent approach is to concentrate on environmental education programs. No information regarding this item was identified in the systematic review. Consequently, this subject is advised to be regarded as a potential avenue for future research or as a continuation of this review. A considerable number of global standards exist; nonetheless, their adaptation to individual countries is a critical concern. Due to the distinct interests and aims of each government, implementation, compliance, and verification pose challenges for many nations.

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