

# Exploration into environmental accounting information disclosure of listed companies in the chemical industry

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**Abstract.** Against the backdrop of the national goal of peaking carbon emissions and achieving carbon neutrality, the disclosure of environmental accounting information by enterprises has attracted much attention. The chemical industry is one of the severely polluting industries, and environmental pollution problems are quite serious. The disclosure of environmental accounting information by enterprises plays a crucial role. The article conducted a study on listed chemical enterprises in China, using case analysis to analyze chemical enterprises in heavy polluting industries. Chinese chemical industry enterprises were selected as samples, and the annual reports, social responsibility reports, and environmental reports disclosed by each enterprise were sorted out to analyze their existing problems. Finally, solutions were proposed from different levels to address the issues. The data in the article is mainly manually collected through the Guotai An database, annual reports published by Juchao Information, environmental reports, and social responsibility reports.

**Keywords:** environmental accounting, information disclosure, chemical industry

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## 1. Introduction

After the country proposed carbon peak and carbon neutrality, the high proportion of carbon emissions in the chemical industry, accounting for 16.7% of the industrial sector, has made various interest groups pay more attention to the disclosure of environmental accounting information in the chemical industry. In this context, the importance of environmental information disclosure in the chemical industry continues to increase. High quality environmental accounting information disclosure helps enterprise management accurately grasp the investment of environmental funds and make more scientific management decisions. By fully disclosing environmental accounting information, Chinese chemical enterprises can better demonstrate their efforts and achievements in environmental protection, enhance international recognition, and further expand the international market.

## 2. Concept and related theories of environmental accounting information

### 2.1. Environmental accounting concepts

Environmental accounting information refers to financial information related to environmental protection, pollution prevention and elimination, environmental resource utilization, and other environmental aspects of an enterprise, excluding non-financial environmental accounting information of the enterprise. Compared to financial accounting, environmental accounting does not only consider the uniqueness of entities in accounting, but also selects the most suitable and comprehensive benefit based on different stakeholders. Factors that should be considered include the public and ecological attributes of entities. In terms of environmental accounting measurement, it is not limited to the traditional four methods, but also calculates the physical quantity and value quantity separately, which may be summarized by adding up, and finally measured with reference currency quantity.

### 2.2. Related theoretical principles

Through a review of recent literature, it has been found that environmental accounting relies mainly on theories such as sustainable development theory, institutional change theory, stakeholder theory, externality theory, agency theory, corporate social responsibility theory, public pressure theory, legitimacy theory, signal transmission theory, and decision usefulness theory.

The legitimacy theory holds that companies need to consider and pay attention to whether they comply with social and environmental norms during their business operations. The company needs to showcase its environmental behavior and performance to the public through more environmental disclosures, so that the public can recognize the reasons for its continued legal and compliant existence. The stakeholder theory holds that the sustained operation of a company requires the support and recognition of stakeholders, and the management of stakeholder relationships is crucial for the survival and development of the company. Environmental disclosure can be seen as a dialogue between the company and stakeholders, and the company needs to inform stakeholders of its environmental policies, environmental behavior, and environmental performance through environmental disclosure. The theory of voluntary disclosure holds that companies are willing to disclose favorable information to distinguish themselves from companies with unfavorable information. The development and improvement of environmental accounting theory are also synchronized with economic development. In the early development of environmental accounting, relevant scholars also started from the micro enterprise level, involving the main theories of sustainable development theory, environmental economics theory, management theory, etc., and injected these theories into the daily management activities of enterprises. With the increasingly perfect development of the market economy, international capital has entered the domestic market, creating more complex chains of interests and economic communities. Therefore, based on accounting theory, more scholars are seeking new breakthroughs in environmental accounting research from the perspectives of game theory, environmental behavior theory, and management science theory of major countries, further enriching the theoretical system of environmental accounting. Its theoretical extension integrates various disciplines and broadens the basic framework of environmental accounting theory.

#### *2.2.1. Sustainable development theory*

The theory of sustainable development has become popular worldwide since its proposal and has become a research focus of academic concern. In 1987, the World Commission on Environment and Development (WCEI) defined sustainable development as development that meets the needs of present generations without compromising the ability of future generations to meet their own needs [1]. This definition has also been widely recognized by scholars studying environmental accounting and introduced into environmental accounting. Davis emphasized the importance of the principle of "need limit fairness" in his work. Therefore, environmental accounting theory also discusses three requirements: firstly, the need to meet human needs as the goal of development; The second is limitation, as the carrying capacity of the environment constrains human behavior; The third is fairness, emphasizing fairness between generations, between different countries and regions within a generation, and between humans and other biological populations. Until today, when emphasizing the concept of harmonious development, the coordinated development of economy and ecology remains the consistent goal that environmental accounting research aims to achieve. The widely recognized theory of sustainable development has become one of the most fundamental theories for studying the development of environmental accounting.

#### *2.2.2. Environmental economic theory*

Enterprise business activities are based on the pursuit of social nature, and within a reasonable carrying capacity, can form a virtuous cycle of interaction. However, the goal of maximizing corporate profits is bound to disrupt this balance, leading to the emergence of externalities. The significant manifestation of this externality is the emergence of environmental problems, namely the contradiction between economic activities and ecological environmental issues [2]. If one focuses solely on economic development and neglects environmental issues, it will highlight environmental problems and invisibly affect the actual business accounting of enterprises. In order to more accurately formulate business performance indicators, it is necessary to incorporate externalities from environmental economics into environmental cost accounting. Therefore, the theory of externalities, as one of the fundamental theories of ecological economics and environmental economics, has also been widely applied in environmental accounting research. The externalities of environmental accounting manifest in two aspects: firstly, the external costs incurred by enterprises due to the impact of resource development and utilization on the ecological environment; Secondly, the external benefits generated by enterprises carrying out ecological and environmental protection activities should be regarded as environmental benefits of the enterprise, which is also the difference between environmental accounting and financial accounting. In traditional financial accounting, the impact of environmental externalities on business operations is not included in accounting transactions. However, in environmental accounting, environmental issues must be considered. Only by comprehensively considering all economic and environmental ecological issues can we achieve true Pareto optimality.

#### *2.2.3. Other related theories*

Accounting itself is involved in the operation and decision-making of enterprises, so in environmental accounting research, management theory, management behavior theory, and management science theory naturally become important theoretical basis. Taylor emphasized that scientific management behavior should adopt targeted behavior management according to different environments, which was confirmed in the steel industry experiments at that time. Montgomery discussed that environmental issues are an inevitable topic in business management. In recent years, with the development of econometrics, behavioral management theory has also explicitly included environmental factors as variables in empirical research and testing.

### 3. Sample data of listed companies in the chemical industry

This article takes the heavily polluting industry - the chemical industry - as the analysis object. Based on the latest industry classification results of listed companies in the third quarter of 2024 released by the China Securities Regulatory Commission, a total of 291 listed chemical companies were obtained. In order to ensure the stability and continuity of the research, ST companies (600301 \* ST Nanhua, 600319 \* ST Yaxing, 600091 \* ST Mingke, 600078 \* ST Chengxing, 300446 \* ST Lecai, 002470 \* ST Jinzheng, 000707 \* ST Shuanghuan, 000523 \* ST Langqi) and newly listed companies after 2021 years were selected. A total of 222 chemical manufacturing companies that meet the conditions were obtained. Using the Guotai An database, 91 companies that disclosed complete data from 2020 to 2024 were finally obtained. There are a total of 455 samples. Analyze the disclosure status of environmental responsibility information based on the relevant data provided in its annual report, social responsibility report, and environmental report.

### 4. Current situation of environmental accounting information disclosure of listed companies in the chemical industry

#### 4.1. Positive information accounts for the majority, while negative information accounts for the minority

**Table 1.** Number of environmental accounting information disclosures by listed companies in the chemical industry

| Qualitative project                                      |          |   |                           |  |          |
|--|----------|---|---------------------------|--|----------|
| Environmental Management                                 |          | Environmental Supervision and Certification |                           | Environmental Information Disclosure Carrier |          |
| Project  | Quantity | Project                                     | Quantity                  | Project                                      | Quantity |
| Environmental protection concept                         | 336      | Key pollution monitoring units              | 325                       | Annual Report of Listed Companies            | 364      |
| environmental goals                                      | 142      | Pollutant emissions meet the standard       | 452                       |  |          |
| Environmental management system                          | 303      | Sudden environmental accidents              | 455                       | Social Responsibility Report                 | 166      |
| Environmental education and training                     | 99       | Environmental violations                    | 455                       |  |          |
| Environmental Protection Special Action                  | 119      | Environmental petition cases                | 455                       |  |          |
| Emergency response mechanism for environmental incidents | 301      | Have you obtained ISO14001 certification    | 154                       | Environmental Report                         | 10       |
| Environmental honors or awards                           | 128      | Has it passed ISO9001 certification         | 154                       |  |          |
| The 'Three Simultaneous' System                          | 144      |   |                           |  |          |
| Quantitative projects                                    |          |   |                           |  |          |
| Environmental Performance and Governance                 |          |   | Environmental liabilities |  |          |
| Project  | Quantity |   | Project                   | Quantity                                     |          |
| Performance and Governance Disclosure                    | 405      |   | Environmental liabilities | 407  |          |

From the Table 1, it can be seen that negative environmental accounting information can have a negative impact on a company's reputation, interests, etc., so companies tend to display positive information in environmental information disclosure. Overall, if 91 listed companies have conducted comprehensive environmental information disclosure within 5 years, the theoretically optimal disclosure quantity should be 455. However, in reality, there are 9 categories of environmental accounting information disclosed within 200, and only 6 categories of information disclosed above 400, indicating that the overall disclosure level may not have reached its optimal level. When chemical companies disclose environmental accounting information, the largest number of disclosed items is pollutant emission standards, with a total of 452 disclosed from 2018 to 2022. The three projects of pollutant emission standards, environmental protection concepts, and key pollution monitoring units are over 300, accounting for 99.34%, 74.34%, and 71.90% respectively. It indicates that most chemical companies meet the standards for pollutant emissions and have disclosed their environmental protection concepts, policies, organizational structures, circular economy development models, and green development. However, when companies are punished for environmental issues, they will deliberately cover up in their reports, generally stating that "there have been no cases of punishment for environmental violations", and only a few companies disclose a small number of violations. From the number of disclosed projects, companies tend to disclose more basic

and positive environmental information, while there is still a certain gap between the remaining projects and the optimal disclosure quantity.

#### 4.2. Low voluntary disclosure intensity, only meeting mandatory disclosure requirements

**Table 2.** Proportion of environmental accounting information disclosure by listed companies in the chemical industry

| Year   | 2020 | 2021 | 2022 | 2023 | 2024 |
|--|------|------|------|------|------|
| Qualitative project                                      |      |      |      |      |      |
| Environmental protection concept                         | 58%  | 69%  | 77%  | 77%  | 88%  |
| environmental goals                                      | 29%  | 25%  | 20%  | 40%  | 43%  |
| Environmental management system                          | 56%  | 75%  | 59%  | 71%  | 71%  |
| Environmental education and training                     | 14%  | 27%  | 10%  | 31%  | 26%  |
| Environmental Protection Special Action                  | 19%  | 33%  | 15%  | 36%  | 27%  |
| Emergency response mechanism for environmental incidents | 67%  | 80%  | 55%  | 67%  | 65%  |
| Environmental honors or awards                           | 25%  | 31%  | 24%  | 27%  | 34%  |
| The 'Three Simultaneous' System                          | 36%  | 36%  | 29%  | 27%  | 29%  |
| Key pollution monitoring units                           | 75%  | 74%  | 51%  | 78%  | 80%  |
| Pollutant emissions meet the standard                    | 99%  | 99%  | 99%  | 100% | 100% |
| Sudden environmental accidents                           | 0%   | 0%   | 2%   | 0%   | 0%   |
| Environmental violations                                 | 1%   | 5%   | 1%   | 2%   | 0%   |
| Environmental petition cases                             | 0%   | 0%   | 0%   | 0%   | 0%   |
| Have you obtained ISO14001 certification                 | 27%  | 32%  | 32%  | 40%  | 38%  |
| Has it passed ISO9001 certification                      | 30%  | 33%  | 34%  | 36%  | 36%  |
| Annual Report of Listed Companies                        | 99%  | 100% | 100% | 100% |      |
| Social Responsibility Report                             | 42%  | 42%  | 44%  | 55%  |      |
| Environmental Report                                     | 0%   | 0%   | 1%   | 10%  |      |
| Quantitative projects                                    |      |      |      |      |      |
| Performance and Governance Disclosure                    | 90%  | 88%  | 82%  | 87%  | 88%  |
| Environmental liabilities                                | 89%  | 88%  | 88%  | 92%  | 95%  |

Through data analysis in Table 2, it can be seen that chemical enterprises have fully disclosed basic environmental information, such as whether the enterprise belongs to a key pollution monitoring unit and whether the enterprise's pollutant emissions meet the standards; Whether the enterprise has any sudden environmental accidents, environmental violations, or environmental petition cases is a mandatory disclosure item, and all disclosures have been made. However, the willingness to disclose voluntary disclosure matters such as whether it has passed ISO9001 (with a disclosure level of around 35%) and whether it has passed ISO14001 (with a disclosure level of around 33%) is not high. At present, chemical enterprises in China are still concerned about their profitability, with a weak awareness of sustainable development and insufficient attention to environmental protection, which may lead to some environmental pollution situations.

#### 4.3. Disclosure focuses on qualitative information, with less quantitative information

**Table 3.** Proportion of environmental accounting information disclosure by listed companies in the chemical industry

| Project and Year                                     | 2020 | 2021 | 2022 | 2023 | 2024 |
|--|------|------|------|------|------|
| Waste gas emission reduction and treatment situation | 55%  | 54%  | 53%  | 57%  | 68%  |
| Wastewater reduction and treatment situation         | 55%  | 56%  | 42%  | 51%  | 55%  |
| Dust and smoke control situation                     | 28%  | 30%  | 25%  | 34%  | 36%  |
| Utilization and disposal of solid waste              | 42%  | 40%  | 42%  | 44%  | 48%  |
| Control of noise, light pollution, radiation, etc    | 21%  | 20%  | 13%  | 25%  | 26%  |
| Implementation of Clean Production                   | 21%  | 25%  | 41%  | 26%  | 23%  |

**Table 3.** Continued

|                                   |     |     |     |     |     |
|-----------------------------------|-----|-----|-----|-----|-----|
| Wastewater discharge volume       | 58% | 55% | 51% | 55% | 68% |
| COD emissions                     | 45% | 43% | 36% | 42% | 47% |
| SO <sub>2</sub> emissions         | 40% | 40% | 29% | 41% | 43% |
| CO <sub>2</sub> emissions         | 3%  | 4%  | 10% | 23% | 46% |
| Smoke and dust emissions          | 39% | 41% | 29% | 46% | 49% |
| Industrial solid waste generation | 2%  | 4%  | 6%  | 9%  | 10% |

From the perspective of the overall proportion of environmental accounting information disclosure, quantitative projects have shown a relatively high overall level. But after data classification, the disclosure level is only a false table. Firstly, as shown in Tables 2 and Table 3, the quality of environmental accounting information disclosed by a company mainly depends on the quantity and reliability of the quantitative environmental accounting information disclosed. Although the overall proportion of quantitative environmental information disclosure far exceeds 80%, the disclosure level of each individual project is far from the ideal level. Most companies cannot achieve quantitative disclosure of projects every year, and some even only disclose one project every year. Secondly, when companies disclose, their annual projects are not fixed and cannot achieve continuous disclosure.

#### 4.4. Diversity in disclosure methods, with annual reports as the main focus

The existing forms of environmental accounting information disclosure mainly include annual reports, social responsibility reports, and environmental reports. Due to the fact that not all environmental disclosure carriers for 2024 have been published in the database so far, a total of 364 samples of environmental information carriers were selected from 2020-2024. According to the data, in 2024, 91 chemical companies disclosed environmental accounting information in their annual reports, and 10 chemical industry companies disclosed environmental accounting information in their environmental reports. Through sorting out the annual reports, environmental reports, and social responsibility reports of listed companies in the chemical industry from 2020 to 2024, it was found that the disclosure of environmental accounting information in the chemical industry is rarely pointed out in environmental reports. Most of them are disclosed through annual reports or social responsibility reports, and only 10 companies with enterprise codes 000553, 300285, 000792, etc. have issued independent environmental reports. Most companies disclose in one form, so the current environmental accounting disclosure method is not unified, and it is not clearly stated in a specific report. Some companies even only disclose in the company summary or notes.

### 5. Current situation of environmental accounting information disclosure of listed companies in the chemical industry

#### 5.1. The subjectivity of information disclosure is too strong

Influenced by the theory of signal transmission, enterprises will prioritize their own interests. With the increasing attention of society to environmental issues, the demand for coordinated development between the economic behavior of enterprises and the ecosystem is becoming increasingly urgent and important [3]. The business strategy of enterprises has shifted from simply pursuing economic benefits to pursuing social benefits, environmental benefits, and fulfilling more social responsibilities, manifested in the voluntary provision of environmental accounting information by enterprises. Environmental accounting not only measures the environmental resources, environmental responsibilities, and environmental costs of enterprises, but also recognizes the environmental benefits or losses obtained by enterprises. Whether a company discloses environmental accounting information and in what form it discloses the above information is currently based on the consequences (positive or negative) of the information release on the company. With the goal of maximizing enterprise value, environmental accounting information should reflect favorable matters for the enterprise. Enterprises prefer to disclose difficult to measure and monetize matters, sending signals to potential investors, consumers, governments, and other stakeholders. The overall environmental awareness of enterprises is not strong, and most enterprises have concerns that the disclosure of environmental accounting information will damage the company's image, thus intentionally avoiding some negative information. For mandatory disclosure matters, most of the data information released by enterprises is low-quality and without reference, and specific substantive environmental information or information that is unfavorable to the enterprise is not disclosed. Enterprises focus more on their own profit issues, and information disclosure is mostly passive, making the disclosed information data lack reference value.

## 5.2. Significant delay in information disclosure

Under the theory of information asymmetry, consumers and investors obtain information in different ways, and the quantity and quality of information they obtain are also different. This leads to a huge gap between information owners with more quantity and better quality and those with less quantity and worse quality [4]. From the analysis of the disclosure status of sample companies, it is found that the disclosure time of environmental accounting information is not timely enough. Many sample companies' annual reports and social responsibility reports disclose environmental accounting information from previous years (mostly the previous year), which is a description of past events and cannot truly reflect the current actual situation. In order to maintain a good corporate image, listed companies often delay or even do not disclose negative information, in order to minimize the damage to the company's interests. The lag in disclosure time results in a lack of timeliness in the environmental accounting information released by the company, greatly reducing its value to stakeholders. Stakeholders find it difficult to timely and effectively understand the company's true environmental accounting situation and make accurate evaluations of the company. At the same time, it is also difficult to obtain economic benefits equivalent to environmental investment returns. Unfair arises from information asymmetry. In heavily polluting enterprises such as chemical companies, if they want to achieve sustainable development, they are likely to cover up their investment in environmental protection in order to increase their own profitability. This will result in stakeholders' information being inaccessible. Once the outside world questions the environmental accounting information of the enterprise, it will cause a huge uproar in the market and result in losses for investors.

## 5.3. The information disclosure method is unified

The specific carriers and forms of environmental accounting information disclosure in sample enterprises are not consistent, making it difficult for information users to obtain and compare environmental accounting information from different enterprises [5]. These non-standard disclosure methods not only affect the relevance and comparability of environmental accounting information, but also make it difficult for stakeholders to make scientific and effective comparisons, thus making it difficult to make correct evaluations. For listed companies, the standardization and transparency of information disclosure have an extremely important impact on their market image, investor confidence, and overall economic benefits. When a company's disclosure methods are not standardized, it may lead to difficulties in understanding and evaluating the company's information from the outside world, resulting in a lack of genuine recognition. This not only hinders the establishment of a good corporate image for listed companies, but may also have a negative impact on the harmonious development of the entire society.

# 6. Conclusion

## 6.1. Enterprises should strengthen the disclosure of environmental accounting information

Currently, most companies are still limited to mandatory government requirements, and few actively disclose environmental information. The disclosure of environmental accounting information largely relies on the company's own environmental awareness and consciousness. If a company only publishes content that is beneficial to itself but avoids content that pollutes the environment, it will reduce its reference value and fail to obtain effective conclusions. To strengthen the initiative of enterprises, it is necessary to enhance the environmental awareness of internal management and staff.

## 6.2. The national system encourages experts to formulate policies for environmental accounting information disclosure

At present, there is no unified standard for environmental information disclosure in China, and it lacks mandatory requirements. There should be clear regulations on the content, method, and location of disclosure, so that investors and other users can better understand and compare. This method can enable enterprises to conduct standardized information disclosure in accordance with relevant regulations, thereby further enhancing their environmental awareness. While improving the laws and systems related to environmental accounting, it is also necessary to conduct research on relevant policies to promote the development of environmental accounting in China.

## 6.3. Implement the improvement of the supervision system as soon as possible

While improving the laws, regulations, and accounting standards for environmental accounting information disclosure, it is also necessary to strengthen the supervision and audit of environmental information disclosure [6]. Firstly, the government should strengthen the supervision of environmental accounting, strictly deal with enterprises that violate laws and regulations related to the environment, increase the crackdown on them, and strictly handle them to enhance the enthusiasm of enterprises to assume social responsibility. At the same time, establish incentive mechanisms to encourage and praise excellent enterprises, so that they can play a demonstrative and leading role for other enterprises. Accelerate the establishment of a third-party supervision and audit mechanism, and broaden the scope of audits. Secondly, companies in similar industries can work together to research and

develop evaluation standards applicable to that industry, forming a relatively unified performance evaluation mechanism for environmental accounting within the industry. This can promote standardization while supervising each other and providing support for government regulation. Finally, the enterprise itself should also improve its internal environmental audit system to monitor and address environmental issues in real-time. Prepare relevant financial statements, consider environmental factors such as environmental costs, environmental expenses, and environmental liabilities, and link environmental performance with the company's performance to increase employee awareness. Establish an accountability mechanism for environmental accounting information disclosure. For departments that have not prepared environmental performance evaluation data or have incomplete evaluation data, regulatory authorities can issue notices or penalties.

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