

**INTERNATIONALIZATION OF ENVIRONMENTAL MANAGEMENT:  
DIRECTIONS AND CONDITIONS OF DEVELOPMENT  
(CASE OF THE PEOPLE'S REPUBLIC OF CHINA)**

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**Abstract.** The problems of the state environmental processes managing have become international in nature in the last decade due to the increasing importance of the environmental paradigm in the general context of analyzing the consequences of rapid economic growth, the need to transition to a "green" and low-carbon economy and ensure the quality of residents' life. The internationalization of environmental process management involves global trends, indicators, management technologies and their synchronization with internal (national) processes.

Based on a comparative analysis of the key macroeconomic and environmental indicators of China and the United States, the authors identify the problems that have arisen in the Chinese environmental management practice and propose directions and forms for improving environmental management based on its internationalization. It was determined that the priority measures for the Chinese government are: 1) the concentration of the national environmental management system at the primary territorial management link level - the municipality; 2) use existing cooperation platforms to strengthen international exchange and cooperation between the Chinese government and other countries on environmental management issues; 3) training and retraining of personnel taking into account the fact that modern international systems stimulate technologies for unifying the collection and processing of environmental data; 4) the need to optimize the budget expenditures structure and the development of "green finance" technologies; 5) basing the environmental management system of the territory on the control of industrial and non-industrial pollution. The conclusion of the authors about the need for significant detail in the disclosure of environmental pollution information by enterprises is important. The authors believe that in the process of internationalization and improvement of China's environmental management, the existing information platforms of international cooperation should be more actively used in order to strengthen international exchange and cooperation. It is also important to take into account that modern information systems stimulate technologies for unifying the collection and processing of environmental data.

**Keywords:** environmental management, internationalization of environmental management, informatization & environmental data processing, training of environmental managers, financing of environmental problems

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**ИНТЕРНАЦИОНАЛИЗАЦИЯ В СФЕРЕ ЭКОЛОГИЧЕСКОГО УПРАВЛЕНИЯ:  
НАПРАВЛЕНИЯ И УСЛОВИЯ РАЗВИТИЯ  
(НА ПРИМЕРЕ КИТАЙСКОЙ НАРОДНОЙ РЕСПУБЛИКИ)**

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**Аннотация.** Проблемы управления экологическими процессами государства в последнее десятилетие приобретают характер интернациональных в силу увеличения значимости экологической парадигмы в общем контексте анализа последствий быстрого экономического роста, необходимости перехода к «зеленой» и низкоуглеродной экономике и обеспечения качества жизни жителей. Интернационализация управления экологическими процессами предполагает учет мировых тенденций, индикаторов, технологий управления и их синхронизацию с внутренними (национальными) процессами.

Базируясь на сравнительном анализе ключевых макроэкономических и экологических показателей Китая и США, авторы выявляют проблемы, возникшие в практике управления природоохранной деятельностью Китая, и предлагают направления и формы совершенствования экологического управления на основе его интернационализации. Определено, что приоритетными мерами для китайского правительства являются: 1) концентрация системы национального экологического управления на уровне первичного территориального управленческого звена - муниципалитета; 2) использование существующих платформ сотрудничества для укрепления международного обмена и сотрудничества между правительством Китая и другими странами по вопросам управления окружающей средой; 3) учет того, что современные международные системы стимулируют технологии унификации сбора и обработки экологических данных, что потребует подготовки и переподготовки кадров; 4) необходимость оптимизации структуры бюджетных расходов и развития технологий «зеленых финансов»; 5) базирование системы экологического управления территории на контроле производственного и внепроизводственного загрязнения. Важным представляется вывод авторов о необходимости значительной детализации раскрытия предприятиями информации о загрязнении окружающей среды. Авторы полагают, что в процессе интернационализации и совершенствования экологического управления Китая следует более активно использовать существующие информационные платформы международного сотрудничества в целях укрепления международного обмена и сотрудничества. Также важно учитывать, что современные информационные системы стимулируют технологии унификации сбора и обработки экологических данных.

**Ключевые слова:** экологическое управление, интернационализация экологического управления, информатизация и обработка экологических данных, подготовка кадров эколог-менеджеров, финансирование проблем экологии

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## 1. Introduction

Improving the environmental management strategy and technology is an important part of improving the China's national management capacity. Enhancing the capabilities of state environmental management and building a national environmental management system are determined by the current basic national conditions of China and the objective needs of economic and social development, and are also fundamental requirements for building a new ecological civilization [1]. Environmental management is now increasingly transcending national boundaries, becoming internationalized.

This article is devoted to the research of the environmental management in China in the context of rapid economic development. The purpose of the study is to identify directions, conditions and factors that contribute to the improvement of Chinese government technologies in the environmental management based on the influence of international development processes.

## 2. Materials and Methods

### 2.1 Economic growth desire is relatively high, and the share of investment in the environment is low in China

It is important to note that the territorial management in the field of ecology in China is of particular importance due to the integrated approach to both the occurrence of pollution from the enterprises and the organization of environmental management. The territory of the municipality (city, county) is

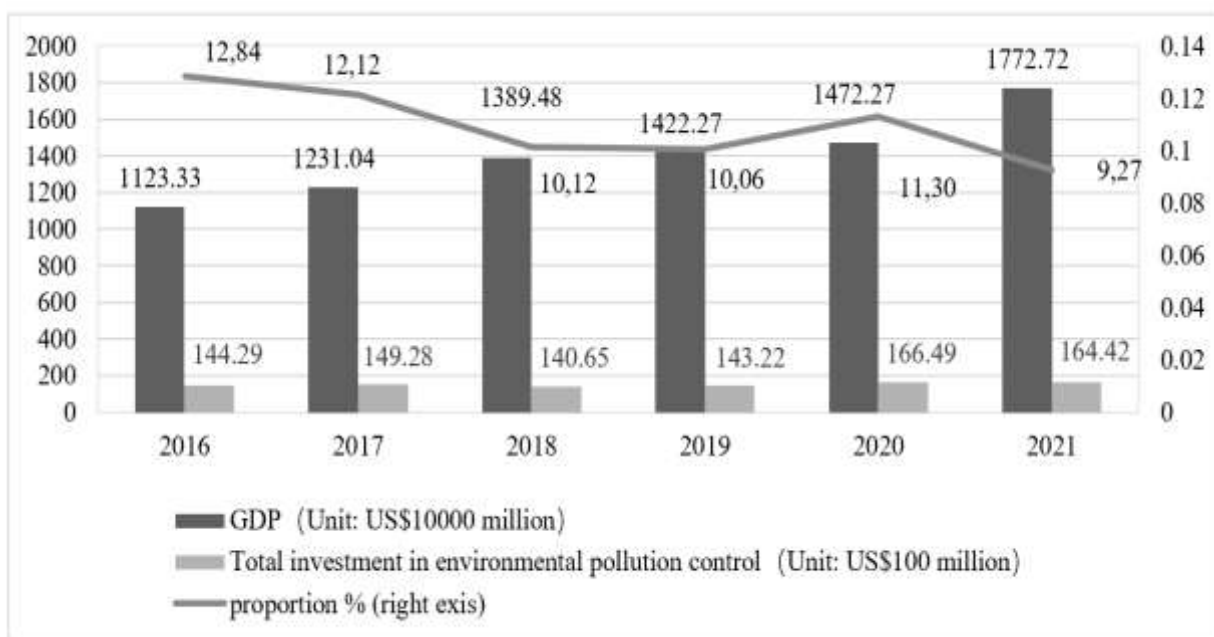
## Problems of Management

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a place where pollution from the enterprises activity is concentrated, and human activity also increasingly affect the state of the environment, for example, the growing use of private cars. Some local governments ignore the social management areas and public services for which they should be responsible and blindly pursue economic growth. Some local governments do not have enough funds to invest in the ecological environment, which is contrary to the concept of sustainable development and "green" strategies.

In 2021, China's total investment in pollution control was US\$ 164.421 billion. The ratio of total investment in pollution control to gross domestic product (GDP) was 9.27 %. From 2016 to 2021, China's total investment in pollution control accounted for a small share of GDP, and the growth rate was slow, as shown in Figure 1 [2].

Due to insufficient investment in environmental funds, the share of environmental resources in the resource allocation of the entire socio-economic development is low, and public finances have low support for government environmental functions. The environmental function of government does not provide a complete picture of the sustainable development role in green (eco) becoming.



*Fig. 1. GDP and total investment in environmental pollution control in China, 2016 – 2021<sup>1</sup>*

Thus, based on the data in Fig. 1, it is possible to conclude that there is a certain increase in environmental protection costs (+ 14 %), however, a 57.8 % increase in GDP over the same period leads to a decrease in the share investment in GDP for environmental projects from 12,84 % to 9.27 % in the PRC in 2016-2021.

### *2.2. Lack of national basic technologies and techniques for environmental protection, independent innovation ability is still weak*

Compared with developed countries, there is still a significant gap in Chinese environmental science and technology, which is mainly manifested by the lack of original core technologies and weak independent innovation ability.

Take patent data as an example, the main patent holding data shown in the "Global Environmental Technology Patent Heat Analysis Report 2008-2017" published jointly by the China Environmental Protection Industry Association and the Hefei Institute of Physical Sciences of the Chinese Academy of Sciences, shown in Table 1 [3].

<sup>1</sup> Developed and compiled by the authors, based on [2]

**Table 1 – Data comparison of core patent holdings, China and the United States, 2008-2017 <sup>1</sup>**

Category	Nationality of applicant: United States (invention patent applications, piece)	Nationality of applicant: China (invention patent applications, piece)	Proportion China / US, %
<b>Patents in air pollution prevention and control</b>	893	118	<b>13,2</b>
<b>Patents in water pollution prevention and control</b>	585	139	<b>23,8</b>
Patents in solid waste disposal	212	75	35,4
Patents in environmental monitoring	274	78	28,5
Patent aspects in soil and groundwater remediation technology	33	9	27,3

Thus, based on the comparison of received patents in the field of environmental issues, it is possible to conclude that China's experience in comparison with the United States seems to be the most positive in terms of the number of patents in the field of solid waste management (35.4% of the US level). The most problematic and requiring priority attention should be recognized as patenting in air pollution prevention and control (13.2% of the US level), as well as in water pollution prevention and control (23.8% of the US level).

Therefore, it is important for China to focus on scientific priorities, research and development, put forward as a priority for patenting in the fields of air & water pollution prevention and control.

*2.3. The ecology and environmental protection industry lacks workers, and the scientific and technical staff still has great potential to highlight as priority research in ecology and environmental protection.*

In 2020, the ratio of total national operating income from environmental management to gross domestic product (GDP) is 1.9%, and the rate of direct contribution to the national economy is 4.5%. The environmental and environmental sector employs about 3.2 million people, which is 0.43% of the total employment in the country [4].

China's environmental protection industry started late, but R&D is progressing fast. In the development process, China's environmental protection technology research closely follows international patterns, forming a more comprehensive research scheme, and has reached the international level of advanced technology in some fields, such as forest and grassland restoration technology, and desertification prevention and control technology in environmental protection technology. restoration. However, the overall level of environmental science and technology research is at the international average, and there is still a large gap with the United States, Germany, the United Kingdom and other leading world powers. Therefore, it is important for Chinese authorities to track quantitative indicators, which are the targets in world practice. At the same time, internationalization creates quantitative parameters that form an integral system, the construction of which in the PRC should be linked to international practice and experience.

### 3. Results

Through a comparative analysis of China's GDP, pollution control investment, popularity of environmental technology patents and other key indicators, it can be shown that, from the point of view of environmental management, China's modernization level has shortcomings and problems, which are mainly in the following aspects:

3.1. Economic growth desire is relatively high, and the share of investment in the environment is low in China.

<sup>1</sup> Developed and compiled by the authors, based on [3]

3.2. Lack of national basic technologies and techniques for environmental protection, independent innovation ability is still weak.

3.3. The ecology and environmental protection industry lacks workers, and the scientific and technical staff still has great potential to highlight as priority research in ecology and environmental protection.

#### **4. Proposals for using the principles of internationalization in improving China's environmental management system**

4.1. States in the modern world, especially such a large one as China, are committed to improving environmental management. Considering the attention to environmental issues, the growth in the number of publications and the significance of these problems, it should be concluded that environmental issues are a priority for the PRC authorities. Therefore, given the global nature of environmental problems, the tasks of internationalization in their solution acquire a strategic character for the state.

4.2 It is advisable to form a monitoring system and detail the mandatory disclosure of information on the main polluting objects local governments: provincial, municipal, and county governments should be assessed in more detail in environmental disclosure activities, such as preparing and publishing the territory's annual environmental report.

*Enterprises:* to ensure favorable conditions for conducting public control, the introduction of regulatory (mandatory) disclosure by enterprises of detailed information on emissions into the environment deserves priority attention: generation and disposal of solid and hazardous waste from enterprises, environmental administrative penalties, energy consumption and energy saving, water consumption and water saving.

*Detailing of information:* it is important to expand the scope of mandatory disclosure of information by enterprises from data on general pollutants and their volumes to disclosure of specific pollutants; from disclosures from key controlled entities to more entities subject to the disclosure procedure; as well as providing information not only about sources of fixed pollution, but also mobile ones.

*Population.* It is important for the PRC government to stimulate the transformation of the lifestyle, regime and consumption patterns of the population into a "green" and low-carbon one.

The authors propose that the government should formulate policies and regulations that encourage the public to engage in environmental behavior and use systems to limit the public's non-environmental behavior. In particular, environmental standards for citizens' families may include: choosing a low-carbon lifestyle, using low-carbon energy-saving and environmental products, healthy and reasonable consumption, and reducing waste.

An important aspect of changing the behavior of the population in public places can be "Environmental Codes", including: eco-friendly travel; using public transport rather than a private car; priority of accommodation in a green, low-carbon and environmentally friendly hotel; maintaining environmental hygiene and infrastructure at tourist sites.

4.3 The Chinese government is constantly expanding the international cooperation platform to strengthen international exchanges and cooperation in environmental management, uses the platform of relevant international conferences to explore the ideas of environmental management. In this way, China can learn from international best practices while sharing its experience in public environmental management. In this way, China is accelerating the reform of domestic technology and environmental protection systems, and improving the capacity and efficiency of environmental management. For example, the creation of the website of the One Belt, One Road environmental protection big data service platform. The platform promotes the exchange of environmental information, the promotion of the exchange of green technologies, and the prevention of environmental and environmental risks of the "Belt and Road".

The site's first major achievement is that, in late 2016, the site released the "Belt and Road Environmental Blue Book – 2015 Report on the State of the Ecological Environment of Key Countries along the Route". The Blue Book covers 26 countries and regions, including Russia, Kazakhstan, Belarus, Mongolia, India, Pakistan, Cambodia, Indonesia, Myanmar, Malaysia, Singapore, Thailand, Turkey, etc. The content of the analysis includes environmental management policy systems, water environment, atmospheric environment, information on waste and soil pollution, nuclear pollution and international cooperation in the field of the environment [5].

The platform brought together key national data, regulations and standards, environmental policies, technology industries, case studies, etc. from more than 30 countries, and collected more than 200 index data from 30 international authoritative public platforms involving more than 190 countries and regions around the world [6].

4.4 The use of information technology in the fight against environmental pollution should be strengthened and the close integration of environmental management with modern technologies should be promoted. Ecological environment management is closely integrated with modern technologies. However, it is important to accelerate the standardization and use of big environmental data, further promote the relationship between the perception of the Internet of things and the Internet, the use of smart terminals and cloud computing, etc., as well as improve the efficiency of collecting environmental information [7].

Taking the automatic pollution source monitoring system as an example, personal wearable electronic devices are gradually becoming popular, and environmental monitoring equipment can be included in this category. With the help of IOT technology, this data will be integrated into valuable information resources. For example, the app "250 You Publish" People can take PM2.5 photos wherever they are and upload them to the app. When tens of thousands of data are collected in an area, they can determine the air quality index for that area based on the coordinates of the photo. PM2.5 is fine airborne particles less than or equal to 2.5 microns in diameter. [8].

With the platform environmental departments can effectively manage the environment. In the future, the platform may also implement more functions so that environmental protection departments of the territories can receive primary information about environmental events throughout the country. For example, the environmental department can quickly locate illegal dumpers and the specific location of a chemical plant leak.

4.5 It is necessary to speed up the reform of the personnel training system, create a high-quality environmental management team, train and retrain personnel for environmental protection:

1) Colleges and universities should pay attention to the development of talents in the environmental protection industry at the same time as the development of innovative talents in the field of ecology and environmental protection in the field of basic science and key technologies.

2) China's environmental protection industry should attract scarce high-level talent in a timely manner according to the actual work needs. The platform of continuous education may become effective at the enterprise.

3) Introduce a system of additional training for employees of local governments and departments of environmental protection.

The authors suggest that local governments and environmental departments develop plans for training personnel, expand the composition of units for on-the-job training. For example, the government of Jiashan County, Zhejiang Province sent 8 specialists to the Shanghai Municipal Landscaping and Appearance Bureau for training. The topic of learning outside the workplace is to conduct in-depth research on the handling of household waste, as well as to study the best practices of the Shanghai Environmental Service, environmental protection work [9].

4.6 Improving the mechanism of financial support and optimization of capital investments in the environment to solve financing problems.

First, it is important to optimize the structure of budget expenditures, ensuring the environment and protecting the environment as a key area. For example, during the 13th Five-Year Plan (2016-2020), national finance allocated a total of 4.421 billion yuan (about \$691.87 billion) to environmental and environmental protection funds, with an average annual increase of 8.2%. Of these, central finance accounted for \$303.91 billion, accounting for 43.7% [5].

Secondly, it is important to fully use the role of market mechanisms, develop green finance and attract more social capital in the field of ecology and environmental protection. Green finance can not only promote environmental protection and governance, but also direct the flow of resources from highly polluting and energy-intensive industries to green development [10].

As of the end of 2019, China's domestic green bond balance was 977.2 billion yuan (about \$140 billion), of which \$136.06 billion worth of green bonds maturing in the next five years, accounting for 88% of the total balance. The total issuance of green corporate bonds in 2019 was about \$7.51 billion, an increase of 124.43% from about \$3.34 billion in 2018, making it the green bond type with the largest increase in domestic labeled bonds [11].

## 5. Conclusion

Increasing the ability of the Chinese government to internationalize and, on this basis, modernize the environmental management of the state, as the authors believe, is of a strategic nature due to the complexity and magnitude of the tasks. A special role in this process in the PRC should be assigned to the municipal (large regional) level of environmental management, which concentrates industrial and non-industrial pollution. The authors propose directions and measures for environmental management improvements.

1) The ecological state of the state in the current conditions seems to be an element of a united ecological world system, since problems can only be solved on a global scale, Internationalization is the basis for obtaining indicative target indicators for the national environmental management system. In addition, managing of industrial and non-industrial environmental problems in order to minimize the impact on humans should be concentrated at the primary territorial management links level - the municipality and/or their regional associations.

2) The environmental management state system should be based on a mandatory mechanism for monitoring, assessing and disclosing environmental information in municipal (territorial) governments. Specialized environmental services of municipalities as state governing bodies should receive information both from enterprises and monitoring systems for controlling non-industrial pollution of the territory. For the successful functioning of the environmental management system, interaction with public organizations of municipalities of large territorial (urban) agglomerations is of key importance.

3) There is a need to make full use of the existing international platforms to strengthen international exchange and cooperation between the Chinese government and other countries on environmental management issues.

4) Environmental management according to international experience, is based on science and technology, such as the Internet, intelligent terminals and cloud computing. Modern systems for the exchange of large volumes of data stimulate technologies for the unification of the collection and processing of environmental data.

5) The priority direction of the implementation of the strategy of internationalization and modernization of the environmental management system is the personnel training, retraining of technical personnel for environmental protection, innovative solutions of local authorities and environmental departments.

6) An important component of China's state environmental management system is the mechanism for enhancing the environment investments. International experience indicates the need to optimize the structure of budget expenditures and develop green finance technologies.

Full use should be made of existing international cooperation platforms to strengthen international exchange and cooperation between the Chinese government and other countries on environmental management issues. It is important to take into account that modern international systems encourage technologies for unifying the collection and processing of environmental data, which will require training and retraining of personnel. International experience indicates the need to optimize the structure of budget expenditures and develop "green" finance technologies. The regional environmental management system should be based on the industrial and non-industrial pollution control.

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